Appendix C

Water and Wastewater Feasibility Study

Acorn Environmental

Water and Wastewater Feasibility Study

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LIST OF ACRONYMS AND ABBREVIATIONS

AF	acre-feet
bgs	below ground surface
BOD	biochemical oxygen demand
CFR	Code of Federal Regulations
CT	product of chlorine residual and modal contact time measured at the same
DU	dwelling unit
DWR	Department of Water Resources
ET	evapotranspiration rate
Ft	feet
Ft^2	square feet
gal	gallons
gpd	gallons per day
gpm	gallons per minute
IHS	Indian Health Services
LS	lump sum
MBR	membrane bioreactor
MCL	Maximum Contaminant Level
MG	million gallons
mg/L	milligrams per liter
µg/L	micrograms per liter
MGD	million gallons per day
MPN	Most Probable Number
NPDES	National Pollution Discharge Elimination System
NTU	nephelometric turbidity units
PLC	programmable logic controller
RWQCB	Regional Water Quality Control Board
SWRCB	State Water Resources Control Board
SDS	Safety Data Sheets
sf	square feet
TSS	total suspended solids
UV	Ultraviolet
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey

WWTP	Wastewater Treatment Plant

SECTION 1 – INTRODUCTION

HydroScience Engineers, Inc. (HydroScience) was retained by Acorn Environmental to prepare a feasibility study evaluating the regulatory, technical, and engineering issues associated with supplying water and handling wastewater from the Shiloh Resort and Casino Project (Project) proposed by the Koi Nation of Northern California. The objectives of this water and wastewater feasibility study are to:

- Estimate the proposed Project's water supply and wastewater disposal requirements;
- Describe the facilities that would be required to supply the required water, and treat the required amount of wastewater;
- Develop a strategy for disposing of wastewater generated by the Project; and
- Identify applicable water and wastewater permitting issues for the proposed Project.

This report evaluates these objectives for two development alternatives located at the project site. Alternative A – Proposed Resort and Casino Project consists of a resort hotel and casino, with event center and conference space, parking structure, and surface parking lots. Alternative B – Reduced Intensity Resort and Casino Project plan consists of a smaller resort hotel and casino without event center or large ballroom and no surface parking lots. A third development alternative (non-gaming) was also evaluated which consists of a resort hotel, winery production facility, tasting room, and dining area and is identified as Alternative C – Proposed Resort and Winery Facility Project. This document describes each alternative's water supply and wastewater requirements, identifies projected flows and demands, and evaluates alternative effluent disposal strategies.

Sections 5 and 6 present a plan summarizing the facilities required to meet the more conservative objectives for Alternative A.

1.1 Proposed Project Site Alternatives

The proposed Project would be constructed in an unincorporated area of Sonoma County just outside the Town of Windsor (Town) (**Figure 1-1**). The 68.6-acre (ac) parcel located at the intersection of East Shiloh Road and Old Redwood Highway would be brought into Trust as part of the proposed Project. A map showing the location of the site is shown in **Figure 1-2**.

The proposed land use on this parcel includes a new casino (excluded in Alternative C), hotel, parking, restaurants, and other associated facilities and are further described in **Section 2.1**. Three separate programs, each comprising of different densities and facilities, will be evaluated as part of this analysis: Alternative A – Proposed Resort and Casino Project, Alternative B – Reduced Intensity Resort and Casino Project and Alternative C – Proposed Resort and Winery Facility Project. See **Appendix A** for a full list of the proposed facilities.

1.2 Report Organization

This report is divided into eight sections as described below.

- Section 1 – Introduction
- Section 2 – Project Alternatives
- Section 3 – Local Hydrogeology
- Section 4 – Background and Regulatory Issues
- Section 5 – Water Facility Requirements
- Section 6 – Wastewater Facility Requirements
- Section 7 – Recommendations
- Section 8 – References

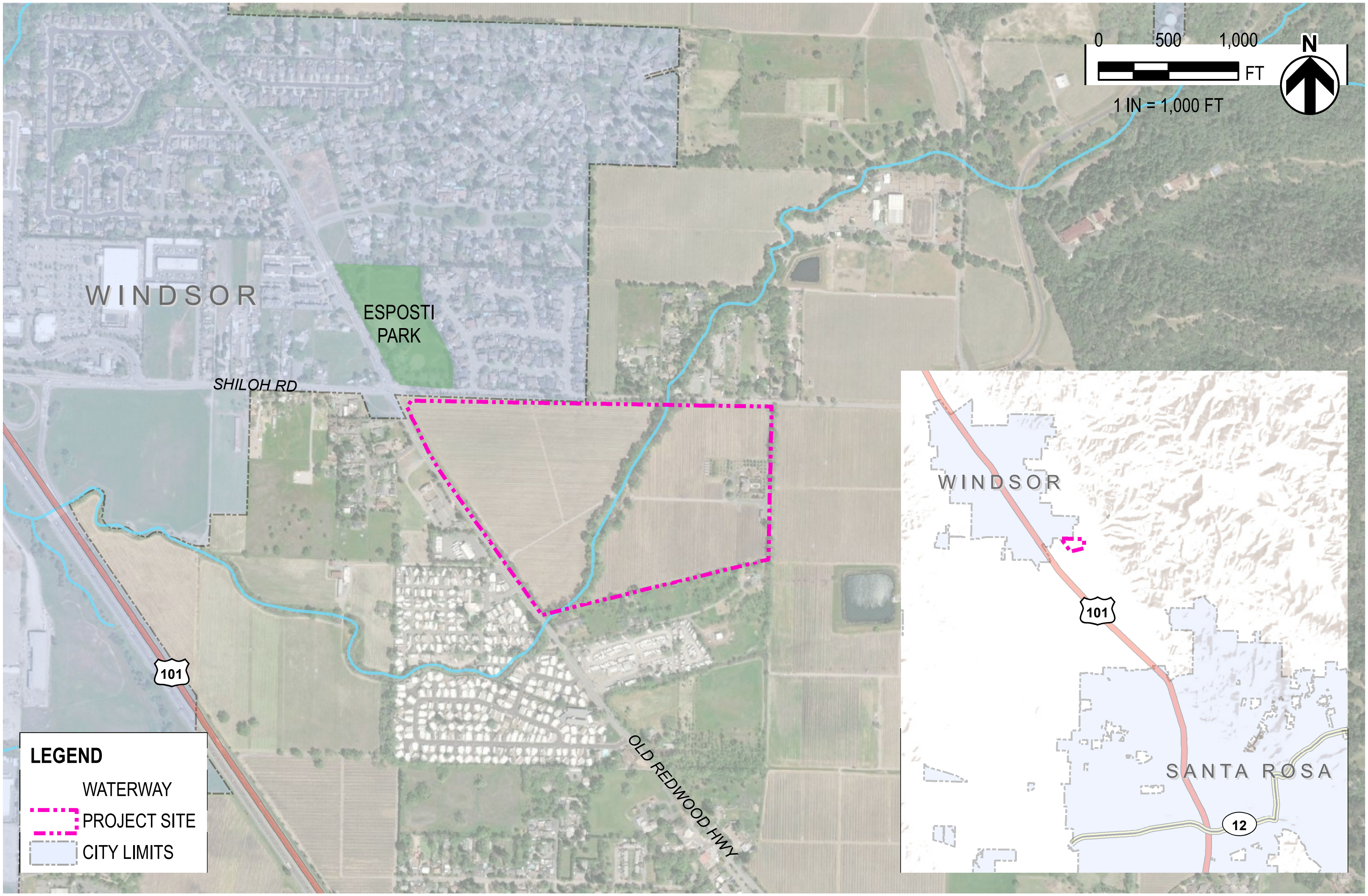

Figure 1-1
Acorn Environmental
Shiloh Resort and Casino Project Water and Wastewater Feasibility Study
Vicinity and Project Location Map

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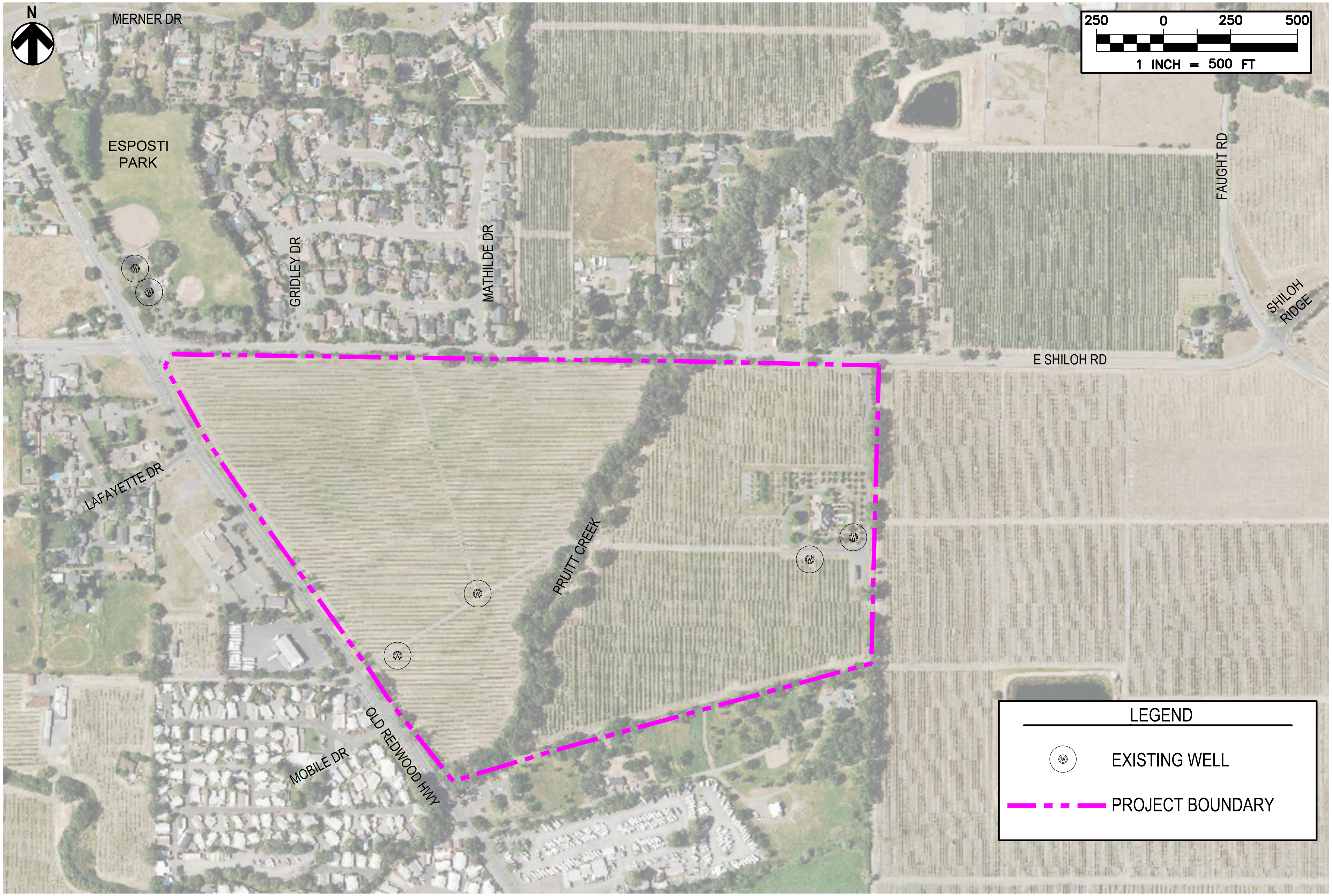

Figure 1-2
Acorn Environmental
Shiloh Resort and Casino Project Water and Wastewater Feasibility Study
Aerial Site Plan

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SECTION 2 – PROJECT ALTERNATIVES

This section provides a summary of each of the three program alternatives and the related water and wastewater facility requirements. For each program alternative, the following information is summarized:

- Water supply requirements;
- Wastewater generated, including discussions about influent water quality, treatment options, and effluent disposal options; and
- Recycled water.

Each alternative is individually described below.

2.1 Program Alternatives

There are two program alternatives that are considered in this feasibility study to understand the range of water and wastewater facility needs. Each program is summarized below:

- **Alternative A:** This program includes a total approximate footprint of 805,000 ft^2, including a casino, multiple restaurants and bars, meeting rooms, 44,900 ft^2 of ballrooms, a spa, and a 400-room hotel. Approximately 183,100 ft^2 of on-site parking spaces will be located on the site east of the gaming facility and would include a 3,692-count parking structure adjacent to paved surface parking. A map of the Alternative A program site plan is included as **Figure 2-1**.
- **Alternative B:** This program includes a total approximate footprint of 554,000 ft^2, including a casino, multiple restaurants and bars, meeting rooms, 12,400 ft^2 of ballrooms, a spa, and a 200-room hotel. This program would also include a 3,692-count parking structure adjacent to paved surface parking. A map of the Alternative B program site plan is included as **Figure 2-2**.
- **Alternative C:** This program includes a total approximate footprint of 212,400 ft^2, including a dining facility, hotel, spa, winery, and visitor center with a dedicated tasting area. Approximately 109,700 ft^2 of on-site parking will also be located east of the facilities. A map of the Alternative C program site plan is included as **Figure 2-3**.

2.2 Water Supply Requirements

Existing water demands for the proposed project site include vineyard irrigation and single-family home use. Water usage was estimated based on a demand rate of 0.317 AF per year/acre and 319 gpd/DU for vineyard irrigation and residential use, respectively. The demand rate for vineyard irrigation is discussed in **Section 2.3.4.1**. The residential water demand rate was based on the 2011 Town of Windsor Water Master Plan estimate for future residential demands. Actual billing/metered data was not available. **Table 2-1** compares the projected average annual demands for Alternatives A, B, and C with estimated existing usage for the proposed project site.

Table 2-1: Comparison of Alternatives and Existing Site Demands

Program Alternative	Average Annual Demand (AFY)
Existing Usage	20
Alternative A	315
Alternative B	215
Alternative C	55

The average water demand, supplemented with recycled water, for Alternatives A, B, and C is shown in **Table 2-2**. The average water demand is expected to be representative of typical daily water use. Peak water demands, which would typically occur on the weekends, were calculated using similar methodology.

Table 2-2: Projected Water Demands for Alternative A, B & C

Program Alternative	Parameter	Projected Water Demands (gpd)	Projected Water Demands with Recycled Water (gpd)
Alternative A	Average Daily Flow	278,000	170,000
	Peak Day Flow	402,000	294,000
Alternative B	Average Daily Flow	189,000	117,000
	Peak Day Flow	258,000	186,000
Alternative C	Average Daily Flow	48,000	19,000
	Peak Day Flow	64,000	35,000

The experience of other similarly sized gaming and entertainment facilities has shown that water demands can be significantly reduced when recycled water is introduced as an alternative water supply source. Water supply requirements, including the use of recycled water, were calculated assuming recycled water would be utilized for toilet flushing, landscape irrigation, vineyard irrigation, cooling tower make-up and other approved non-potable uses under Title 22 regulations. Although it doesn't apply to uses on Trust lands, the recycled water quality will be designed to produce the equivalent water quality to disinfected tertiary recycled water as defined by Title 22.

Preliminary projections of the water supply needed to reliably meet water demand for both programs are summarized in **Table 2-3**. These projections are based on estimated average wastewater flows (see **Table 2-5**) and include a 20% allowance for system losses as well as a safety factor to ensure adequate supply. These are preliminary and for planning purposes only.

Table 2-3: Projected Water Supply Design Flows

Program Alternative	Water Supply Requirement without Recycled Water (gpm)	Water Supply Requirement with Recycled Water (gpm)	Minimum Recommended Firm Water Supply (gpm)
Alternative A	300	225	300
Alternative B	200	150	200
Alternative C	50	30	50

Notes:

1. Units of gpm = gallons per minute.
2. Reduction in water supply requirement is higher for Alternative A than Alternative B alternative since dual plumbing use and cooling tower demands are greater for the larger facility.

A “firm” water source is considered that which can be supplied by the system with the single largest source out of service, in a redundant system. The “firm” water supply is required 24 hours a day, 365-day a year, and can meet the Maximum Day Demand for the project. Water system redundancy may be achieved in a variety of ways – in a groundwater system, multiple wells or another redundant source would normally be required. Diurnal peaks, fire flow, and other peak demands may be met with storage tanks.

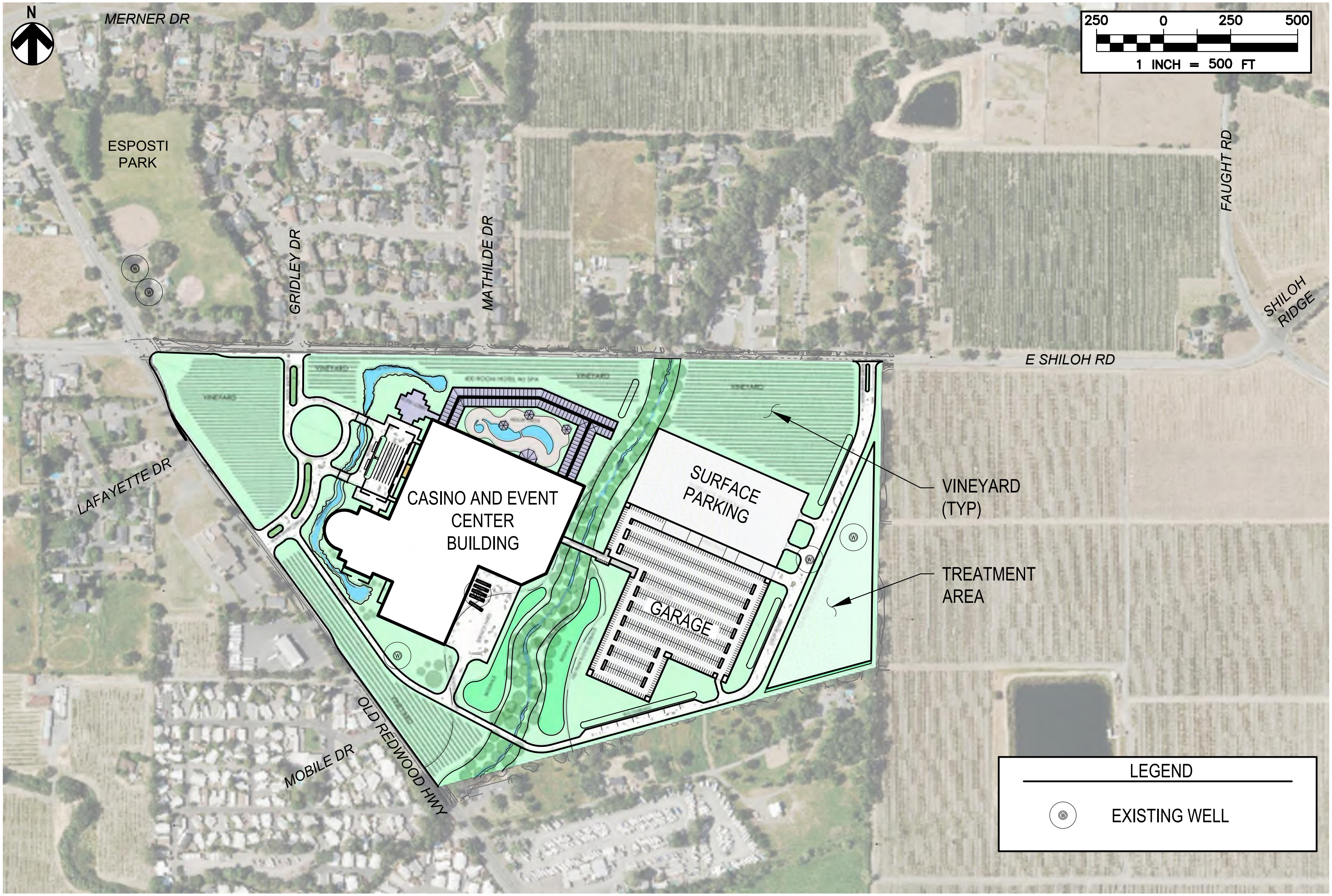

Figure 2-1
Acorn Environmental
Shiloh Resort and Casino Project Water and Wastewater Feasibility Study
Proposed Site Plan - Alternative A

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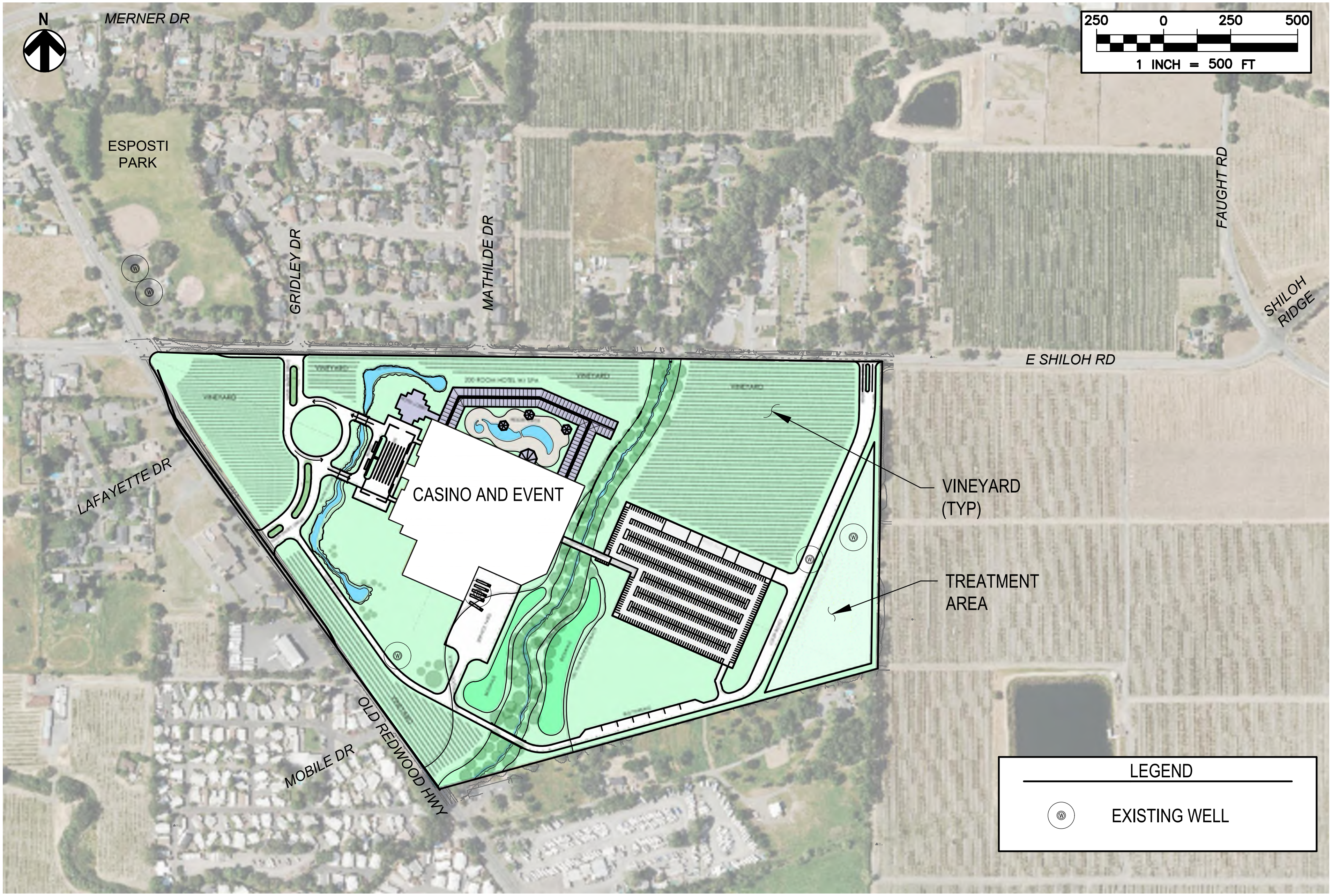

Figure 2-2
Acorn Environmental
Shiloh Resort and Casino Project Water and Wastewater Feasibility Study
Proposed Site Plan - Alternative B

HydroScience

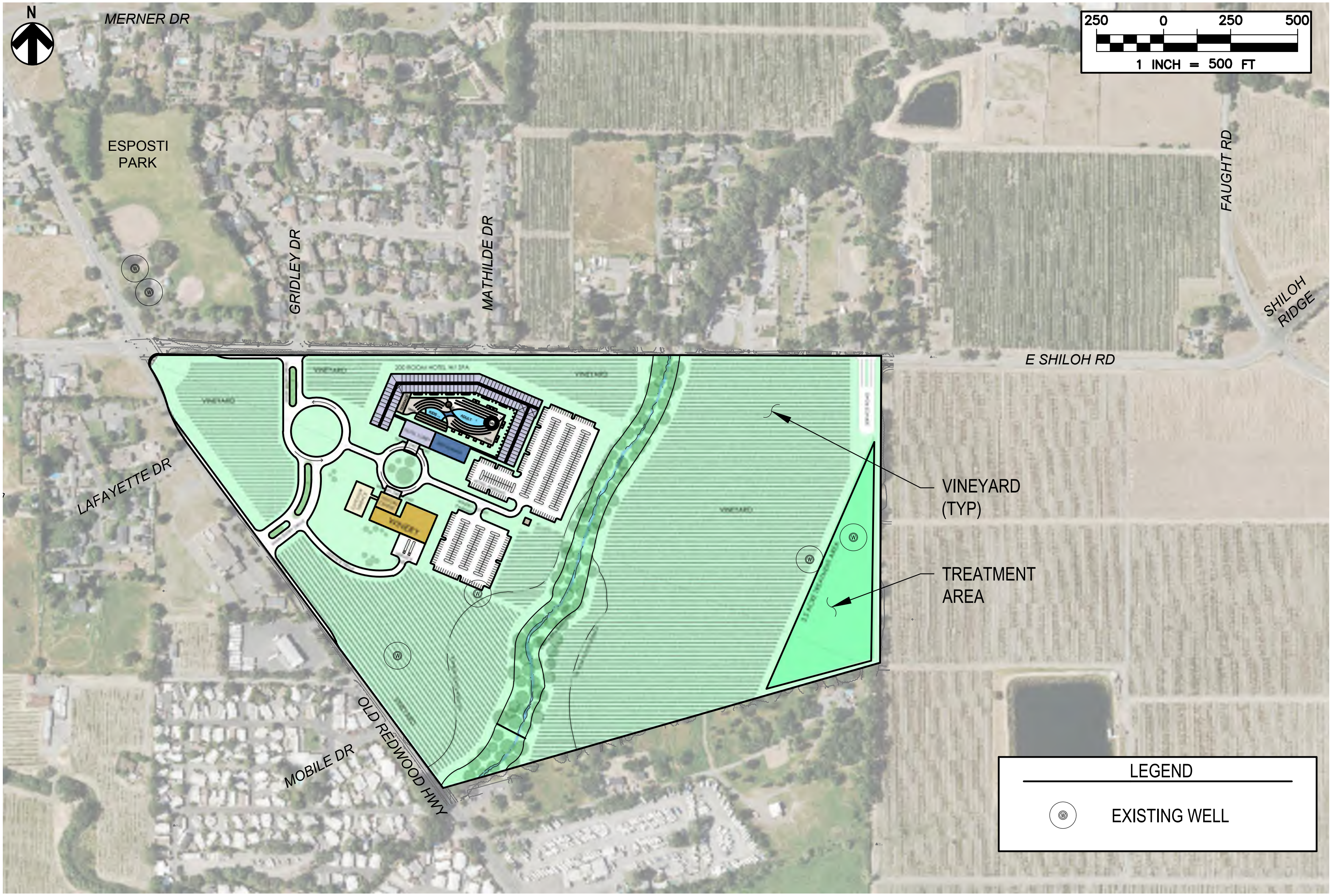

Figure 2-3
Acorn Environmental
Shiloh Resort and Casino Project Water and Wastewater Feasibility Study
Proposed Site Plan - Alternative C

HydroScience

In addition to the use of recycled water, the project alternatives are also expected to be designed and managed to minimize potable water usage. Recommended water conservation measures include low flow fixtures, voluntary towel re-use, central plant optimization, recirculating fountains or water features, high efficiency/water conserving appliances, etc. For restaurants, potable water can also be conserved, if only served to patrons who request it. To facilitate this, sub-metering of water for each of the uses within the Project will discourage waste and help identify areas where consumption can be reduced. Employee training and participation, regular maintenance, and customer education are all expected to also help reduce water use.

Fire flow requirements (or guidelines) are set by the local fire authorities, based on the building's use and classification. Storage requirements for casinos are generally controlled by fire protection requirements, and not by domestic peaking requirements. Storage requirements will be determined upon issuance of the fire flow and duration requirement from the local fire authority. Fireflow requirements for a large facility such as this can be as much as 8,000 gpm for 4 hours with up to 75% reduction (reduced to 2,000 gpm for 4 hours) for automatic fire sprinklers.

2.2.1 Water Supply

The Project will require both a potable and irrigation water supply for use within the Project. Potable water could be obtained through the construction of on-site groundwater wells. It was noted that there are already multiple on-site wells used for irrigation with capacities ranging up to over 600 gpm, though it is unclear whether these wells are suitable for use as a potable water supply well. Irrigation water could be obtained either through reuse of effluent from the proposed onsite wastewater treatment plant (WWTP) as recycled water, use of the existing onsite irrigation well, or use of potable water.

It is expected that groundwater is available within the Project site based on recent investigations at Esposti Park. Esposti Park has both an existing Town irrigation well as well as a standby potable water supply well. The potable water supply well is not currently active; however, the Town has evaluated the thickness and productivity of the deeper sedimentary units at the existing well location and documented those results in the *Windsor Groundwater Well Installation and Testing Report* prepared in September 2010 and included as **Appendix B** as well as the *Town of Windsor and Windsor Water District Esposti Supply Well Redevelopment, Pumping Test and Treatment Feasibility Study (October 3, 2017)*, included as **Appendix C**. Based on these evaluations, discussed further in **Section 3.3.1**, it is estimated that a new on-site potable water supply well can reliably produce 400 gpm.

For any onsite groundwater well, it is likely that groundwater treatment will be required to remove arsenic and manganese. The number of wells required would be dependent on the capacity of each new groundwater well. At a minimum, sufficient capacity would be required to meet the maximum day demand with the largest source out of service. One potential primary groundwater well location is shown on **Figure 2-4**. The anticipated well capacity, location and operating strategy would be developed further during the design phase. Additional information about groundwater supplies is included in **Section 4.1**.

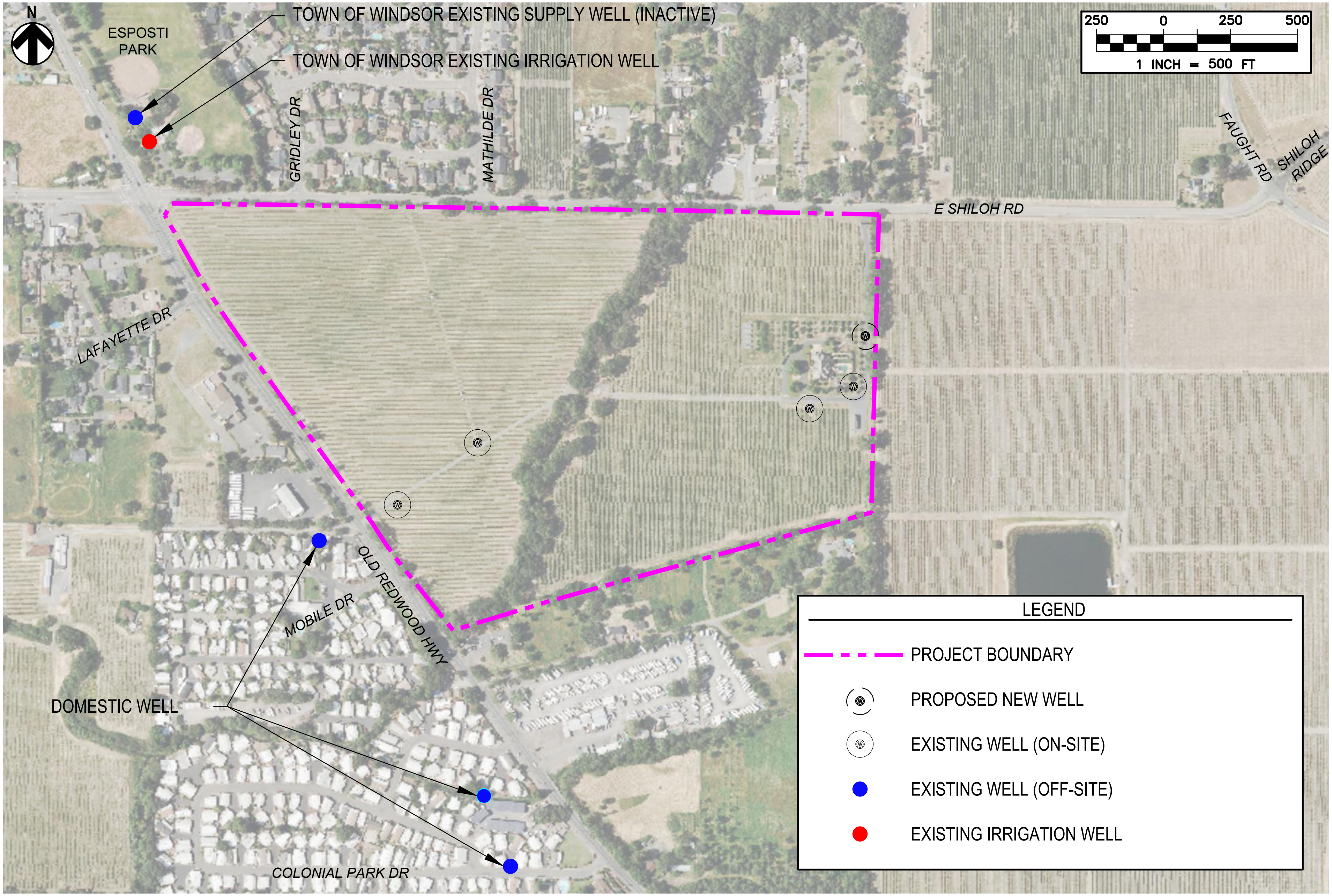

Figure 2-4
Acorn Environmental
Shiloh Resort and Casino Project Water and Wastewater Feasibility Study
Local Groundwater Well Site Map

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2.3 Wastewater

This section identifies the expected strength of influent wastewater, describes existing wastewater treatment facilities, and identifies the wastewater treatment options explored for Alternative A. Projected wastewater flows and the proposed WWTP process train are also identified.

2.3.1 Influent Water Quality

The quality of influent water for gaming facilities differs from the quality of domestic sewage. This section provides background on the typical quality of influent water at gaming facilities and identifies the facilities required to treat it.

Traditional wastewater treatment options, such as primary clarifiers, activated sludge, conventional filtration, and disinfection, were not considered as WWTP options due to the limited proposed treatment area layout.

Typical gaming facility wastes have higher BOD and TSS values compared to domestic wastewater, as identified in **Table 2-4**. Shock loadings are also typical of gaming facility wastewater. Weekend flows are much higher than weekday flows, and evening flows are higher than daytime flows. This assumption is based on the higher utilization of similar facilities outside of normal business hours. Other similar facilities also experience increased utilization of the casino facilities during evenings and on the weekend.

Table 2-4: Typical WWTP Influent Water Quality

Parameter	Units	Alternative A	Typical Domestic Sewage
BOD	mg/L	450-600	200-300
TSS	mg/L	450-600	200-300

Any wastewater treatment process selected for use must be able to handle the high strength waste and react well to wide variations in flow.

2.3.2 Capacity

Average weekday and peak weekend flows for Alternative A, B, and C were obtained from analysis of similar facilities.

2.3.2.1 Alternative A and B

Real-time data from similar facilities and previous project wastewater flow projections were compared and the most conservative was used to estimate the unit flows for the proposed Project. An occupancy level factor was used to estimate flows during daytime and evening hours for a typical weekday and weekend. The average day flow was estimated using the weighted average of the weekday and weekend estimated flow projections. These projections are based on the Alternative A and Alternative B space program provided by Acorn. **Table 2-5** summarizes the projections of wastewater volumes generated by Alternative A. **Table 2-6** summarizes the projections of wastewater volumes generated by Alternative B. For the full flow projection table see **Appendix A**.

Table 2-5: Projected Wastewater Flows for Alternative A

Area Description	Estimated Occupancy			Wastewater Flow (gpd)	
	Number	Units	gpd/Unit	Wt. Average	Weekend
Casino Gaming and Support Areas	114,345	SF	0.6	38,000	51,000
Retail	2,250	SF	0.05	60	80
Coffee Shop	2,750	SF	2.6	4,000	5,000
Food Hall	465	Seats	60	15,000	21,000
Restaurants (5)	1,240	Seats	70	48,000	65,000
Bars (2)	17,755	SF	0.7	6,000	8,000
Lounges (2)	29,285	SF	0.5	7,000	10,000
Service Bar/Unassigned	19,815	SF	0.1	1,000	1,000
Event Center	2,800	Seats	35	34,000	59,000
Ballroom (2)	44,900	SF	0.75	10,000	24,000
Spa	13,930	SF	0.1	1,000	1,000
Hotel	400	Rooms	250	53,000	70,000
Support Facilities[1]	1	LS		14,000	19,000
Total Wastewater Generated				**232,000**	**335,000**

Notes:
1. Support facilities are lump sum values for back-of-house for Casino and hotel combined.
2. All flows are rounded to the nearest 1,000 gpd.
3. Total wastewater generated sum may be off due to rounding of individual facility wastewater generated.
4. Weighted average is the sum of the weekday flows over four days plus the sum of the weekend flows over three days divided by seven days.

Based on the wastewater generation rates identified in **Table 2-5**, the WWTP must have the capability to treat and/or convey the Project's maximum weekend demand of approximately 335,000 gpd.

Table 2-6: Projected Wastewater Flows for Alternative B

Area Description	Estimated Occupancy			Wastewater Flow (gpd)	
	Number	Units	gpd/Unit	Wt. Average	Weekend
Casino Gaming and Support Areas	114,345	SF	0.6	38,000	51,000
Retail	2,250	SF	0.05	60	80
Coffee Shop	2,750	SF	2.6	5,000	6,000
Food Hall	465	Seats	60	15,000	21,000
Restaurants (5)	1,240	Seats	70	48,000	65,000
Bars (2)	17,755	SF	0.7	6,000	8,000
Lounges (2)	20,735	SF	0.5	5,000	7,000
Service Bar/Unassigned	19,815	SF	0.1	1,000	1,400
Ballroom	12,400	SF	0.75	3,000	7,000
Spa	13,930	SF	0.1	1,000	1,000
Hotel	200	Rooms	250	26,000	35,000
Support Facilities[1]	1	LS		10,000	13,000
Total Wastewater Generated				**158,000**	**215,000**

Notes:
1. Support facilities are lump sum values for back-of-house for Casino and hotel combined.
2. All flows are rounded to the nearest 1,000 gpd.
3. Total wastewater generated sum may be off due to rounding of individual facility wastewater generated.
4. Weighted average is the sum of the weekday flows over four days plus the sum of the weekend flows over three days divided by seven days.

Based on the wastewater generation rates identified in **Table 2-6**, the WWTP must have the capability to treat and/or convey the project's maximum weekend demand of approximately 215,000 gpd.

2.3.2.2 Alternative C

Wastewater flow projections for Alternative C were estimated using the same method as presented in **Section 2.3.2.1** for Alternative A and B, except for the winery. Alternative C projections are based on the space program provided by Acorn.

The estimation of wastewater flows generated by the wine-making process was based on real-time data and experienced personnel from similar facilities. The quantity of process wastewater generated is approximately proportional to the number of cases of wine produced annually. To calculate the total annual estimated wastewater flow, the number of cases is then multiplied by the efficiency of the processes; larger wineries tend to have more efficient processes. The approximate efficiencies are:

Small Wineries (less than 20,000 cases/year) – 7 gal/case

Medium Wineries (20,000-50,000 cases/year) – 4.8 gal/case

Large Wineries (greater than 50,000 cases/year) – 2.5 gal/case

Acorn has identified the proposed winery as a small facility with a proposed production of 15,000 cases per year. Since this would be a new facility, we would expect the efficiency of production to be better than an existing or older facility, thus the efficiency ratio used for the calculation of winery flows is 4.8 gallons per case.

Most of the water use, and wastewater generation, occurs during the crush season. Crush season is typically between September and November and is based on the climate, which varies from year to year – hotter weather typically results in an earlier crush season. For this analysis, it was assumed that the crush season occurred in October as the worst-case scenario for the facility since precipitation is beginning to increase thus irrigation demand is decreasing and seasonal surface water discharge is limited for this month. It was also assumed that 90% of the annual process wastewater flow for the winery occurs during the crush season, while the remaining 10% is distributed over the remainder of the year.

The length of the crush season also varies by winery size – smaller wineries have a shorter crush season because they are crushing a smaller quantity of grapes. Small wineries can spend one to two weeks crushing, while larger wineries can extend to two months. For this analysis, it was assumed that crush would occur within one month.

Anticipated crush flows were applied to the month of October and the average daily wastewater flow was calculated by dividing the total crush season flows by 31 days. Average daily wastewater flow for the remainder of the year (non-crush season) was calculated by dividing the remaining flow by the remaining number of days in the year – 11 months (334 days) for this analysis.

Alternative C projections for wastewater volumes generated are summarized in **Table 2-7**. Wastewater volumes for the winery represent typical flow during crush season.

Table 2-7: Projected Wastewater Flows for Alternative C

Area Description	Estimated Occupancy			Wastewater Flow (gpd)	
	Number	Units	gpd/Unit	Wt. Average	Weekend
Dining	4,700	SF	2.6	6,700	9,200
Winery[5]	20,000	SF		2,200	2,200
Visitor Center	2,500	SF	0.05	70	90
Tasting Room	2,500	SF	0.3	400	600
Spa	14,000	SF	0.1	1,000	1,300
Hotel	200	Rooms	250	26,400	35,000
Lobby	5,000	LS		3,300	5,000
Total Wastewater Generated				**40,100**	**53,400**

Notes:
1. All flows are rounded to the nearest 1,000 gpd.
2. Total wastewater generated sum may be off due to rounding of individual facility wastewater generated.
3. Weighted average is the sum of the weekday flows over four days plus the sum of the weekend flows over three days divided by seven days.
4. The visitor center (building area of 5,000 SF) includes a section for a tasting area. The tasting area is assumed to be 50% of the visitor center area building space.
5. The winery flow projections represent typical average daily flow during crush season for one month. The water balance reflects the wastewater flow variation by month.

Based on the wastewater generation rates identified in **Table 2-7**, the WWTP must have the capability to treat and/or convey the project’s maximum weekend demand of approximately 53,400 gpd.

2.3.2.3 Summary of Alternative WWTP Design Flows

Based on the weekend capacity, **Table 2-8** identifies the proposed design flows for the WWTP for Alternative A, B, and C. The design flows are higher than the projected flows in order to provide a safety factor for design to account for the typical diurnal variation. Additional storage will also be provided for equalization of the peak daily flows.

Table 2-8: WWTP Design Flows for Alternative A, B & C

Program Alternative	Parameter	Projected Wastewater Flow (gpd)	Design flow (gpd)
Alternative A	Average Daily Flow	232,000	300,000
	Average Weekend Flow	335,000	400,000
Alternative B	Average Daily Flow	158,000	200,000
	Average Weekend Flow	215,000	300,000
Alternative C	Average Daily Flow	40,100	50,000
	Average Weekend Flow	53,400	75,000

The wastewater treatment facilities for Alternative A and Alternative B must be designed with a wastewater treatment capacity of 400,000 and 300,000 gpd, respectively. For Alternative C, wastewater treatment facilities must be designed with a treatment capacity of 75,000 gpd.

2.3.3 Wastewater Treatment Facilities

Treatment for wastewater from the proposed alternatives would require the construction of an on-site WWTP to provide primary, secondary, and tertiary treatment of on-site sewage for both reuse and discharge on-site. The proposed location for an on-site WWTP is in the southeast corner of the property. However, there are significant space limitations within the site that require any wastewater treatment process to provide high quality effluent on a small footprint.

A proposed on-site WWTP treatment process for Alternative A would include:

- Coarse Screening Facility
- Influent Pump Station
- Headworks
- Equalization
- Packaged Immersed Membrane Bioreactors (MBRs)
- UV Disinfection & Chlorination
- Sludge Storage and Dewatering Station
- Plant Drain and Supernatant Return Pump Station
- Effluent Pump Station, and
- Operations Building

This treatment process was selected for various reasons, including: 1) the desire for a small footprint for an on-site WWTP, 2) the proven effectiveness of this process at other similar facilities, and 3) the production of high-quality effluent suitable for reuse and discharge. The justification for selection of the MBR treatment process is summarized below. A proposed location for the different alternative wastewater facilities is shown in **Figure 2-1, Figure 2-2** and **Figure 2-3**.

MBRs have successfully treated wastewater for similar-sized gaming facilities with discharge permits at other local gaming facility sites. The MBR treatment process is a tertiary treatment process similar to an activated sludge treatment plant, but with membranes immersed in an aeration basin. A typical MBR system consists of an anoxic tank for denitrification of the plant influent, followed by an aeration tank for oxidation of organic matter and nitrification. Membrane cartridges are suspended at the effluent end of the aeration tank. The membranes have a pore size in the sub-micron range, and are able to filter out most of the coliform bacteria and solids. Water is drawn through the membranes by blowers, which pull a slight vacuum and force this permeate into the center of the spaghetti-strand shaped membranes. Solids are left in the aeration tank for recirculation to the anoxic zone and/or wasting to solids handling process(es).

Effluent from these types of MBR plants typically contain no suspended solids and have a turbidity of less than 0.2 NTU. This treatment typically results in producing MBR effluent of excellent quality. The MBR process also provides aeration, nitrification, and denitrification processes within a compressed footprint. These processes have the effect of producing effluent with a neutral pH, lower nitrogen concentrations, and lower phosphorous concentrations than alternative tertiary treatment processes.

The MBR treatment process is capable of producing effluent meeting the Title 22 coliform bacteria effluent requirements without the use of chlorine or other common disinfectants. Other tertiary treatment systems typically require a disinfection process to meet the effluent coliform requirement. However, in order to comply with treatment and water reuse regulations, both a UV disinfection and chlorine disinfection processes will be provided downstream of the MBR processes.

Although the MBR treatment process is somewhat sophisticated, it is relatively simple to operate and maintain due to the absence of traditional WWTP components such as clarifier mechanisms or drives. In addition, there is a long history of effectiveness at similar facilities.

Operation: Typically, wastewater will flow by gravity from the facilities through a grease interceptor, coarse screening facility, and then into an influent pump station. The coarse screening facility would remove larger solids and debris that are typically found in Casino/hotel sewage. The influent pump station will lift the wastewater to the plant headworks facilities through a pressurized sewer main. After passing through the headworks, wastewater will flow by gravity to the influent distribution channel. The distribution channel will be used to distribute wastewater to the parallel MBR trains. Each train will be equipped with an anoxic basin and an aeration basin to provide oxidation, nitrification, and denitrification. Water will flow out of the aeration basin and into a membrane chamber that will be shared by both process trains. Permeate will be extracted through the membranes and conveyed to either the UV disinfection or chlorine disinfection processes. Water intended for reuse on-site for Title 22 purposes will be chlorinated with sodium hypochlorite. Water intended for discharge to the creek will be UV disinfected. The proposed wastewater flow diagram is shown in **Figure 2-5**.

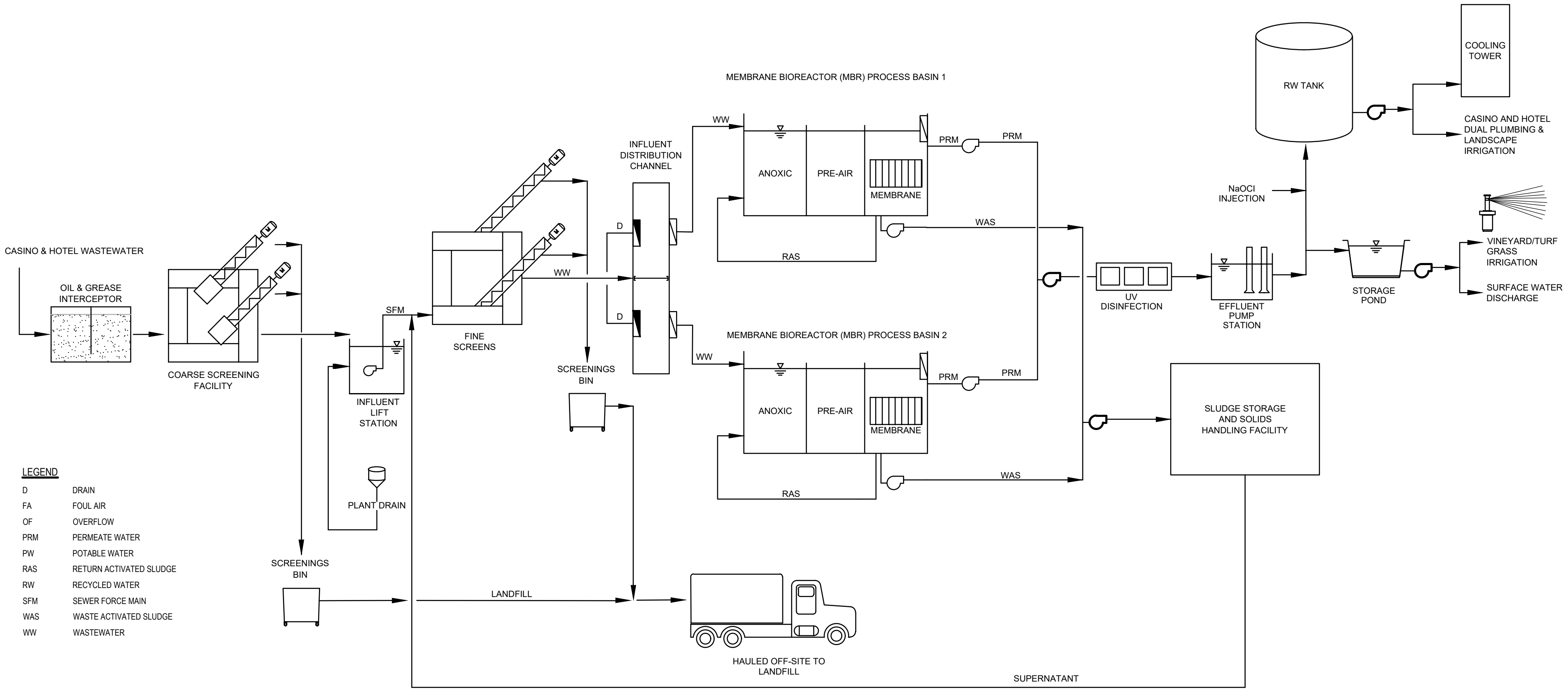

Figure 2-5
Acorn Environmental
Shiloh Resort and Casino Project Water and Wastewater Feasibility Study
Wastewater Treatment Process Flow Diagram

HydroScience

2.3.4 Effluent Disposal

The on-site WWTP will treat wastewater to a tertiary level and allow the Project to consider a wide range of effluent disposal options. Tertiary treatment is typically defined as a process that has undergone primary treatment consisting of a gravity settling process, secondary treatment consisting of a biological process, and tertiary treatment consisting of both a filtration and a disinfection process. These treatment processes can be combined into one process spanning the different types of treatment.

Recycled water will be used in the casino/hotel restrooms for toilet and urinal flushing that will meet Title 22 criteria. Although the use of recycled water in the restrooms of the casino/hotel is on Trust lands, the recycled water quality will be designed to produce the equivalent water quality to disinfected tertiary recycled water as defined by Title 22. In general, this quality of recycled water is approved for all approved non-potable uses in the state of California.

Recycled water will also be used for cooling tower makeup. Using treated effluent for cooling tower makeup will help reduce storage requirements through cooling tower drift, evaporation system leakage losses, and blowdown. The brine generated as a byproduct of the recycled water treatment will be hauled offsite. The East Bay Municipal Utility District (EBMUD) accepts and treats a variety of liquid and solid wastes and offers a convenient disposal location 24 hours a day, seven days a week, 365 days a year. Other common disposal alternatives include evaporative ponds, disposal to ocean, deep well injection, incineration, additional treatment to concentrate waste, etc. Given the limited area for additional treatment or evaporative ponds, it is anticipated that the brine will be disposed of off-site. Estimation for brine volume, concentration, and disposal will be determined based on source water quality, generated wastewater volume and quality, and specific treatment components.

In order to evaluate other wastewater disposal strategies, the following assumptions were made:

- Recycled water use on-site will be maximized.
- The Project must identify a reliable wet season disposal method.
- The Project must comply with all applicable regulatory requirements.

Permitting Requirements: The new on-site WWTP will be located on Trust lands. Thus, project permitting will be regulated by the United States Environmental Protection Agency (USEPA). The USEPA is expected to implement the equivalent standards that would be adopted by the Regional Water Quality Control Board for discharges onto state lands, as defined by the Basin Plan. For additional information on the expected permitting requirements, the reader is referred to **Section 4.2**.

The following three potential methods of wastewater discharge are further discussed in this section:

- Vineyard and landscape irrigation
- Seasonal surface water discharge
- Seasonal storage pond

The beneficial uses of the potential receiving waters will also be identified because these uses must be maintained and protected from potential pollutants.

2.3.4.1 Vineyard and Landscape Irrigation

The primary criteria used to determine the required landscape irrigated acreage are evapotranspiration (ET) rates and precipitation information. Water demands per acre of irrigated area are calculated for each month based on evapotranspiration (ET) rates and precipitation records with an additional factor to account for a very wet year. This monthly demand is then used to calculate an annual disposal capacity per acre in such a wet year.

ET Rates: ET is a measure of water usage by a particular plant or crop, and is a function of the net solar radiation, air temperature, wind speed, and vapor pressure in a particular location. Evapotranspiration rates for a specific crop in a specific location are calculated on a monthly basis by the following equation:

$$ET = ET_o * k_c$$

where:

ET_0 = *Normal year reference crop evapotranspiration rate for a given geographic location (California Department of Water Resources [DWR], California Irrigation Management Information System [CIMIS] database)*

k_c = *Crop coefficient for a given crop (DWR Leaflets)*

For this Project, reference crop normal year evapotranspiration rates (ET_0) for the CIMIS station closest to the area were obtained from the DWR CIMIS database. Crop coefficients for cool weather turf grasses were obtained from University of California, Division of Agriculture and Natural Resources Center for Landscape and Urban Horticulture. Calculated ET rates and irrigation demands are shown in **Table 2-9**.

Precipitation: Precipitation data was obtained from the National Oceanic and Atmospheric Administration's (NOAA) online database using the closest station to the Project site. Monthly rainfall values from 1999 through the present were averaged to obtain typical monthly rainfall data.

Estimated Unit Irrigation Demands: Typical monthly unit irrigation demands for turf grasses are summarized in **Table 2-9** and were calculated using the following formula:

$$ID = \frac{(ET - Pe_p)l_r}{e_i}$$

where:

ID = *Irrigation demand in inches*

ET = *Evapotranspiration for turf grasses*

P = *Average precipitation, NOAA*

e_p = *Precipitation irrigation efficiency, 0.95. Assumes 0.5% of rainfall during growing season is lost to evaporation, runoff, etc.*

l_r = *Loss Rate, equal to 1.05. This assumes that approximately 5% of the applied water passes through the grass root zone and is lost.*

e_i = Irrigation efficiency, varies throughout the year between 0.60 in the summer and 0.95 in the winter. This assumes that 5-40% of the applied irrigation water is lost to the environment. For planning purposes an irrigation efficiency of 0.80 was used.

Table 2-9: Typical Irrigation Demands for Regional Turf Grasses

Month	ET (Inches)	P (Inches)	ID (Inches)	ID (Feet)
January	0.78	5.35	0.00	0.00
February	1.24	5.61	0.00	0.00
March	2.17	3.92	0.00	0.00
April	4.01	1.88	2.79	0.23
May	5.15	0.92	5.55	0.46
June	6.04	0.24	7.61	0.63
July	6.04	0.01	7.91	0.66
August	5.27	0.01	6.91	0.58
September	4.11	0.14	5.21	0.43
October	2.20	2.00	0.27	0.02
November	1.07	3.16	0.00	0.00
December	0.72	6.75	0.00	0.00
Total	**38.81**	**30.00**	**36.26**	**3.02**

Notes:

1. The irrigation demand shown is for average rainfall. A lower irrigation demand was used in the 100-year annual precipitation event.

As shown, above, in **Table 2-9**, the typical annual unit irrigation demand for grasses is estimated at 36.3 inches or 3.02 feet.

Vineyards use much less water than turf grasses. To estimate irrigation demands for vineyards, local vineyard irrigation sources containing typical irrigation rates for Windsor, Carneros, Napa, and Sonoma County were consulted. For the purpose of this document, annual demands for vineyards were estimated to be 0.317 AF per acre.

Sizing: The irrigated areas are limited by the proposed Project site plan for Alternative A and Alternative B. The irrigated areas include on-site landscaping for the proposed Project and no capacity to expand or increase irrigation areas is available unless vineyard area is reduced (and replaced with a crop with a higher ET) or an off-site landscaped area alternative is identified.

2.3.4.2 Surface Water Discharge

For discharge of treated wastewater to the Russian River or its tributaries, a NPDES discharge permit is required. Any discharge to the Russian River and tributaries would be regulated by the RWQCB. Discharge to the creek would involve applying for a NPDES permit, which allows discharges to surface water in accordance with the Federal Clean Water Act and applicable provisions of the Water Quality Control Plan for the North Coast Region (Basin Plan). It is understood that the Basin Plan requirements do not apply to Tribal lands. However, the proposed effluent limitations identified in this Section are consistent with the Basin Plan.

The amount of effluent discharge allowed by the Basin Plan is typically limited to a percentage of the measured streamflow in the Russian River at the point of discharge. The initial permit point of the compliance would probably be granted based on conditions at the actual point of discharge. In all local discharge permits reviewed in this document, the existing USGS flow gauging station most representative of the flow in the receiving water was used for the purposes of complying with Basin Plan mandated limitations for flow. The most likely flow monitoring location would be at the USGS gauging station at Mark West Creek (USGS #11466800). The gauging station is shown on **Figure 2-6**. Gauging station #11466800 is the station closest to the Project site and directly downstream of the proposed discharge location near Mirabel Heights, CA. Historical flow data for gauging station #11466800 is shown in **Table 2-10**. This is the most practical site to determine flows, since data has been collected for over five years, and real-time data is available. This gauging station is located downstream of the confluence of Windsor Creek and Mark West Creek. Based on flow records obtained from this station, it is feasible to meet a 1% dilution requirement based on the project makeup and proposed wastewater treatment and disposal facilities using data from this station as the basis for the flow limitation in the Project’s NPDES permit.

To comply with the surface water rate discharge flow limitation, it is expected that the WWTP will need to limit effluent discharge to Pruitt Creek to 1% of the measured flow in Mark West Creek at USGS Gauging Station #11466800 near Mirabel Heights, CA.

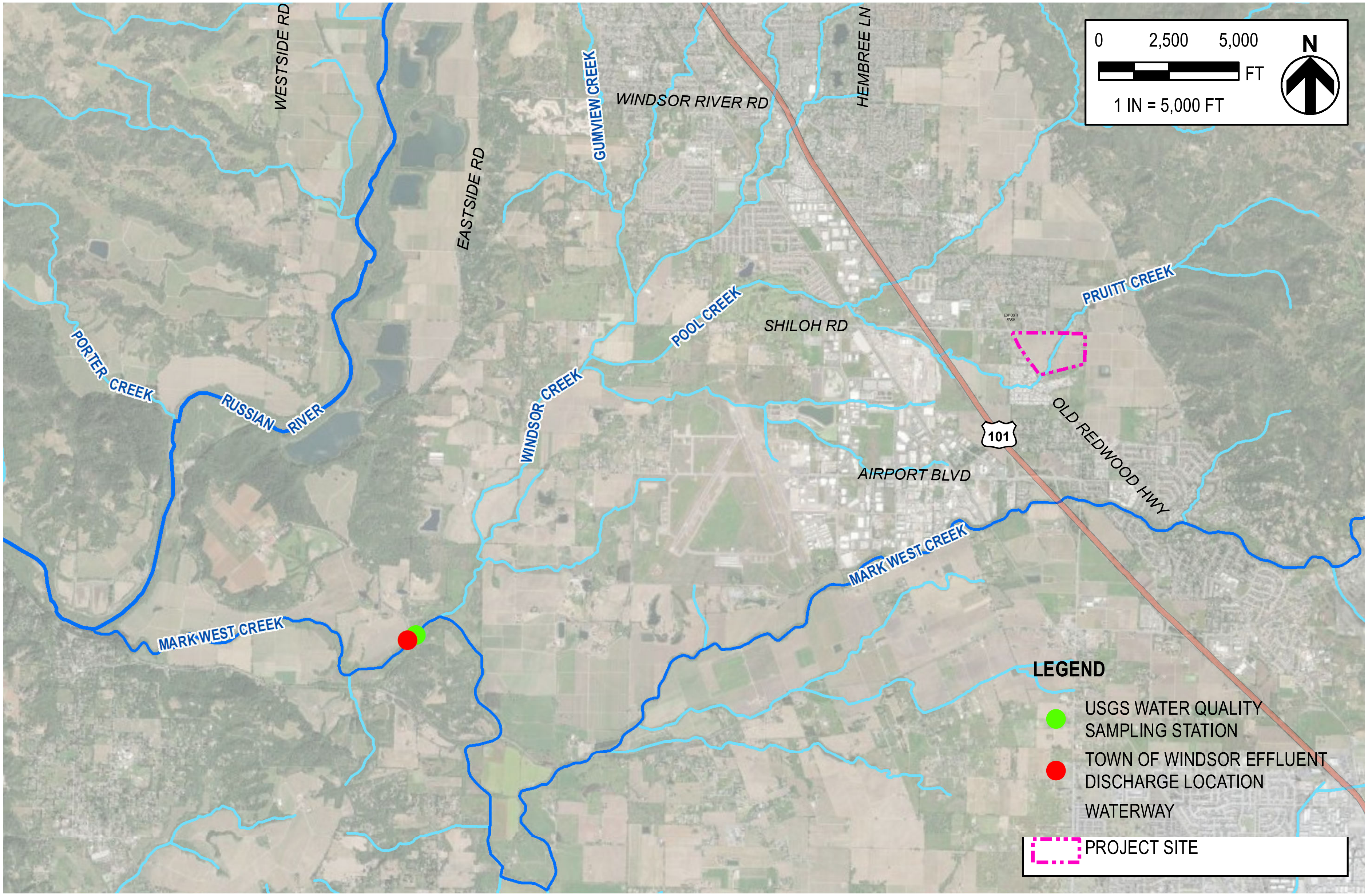

Figure 2-6

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USGS Gauging Station Location

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Seasonal Surface Water Discharge

Seasonal surface water discharge means the utilization of different effluent disposal options during the dry and wet seasons to address local season-specific regulatory and environmental concerns. The use of different seasonal effluent disposal options is a common practice in the State of California. The disposal locations would be utilized only during the wet season. The wet season and dry season discharge methods are defined below.

- **Dry season (May 15 through September 30):** Disposal through a combination of on-site recycled water use for landscape irrigation, cooling towers, toilet flushing, and vineyard irrigation.
- **Wet season (October 1 through May 14):** Disposal through a combination of the dry season uses, and surface water discharge.

The RWQCB prohibits effluent discharges from WWTPs to the Russian River and its tributaries between May 15 and September 30 in their Basin Plan due to significant seasonal flow variations for the Russian River tributaries during the summer and winter months. Their goal was to ensure that these water bodies do not become effluent dominated streams. Discharges during the wetter winter months (October 1 to May 14) when flows are higher are typically allowed to be a certain percentage of the average daily streamflow. It is likely that any new WWTP discharge would be subject to similar seasonal discharge requirements. It is not expected that year-round discharges to a tributary of the Russian River would be permitted by the USEPA under any circumstances as the USEPA typically permits projects discharging onto trust lands in a similar manner as the RWQCB. The Basin Plan also limits discharges of wastewater effluent to a percentage of the streamflow at the point of discharge. Although the proposed discharge location is more than 5.5 miles from an active USGS gauging station, historical streamflows are known and can be used as a basis for streamflow data. However, the percentage of the total streamflow the USEPA will allow the Project to discharge is unknown.

The monthly streamflow statistics for the USGS gauging station at Mark West Creek are presented in **Table 2-10**. From this data, it is apparent that discharges immediately before and after the summertime months (May and October) may be limiting for the project, and that streamflow rates are highly variable from year to year. For conservatism, the water balance used for this Project utilizes the dry year averages (2012-2015) for projecting the allowable 1% discharge to Pruitt Creek. Thus, for any discharge scenario developed for the Project, backup contingency plans should be developed for low flow conditions. **Table 2-10** suggests that at a minimum, discharge of at least 72,000 gpd could be permitted in Pruitt Creek during the month of October, with more allowed during the wetter winter months.

Table 2-10: Daily Average Streamflow at USGS Gauging Station #11466800

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2005										14	37	1,516
2006	1,317	487	1,585	1,282	83	29	12	7	4	10	52	315
2007	72	815	194	88	35	9	3	2	2	26	16	159
2008	1,369	719	101	35	14	5	2	0	0	2	36	
2009	29			39		11	3	1	0		13	56
2010						41	11	4	2			
2011										21	26	15
2012	360	73	841	353	41	11	3	1	1	5	164	1,497
2013	157	57	48	73	15	15	7	2	2	1	5	10
2014	5	807	343	308	19	6	1	0	4	3	22	1,368
2015	60	404	42	37	14	5	1	0	0	0	2	127
2016	964	141	1,461	78	30	8	1	0	0	64	193	794
2017	2,525	2,426	364	461	57	18	5	2	1	1	74	24
2018	305	53	653	491	38	12	3	2	1	7	62	175
2019	821	2,234	1,385	268	161	37	9	3	1	1	7	347
2020	241	81	35	61	29	5	1	0	0	0		
Avg. Monthly, cfs	633	691	588	275	45	15	4	2	1	11	51	493
Avg. Monthly, MGD	409	447	380	178	29	10	3	1	1	7	33	318
Calculated 1% Daily Flow Values (gpm)												
1% of Avg. Monthly	2,840	3,103	2,637	1,234	200	0	0	0	0	50	227	2,211

Notes:
Blank cells signify monthly flow data is incomplete. Blank readings are not counted in calculating average flows.

Beneficial Uses of Potential Receiving Waters

The receiving water, Pruitt Creek, is a tributary of the Russian River. The North Coast RWQCB assigned existing and potential beneficial uses to Mark West Creek and to the Russian River. Beneficial uses that are assigned to a surface water are applicable to its tributaries. Any surface water discharge by the Project to Mark West Creek would be designed to comply with the beneficial uses and water quality objectives of that water body, as well as the Russian River. It is understood that the Basin Plan requirements do not apply to Tribal lands.

Beneficial uses for both Mark West Creek and the Russian River are listed in **Table 2-11**.

Table 2-11: Beneficial Uses of Mark West Creek and Russian River

Beneficial Uses		Category
MUN	Municipal and Domestic Supply	E
AGR	Agricultural Supply	E
IND	Industrial Service Supply	E
PRO	Industrial Process Supply	P
GWR	Groundwater Recharge	E
FRSH	Freshwater Replenishment	E
NAV	Navigation	E
POW	Hydropower Generation	P
REC1	Water Contact Recreation	E
REC2	Non-Water Contact Recreation	E
COMM	Commercial and Sport Fishing	E
WARM	Warm Freshwater Habitat	E
COLD	Cold Freshwater Habitat	E
WILD	Wildlife Habitat	E
RARE	Rare, Threatened, or Endangered Species	E
MIGR	Migration of Aquatic Organisms	E
SPWN	Spawning, Reproduction, and/or Early Development	E
SHELL	Shellfish Harvesting	P
EST	Estuarine Habitat	E
AQUA	Aquaculture	P

Source: Basin Plan, updated June 2018, North Coast Region.
Notes:
E = Existing beneficial uses
P = Potential beneficial uses

Existing beneficial uses are uses as they exist at the present time, while potential uses are uses that:

- May have existed prior to November 1975;
- Are attainable via future plans;
- Conditions make future use likely;
- Have identified the water as a potential source of drinking water based on the quality and quantity available;
- May be classified as an existing use after future review; or
- Are listed as future water quality goals for possible use.

Beneficial uses of Waters of the United States are uses that must be protected against water quality degradation, and reflect the demands on the water resources for this stream. Water quality objectives for Mark West Creek are based on the identified beneficial uses. Some of these water quality objectives are summarized in **Table 2-12**.

Table 2-12: Water Quality Objectives of Receiving Waters

Parameter	Description
Color	Water shall be free of coloration that causes a nuisance or adversely affects beneficial uses.
Taste & Odor	Water shall not contain taste or odor producing substances in concentrations that impart undesirable tastes or odors to fish flesh or other edible products of aquatic origin, or that causes nuisance or adversely affect beneficial uses. For waters designated MUN, chemical constituents, radionuclides, and pesticides shall not be present at levels prohibited by the drinking water standards set forth in Title 22 of the California Code of Regulations.
Turbidity	Shall not be increased more than 20% above naturally occurring background levels.
Bacteria	In waters designated REC-1, the median fecal coliform concentration on a minimum of not less than five samples for any 30-day period shall not exceed 50 per 100 mL, nor shall more than ten percent of the total samples during any 30-day period exceed 400 per 100 mL. In waters designated SHELL, the fecal coliform concentration throughout the water column shall not exceed 43 per 100 mL for a 5-tube serial dilution, or 49 per 100 mL for a 3-tube serial dilution.
Temperature	At no time or place shall the temperature of any waters designated COLD or WARM be increased by more than five degrees Fahrenheit.
Chemical Constituents, Radioactivity, and Pesticides	For waters designated MUN, chemical constituents, radionuclides, and pesticides shall not be present at levels prohibited by the drinking water standards set forth in Title 22 of the California Code of Regulations.
Other Parameters	The following are prohibited in concentrations that cause nuisance to or adversely affect beneficial uses: floating material, suspended material, suspended sediment, settleable material, oil and grease, biostimulatory substances. Discharges containing toxic substances, pesticides, chemical constituents, or radioactivity in concentrations that impact beneficial uses are prohibited.

Source: Basin Plan, updated June 2018, North Coast Region.

2.3.4.3 Seasonal Storage Pond

The seasonal storage pond would be used to seasonally store WWTP effluent until it can be reused on-site or discharged to the surface water discharge. The regulatory requirements for the operation of seasonal storage ponds are typically minor, and the primary consideration is the disposition of the effluent contained therein. The ponds would need to be lined with a impermeable material such as clay or an impermeable plastic liner to minimize percolation into the groundwater. It is also suggested that any seasonal evaporation ponds be located downgradient from any proposed water supply well used for the Project and outside of the 100-year flood plain. There is expected to be sufficient area for pond(s) to be sited outside of the 100-year floodplain. If any pond were to be located within the 100-year floodplain, it would need to be bermed with adequate freeboard to bring the pond high water level above the 100-year flood level.

Seasonal storage ponds are sized according to the volume of disposal via all methods previously described (irrigation and surface water discharge) and the remaining carry-over volume required from month to month. Seasonal storage ponds would be significantly upsized if it were determined that the Project either could not or is limited in its ability to discharge wastewater effluent on-site.

2.3.4.4 Effluent Disposal Summary

The preferred methods for effluent disposal would include seasonal surface water discharge, maximizing on-site recycled water use including vineyard and landscape irrigation, and use of seasonal storage ponds. Provided is a description of each option under Alternative A and Alternative B:

Alternative A

- **Option 1:** During the dry season, effluent from the on-site WWTP would be recycled and used on-site for dual plumbed and cooling tower makeup, as well as for landscape and vineyard irrigation at agronomic rates. Effluent that could not be used for either purpose would be stored in the seasonal storage pond.

  During the wet season, effluent from the on-site WWTP would be recycled and used on-site for dual plumbed and cooling purposes, discharged on-site to Pruitt Creek, stored in on-site seasonal storage ponds, and used to irrigate the vineyards and landscaping at agronomic rates. The landscaped areas and vineyard would be irrigated by pumping effluent out of the seasonal storage pond. Effluent stored in the seasonal storage pond would be discharged to Pruitt Creek, tributary to the Russian River, in accordance with flow limitation requirements.
- **Option 2:** Similar to Option 1, except that seasonal storage would be accomplished with a closed tank. The primary objective is to reduce the storage footprint such that it may fit within the proposed water treatment site. A tank will have a smaller footprint but will be a taller facility. Since evaporation loss would not occur in a closed tank, this option means a larger storage volume required overall.
- **Option 3:** Similar to Option 1 with the addition of 11 acres of off-site irrigation for effluent disposal and consequently reduced seasonal storage volume required.
- **Option 4:** Similar to Options 2 and 3, which includes a seasonal storage tank, and the addition of 11 acres of off-site irrigation for effluent disposal and consequently reduced seasonal storage volume. Since evaporation loss would not occur in a closed tank, this option means a larger storage volume required over Option 3.

Option 1 and 2 strategy assumes that the Project will be able to dispose of effluent only within the project site. The second effluent disposal strategy (Option 3 and 4) assume that effluent will be disposed of to offsite turf irrigation (yet to be identified) in addition to all other disposal methods listed. Option 2 and 4 assume a closed tank will be used for seasonal storage versus an open storage pond. **Table 2-13** summarizes conceptual estimates of the seasonal storage requirements and disposal requirements for the four effluent disposal strategies for Alternative A. These estimates are preliminary and are for planning purposes only.

The Alternative A storage pond, closed tank option and disposal areas for the wet season discharge and wet season storage are shown in **Figure 2-7** through **Figure 2-10**. Portions of the areas identified for vineyards are within the 100-year flood zone. This, however, is not expected to be an issue, during periods of rain since it is assumed that the vineyards will not be irrigated during the wet season.

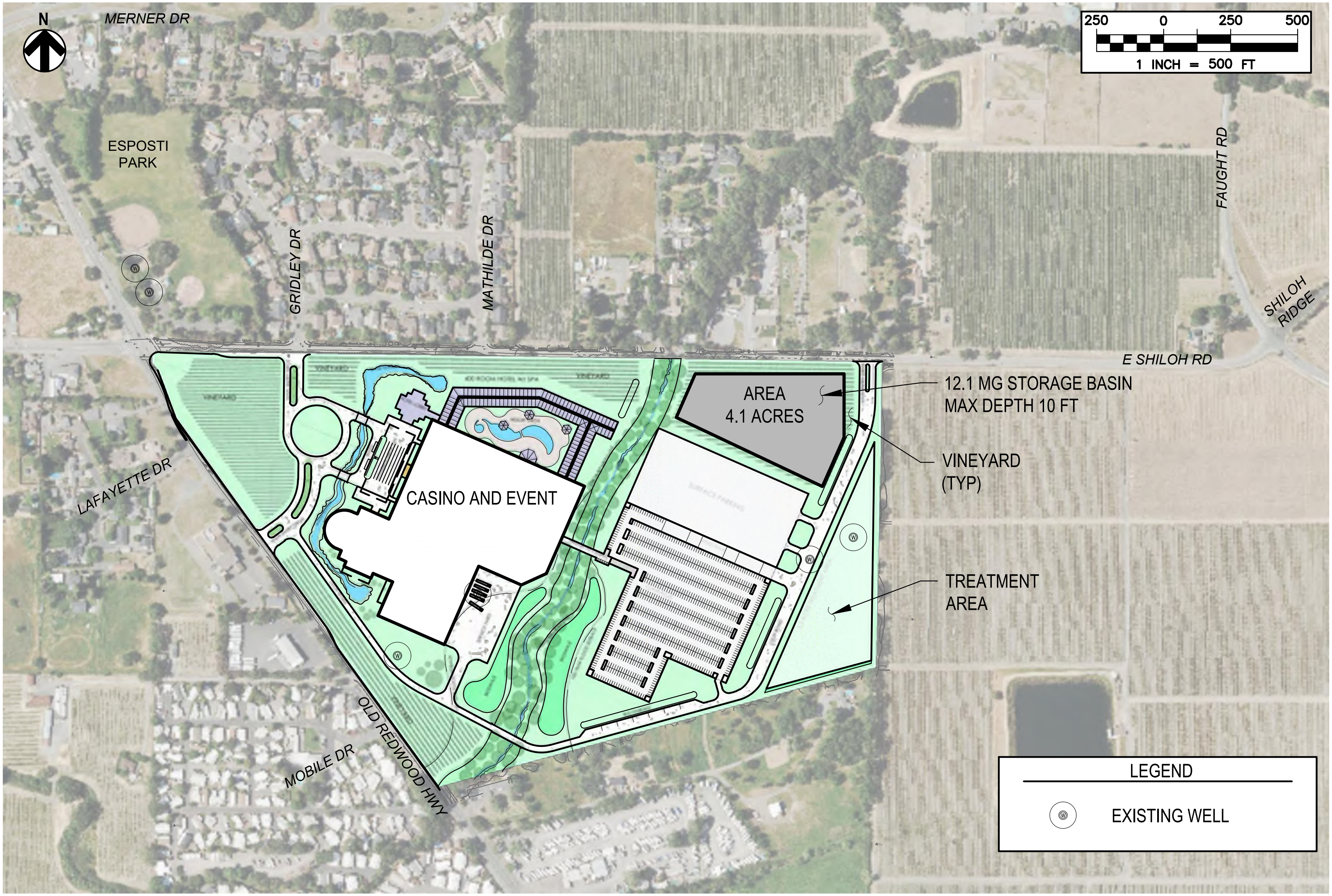

Figure 2-7
Acorn Environmental
Shiloh Resort and Casino Project Water and Wastewater Feasibility Study
Option 1 - Alternative A

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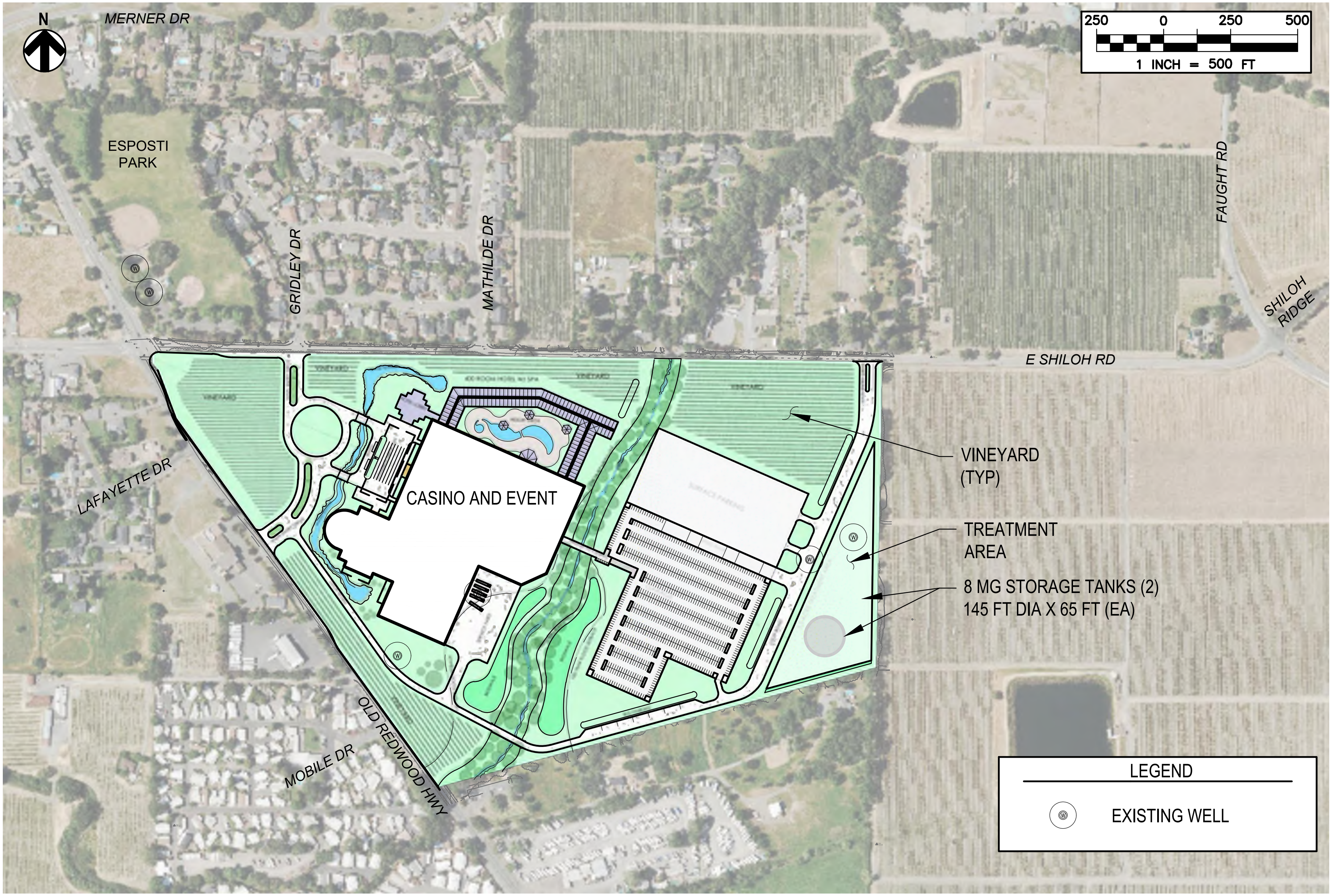

Figure 2-8
Acorn Environmental
Shiloh Resort and Casino Project Water and Wastewater Feasibility Study
Option 2 - Alternative A

HydroScience

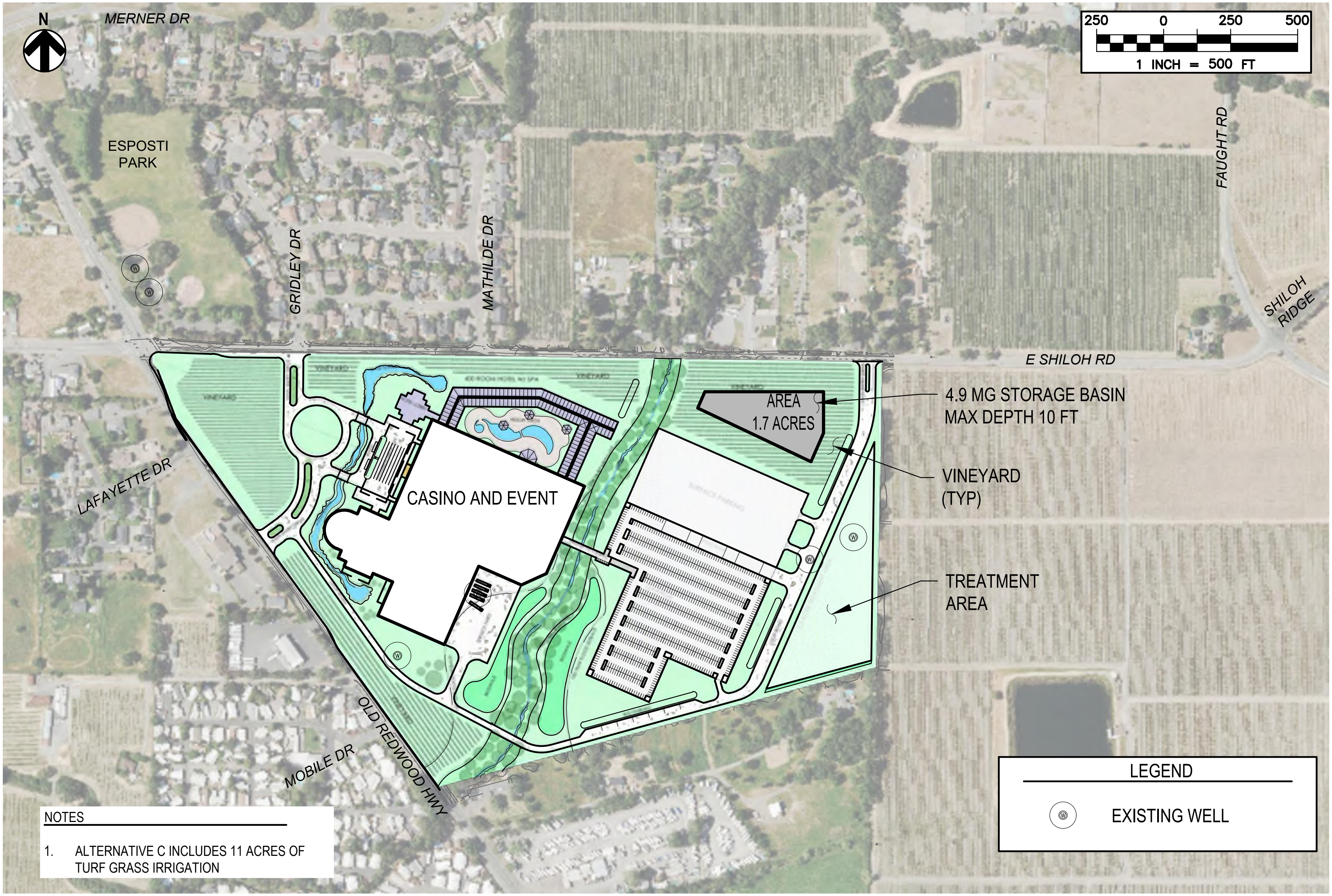

Figure 2-9
Acorn Environmental
Shiloh Resort and Casino Project Water and Wastewater Feasibility Study
Option 3 - Alternative A

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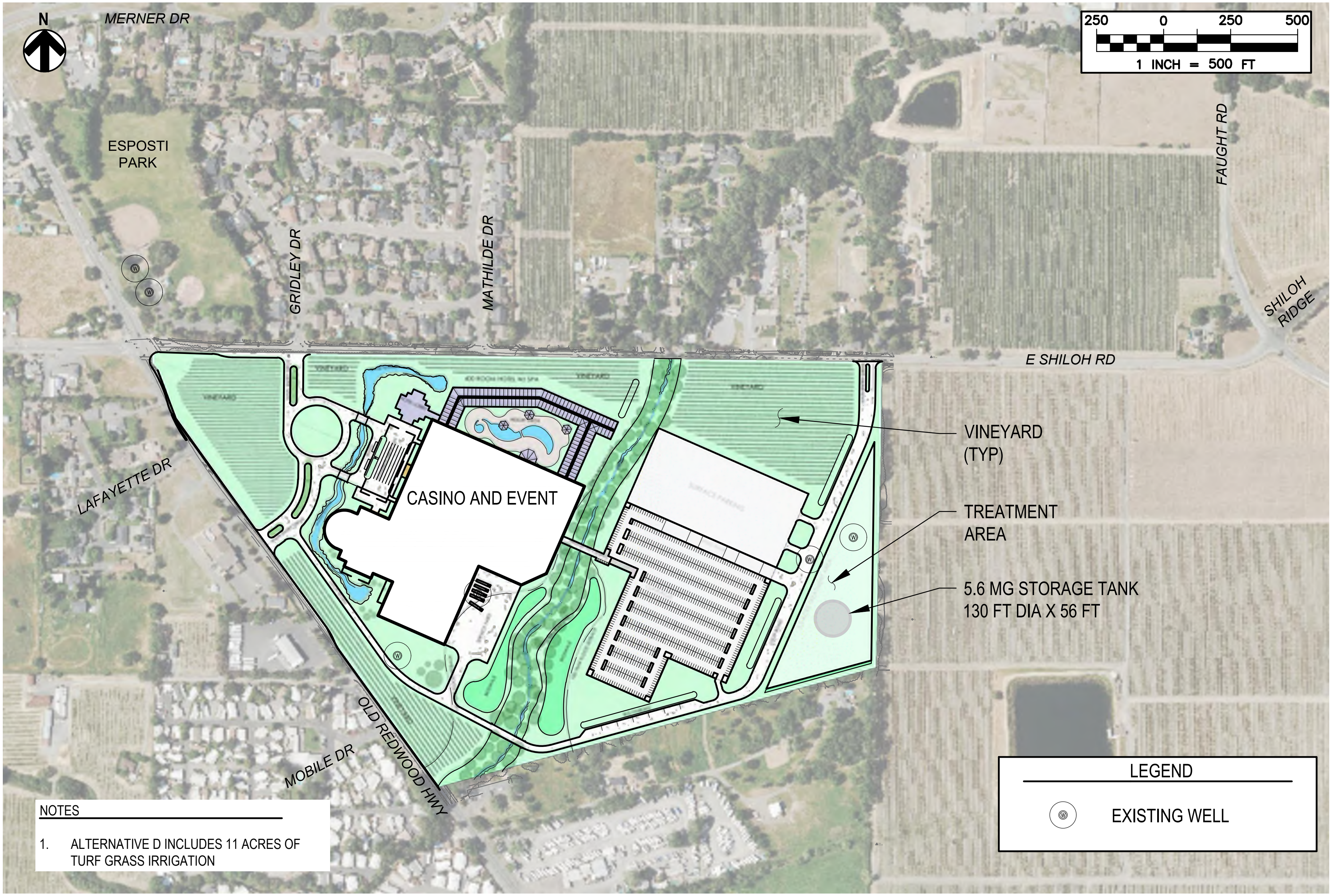

NOTES

1. ALTERNATIVE D INCLUDES 11 ACRES OF TURF GRASS IRRIGATION

Figure 2-10

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Shiloh Resort and Casino Project Water and Wastewater Feasibility Study

Option 4 - Alternative A

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Table 2-13: Estimated On-Site Seasonal Disposal Requirements for Alternative A

Seasonal Disposal Strategy	Landscape Irrigation (AF)	Vineyard Irrigation (AF)	Offsite (AF)	Surface Water Discharge (AF)	Max Storage (AF)
Option 1	13.3	3.9	0	116.1	37.1
Option 2	13.3	5.5	0	122.7	48.7
Option 3	13.3	4.8	33.2	87.2	15.0
Option 4	13.3	5.5	33.2	89.3	17.0

Notes:

1. This disposal strategy assumes that all effluent will be disposed to the irrigated areas from April to October and stored in a reservoir for surface water discharge during the wet season.
2. Offsite irrigation assumes an additional 11 acres of offsite turf grass irrigation.
3. Landscape irrigation includes 4.4 acres of irrigated area. Vineyard irrigation consists of 17.4 acres of vineyards for a total disposal area of 21.8 acres.

It is noted that for open-air storage ponds in this region, evaporative losses are estimated to be greater than precipitation captured. Thus, required storage for tanks is greater than those of storage ponds as shown in **Table 2-13**. Additional offsite turfgrass would reduce the amount of onsite seasonal storage required up to a point. The limiting month at the end of the dry season is the month of October when irrigation demand is zero and surface water discharge is limited. It is estimated that at a minimum, approximately 3.4 MG (10.6 AF) of storage (closed tank or open storage basin) would be required regardless of the available irrigation area.

Alternative B

There are two effluent disposal strategies for Alternative B.

- **Option 1:** During the dry season, effluent from the on-site WWTP would be recycled and used on-site for dual plumbed and cooling purposes and used to irrigate the vineyards and landscaping at agronomic rates. Effluent that could not be used for either purpose would be stored in the seasonal storage pond. Some amount of evaporation will also occur out of the storage pond.

  During the wet season, effluent from the on-site WWTP would be recycled and used on-site for dual plumbed and cooling purposes, discharged on-site to Pruitt Creek, stored in on-site seasonal storage ponds, and used to irrigate the vineyards and landscaping at agronomic rates. The landscaped areas and vineyard would be irrigated by pumping effluent out of the seasonal storage pond. Effluent stored in the seasonal storage pond would be discharged to Pruitt Creek, tributary to the Russian River, in accordance with flow limitation requirements.

- **Option 2:** Similar to Option 1, with the addition of 9 acres of off-site irrigation for effluent disposal and consequently reduced seasonal storage volume required.

Option 1 strategy assumes that the Project will be able to dispose of effluent to only within the project site. The second effluent disposal strategy, Option 2, assumes that effluent will be disposed of to offsite landscape irrigation in addition to all other disposal methods listed. Both options assume an open storage pond will be used for seasonal storage. **Table 2-14** summarizes conceptual estimates of the seasonal storage requirements and disposal requirements for two effluent disposal strategies for Alternative B.

These estimates are preliminary and are for planning purposes only. The Alternative B options and disposal areas for the wet season discharge and wet season storage are shown in **Figure 2-11** and **Figure 2-12**. Portions of the areas identified for vineyards are within the 100-year flood zone. This, however, is not expected to be an issue, during periods of rain since it is assumed that the vineyards will not be irrigated during the wet season.

Table 2-14: Estimated On-Site Seasonal Disposal Requirements for Alternative B

Seasonal Disposal Strategy	Landscape Irrigation (AF)	Vineyard Irrigation (AF)	Offsite (AF)	Surface Water Discharge (AF)	Max Storage (AF)
Option 1	20.2	6.3	0	66.9	13.9
Option 2	20.2	6.6	11.2	56.7	6.7

Notes:
1. This disposal strategy assumes that all effluent will be disposed to the irrigated areas from April to October and stored in a reservoir for surface water discharge during the wet season.
2. Offsite irrigation assumes an additional 9 acres of offsite turf grass irrigation.
3. Landscape irrigation includes 6.7 acres of irrigated area. Vineyard irrigation consists of 22 acres of vineyards for a total disposal area of 28.7 acres.

Additional offsite turfgrass would reduce the amount of onsite seasonal storage required up to a point. The limiting month at the end of the dry season is the month of October when irrigation demand is zero and surface water discharge is limited. It is estimated that at a minimum, approximately 2.2 MG (6.7 AF) of storage in an open storage pond would be required regardless of the available irrigation area. If Option 1 was pursued with a closed storage tank instead, then the required volume would be approximately 6 MG (18.3 AF).

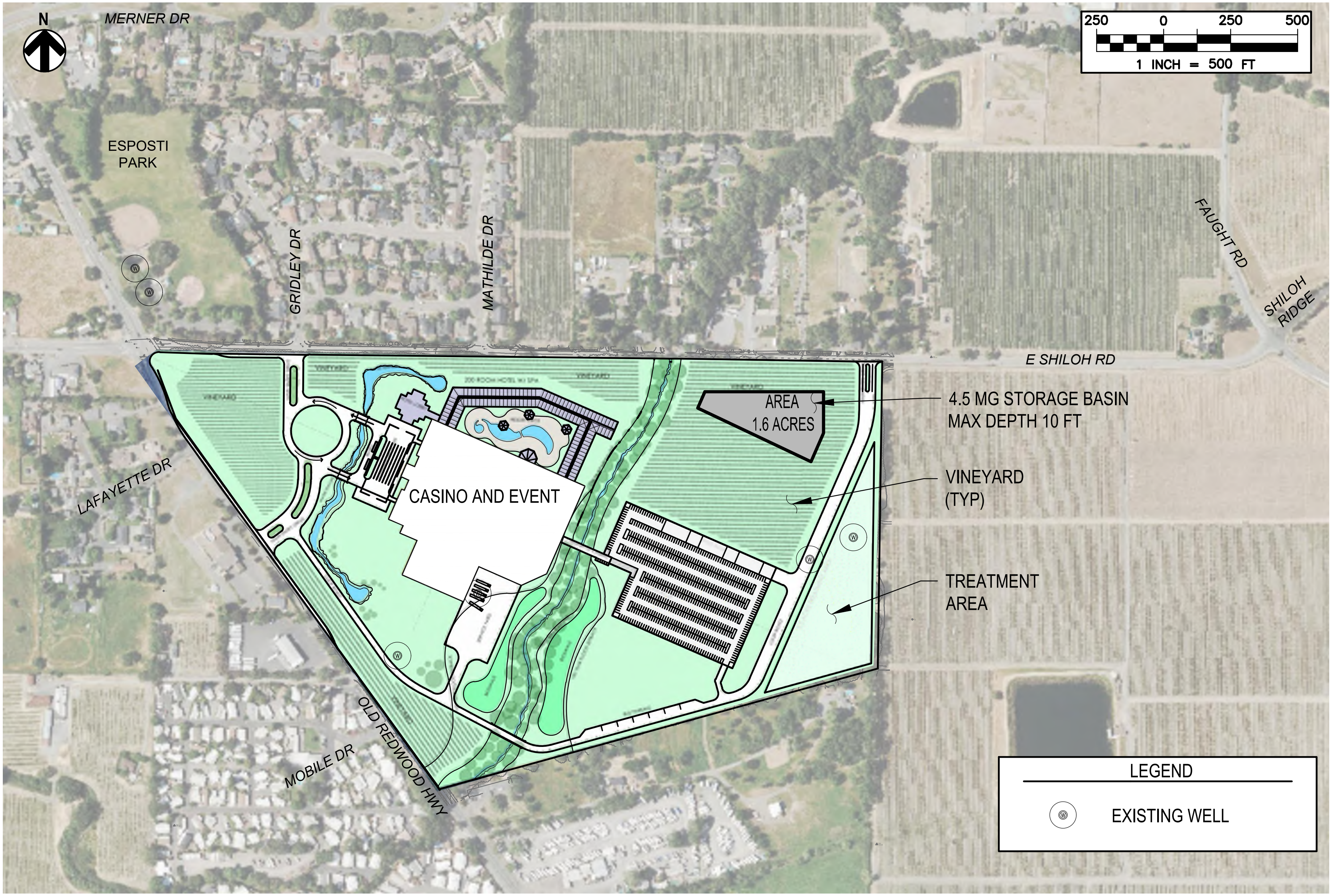

Figure 2-11
Acorn Environmental
Shiloh Resort and Casino Project Water and Wastewater Feasibility Study
Option 1 - Alternative B

HydroScience

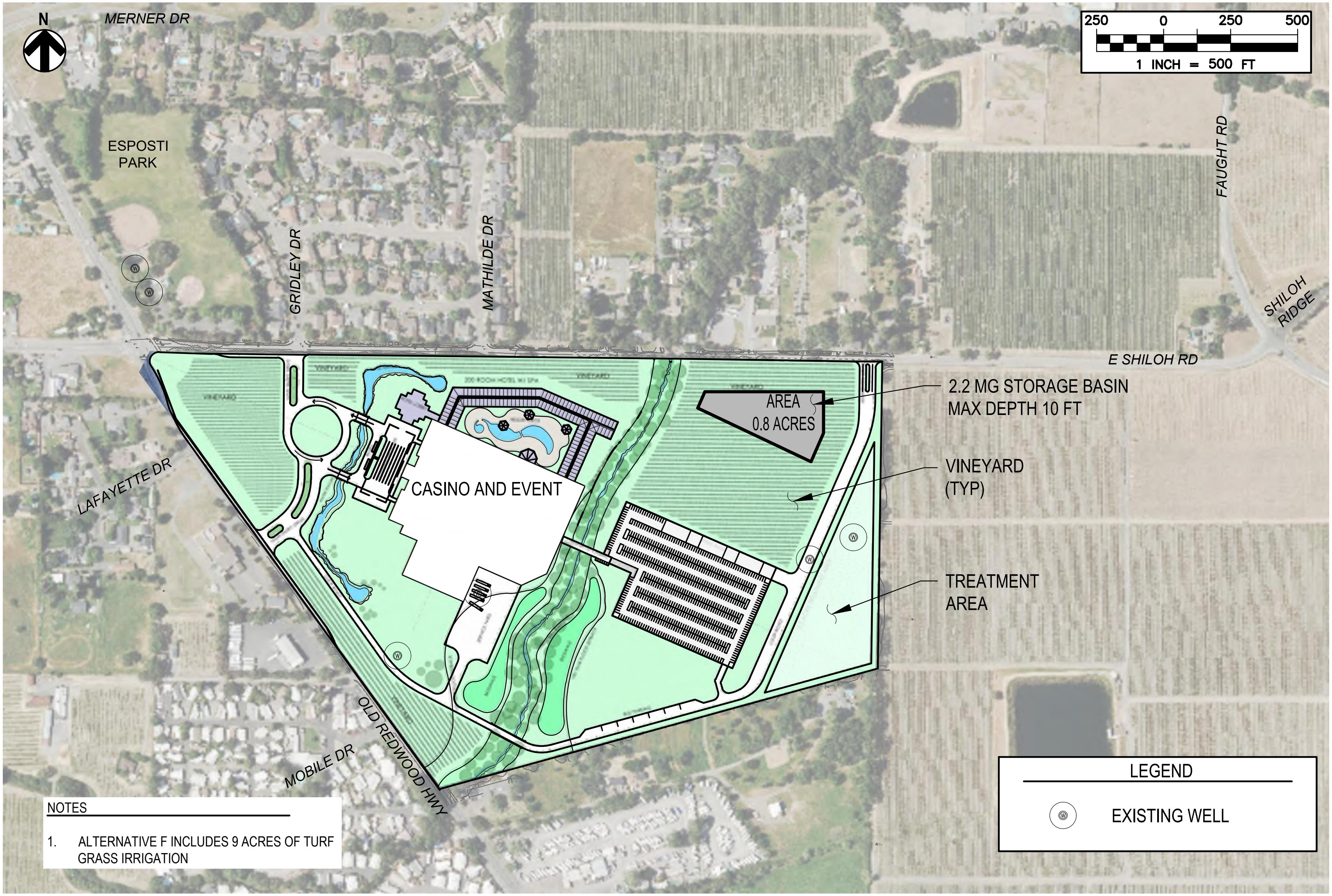

Figure 2-12
Acorn Environmental
Shiloh Resort and Casino Project Water and Wastewater Feasibility Study
Option 2 - Alternative B

HydroScience

Alternative C

There is one option identified for Alternative C given the acreage available for landscape/vineyard irrigation with recycled water.

During the dry season, effluent from the on-site WWTP would be recycled and used on-site for dual plumbed and cooling purposes and used to irrigate the vineyards and landscaping at agronomic rates. Effluent that could not be used for either purpose would be stored in the seasonal storage pond. Some amount of evaporation will also occur out of the storage pond.

During the wet season, effluent from the on-site WWTP would be recycled and used on-site for dual plumbed and cooling purposes, discharged on-site to Pruitt Creek, stored in on-site seasonal storage ponds, and used to irrigate the vineyards and landscaping at agronomic rates. The landscaped areas and vineyard would be irrigated by pumping effluent out of the seasonal storage pond. Effluent stored in the seasonal storage pond would be discharged to Pruitt Creek, tributary to the Russian River, in accordance with flow limitation requirements.

Storage is sized so that sufficient recycled water is stored through the wet season to meet the irrigation demands of the dry season.

Table 2-15: Estimated On-site Seasonal Disposal Requirements for Alternative C

Seasonal Disposal Strategy	Landscape Irrigation (AF)	Vineyard Irrigation (AF)	Offsite (AF)	Surface Water Discharge (AF)	Max Storage (AF)
Option 1	0.3	13.7	0	2.3	13.2

Notes:

1. This disposal strategy assumes that all effluent will be disposed to the irrigated areas from April to October and stored in a reservoir for surface water discharge during the wet season.
2. Landscape irrigation includes 8.3 acres of irrigated area. Vineyard irrigation consists of 45.3 acres of vineyards for a total disposal area of 53.6 acres.

As shown in **Table 2-15** above, this strategy assumes that the Project will be able to dispose of effluent to only within the project site. If this alternative was pursued with a closed storage tank instead, then the required volume would be approximately 3.4 MG (10.4 AF).

These estimates are preliminary and are for planning purposes only. The Alternative C storage and disposal areas are shown in **Figure 2-13**. Portions of the areas identified for vineyards are within the 100-year flood zone. This, however, is not expected to be an issue, during periods of rain since it is assumed that the vineyards will not be irrigated during the wet season.

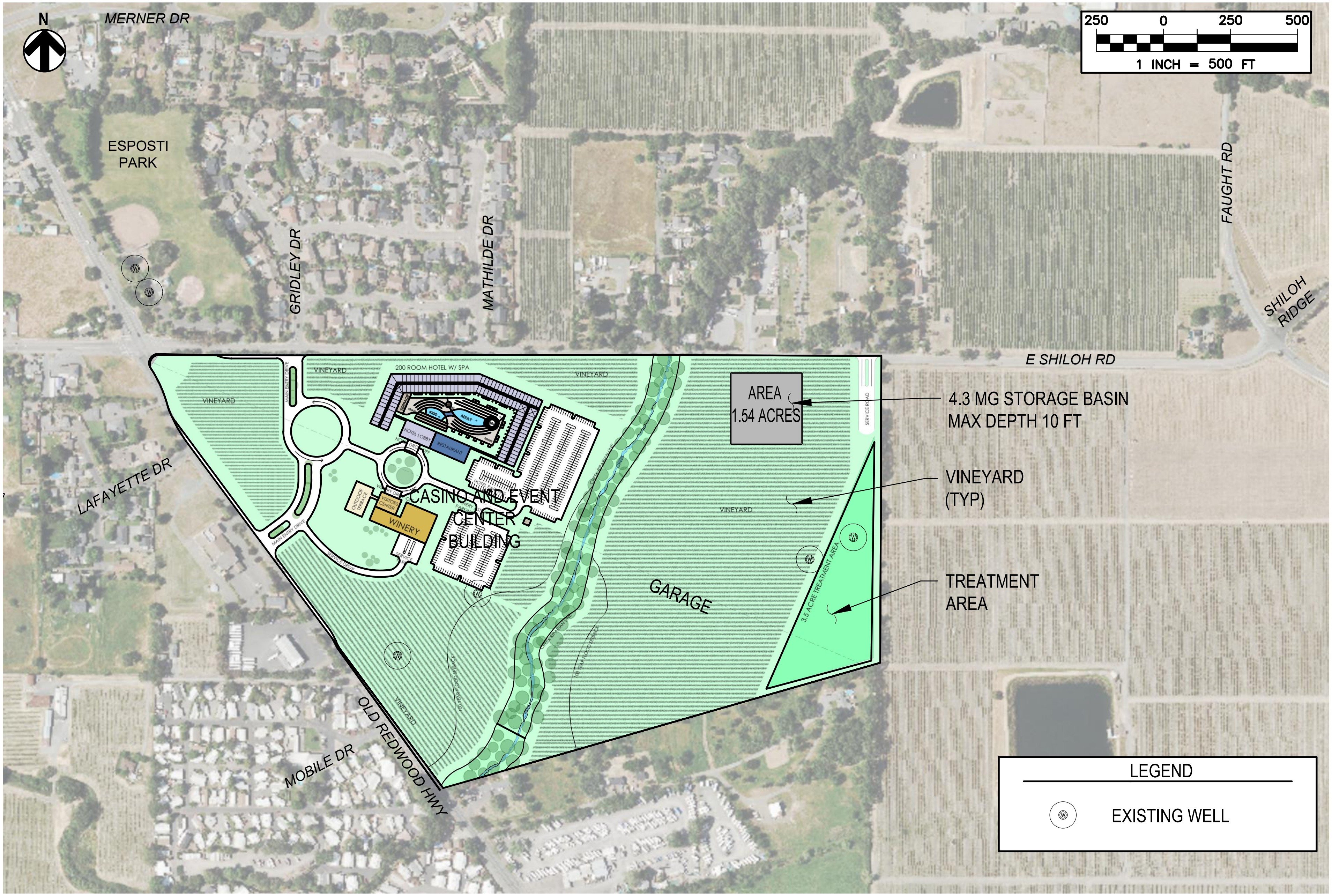

Figure 2-13
Acorn Environmental
Shiloh Resort and Casino Project Water and Wastewater Feasibility Study
Option 1 - Alternative C

HydroScience

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SECTION 3 – LOCAL HYDROGEOLOGY

This section presents a summary of the available information regarding the hydrogeology at the Project site.

3.1 Santa Rosa Valley Basin

According to the DWR Bulletin 118, California's Groundwater Update 2020 (November 2021), the groundwater basin underlying the Town is the Santa Rosa Plain, a sub-basin (DWR number 1-055.01) of the Santa Rosa Valley Basin. The Santa Rosa Plain drains toward the Russian River and is part of the North Coast Hydrologic Region. The Santa Rosa Plain Sub-basin is the largest basin in the County and underlies the most populated areas of the County. The Windsor hydrogeologic subarea is located in the northern portion of the Santa Rosa Plain and underlies the Town of Windsor (Windsor Basin).

The following description is excerpted from the California's Groundwater Update 2013 (DWR April 2015):

The second largest groundwater basin in the North Coast region is the Santa Rosa Valley Groundwater Basin (1-055) in Sonoma County. The groundwater basin covers approximately 101,000 acres, and is divided into three groundwater subbasins: the Santa Rosa Plain (1-055.01), Healdsburg Area (1-055.02), and Rincon Valley (1-055.03). The groundwater basin extends to the northwest to the edge of the Russian River floodplain, west to the Mendocino Range, south to the hills dividing the Santa Rosa and Petaluma valleys, southeast to the Sonoma Mountains, and northeast to the Mayacamas Mountains.

The Santa Rosa Plain Groundwater Subbasin covers an area of approximately 80,000 acres and is home to approximately half of the population of Sonoma County. The four main geologic units, which form the primary aquifers in the Santa Rosa Plain Groundwater Subbasin, are sedimentary deposits of the Alluvium and Glen Ellen formations, the Wilson Grove Formation (previously described as the Merced Formation), and the Sonoma Volcanics. The groundwater subbasin's best water-producing units are stream channels filled with alluvial sands and gravels, groundwater basin-fill alluvium and alluvial fan deposits that connect the Santa Rosa Plain with its bordering hills, and massive sandstone units of the Wilson Grove Formation. The Sonoma Volcanics, a thick sequence of lava flows present along the eastern boundary of the groundwater basin, produce variable amounts of water. The Petaluma Formation also produces variable amounts of water, but underlies much of the groundwater basin at depth and is important in terms of its extensive distribution and the number of wells producing from it. Groundwater within the Santa Rosa Plain Groundwater Subbasin is generally present under confined conditions, except locally in the vicinity of clay or silt horizons where conditions may be semi-confined or confined.

The Glen Ellen Formation consists of continental deposits of partially cemented gravel, sand, silt, and clay, and also yields modest amounts of water to smaller groundwater wells. The thickness of the formation ranges from approximately 1,500 to 3,000 feet. Permeability of the formation varies greatly by location; data indicates that some wells can produce more than 500 gallons per minute (gpm), but most wells produce less and incur significant drawdowns. The Glen Ellen Formation produces groundwater primarily for domestic well use. This formation is notable because it is composed of continental sediments, rather than marine sediments, like many of the other water-bearing formations in the area.

3.1.1 Windsor Basin

The following is excerpted from the Hydrologic and Geochemical Characterization of the Santa Rosa Plain (SRP) Watershed – Scientific Investigations Report 2013–5118 (U.S. Geological Survey, 2013):

The analysis of gravity data reveals two deep, steep-sided sedimentary basins: the Windsor basin beneath the northern part of the SRP and the Cotati basin beneath the southern part, which are separated by a buried bedrock ridge (McPhee and others, 2007; Langenheim and others, 2008). The Windsor basin is about 5.5 by 7.5 mi in size and is centered near the town of Windsor. The thickest exposures of the Glen Ellen Formation in the Santa Rosa Plain Watershed are observed near this basin in the hills that flank the northeast side of the Santa Rosa Plain Watershed. The basin has a roughly triangular form, bounded by the Healdsburg fault segment on the northeast, the Trenton Ridge fault to the south, and a zone of poorly exposed normal faults on the west. Inversion of gravity data indicates the basin is 3,000–6,500 ft deep (Langenheim and others, 2008). The southern and western margins of the Windsor basin appear to have a series of downward steps into the basin (Langenheim and others, 2010), indicating that normal faulting played a role in basin subsidence. Based on outcrop and well data, the deeper parts of the Windsor basin are likely filled with tuff beds and lavas of the Sonoma Volcanics intercalated with sedimentary units of the Petaluma Formation (McLaughlin and others, 2008). Rocks of the Glen Ellen Formation and Quaternary alluvial fan deposits overlie these older rocks.

3.2 Project Site Geotechnical Conditions

A geotechnical study was conducted by Cal Engineering & Geology, Inc. and their observations and conclusions were documented in the Draft Geotechnical Data Memorandum on May 9, 2022. It was concluded that development was not precluded by the soil and geotechnical conditions observed at the site. It is noted that prior to any construction on the site, additional work associated with the preparation of a geotechnical report is required. However, the study provides a summary of the site's soil and geologic conditions.

Three general soil types were observed at the site. Alluvial deposits were encountered in each test pit to the maximum depth explored of 6 feet. The encountered alluvium within the upper four feet of several test pits primarily consisted of lean clays with varying amounts of sand, silt, and gravel and occasional silty sand layers. Shallow soils encountered in another test pit were more granular and consisted of moist to wet silty sand, clayey gravel, and clayey sand from 0 to 5 feet below the ground surface. Sandy lean clay and lean clay with sand was encountered in all test pits from approximately 5 to 6 feet below ground surface. For a more detailed description of the encountered soils, the test pit logs, and laboratory test results are included in **Appendix D.**

3.3 Local Groundwater Supply

The Windsor Water District serves the Town and select parcels south of Shiloh Road and west of Old Redwood Highway. The following details about the water supply are excerpted from the 2020 Draft Urban Water Management Plan (July 2021).

The Town's active potable water supply sources are the Russian River Well Field and Sonoma Water's transmission system (aqueduct). Both provide surface water from the Russian River. The Russian River Well Field has been in operation since 1984. The well field is located on a 27-

acre parcel located near the Russian River. It currently contains five production wells which intercept underflow from the Russian River with individual capacities of approximately 1,300 gallons per minute (gpm). The well field is owned by the Town, and water is extracted under water rights maintained by Sonoma Water. The Town currently has an application pending with the State Water Resources Control Board (SWRCB) Division of Drinking Water (submitted by the Windsor Water District in 1990) to obtain its own water rights for diversion via these wells.

The Town has purchased surface water from Sonoma Water since 1985 (Town of Windsor, 2015). Purchased water is delivered through Sonoma Water's 36-inch diameter Santa Rosa Aqueduct, and continues through a 12-inch diameter water transmission main at the southern end of the Charles M. Schulz–Sonoma County Airport where it connects to the Town's water system. Sonoma Water diverts water into the Santa Rosa Aqueduct via Ranney Collectors under the Russian River and supplements this supply with groundwater wells located in the Santa Rosa Plain Groundwater Basin.

The Town owns five off-river groundwater wells. These wells include the Esposti Park irrigation well, the Esposti Park potable well, Bluebird Well 1, Bluebird Well 2 and the Keiser Park irrigation well. Only one of the five wells, the Esposti irrigation well, is active; the remaining four off-river groundwater wells are inactive. The Esposti irrigation well provides raw water for park irrigation and is not used as a potable source.

The Town has begun implementation of a well drilling program beginning with the Esposti Park potable well to evaluate the thickness and productivity of the deeper sedimentary units in the Windsor area to develop groundwater wells that can be used to augment the Town's water supply.

Other local domestic wells located within the vicinity of the Project site are generally shallow from 100 up to 200 ft below ground surface (bgs). (*Sustainable Groundwater Management Act (SGMA) Data Viewer*, DWR, https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer#gwlevels)

3.3.1 Esposti Park Well

The Town is in the process of developing the Esposti potable well as a potable water source. In 2010, the Town initiated exploratory drilling, well construction, and testing at Bluebird Court and Esposti Park. For the purpose of this Study due to its proximity to the Project site, the Esposti Park well will be discussed in detail. Esposti Park shares the intersection of Shiloh Road and Old Redwood Highway with the Project site. It is expected that the subsurface conditions at the Project site will be similar if not identical to those at Esposti Park.

An exploratory borehole was drilled to 1,040 ft bgs. Drill cutting samples were logged during pilot drilling by a California-licensed hydrogeologist. In general, the sand and gravel units encountered during drilling correlate with the Glen Ellen Formation. The generalized lithology encountered during drilling is summarized in **Table 3-1**.

Table 3-1: Esposti Park Lithologic Summary

Top Depth (feet)	Bottom Depth (feet)	Lithology
0	60	Light brown sandy clay
60	82	Variably colored well-sorted sand
82	90	Light gray sandy clay
90	115	Poorly sorted medium gravel, variably-colored; grading to green gray with depth
115	132	Dark gray-green silty clay
132	152	Gray-green sand with rare cobble; poorly sorted. Increasing coarseness with depth
152	163	Light brown sandy clay
163	223	Gray-green sand with rare cobble; poorly sorted. Increasing coarseness with depth to fine-to-medium sand
223	232	Light gray silty clay
232	336	Poorly sorted sand with rate pebbles. Increasing coarseness. Changing to gravel with sand and then to medium sand with pebbles
336	350	Light gray sandy clay. Light brown volcanic ash identified starting at 341 feet bgs
350	377	Variably colored gravel and sand. Grades from fine to medium. Some volcanic ash.
377	381	Ash predominant with sand and gravel
381	650	Variably-colored gravel and sand. Some ash interspersed at intervening layers. Interspersed clay with sand and gravel between 510 and 520 feet bgs.
650	700	Interbedded clay and ash with some sand. Trending to tan clay with depth
700	736	Gravel and sand
736	804	Dark gray micaceous clay with layers of sand ranging from fine to medium.
804	826	Gray-green fine to medium sand. Abundant ash starting at 810 feet bgs.
826	832	Light gray sandy clay
832	841	Sand and gravel
841	854	Dark gray fat clay
854	862	Poorly sorted sand with gravel, variably colored
862	970	Dark gray fat clay
970	1030	Silty sands to poorly sorted sand
1030	1040	Clay

The well screen was designed to screen permeable sands and gravels with good water quality as identified by field observations, soil cuttings and depth-specific water quality samples collected during borehole advancement. A total screen length of 160 feet was installed over six intervals as detailed in **Table 3-2**. The screen consists of stainless-steel continuous wire-wrap construction with a 0.125 inch slot size. Stainless steel blank casing ranging in length from 10 to 50 feet in length separates the screened intervals and was placed opposite lower permeability strata within the more permeable strata.

Table 3-2: Esposti Park Screened Intervals and Lengths

Screened Interval Depths (feet bgs)	Screen Length (feet)
380 to 420	40
430 to 450	20
460 to 470	10
480 to 510	30
545 to 565	20
615 to 655	40
Total Length	**160**

After well construction and development, groundwater samples were collected and analyzed. Results indicated concentrations of arsenic and manganese that exceeded drinking water standards. Further investigation was stalled due in part to the water quality issues coupled with a lack of urgency to develop additional water supply. The original well testing report: *Windsor Groundwater Well Installation and Testing Project Summary Report (September 2010)* detailing the subsurface conditions and well construction is included as **Appendix B**.

In 2016 and 2017, the Town reinitiated the well investigation and pursued redevelopment of the Esposti Supply Well; performing a pump test and evaluating water quality and treatment options. Results of this work determined that the well can reliability produce 400 gpm. Pumping at a rate of 800 gpm is possible but is not sustainable for more than a day due to hydrogeologic limitations to aquifer permeability. The groundwater production is from confined aquifer units located below 380 ft bgs. Pumping from the confined aquifer did not result in a significant effect on the overlying shallow groundwater. Thus it is not expected to affect local domestic wells installed at shallower depths (up to 200 ft bgs).

The well produces water that meets all of the requirements for drinking water with the exception of arsenic and manganese. The 2016 concentration of arsenic was 0.057 milligrams per liter (mg/L) and manganese was 0.860 mg/L. These concentrations are significantly above the maximum contaminant levels (MCLs) of 0.010 mg/L and 0.050 mg/L, respectively. The testing also confirmed that these elevated concentrations of arsenic and manganese are repeatable and consistent, screened across multiple aquifer zones.

The recommended option for water treatment is a two-step process; the first step removes manganese through catalytic oxidation (greensand filtration) and the second step removes arsenic through media adsorption.

The redevelopment, testing, and recommendations for the Esposti Well are documented in the *Town of Windsor and Windsor Water District Esposti Supply Well Redevelopment, Pumping Test and Treatment Feasibility Study (October 3, 2017)*, included as **Appendix C**.

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SECTION 4 – BACKGROUND AND REGULATORY ISSUES

This section identifies the typical regulatory requirements applicable to the Project with respect to the proposed water supply, wastewater treatment, and wastewater discharge methods identified in this report.

4.1 Water Supply

In general, Sonoma Valley water supply issues are characterized by limited groundwater supply and over-committed surface water supplies. Thus, the primary options that exist for securing water for the Project include evaluating the existing irrigation wells and their suitability as a potable water supply and constructing a new on-site water supply well.

4.1.1 Groundwater Supply and Management

Historically, shallow zone wells (<200 feet deep) showed no significant decline in groundwater levels. There are several shallow wells located within the vicinity of the Project site, as is typical for the periphery of the Town. It was noted during the pumping tests at Esposti well that there was no decline in groundwater levels in the shallow zone (Esposti irrigation well) indicating that pumping from the intermediate zone (>380 ft bgs) does not generally affect shallow zone water levels in those wells. Water level elevations in three shallow wells located south of the Project site (**Figure 2-4**) and monitored by DWR are historically stable.

Groundwater quality in neighboring wells commonly include higher levels of iron, manganese, and arsenic requiring treatment for elevated levels. Each of these constituents is found in higher-than-normal concentrations in certain areas of Sonoma County.

Neither iron nor manganese in water presents a health hazard. Iron will cause reddish-brown staining of laundry, porcelain, dishes, utensils, and even glassware. Manganese acts in a similar way but causes a brownish-black stain. Soaps and detergents do not remove these stains, and the use of chlorine bleach and alkaline builders (such as sodium carbonate) can actually intensify the stains. If these constituents are present in groundwater, treatment of the groundwater to remove these constituents is recommended.

Arsenic occurs naturally as a trace component in many rocks and sediments. Whether the arsenic is released from these geologic sources into groundwater depends on the chemical form of the arsenic, the geochemical conditions in the aquifer, and the biogeochemical processes that occur. Arsenic also can be released into groundwater as a result of human activities, such as mining, and from its various uses in industry, in animal feed, as a wood preservative, and as a pesticide. In drinking-water supplies, arsenic poses a problem because it is toxic at low levels and is a known carcinogen. In 2001, the USEPA lowered the MCL for arsenic in public-water supplies to 10 micrograms per liter (µg/L) from 50 µg/L.

Construction of an on-site well will be largely exempt from local environmental and public reviews associated with off-site impacts, but will be subject to Federal environmental and public reviews through the National Environmental Policy Act (NEPA) and regulatory oversight by the USEPA and the IHS.

Adjacent Domestic Wells: The well drillers logs for the Esposti well show that the water bearing zones in the local soils are separated by impervious clay layers preventing the vertical movement of water from the upper bearing zones, where most domestic wells terminate, if the lower zones are being pumped. The Esposti potable well is drilled to 675 feet. Domestic wells, on the other hand, are not typically drilled to depths greater than 200 feet. This suggests that these wells draw from the shallow alluvial aquifer. During testing of the Esposti potable well there was no change in the water levels of the irrigation well, which was drilled to 300 feet bgs and is located 30 feet from the potable well. There are several domestic wells located to the west and southwest of the Project site. To prevent significant impacts to local domestic wells, the proposed Project should also construct deep terminating wells, screen in the deeper water bearing formations below a depth of 200 feet, similar to the Town's local well construction. It is not anticipated that properly constructed on-site wells for the Project will adversely affect local wells.

No information was available regarding the construction of the existing on-site irrigation wells. It is recommended that the well is tested and investigated further to understand its construction, capacity, and water quality.

Groundwater Sustainability Plan (GSP): The Santa Rosa Plain groundwater basin is monitored by the Groundwater Sustainability Agency. The recently updated GSP (January 2022), indicates that groundwater is typically a primary source for water supply for irrigated agriculture and a secondary source of supply for many municipal water purveyors (except California American Water Company's Larkfield District); most of the water supply is imported water and local surface water. The Project will evaluate the current GSP to maintain the integrity of the subbasin water quality and available supply for the future. The Project's intent is to use recycled water where appropriate to reduce the potable water consumption it would otherwise require. The recycled water quality will be per Title 22 standards for tertiary treated effluent for reuse as described in the next section.

4.2 Recycled Water

It is expected that the WWTP will produce recycled water for on-site reuse, which will add to the water quality requirements of the effluent from the WWTP. In order to reuse recycled water on non-trust land in California, a Title 22 reclamation permit would be required. The RWQCB typically issues this permit in California. However, on trust land, the USEPA would regulate the use of recycled water use and would be responsible for granting a NPDES permit to use recycled water on-site. The USEPA has typically deferred their recycled water standards to California's Title 22 standards for trust land projects in California. IHS would regulate the use of recycled water on trust lands. For the range of uses considered for this project, it would be expected that the WWTP would need to produce disinfected tertiary recycled water in accordance with Title 22 requirements. Disinfected tertiary recycled water meets the following water quality requirements, which are specific to the MBR treatment process expected for the Project's wastewater treatment facility:

- Has been passed through a microfiltration, ultrafiltration, nanofiltration, or reverse osmosis membrane so that the turbidity of the filtered wastewater does not exceed any of the following:
    - 0.2 NTU more than 95 percent of the time within a 24-hour period; and
    - 0.5 NTU at any time.

- The filtered wastewater has been disinfected by either:
  - A chlorine disinfection process following filtration that provides a CT (the product of total chlorine residual and modal contact time measured at the same point) value of not less than 450 milligram-minutes per liter at all times with a modal contact time of at least 90 minutes, based on peak dry weather design flow; or
  - A disinfection process that, when combined with the filtration process, has been demonstrated to inactivate and/or remove 99.999 percent of the plaque forming units of F-specific bacteriophage MS2, or polio virus in the wastewater. A virus that is at least as resistant to disinfection as polio virus may be used for purposes of the demonstration. The median concentration of total coliform bacteria measured in the disinfected effluent does not exceed an MPN of 2.2 per 100 milliliters utilizing the bacteriological results of the last seven days for which analyses have been completed and the number of total coliform bacteria does not exceed an MPN of 23 per 100 milliliters in more than one sample in any 30 day period. No sample shall exceed an MPN of 240 total coliform bacteria per 100 milliliters.

In addition to the aforementioned recycled water quality requirements, there are a number of operational, use, and reporting restrictions identified in Title 22. However, it is not expected that any of these requirements will limit the viability of recycled water reuse on-site, and these requirements are typical for any recycled water use application. All uses of recycled water would have to be approved by USEPA. As long as disinfected tertiary recycled water is produced, there would appear to be no issues associated with this intended use. It is also noted that the minimum quality of discharge to the Russian River is typically disinfected tertiary recycled water.

4.3 Wastewater

The regulatory requirements pertinent to wastewater treatment and wastewater discharge methods are identified in *Section 2.3 Wastewater* and *Section 2.3.4 Effluent Disposal*, respectively. The reader is referred to those sections for additional details.

The WWTP will be designed to comply with the effluent quality requirements of the NPDES permit when these are determined. The MBR process discussed in *Section 2.3.3 Wastewater Treatment Facilities* is expected to be capable of meeting these requirements with minimal modifications.

Nitrogen removal will be achieved in the anoxic basin of the MBR process as discussed in *Section 6.2.3 Immersed Membrane Bioreactor System (Packaged)*. It is expected that the effluent nitrogen concentrations will meet the limitations imposed by the USEPA in their NPDES permit.

If phosphorus removal is required, the MBR process is well suited to provide for phosphorous removal to very low concentrations. Phosphorus removal is enhanced in MBR treatment plants by employing one or multiple of the following operational methods: 1) addition of a coagulant to the aeration basin, 2) a higher solids retention time in the MBR basins, 3) ensuring there is an ample carbon source for the microorganisms, and 4) utilization of a membrane, which virtually eliminates any particulate phosphorus in the effluent. The method(s) the Tribe will employ for phosphorus removal will be determined during the WWTP design phase, but those methods would be designed to comply with the NPDES permit effluent limitations.

This section will present the requirements for determining the potential impacts of receiving waters upon discharge of tertiary treated wastewater, and the sludge disposal options and pertinent disposal regulations.

4.3.1 Baseline Monitoring Program

Baseline water quality for receiving waters, Mark West Creek tributary to Russian River, is required as a basis for determining if the beneficial uses of the receiving waters will be impacted by the proposed discharge of tertiary treated wastewater.

The current NPDES permits for the Dry Creek Rancheria WWTP (Dry Creek WWTP), Ukiah WWTP, and Windsor WWTP may be reviewed to gain a sense of the requirements specified in local NPDES permits issued by the USEPA and North Coast RWQCB and are publicly available. These WWTPs are the nearest to the proposed Shiloh Resort WWTP with a surface water discharge to the Russian River or its tributaries, and are the most applicable surface water discharge permits for the WWTP. These permits all include seasonal surface water discharge to the Russian River or its tributaries, tertiary treatment, and land disposal.

The primary unknown regulatory issues associated with the proposed wet season discharge of wastewater to Mark West Creek is the surface water quality at the discharge location. Since there is an existing gauge station at Mark West Creek, and streamflows are highest at that location, this is a logical area to begin baseline water quality monitoring.

In order to begin detailed discussions with the RWQCB on the feasibility of discharging to the Pruitt Creek, the Project would need to begin to collect receiving water quality data near the anticipated discharge site and at the Mark West Creek gauge station. This data would help the RWQCB evaluate the background water quality of the receiving waters, identify potential water quality restrictions, and understand the impacts of the proposed new discharge on the aquatic habitat.

4.3.2 Sludge Disposal

Sludge (biosolids) produced by the WWTP must also be disposed of in accordance with the California Code of Regulations, Water Code, Resource Conservation and Recovery Act, and the RWQCB policy. These regulations are commonly referred to as the 40 CFR Part 503 Biosolids Rule promulgated by the USEPA. It is anticipated that biosolids produced by the project WWTP will be disposed of to an off-site landfill in accordance with all regulatory requirements. Prior to off-site disposal, biosolids will be dewatered. The dewatered sludge, also known as cake, would be periodically hauled to a Class III landfill for disposal. The frequency and volume of dewatered sludge is typically determined during the design phase of the project, as more data is available on the source water quality and treatment process.

4.3.3 Cooling Tower Brine Generation and Disposal

The flowrate and water quality of brine generation from cooling tower processes is unknown. It will ultimately depend on the water chemistry of the makeup water, type/model of the cooling system and operation of the cooling system. Disposal sources for brine generation from cooling processes generally include offsite disposal or discharge to: surface water bodies, sewer system, ocean outfall, deep well injection, incineration, and environmental service providers. If disposal to the WWTP is the preferred option, further evaluation will be required to determine the maximum limits of constituents of concern, expected brine flow rates, expected water quality monitoring parameters, cycles of concentration, etc. Further evaluation will be needed to determine the brine generation volume and most cost-effective disposal alternative. Similarly for the brine generated from the recycled water treatment process (see **Section 2.3.4**), EBMUD accepts and treats this type of waste.

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SECTION 5 – WATER FACILITY REQUIREMENTS

This section identifies preliminary water supply, water treatment, water storage, and pumping requirements to supply the proposed Project with water.

The facilities identified in this section are based on HydroScience's experience with similar projects. The general concept for the water supply facility is that the Project will maximize the reuse of recycled water in order to minimize the water supply requirements for the Project. This section describes the following facilities:

- Water Production Wells
- Water Treatment Plant
- Water Storage Tank and Pump Station

The overall water facilities will be located based on the final design of the Project facilities. All of the recommended water supply facilities described in this section are preliminary and should be utilized for planning purposes only.

5.1 Water Production Wells

The potable water supply system must have a firm reliable supply based on projected water demands. Firm capacity is the remaining water supply capacity with the largest single source out of service. In a well system, it is generally recommended to have a minimum of two wells available for service, so one can be serviced without interrupting the water supply. The actual well capacity, location, and operating strategy will be further developed during the design phase.

A key design requirement that must be addressed during the construction of the wells is the need to minimize impacts to neighboring domestic wells. The test hole should be drilled a minimum of approximately 700 feet deep, and screen sections should be placed primarily in the deeper aquifer sections, and not in the upper aquifers above 200 feet. Per DWR, the new well or existing well to used will require a minimum radius of 50-ft control zone around the well, to protect the source from vandalism, tampering, and other possible sources of contamination. The wells are anticipated to have similar lithographic, water production, and water quality characteristics as the existing Esposti Park Supply Well. The Town has detected high concentrations of arsenic and manganese thus, the implementation of water treatment to remove arsenic and manganese, as described in **Section 5.2**, will likely be required to treat the well water.

Table 5-1 shows the recommended design criteria for on-site wells. Each well is expected to have an approximate footprint of 20 feet by 30 feet, including the pump, well, piping, and miscellaneous equipment. Each well would also be setback from any recycled water use area or impoundment as required by Title 22 criteria.

Table 5-1: Recommended Water Production Well Design Criteria

Parameter	Value
Approximate depth	700 ft
Casing diameter	12-inch
Surface seal depth	100 feet minimum
Casing material	Copper bearing steel
Screen material	Wire-wrapped stainless steel
Approximate screen depth range	Between 350 ft and 650 ft
Pump type	Vertical turbine multistage
Method of control	On/off by tank level

5.2 Water Treatment Plant

Based on the groundwater conditions identified in **Section 3**, and the known arsenic and manganese issues found in local wells described in **Section 4**, it is anticipated that water supplied from any on-site well will exceed the State drinking water standards for arsenic and manganese. Thus, an on-site water treatment plant to remove these constituents will be required. It is recommended that the treatment plant utilize a manganese greensand pressure filtration process to remove manganese to acceptable levels. The backwash waste stream would be directed into a holding tank and settled water would be recycled back into the front of the plant at a rate not exceeding 10% of the plant’s rated capacity. Manganese sludge would be periodically discharged from the tank to the sewer system. Media adsorption is recommended for the removal of arsenic. Arsenic is removed by filtering the water through media consisting of oxides and/or hydroxides of Fe, Ti, or Al. There are a variety of media on the market for the removal of arsenic. Treatment modeling of the specific water chemistry is required to narrow down the various media options. On-site pilot testing or testing using rapid small-scale column testing follows treatment modeling.

The two treatment vessels would be installed in series. A typical layout of the treatment plant is shown in **Figure 5-1**. A process flow diagram showing how water is treated within the treatment plant is shown as **Figure 5-2**.

CONTROL BUILDING SPECIFICATIONS:

10' x 10' x (LOW SIDE) W 8' x 10' CANOPY
-SHED STYLE 1:12 SLOPE

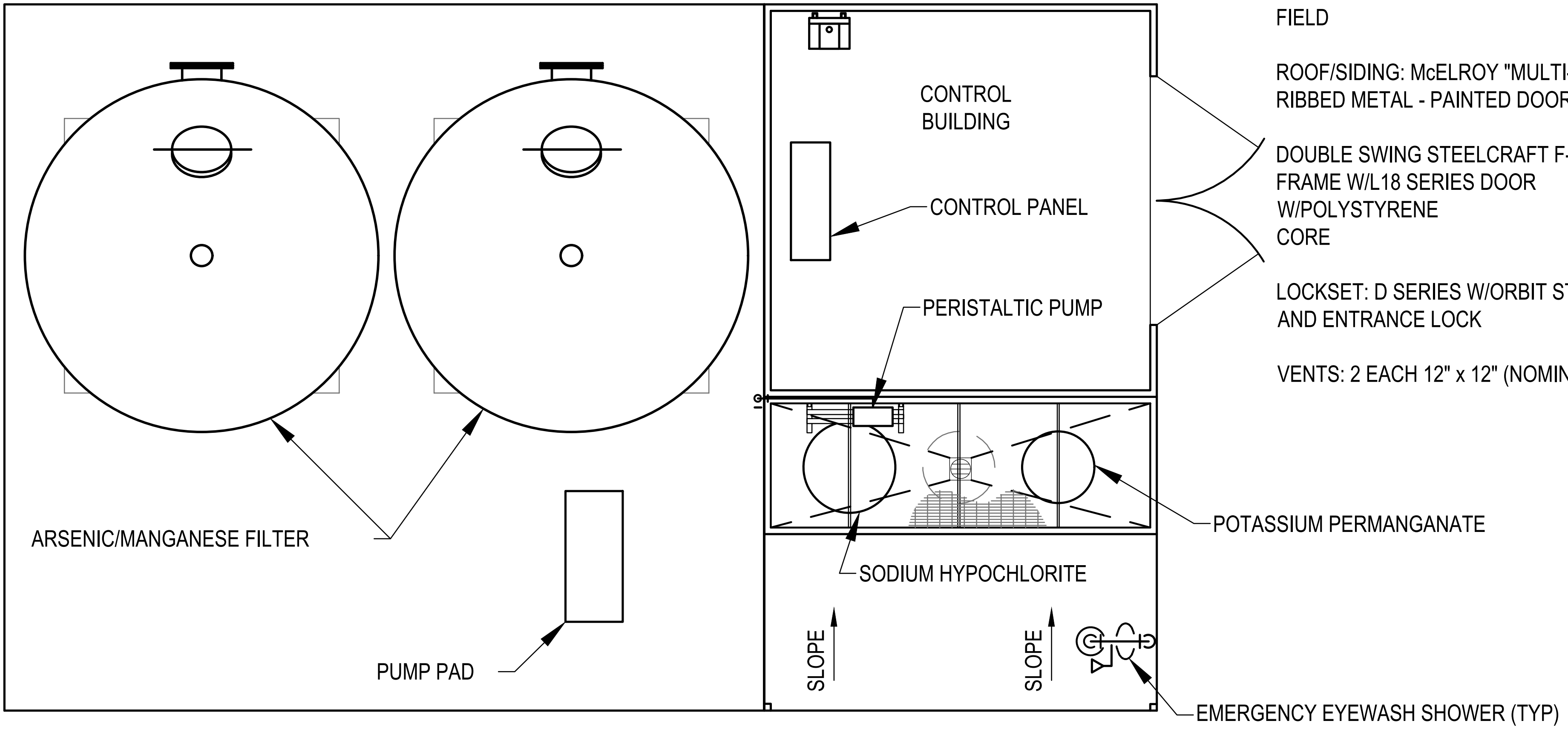
FRAME: 2" x 2" x 120 STEEL TUBE ALL
WELDED WALL SECTIONS TO BE BOLTED IN
FIELD

ROOF/SIDING: McELROY "MULTI-RIB" 28 GA
RIBBED METAL - PAINTED DOOR: 6' x 6'-8"

DOUBLE SWING STEELCRAFT F-16 SERIES
FRAME W/L18 SERIES DOOR
W/POLYSTYRENE
CORE

LOCKSET: D SERIES W/ORBIT STYLE KNOB
AND ENTRANCE LOCK

VENTS: 2 EACH 12" x 12" (NOMINAL)



SITE PLAN
SCALE: 1" = 50'-0"

Figure 5-1
Acorn Environmental
Shiloh Resort and Casino Project Water and Wastewater Feasibility Study
Preliminary Water Treatment Plant Layout

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PIPE SERVICE KEY

BW	BACKWASH
D	DRAIN
FW	FILTERED WATER
KMN	POTASSIUM PERMANGANATE
O	OVERFLOW
RW	RAW WATER
SW	SURFACE WASH
SCLS	SODIUM HYPOCHLORITE
SAM	SAMPLE
W	WATER
ARV	AIR RELEASE VALVE

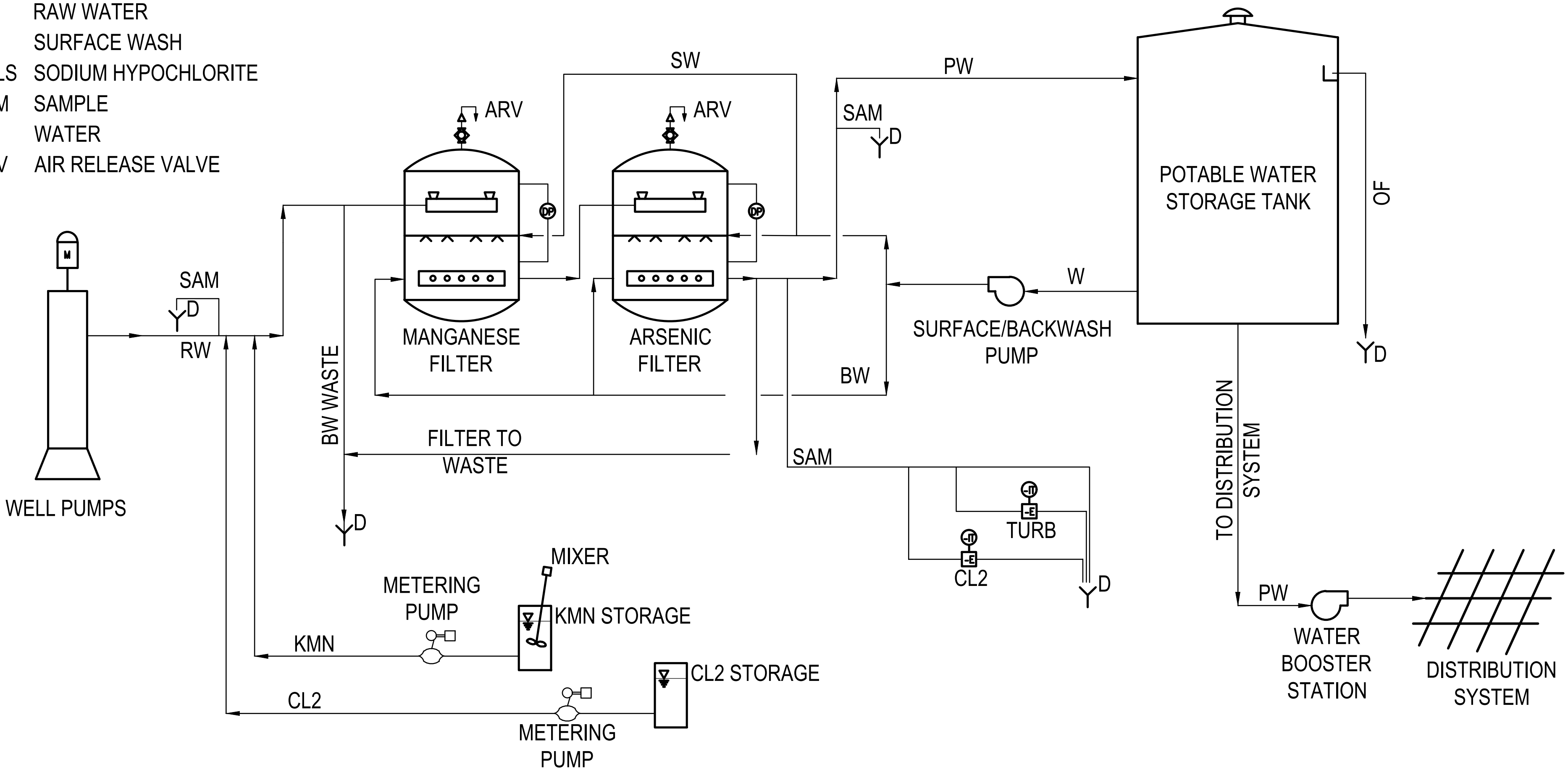

Figure 5-2
Acorn Environmental
Shiloh Resort and Casino Project Water and Wastewater Feasibility Study
Preliminary Process Flow Diagram

HydroScience

The manganese filtration process consists of oxidation using a feed stream of sodium hypochlorite, and filtration through a manganese greensand filtration media. The function of the manganese greensand is to provide a catalyst to fully oxidize manganese, which may not be accomplished solely with a sodium hypochlorite oxidant. Potassium permanganate will be used to initially condition and prepare the media, and it may be used continuously or intermittently to aid in oxidation, if required. Arsenic is removed with simple on/off cycling and infrequent backwashing is required. Gentle breakthrough curve allows for reduced sampling frequency. Pilot testing is required to determine adsorption capacity. Efficiency is subject to competing adsorption by non-target compounds. Sodium hypochlorite would be used to disinfect the water before on-site distribution. A continuous monitoring residual analyzer will monitor chlorine residual at the end of the filters, before entering a water storage tank. Chlorine dosage control would be manual, with options for automatic pacing based on residual. The water treatment plant process facilities would be located within an enclosed building.

Significant features of the plant would include:

- PLC control system interlinked to a common water/wastewater SCADA system.
- Surface wash to reduce the possibility of “mudball” formation on the media surface.
- Fail-safe control valves that would fail in the filter-forward mode of operation.

The recommended Water Treatment Plant design criteria are summarized in **Table 5-2.**

Table 5-2: Recommended Water Treatment Plant Design Criteria for Alternative A

Parameter	Value
Process	Pressure filtration
Media for Catalytic Oxidation	Anthracite/greensand
Number of filters[1]	1
Filter loading rate	3 gpm/sf
Filter size	10 ft diameter
Media for Adsorption	TBD
Number of filters[1]	1
Filter loading rate	3 gpm/sf
Filter size	10 ft diameter
Oxidant	Sodium Hypochlorite
Process control	PLC/on with service well

Notes:
1. Number of filters does not include redundant unit. Systems are typically designed for N+1 redundancy; two total filters per filter type is recommended.

5.3 Water Storage Tank and Pump Station

A water storage tank would be constructed to store water produced by the water treatment plant. The actual required capacity of the tank is dependent on the Project’s fire flow requirements, however, the anticipated capacity is approximately 1.0 million gallons (MG), and would be of welded steel construction meeting all American Water Works Association (AWWA) specifications for welded steel tanks. A typical section of a tank is shown in **Figure 5-3**. The tank would be a cylindrical shape. Having a shorter tank will make it easier to camouflage, and would hide the tank better from the site's guests. The tank sizing would be based on standard pre-engineered tank dimensions, which are typically in 8-foot increments. It is also possible that the tank would be partially or completely buried, but for the purposes of this analysis, it is assumed that the tank would be located at grade.

Since the site is largely flat, with no land at an elevation suitable for gravity feed to the distribution system, it is recommended that this tank be utilized as the supply, and a pump station be utilized to maintain pressure in the distribution system. This potable water pump station will be required to convey water from the storage tank to the facilities requiring potable water, and would be sized to handle both fire flow and domestic demands. The ultimate pumping capacity will be dependent on fire flow requirements, and would be satisfied by two variable-speed high-service pumps that are half the capacity of the projected flow requirement. **Table 5-3** shows the design criteria for the water storage tank and pump station.

Table 5-3: Recommended Water Storage Tank and Pump Station Design Criteria

Parameter	Value
Water Storage Tank	
Approximate size	1.0 MG
Approximate diameter	75 feet
Approximate height	32 feet
Construction	Welded steel
Potable Water Pump Station	
Low service pump number	2
Low service pump type	Variable speed turbine
High service pump number	2
Hydropneumatic tank approximate volume range[1]	1,000 - 2,000 gallons

Notes:
1. Exact volume is TBD and will be determined during the design phase of the project. Tank volume is dependent on the flowrate and pressure the hydropneumatics tank is expected to provide.

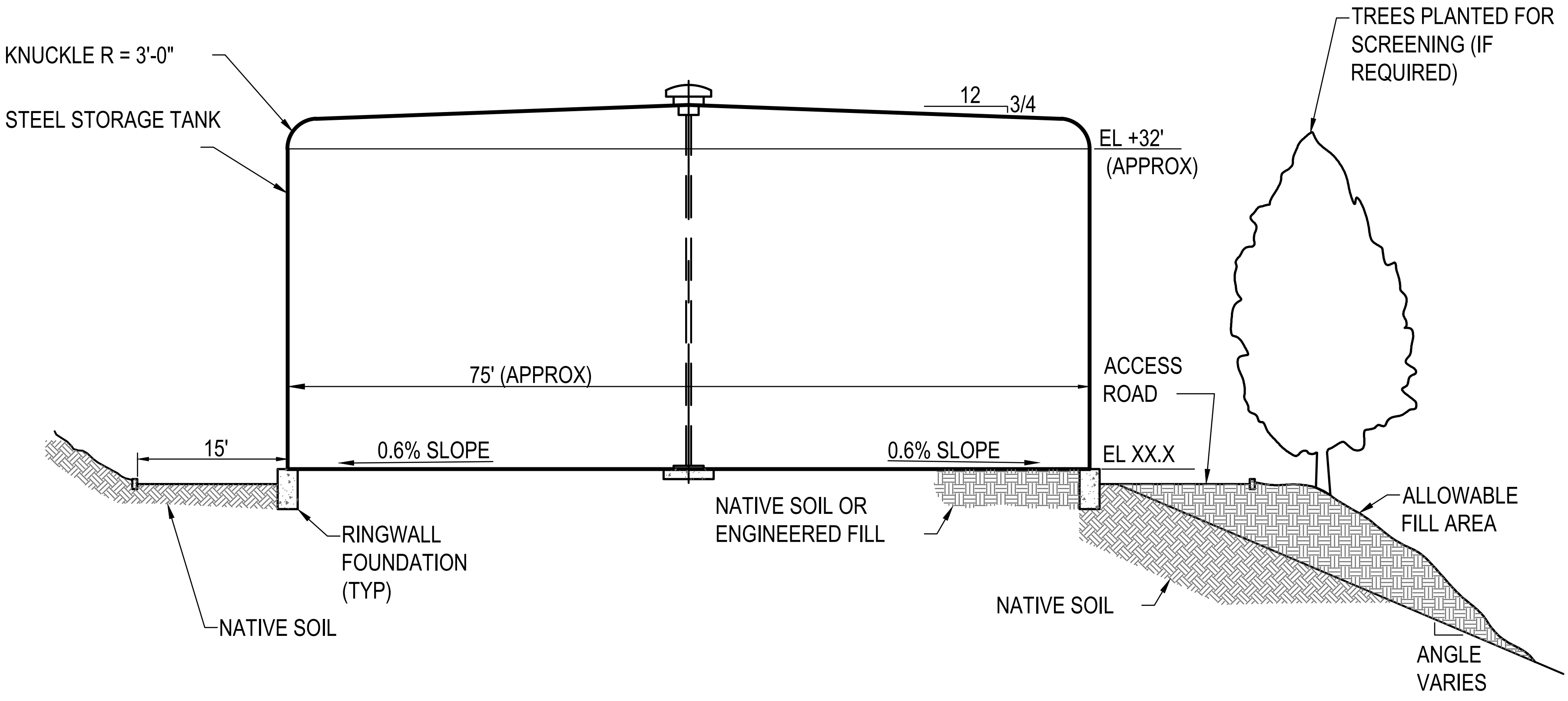

Figure 5-3
Acorn Environmental
Shiloh Resort and Casino Project Water and Wastewater Feasibility Study
Typical Potable Water Storage Tank

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SECTION 6 – WASTEWATER FACILITY REQUIREMENTS

This section identifies preliminary wastewater collection, wastewater treatment, effluent discharge, and recycled water facilities required to manage wastewater generated by the proposed Project.

The general concepts for the wastewater facilities are to comply with all applicable permitting requirements, maximize on-site water reuse, and ensure that the wastewater and recycled water facilities are designed in a manner that does not limit existing uses or future expansion. This section describes the following facilities:

- Collection System
- Treatment Plant
- Discharge Facilities
- Operations and Maintenance
- Recycled Water Facilities

The overall wastewater facilities will be located based on the final design of the Project facilities. All of the recommended wastewater facilities described in this section are preliminary, and should be utilized for planning purposes only.

6.1 Wastewater Collection System

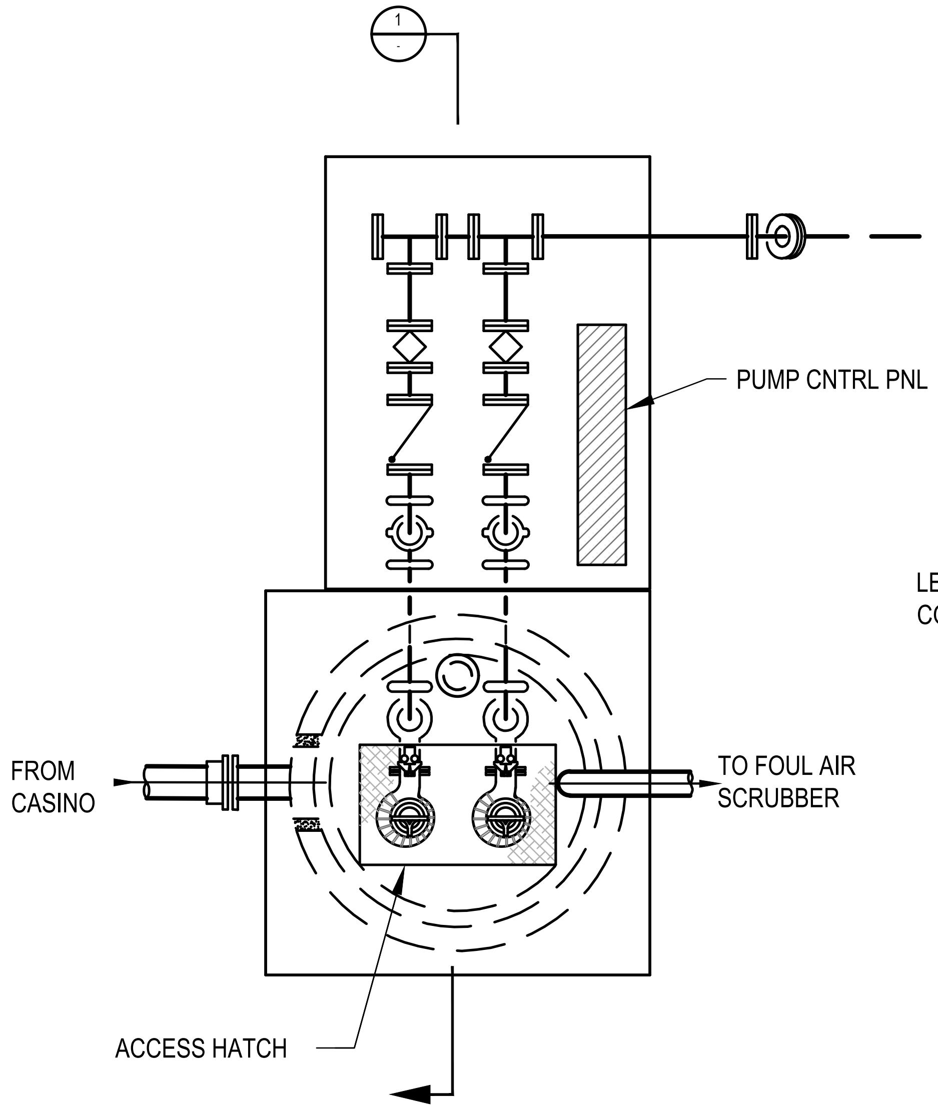
Wastewater from casino facilities is typically gravity fed to a lift station. Gravity sewer would likely be laid along planned roadways within the parcel to facilitate future maintenance, The gravity sewer main will require crossing beneath the existing creek to reach the proposed lift station and WWTP site. This may require a siphon under the creek, depending on the depth of the gravity main relative to the depth of the creek bed.

Wastewater will be pumped through a sewage transmission pipeline from the casino lift station to the headworks of the WWTP. It is likely that a duplex wet well sewage lift station with a standby pump will be required to convey sanitary sewage to the WWTP. The lift station wet well will also be used to collect surface water runoff from the treatment site.

Recommended design criteria for the lift station(s) are shown in **Table 6-1**. A figure showing a typical sewage lift station layout is shown in **Figure 6-1**. The station should be designed to lift the maximum daily flow with one pump out of service.

Table 6-1: Recommended Sanitary Sewage Lift Station Design Criteria

Parameter	Value
Purpose	Lift raw water to WWTP facilities
Type	Submersible non-clog centrifugal
Quantity	Three (2 duty, 1 standby)
Controls	Variable speed, level switch start and shutoff



TYPICAL LIFT STATION PLAN

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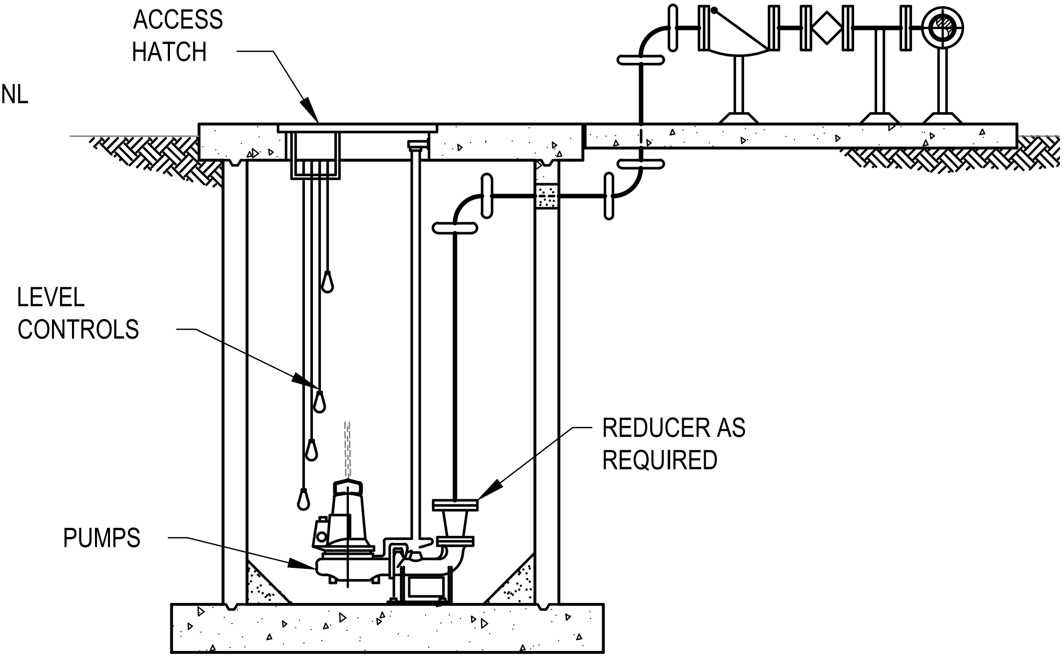

SECTION 1
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Figure 6-1
Acorn Environmental
Shiloh Resort and Casino Project Water and Wastewater Feasibility Study
Typical Influent Lift Station

6.2 Wastewater Treatment Plant

This section provides a description of the recommended wastewater treatment components required for the Project. Each of the following major process components is described below:

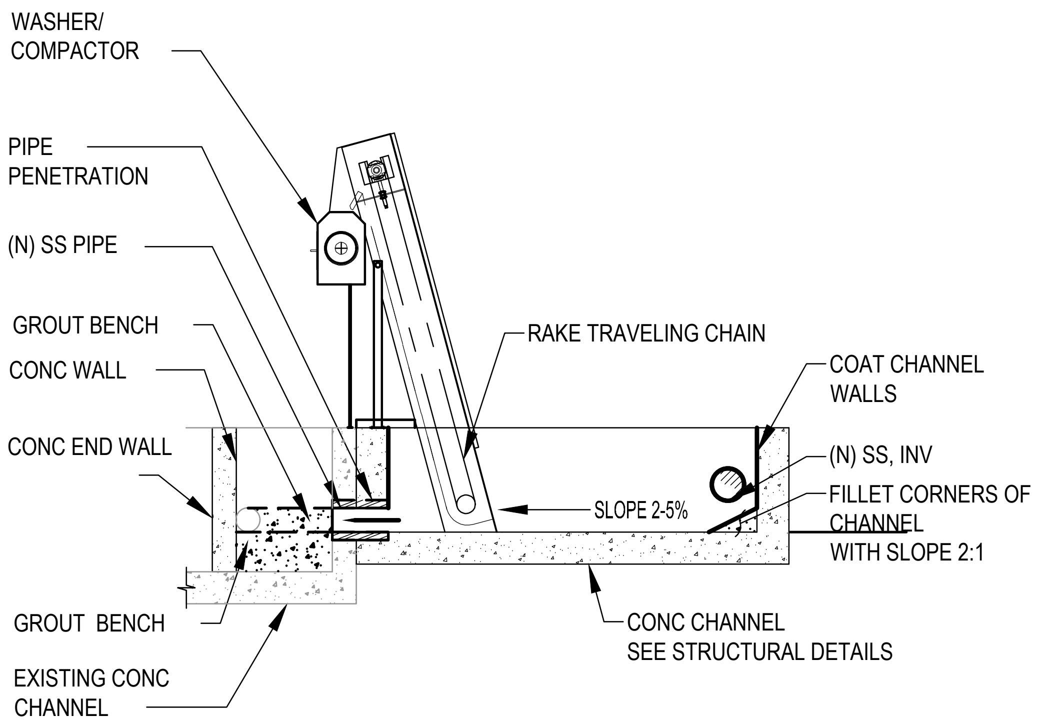
- Coarse Screening Facility;
- Headworks;
- Immersed Membrane Bioreactors;
- UV Disinfection;
- Chlorine Disinfection;

6.2.1 Coarse Screening Facility

The coarse screening facility for the WWTP is typically gravity fed and upstream of the casino lift station wet well. Due to the sources and quality of the wastewater, it is important to remove large debris to protect the downstream processes, specifically the pumps. Sewage lift station pumps typically handle solids less than 3” in diameter, so large towels, bedsheets, etc., may cause clogging and significant downtime. A typical layout for the coarse screening facility is shown as **Figure 6-2**. **Table 6-2** shows some of the design criteria for the headworks facility.

Table 6-2: Coarse Screen Design Criteria

Parameter	Value
Coarse Screening facilities	Enclosed bar screen, multi-rake style, ¼” bar spacing, washer/compactor system, and bar screen bypass system
Metering facilities	Magnetic flow meter on influent pipe
Odor control	Corrosion resistant plate covered channels, soil filter
Control	Continuous operation



TYPICAL SCREEN SECTION A
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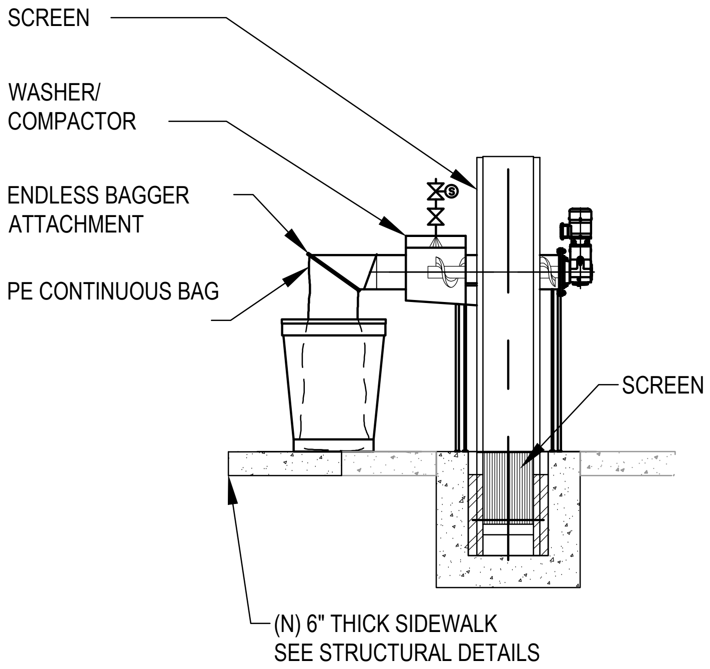
SCALE: 3/4" = 1'-0"



TYPICAL SCREEN SECTION B
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SCALE: 1/4" = 1'-0"

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Figure 6-2
Acorn Environmental
Shiloh Resort and Casino Project Water and Wastewater Feasibility Study
Typical Coarse Screening Facility

6.2.2 Headworks

The headworks for the WWTP would typically include influent flow measurement, rotary type fine screens, and any required grit removal facilities. Due to the sources and quality of the wastewater, it is not expected that grit removal facilities are required at this time. However, fine screens are required to protect excessive fouling of the MBR membranes. The fine screens typically include a built-in washer/compactor and 2-mm openings that remove hair, inorganics, and wastes. The 2-mm opening is necessary to protect the integrity of the membrane filters downstream. The washed and compacted screenings collected at the headworks are typically stored in bins on-site to be periodically disposed of at a landfill.

The raw influent would be pumped by the collection system pump station through the headworks facility. After flow measurement, influent would be routed to a covered headworks influent box for distribution to two influent channels. During normal operation, one channel would be in-service, with the other available as a standby. Slide gates would control flow to each channel. Each headworks channel would be sized to match the hydraulic capacity of the plant. Within the channels would be rotary type fine screens to remove large materials from the raw influent. A map showing a typical layout for the headworks facility is shown as **Figure 6-3**. **Table 6-3** shows some of the design criteria for the headworks facility.

Table 6-3: Headworks Design Criteria

Parameter	Value
Screening facilities	Enclosed cylindrical screen with 2-mm circular perforations, integral shaftless helical scraper/conveyor and compactor, mechanical washer to break up fecal material
Metering facilities	Magnetic flow meter on influent pipe
Odor control	Corrosion resistant plate covered channels, soil filter
Control	Continuous operation

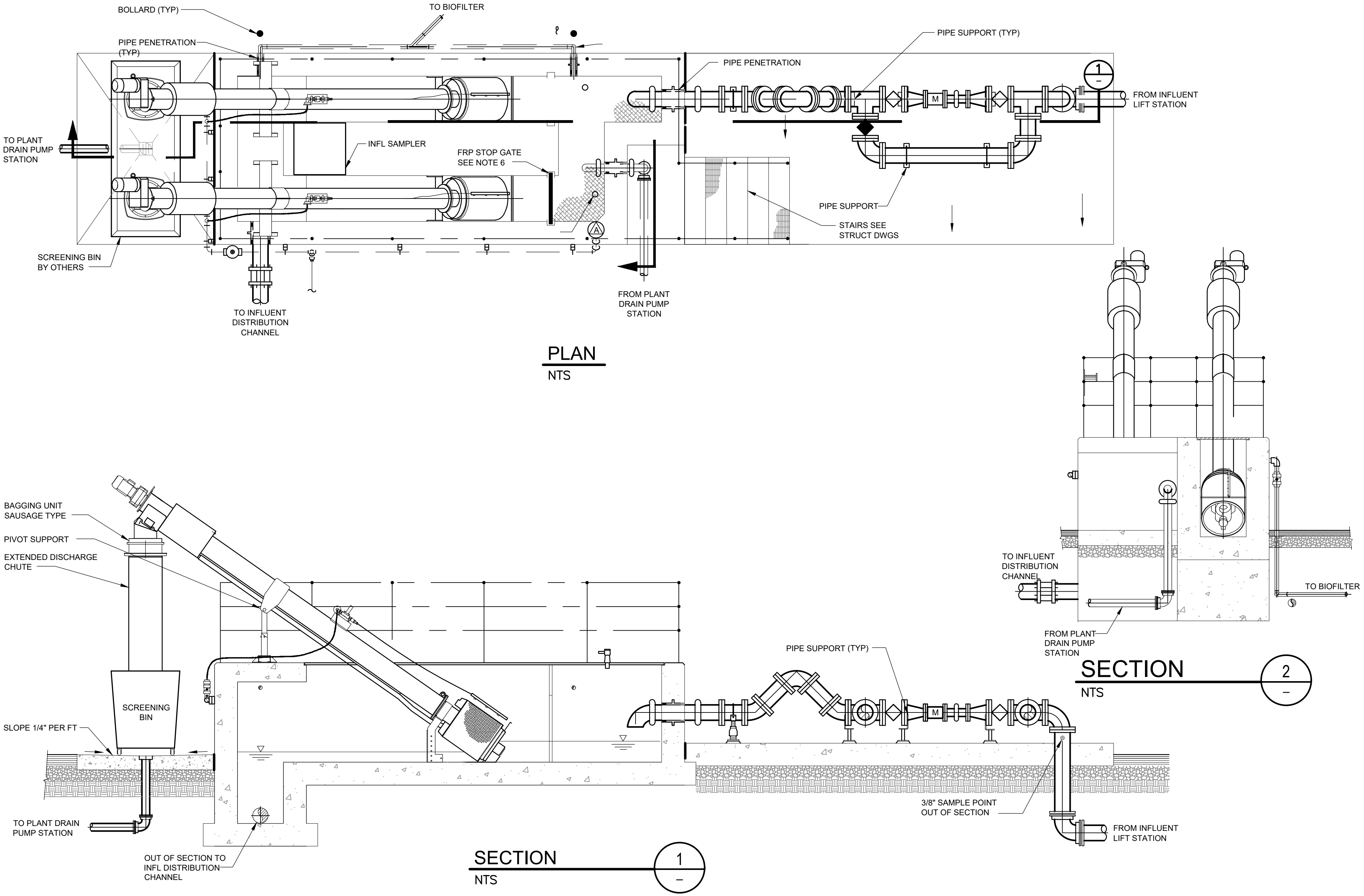

Figure 6-3

Acorn Environmental

Shiloh Resort and Casino Project Water and Wastewater Feasibility Study

Typical Headworks Facility

6.2.3 Immersed Membrane Bioreactor System (Packaged)

An MBR is recommended because of the ease of permitting the plant due to the high-quality effluent, and the effluent's potential suitability for discharge. Sewage would travel between the headworks and the MBRs within a covered influent distribution force main. The force main would pass through headworks to an influent splitter box that would evenly distribute the flow to the two MBR process trains. Sluice gates would be provided to isolate basins for maintenance.

Each MBR process train is divided into three sections: an anoxic section, an aerobic section with mechanical mixers, and an aerobic section containing the immersed membranes. A typical layout for the MBR is shown as **Figure 6-4**. The proposed wastewater treatment plant would meet the design flow requirements specified in **Section 2.3.2**. The general configuration of the packaged MBR would be as follows.

Anoxic Basin: Within the anoxic basin, the influent is mixed with mixed liquor in a tank with a dissolved oxygen (DO) equal to zero. The mixed liquor is pumped back to the anoxic basin from the immersed membrane section of the MBR. The introduction of new influent wastewater to the basin provides a substrate for the return activated sludge to respire and synthesize. The lack of DO in the basin facilitates nitrification and denitrification. Ammonia compounds are converted to nitrates by nitrifying bacteria. Denitrifying bacteria convert nitrates to nitrogen gas, which volatilize out of the basin. The proportion of recirculated mixed liquor to the volume of influent is approximately 6:1. The anoxic basin has a relatively small retention time compared to the aeration basin or the immersed membrane section, due to its smaller volume.

Aeration Basins: The mixed liquor produced by the anoxic basin would flow by gravity through a short channel to the adjacent aeration basin. The aeration basin differs from the anoxic basin in that this basin contains DO, which is introduced to the tank through a series of fine bubble diffusers, connected by headers and pumped by a series of blowers. The DO is required to convert dissolved organic material into a filterable solid material. In this process, aerobic bacteria utilize the carbon in the wastewater for respiration and cell synthesis. The primary outcome result from this basin is an overall reduction in the biochemical oxygen demand (BOD), and the production of a filterable floc.

Immersed Membranes: The microfiltration membranes are long, hollow, spaghetti-like fibers with a nominal pore size of between 0.1 – 0.4 microns. Each of the individual microfiltration membranes is bundled together into modules, and each module is approximately 6 inches in diameter and 5 feet tall. The modules are grouped into sets, called cassettes, which are immersed into the mixed liquor solution. Each of the membrane modules is attached to headers, which create a suction and force water (permeate) through the membrane into the hollow center and onwards to the disinfection process. The mixed liquor that is not forced through the membrane is recirculated back to the anoxic zone. A portion of this recirculated mixed liquor is wasted to the dewatering system and disposal.

Each MBR train contains one permeate pump to force water through the membrane, including an additional standby permeate pump for the overall process that can draw from either train. These pumps can also pump permeate to the backpulse tanks, where water is stored in order to backwash the membrane. The permeate pumps also function as backpulse pumps, which pump permeate from the permeate tanks back to the membranes and keeps solids from accumulating on the membrane surface. The membranes are typically backwashed every 15 minutes, and each backwash lasts about two minutes. The entire backwash process is controlled by a PLC, which operates automatic control valves and isolates the membranes from the permeate pumping process. Sodium hypochlorite and/or citric acid is typically injected into the backpulse flow to facilitate membrane cleaning and prevent regrowth in the membrane modules.

Other facilities: A number of pumps, blowers, chemical storage, chemical metering, control, and electronic facilities are required in order to operate the MBR process. Some of these facilities are typically located in a building near the MBR process or are included on an equipment pad near the MBR system fully enclosed with sound attenuation provisions. Typically, an operations building is constructed which houses plant controls, the motor control center, maintenance facilities, chemical storage and metering, a laboratory, restroom/ washroom, and offices/space for staff. During design development, these facilities will be further defined. **Figure 6-5** shows the proposed electrical, controls, and operations building.

It is typical for a wastewater facility design to include equalization and emergency storage capacity. Equalization capacity will moderate the peak daily flows entering the WWTP. Emergency storage is typically plumbed into the sewage lift station designed to provide sufficient capacity for a peak flow event (or to-be-determined volume) if the lift station fails to deliver. The equalization tank would consist of a concrete tank either at or below grade, of a to-be-determined volume and size. Emergency storage is typically buried concrete or reinforced plastic that is gravity fed and drained from the sewage lift station.

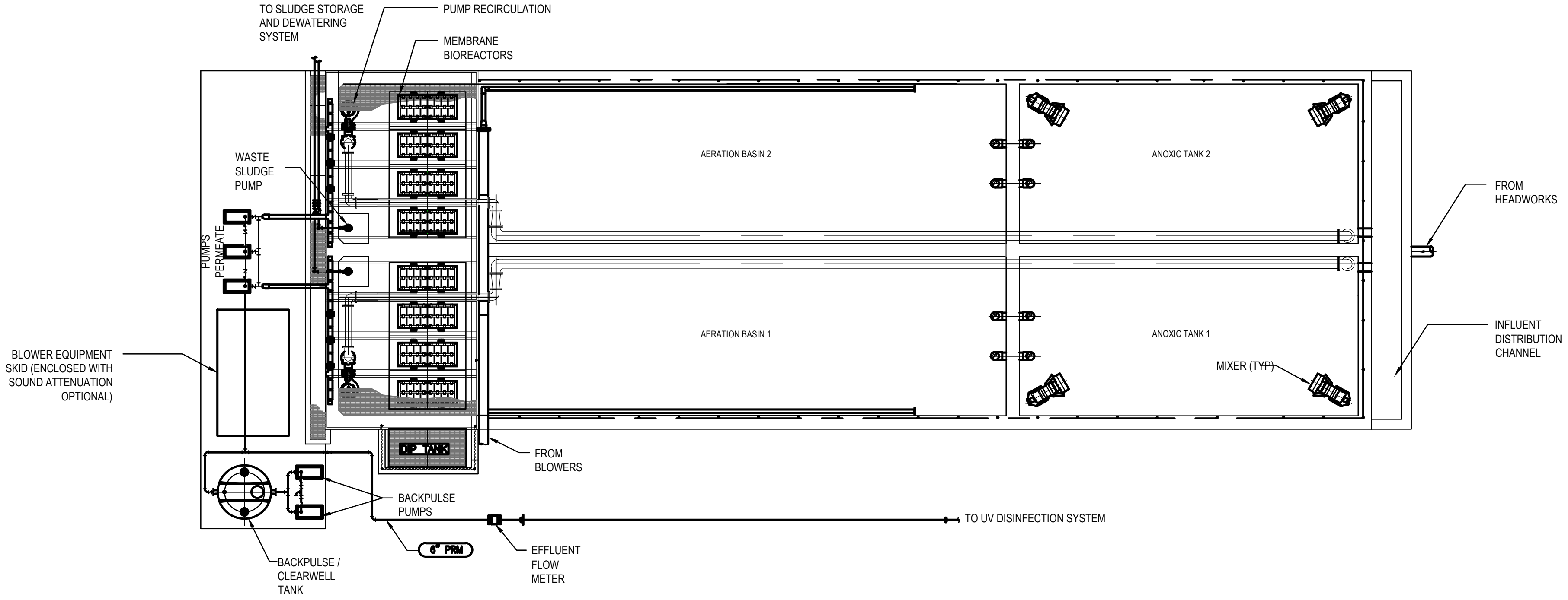

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Figure 6-4
Acorn Environmental
Shiloh Resort and Casino Project Water and Wastewater Feasibility Study
Preliminary Wastewater Treatment Facility Plan

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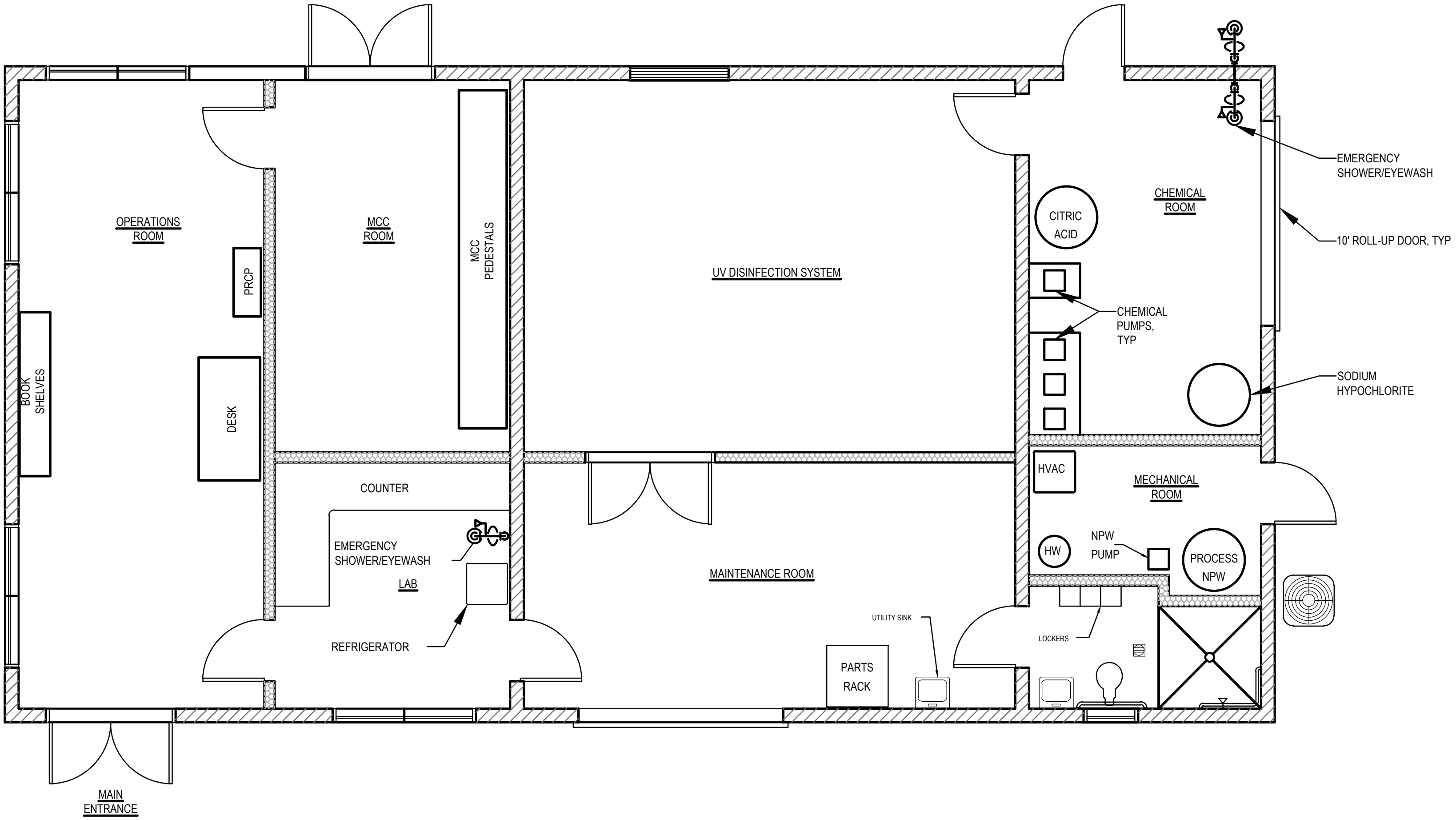

PLAN

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Figure 6-5
Acorn Environmental
Shiloh Resort and Casino Project Water and Wastewater Feasibility Study
Preliminary Operations Building Floor Plan

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6.2.4 Ultraviolet Disinfection

Disinfection to meet discharge and reclamation virus and coliform water quality standards would be provided by constructing or installing an ultraviolet (UV) disinfection system in the operations building. UV disinfection facilities are typically contained within a long, narrow steel channel tank or pipe channel, with banks of UV lamps situated in a laminar flowing channel. A weir would control the water level in the channel, ensuring that the lamps are always submerged. Each UV lamp emits a light with a specific wavelength that is capable of inactivating bacteria and virus, preventing them from reproducing. A proposed location for UV facilities is shown in **Figure 6-5** in the operations building floor plan. **Table 6-4** shows a summary of the recommended UV disinfection design criteria.

Table 6-4: UV Disinfection Design Criteria

Parameter	Value
Lamp location	In-line
Type of lamps	2020W medium pressure UV lamps
Transmittance	65% through quartz sleeve
Flow metering	Magnetic flow meter

6.2.5 Chlorine Disinfection

Though the UV facilities would be designed to disinfect the treated wastewater, they do not continue to disinfect the wastewater after it leaves the UV channel. In order to prevent regrowth of bacteria in the recycled water distribution system, sodium hypochlorite is typically added in small quantities. The introduction of this chemical creates a residual concentration of chlorine that persists in the recycled water and ensures that it is safe to use after it leaves the WWTP. Typical recycled water distribution systems require at least a positive chlorine residual at the point of use, and the dosing of sodium hypochlorite will be adjusted to meet this goal. It is believed that a dose of between 2-3 mg/L for recycled water used for on-site irrigation, cooling, or toilet/urinal flushing would suffice. Chlorine would be dosed at a location downstream of the UV disinfection facilities, and before recycled water is pumped to the recycled water storage tank. Any water discharged to surface waters would be non-chlorinated or fully de-chlorinated prior to discharge.

Chlorine is a very common disinfectant in the treatment and disinfection of wastewater. Sodium hypochlorite is used throughout the wastewater industry for chlorine disinfection, and when used in accordance with that chemical's SDS, is safe for use for this purpose.

6.2.6 Effluent Pump Station

The purpose of the effluent pump station would be to pump treated wastewater to the recycled water storage tank for storage and disposal. This pump station is expected to be a low head pump station that fills the recycled water tank to provide system storage. This pump station would also provide pumping capacity to convey treated effluent directly to the seasonal storage basin/tank if needed, during a higher-than-normal precipitation year for surface water disposal.

6.2.7 Operation and Maintenance

A detailed description of the operations and maintenance program will be prepared following completion of the WWTP design. However, it is expected that the WWTP would be operated and maintained similarly to the standards of other tertiary WWTPs in California.

To this effect, this WWTP will be staffed with operators who are qualified to operate the plant safely, effectively, and in compliance with all permit requirements and regulations. It is expected that the operators will have qualifications similar to those required by the SWRCB Operator Certification Program. This program specifies that for tertiary level WWTPs with design capacities of 1.0 MGD or less, the chief plant operator must be at least a Grade III operator. Supervisors and Shift Supervisors must be at least a Grade II.

6.3 Recycled Water

This section discusses the recommended design criteria for the Project's recycled water facilities. The recommended on-site recycled water facilities include:

- Recycled Water Storage Tank and Pump Station for On-site Landscape Irrigation/Dual Plumbing Facilities/Vineyard Irrigation/Cooling Tower Makeup
- Seasonal Storage Ponds/Tank and Distribution Pump Station

Each of the recycled water facilities is described in the following sections. The overall recycled facilities will be located based on the final design of the Project facilities. All of the recommended facilities described in this section are preliminary and should be utilized for planning purposes only.

6.3.1 Recycled Water Storage Tank and Pump Station

The purpose of this tank would be to provide equalization storage for on-site recycled water use used by the Project for toilet flushing, on-site landscaping, vineyard irrigation, and other uses. Should seasonal storage facilities be constructed, the water may also be pumped to the seasonal storage basins from this storage tank. If desired, recycled water could be utilized to supply water for fire protection, such as the sprinkler systems and fire hydrants.

A typical section for the tank is shown as **Figure 6-6**. The recycled water storage tank would be constructed within the proposed WWTP site. Since the proposed site is relatively flat, the tank would not maintain pressure in the recycled water distribution system. This storage tank would be similar to the potable water storage tank with respect to construction methods. **Table 6-5** shows a summary of the recommended storage tank design criteria assuming the stored recycled water would supply only the Casino and Hotel facilities, Casino landscape and vineyards.

Table 6-5: Recycled Water Storage Tank Design Criteria

Parameter	Value
Approximate size	1 MG
Approximate diameter	60 feet
Approximate height	43 feet
Construction	Welded steel

The recycled water pump station would pump water from the recycled water storage tank to the recycled water distribution system. This pump station would likely need to continuously operate, since there will be no system storage. There are no suitable locations at the proposed Project site for a recycled water storage tank at an elevation that would allow gravity to maintain distribution system pressure.

Optionally, and if layout area permits, the recycled water storage tank and pump station may be sized to meet the recycled water demands of the Project in addition to providing seasonal storage capacity. However, this would require further evaluation and planning.

6.3.1.1 On-Site Water Reuse Facilities

This report assumes that the casino building will be dual-plumbed with both potable and recycled water. The primary uses of recycled water will be for toilet and urinal flushing, on-site landscape irrigation, on-site vineyard irrigation, and cooling tower makeup. The on-site recycled water reuse facilities will be designed to ensure that they comply with all SWRCB standards. The required on-site facilities will be identified upon completion of a site plan and preliminary engineering. The primary on-site design requirements include:

- Recycled water irrigation facilities marked in a purple color.
- Signage informing the public recycled water is used.
- Pipelines in separate trenches a minimum distance away from other water pipelines.
- Labeling of recycled water valves, boxes, and sprinkler heads.

Within the building, the interior plumbing system will have to be plumbed separately from the building’s potable water system and contain no cross connections. The dual plumbed piping systems must be distinctly marked and color-coded.

6.3.2 Seasonal Storage and Discharge Facilities

The proposed seasonal discharge strategy will rely heavily on utilizing the irrigated areas for the summer application of recycled water that cannot be discharged off-site. Seasonal holding ponds, if required, would be constructed using semi-buried ponds and berms. The ponds would need to be lined with a relatively impermeable material such as clay or concrete to minimize percolation into the groundwater and are expected to be located outside of the 100-year flood plain. A typical section for the pond is shown as **Figure 6-7.**

The discharge pump station would pump out of the seasonal storage ponds/tank to the irrigated areas for re-use. These pumps will operate seasonally, typically between April and October, and would be sized to convey the entire volume of recycled water stored in the seasonal storage ponds plus a portion of the daily summertime wastewater flows within a 5-day a week, 8 hours per day time period between March and October.

If a discharge permit is obtained from the RWQCB, the preferred location for a discharge facility is near Pruitt Creek, tributary to Pool Creek and Mark West Creek. This would include a new discharge pipeline, outfall structure, and facility since currently none exist. The outfall structure would be designed to prevent erosion of the natural creek banks and erosion downstream. The elevation of the outfall pipe invert is typically determined during the design phase of the project. The outfall pipe outlet will likely include a duckbill check valve or similar component to protect against settlement/silting inside the pipe or nesting of small animals or rodents. The area around the outfall pipe will be covered with rip rap or similar material to prevent natural erosion around the pipe from occurring and to protect the banks during periods of discharge. The pipe material will need to be suitable for permanent exposure to sunlight and creek water quality conditions.

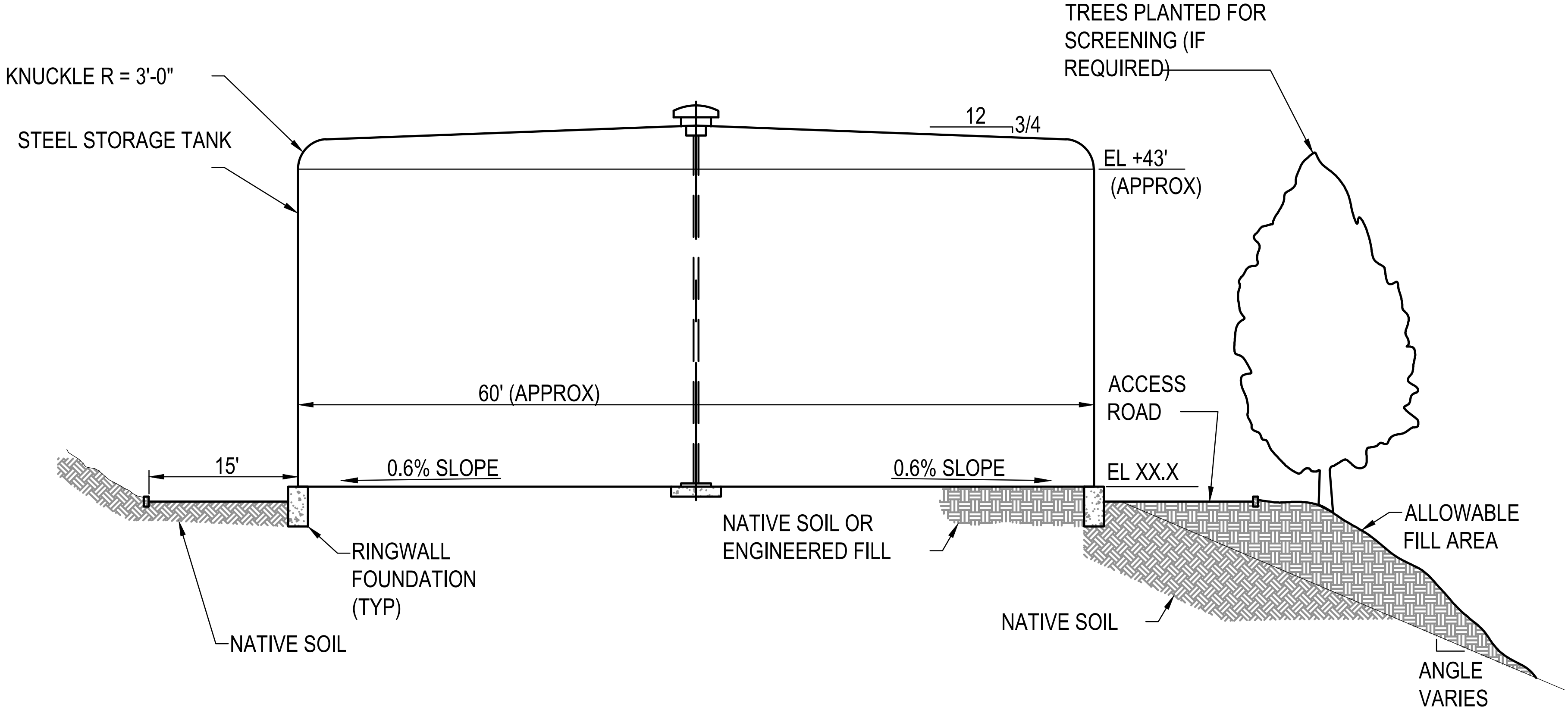

Figure 6-6
Acorn Environmental
Shiloh Resort and Casino Project Water and Wastewater Feasibility Study
Typical Recycled Water Storage Tank

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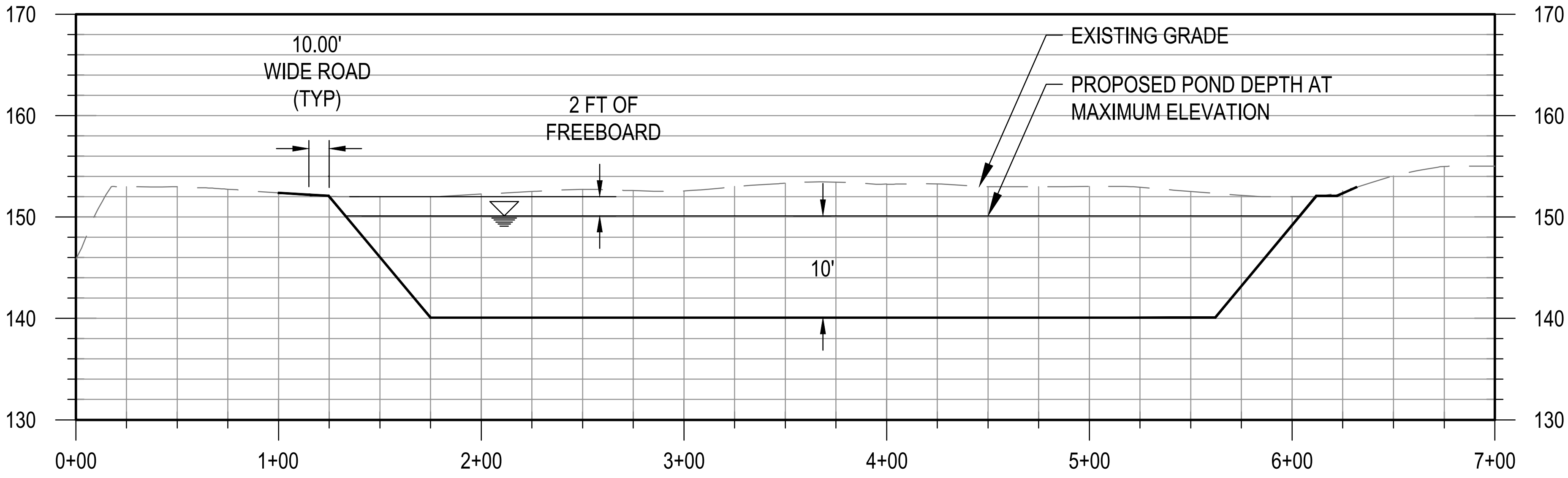

TYPICAL BASIN SECTION

(ELEVATIONS SHOWN ARE FOR INFORMATIONAL PURPOSES ONLY)

Figure 6-7
Acorn Environmental
Shiloh Resort and Casino Project Water and Wastewater Feasibility Study
Typical Open Storage Basin Elevation

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SECTION 7 – RECOMMENDATIONS

This feasibility study report makes the following preliminary recommendations with respect to the proposed Project. This section identifies the recommendations for Alternative A and Alternative B program alternatives.

7.1 Water Supply

The Project should drill two on-site water supply wells to a depth of approximately 700 feet. Each well should be capable of meeting the peak day Project water demands.

The wells should screen off the more shallow aquifers above approximately 200 feet drawing from the deeper aquifer at depths around 400-600 feet.

The Project should plan on the following water supply facilities:

- Investigate the disposition of the existing onsite irrigation well and determine its suitability as a potable water supply source
- One additional potable well (assuming the existing well could be utilized as a second supply)
- Arsenic and Manganese water treatment plant
- Steel water storage tank
- Water distribution pump station

7.2 Wastewater Handling

The Project should construct an on-site WWTP to treat an average weekend flow of 400,000 gpd, 300,000 gpd, and 75,000 gpd for Alternatives A, B, and C, respectively.

The Project should maximize the on-site recycling of wastewater.

The Project should apply for a NPDES permit to discharge effluent to Pruitt Creek.

Flow limitations for off-site discharged should be monitored with the existing USGS gauging station at Mark West Creek. The Project should prepare contingency plans for on-site disposal of wastewater in the event that the NPDES permit is delayed or denied.

The Project should plan on constructing the following wastewater handling facilities:

- Immersed membrane bioreactor WWTP with UV Disinfection & Chlorination
- Effluent pump station
- Recycled water storage tank and pump station
- Recycled water distribution pump station
- Seasonal storage pond
- Acquiring additional property for turf grass irrigation (Alternative A and B only)

SECTION 8 – REFERENCES

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APPENDIX A

Acorn Environmental
Water and Wastewater Feasibility Study
Projected Water and Wastewater Flows

Koi Full Build-out Space Program

	SF	SUBTOTAL	TOTAL	COMMENTS
CASINO				
Casino - Grade Level				
Vestibule	780			
Lobby	12110			
Event Center	53380			2800 Seats
BOH	56750			
Loading Dock	6750			
Net to Conversion	12,977	129,770.00		
Casino - 2nd floor				
Gaming Floor	114,345			3000 Slots / 110 Table Games
Casino Bar	7,855			
Reception Lobby	1,500			
Retail	2,250			
Unassigned 1	2,700			
Service Bar 1	1,250			
Mens Restroom 1	1,250			
Womens Restroom 1	1,250			
High Limits	8,250			
Board Room 1	2,500			
Board room 2	3,700			
Breakout	14,535			
Ballroom	12,400			
Mens Restroom 2	1,000			
Women's Restroom 2	1,000			
Service Bar 2	1,000			
BOH/ Service Elevator	1,240			
Mens Restroom 3	1,000			
Womens Restroom 3	1,000			
Service Bar 3	1,000			
Unassigned 2	11,035			
Cage/ Bank	5,400			
Bridge	5,240			
Sports Book	9,900			
BOH	1,680			
BOH/ Service Elevator	2,100			
Kitchen 1	5,100			
Restaurant 1	7,000			230 Seats
Food Hall	14,000			465 Seats
Mens Restroom 4	830			
Womens Restroom 4	830			
Service Bar 4	830			
Coffee Shop	2,750			
Unassigned 3	2,000			
Large Ballroom	32,500			
Breakout	8,550			

	SF	SUBTOTAL	TOTAL	COMMENTS
Mens Restroom 5	1,600			
Womens Restroom 5	1,600			
BOH	6,300			
Circulation	45,547			
Net to gross conversion	34,582	345,817		
Casino - 3rd floor				
Restaurant 2	5,870			195 Seats
Kitchen 2	3,790			
Restaurant 3	13,940			465 Seats
Restaurant 4	5,290			175 Seats
Kitchen 3	4,390			
Restaurant 5	5,340			175 Seats
Circulation	16,050			
BOH	5,300			
Net to gross conversion	5,997	59,970	535,557	
HOTEL				
Hotel - Grade Level				
Check -in	11,900			
Guestrooms (100)	51,885			100 Rooms per floor
Circulation	5,720			
BOH	3,170			
Net to gross conversion	7,268	72,675		
Hotel - 2nd Floor				
Guestrooms (100)	51,885			100 Rooms per floor
Circulation	5,720			
BOH	3,170			
Net to gross conversion	6,078	60,775		
Hotel - 3rd Floor				
Guestrooms (100)	51,885			100 Rooms per floor
Circulation	5,720			
BOH	3,170			
Net to gross conversion	6,078	60,775		
Hotel - 4th Floor				
Guestrooms (100)	51,885			100 Rooms per floor
Circulation	5,720			
BOH	3,170			
Net to gross conversion	6,078	60,775		
Hotel - 5th Floor				
Spa	13,930			10 Occupants + Staff
Net to gross conversion	1,393	13,930	268,930	
Heated and Cooled Total			804,487	
PARKING				
Casino				
Drop-off	51,000			
Covered - On Grade	235,000			
Bus	6,200	292,200		
Garage				
Garage - Grade level	303,520			
Garage - 2nd floor	303,520			

	SF	SUBTOTAL	TOTAL	COMMENTS
Garage - 3rd Floor	303,520			
Garage - 4th floor	303,520	1,214,080		
Paved Multi-purpose Area				
Parking	183,100	183,100	1,689,380	
Sq Footage Grand Total			**3,298,354**	
Parking Count Summary				
Casino/ Drop-off	800			
Garage - 1st Floor	923			
Garage - 2nd Floor	923			
Garage - 3rd Floor	923			
Garage - 4th Floor	923			
Paved Multi-Purpose Area	618			
Bus	9	5119		

Koi Reduced Intensity Space Program

	SF	SUBTOTAL	TOTAL	COMMENTS
CASINO				
Casino - Grade Level				
Vestibule	780			
Lobby	12110			
BOH	28423			
Loading Dock	6750			
Net to Conversion	4,806	48,063.00		
Casino - 2nd floor				
Gaming Floor	114,345			3000 Slots / 110 Table Games
Casino Bar	7,855			
Reception Lobby	1,500			
Retail	2,250			
Unassigned 1	2,700			
Service Bar 1	1,250			
Mens Restroom 1	1,250			
Womens Restroom 1	1,250			
High Limits	8,250			
Board Room 1	2,500			
Board room 2	3,700			
Breakout	14,535			
Ballroom	12,400			
Mens Restroom 2	1,000			
Women's Restroom 2	1,000			
Service Bar 2	1,000			
BOH/ Service Elevator	1,240			
Mens Restroom 3	1,000			
Womens Restroom 3	1,000			
Service Bar 3	1,000			
Unassigned 2	11,035			
Cage/ Bank	5,400			
Bridge	5,240			
Sports Book	9,900			
BOH	1,680			
BOH/ Service Elevator	2,100			
Kitchen 1	5,100			
Restaurant 1	7,000			230 Seats
Food Hall	14,000			465 Seats
Mens Restroom 4	830			
Womens Restroom 4	830			
Service Bar 4	830			
Coffee Shop	2,750			
Unassigned 3	2,000			
Mens Restroom 5	1,600			
Womens Restroom 5	1,600			
BOH	6,300			

	SF	SUBTOTAL	TOTAL	COMMENTS
Circulation	38,629			
Net to gross conversion	29,785	297,849		
Casino - 3rd floor				
Restaurant 2	5,870			195 Seats
Kitchen 2	3,790			
Restaurant 3	13,940			465 Seats
Restaurant 4	5,290			175 Seats
Kitchen 3	4,390			
Restaurant 5	5,340			175 Seats
Circulation	16,050			
BOH	5,300			
Net to gross conversion	5,997	59,970	405,882	
HOTEL				
Hotel - Grade Level				
Check -in	11,900			
Guestrooms (100)	51,885			100 Rooms per floor
Circulation	5,720			
BOH	3,170			
Net to gross conversion	7,268	72,675		
Hotel - 2nd Floor				
Guestrooms (100)	51,885			100 Rooms per floor
Circulation	5,720			
BOH	3,170			
Net to gross conversion	6,078	60,775		
Hotel - 3rd Floor				
Spa	13,930			10 Occupants + Staff
Net to gross conversion	1,393	13,930	147,380	
Heated and Cooled Total			553,262	
PARKING				
Casino				
Drop-off	51,000			
Covered - On Grade	235,000			
Bus	6,200	292,200		
Garage				
Garage - Grade level	303,520			
Garage - 2nd floor	303,520			
Garage - 3rd Floor	303,520			
Garage - 4th floor	303,520	1,214,080		
Sq Footage Grand Total			**1,106,524**	
Parking Count Summary				
Casino/ Drop-off	760			
Garage - 1st Floor	923			
Garage - 2nd Floor	923			
Garage - 3rd Floor	923			
Garage - 4th Floor	923			
Bus	9	4461		

	SF	SUBTOTAL	TOTAL	O.L.	COMMENTS
Koi Non - Gaming Square Footages					
Hotel	65,000 / Level	130,000 SF			
Hotel Lobby	8,000 SF				
Spa	14,000 SF			760 (Includes Hotel/Lobby)	
Restaurant	4,700 SF	4,700 SF Kitchen		337	
Winery	20,000 SF			67	
Visitor Center	5,000 SF			17	
			212,400 SF	**1,181**	

Parking Calculations	**Regulation Summary**	**SF/Room Count**			**Spaces Required**
Hotel	1 space/unit plus 1 space for manager	200 Rooms	5 Managers/ Staff		205 Req'd
Dining	1 Space/60 sq. ft. dining area	4,700 SF			79 Req'd
Spa	1 Space/100 SF	14,000 SF			140 Req'd
Winery	1 Space/2000 SF	46,000 SF			23 Req'd
Visitor Center	1 Space/250 SF	5,000 SF			20 Req'd
					Total
					467 Req'd

*O.L. Stands for Occuapant Load

Parking Code -https://library.municode.com/ca/sonoma_county/codes/code_of_ordinances?nodeId=CH26SOCOZORE_ART86PARE

Koi Full Build-out Space Program

	SF	SUBTOTAL	TOTAL	O.L.	COMMENTS

CASINO

Casino - Grade Level

Vestibule	780				
Lobby	12110				
Event Center	53380			2800	2800 Seats
BOH	59330			198	
Loading Dock	6750				
Net to Conversion	13,235	132,350.00		2,998.00	

Casino - 2nd floor

Gaming Floor	114,345			10395	2,750 Slots/105 Table Games
Casino Bar	7,855				
Reception Lobby	1,500				
Retail	2,250				
Unassigned 1	2,700				
Service Bar 1	1,250				
Mens Restroom 1	1,250				
Womens Restroom 1	1,250				
High Limits	8,250			750	
Board Room 1	2,500			250	
Board room 2	3,700			370	
Breakout	14,535				
Ballroom	12,400			1,240	
Mens Restroom 2	1,000				
Women's Restroom 2	1,000				
Service Bar 2	1,000				
BOH/ Service Elevator	1,240				
Mens Restroom 3	1,000				
Womens Restroom 3	1,000				
Service Bar 3	1,000				
Unassigned 2	11,035				
Cage/ Bank	5,400				
Bridge	5,240				
Sports Book	9,900				
BOH	1,680				
BOH/ Service Elevator	2,100				
Kitchen 1	5,100			26	
Restaurant 1	7,000			467	230 Seats
Food Hall	14,000			465	465 Seats
Mens Restroom 4	830				
Womens Restroom 4	830				
Service Bar 4	830				
Coffee Shop	2,750			184	
Unassigned 3	2,000				

	SF	SUBTOTAL	TOTAL	O.L.	COMMENTS
Large Ballroom	32,500			3250	
Breakout	8,550				
Mens Restroom 5	1,600				
Womens Restroom 5	1,600				
BOH	6,300				
Circulation	45,547				
Net to gross conversion	34,582	345,817		17,397	
Casino - 3rd floor					
Restaurant 2	5,870			392	195 Seats
Kitchen 2	3,790			19	
Restaurant 3	13,940			930	465 Seats
Restaurant 4	5,290			353	175 Seats
Kitchen 3	4,390			22	
Restaurant 5	5,340			356	175 Seats
Circulation	16,050				
BOH	5,300				
Net to gross conversion	5,997	59,970		2,072	
			538,137	**19,469**	
HOTEL					
Hotel - Grade Level					
Check -in	11,900				
Guestrooms (100)	51,885				100 Rooms per floor
Circulation	5,720				
BOH	3,170				
Net to gross conversion	7,268	72,675			
Hotel - 2nd Floor					
Guestrooms (100)	51,885				100 Rooms per floor
Circulation	5,720				
BOH	3,170				
Net to gross conversion	6,078	60,775			
Hotel - 3rd Floor					
Guestrooms (100)	51,885				100 Rooms per floor
Circulation	5,720				
BOH	3,170				
Net to gross conversion	6,078	60,775			
Hotel - 4th Floor					
Guestrooms (100)	51,885				100 Rooms per floor
Circulation	5,720				
BOH	3,170				
Net to gross conversion	6,078	60,775			
Hotel - 5th Floor					

	SF	SUBTOTAL	TOTAL	O.L.	COMMENTS
Spa	13,930				10 Occupants + Staff
Net to gross conversion	1,393	13,930	**268,930**	**1,345**	
Heated and Cooled Total			**807,067**	**20,814**	

PARKING

Casino					
Drop-off	51,000				
Covered - On Grade	235,000				
Bus	6,200	292,200			
Garage					
Garage - Grade level	303,520				
Garage - 2nd floor	303,520				
Garage - 3rd Floor	303,520				
Garage - 4th floor	303,520	1,214,080			
Paved Multi-purpose Area					
Parking	183,100	183,100	1,689,380		
Sq Footage Grand Total			**3,303,51**		

Parking Count Summary

Casino/ Drop-off	800				
Garage - 1st Floor	923				
Garage - 2nd Floor	923				
Garage - 3rd Floor	923				
Garage - 4th Floor	923				
Paved Multi-Purpose Area	618				
Bus	9	5119			

Parking Calculations	**Regulation Summary**	**SF/Room Count**			**Spaces Required**
Hotel	1 space/unit plus 1 space for manager	400 rooms	40 Managers/ Staff		440 Req'd
Dining	1 Space/60 sq. ft. dining area	51,440 SF			857 Req'd
Event Center	1 Space/4 seats or 1 space/75 sq. ft. floor area, whichever is greater	2800 Seats/ 53380 SF			712 Req'd
Casino	1 Space per slot machine/2 Space per table game	2,960			2,960 Req'd
					Spaces Required
					4,969

Parking Code -https://library.municode.com/ca/sonoma_county/codes/code_of_ordinances?nodeId=CH26SOCOZORE_ART86PARE

Project: **Shiloh Resort and Casino Project**
Program **Alternative A**
Date: **12/7/2022**
Title: **Water Demand and Wastewater Flow Projection**

						A.M.		P.M.		Typical WEEKDAY Flows	A.M.		P.M.		Typical WEEKEND Peak Flows	WEIGHTED AVERAGE Day Flows
Element	**Units**	**Quantity**	**Quantity**	**Unit Flow (gpd/unit)**	**Base Flow**	**Factor**		**Factor**			**Factor**		**Factor**			
			SF	**gpd/unit**	**gpd**	**%**	**gpd**	**%**	**gpd**	**gpd**	**%**	**gpd**	**%**	**gpd**	**gpd**	**gpd**
CASINO			535,557													
Casino - Grade Level																
Vestibule	SF		780	0	0	0%	0	0%	0	0	0%	0	0%	0	0	0
Lobby	SF		12,110	0.0	0	30%	0	50%	0	0	70%	0	80%	0	0	0
Event Center	seats	2800	53,380	35	98,000	0%	0	30%	29,400	14,700	30%	29,400	90%	88,200	58,800	33,600
BOH	LS	1	56,750	7,000	7,000	30%	2,100	50%	3,500	2,800	70%	4,900	100%	7,000	5,950	4,150
Loading Dock	SF		6,750	0	0	0%	0	0%	0	0	0%	0	0%	0	0	0
Subtotal					**105,000**					**17,500**					**64,750**	**37,750**
Casino - Second Floor																
Gaming Floor	SF		114,345	0.6	68,607	30%	20,582	50%	34,304	27,443	60%	41,164	90%	61,746	51,455	37,734
Casino Bar	SF		7,855	0.7	5,106	30%	1,532	50%	2,553	2,042	60%	3,063	100%	5,106	4,085	2,918
Reception Lobby	SF		1,500	0.0	0	30%	0	50%	0	0	60%	0	80%	0	0	0
Retail	SF		2,250	0.05	113	30%	34	50%	56	45	60%	68	80%	90	79	59
Unassigned	SF		15,735	0.1	1,574	30%	472	50%	787	629	60%	944	80%	1,259	1,101	832
Service Bar	SF		4,080	0.1	408	30%	122	50%	204	163	60%	245	80%	326	286	216
Men's Restroom	SF		5,680	0.0	0	0%	0	0%	0	0	0%	0	0%	0	0	0
Women's Restroom	SF		5,680	0.0	0	0%	0	0%	0	0	0%	0	0%	0	0	0
High Limits	LS	1	8,250	2,500	2,500	30%	750	50%	1,250	1,000	60%	1,500	80%	2,000	1,750	1,321
Board Room	SF		6,200	0.5	3,100	30%	930	50%	1,550	1,240	60%	1,860	80%	2,480	2,170	1,639
Breakout	SF		23,085	0.5	11,543	30%	3,463	50%	5,771	4,617	50%	5,771	80%	9,234	7,503	5,854
Ballroom	SF		44,900	0.75	33,675	0%	0	0%	0	0	50%	16,838	90%	30,308	23,573	10,103
BOH/Service Elevator	SF	1	9,220	1,500	1,500	0%	0	0%	0	0	0%	0	0%	0	0	0
Cage/Bank	SF		5,400	0	0	0%	0	0%	0	0	0%	0	0%	0	0	0
Bridge	SF		5,240	0	0	0%	0	0%	0	0	0%	0	0%	0	0	0
Sports Book	SF		9,900	0.7	6,435	30%	1,931	50%	3,218	2,574	50%	3,218	80%	5,148	4,183	3,263
Kitchen	SF		5,100	0.0	0	30%	0	50%	0	0	70%	0	100%	0	0	0
Restaurant 1	seats	230	7,000	70	16,100	30%	4,830	50%	8,050	6,440	60%	9,660	90%	14,490	12,075	8,855
Food Hall	seats	465	14,000	60	27,900	30%	8,370	50%	13,950	11,160	60%	16,740	90%	25,110	20,925	15,345
Coffee Shop	SF		2,750	2.6	7,150	50%	3,575	50%	3,575	3,575	90%	6,435	60%	4,290	5,363	4,341
Circulation	SF		45,547	0.0	0	0%	0	50%	0	0	50%	0	80%	0	0	0
Subtotal					**185,709**					**60,929**					**134,546**	**92,479**
Casino - Third Floor																
Restaurant 2	seats	195	5,870	70	13,650	30%	4,095	50%	6,825	5,460	60%	8,190	90%	12,285	10,238	7,508
Restaurant 3	seats	465	13,940	70	32,550	30%	9,765	50%	16,275	13,020	60%	19,530	90%	29,295	24,413	17,903
Restaurant 4	seats	175	5,290	70	12,250	30%	3,675	50%	6,125	4,900	60%	7,350	90%	11,025	9,188	6,738
Restaurant 5	seats	175	5,340	70	12,250	30%	3,675	50%	6,125	4,900	60%	7,350	90%	11,025	9,188	6,738
Kitchen	SF		8,180	0.0	0	30%	0	65%	0	0	70%	0	100%	0	0	0
Circulation	SF		16,050	0.0	0	30%	0	65%	0	0	50%	0	80%	0	0	0
BOH	LS	1	5,300	7,000	7,000	30%	2,100	65%	4,550	3,325	50%	3,500	80%	5,600	4,550	3,850
Subtotal					**77,700**					**31,605**					**57,575**	**42,735**
HOTEL[6]																
Hotel - Grade Level																
Check-In	SF		11,900	0.0	0	30%	0	50%	0	0	100%	0	100%	0	0	0
Guestrooms	rooms	100	51,885	250	25,000	30%	7,500	50%	12,500	10,000	50%	12,500	90%	22,500	17,500	13,214
Circulation	SF		5,720	0.0	0	30%	0	50%	0	0	100%	0	100%	0	0	0
BOH	LS	1	3,170	2,500	2,500	30%	750	50%	1,250	1,000	80%	2,000	50%	1,250	1,625	1,268
Subtotal					**27,500**					**11,000**					**19,125**	**14,482**
Hotel - Second Floor																
Guestrooms	rooms	100	51,885	250	25,000	30%	7,500	50%	12,500	10,000	50%	12,500	90%	22,500	17,500	13,214
Circulation	SF		5,720	0.0	0	30%	0	50%	0	0	100%	0	100%	0	0	0
BOH	LS	1	3,170	2,500	2,500	30%	750	50%	1,250	1,000	80%	2,000	50%	1,250	1,625	1,268
Subtotal					**27,500**					**11,000**					**19,125**	**14,482**
Hotel - Third Floor																
Guestrooms	rooms	100	51,885	250	25,000	30%	7,500	50%	12,500	10,000	50%	12,500	90%	22,500	17,500	13,214
Circulation	SF		5,720	0.0	0	30%	0	50%	0	0	100%	0	100%	0	0	0
BOH	LS	1	3,170	2,500	2,500	30%	750	50%	1,250	1,000	80%	2,000	50%	1,250	1,625	1,268
Subtotal					**27,500**					**11,000**					**19,125**	**14,482**
Hotel - Fourth Floor																
Guestrooms	rooms	100	51,885	250	25,000	30%	7,500	50%	12,500	10,000	50%	12,500	90%	22,500	17,500	13,214
Circulation	SF		5,720	0.0	0	30%	0	50%	0	0	100%	0	100%	0	0	0
BOH	LS	1	3,170	2,500	2,500	30%	750	50%	1,250	1,000	80%	2,000	50%	1,250	1,625	1,268
Subtotal					**27,500**					**11,000**					**19,125**	**14,482**
Hotel - Fifth Floor																
Spa	No. Occup	10	13,930	0.10	1,393	50%	697	50%	697	697	90%	1,254	90%	1,254	1,254	935
Subtotal					**1,393**					**697**					**1,254**	**935**
Total Area			**802,387**													
GRAND TOTAL WW FLOWS				**BASE FLOW**	**479,900**		**WEEKDAY AVERAGE FLOW**			**154,800**		**WEEKEND AVERAGE FLOW**			**334,700**	**231,900**
Calculated Peaking Factor										1.00					2.16	1.50
AVG POTABLE WATER DEMAND (20% INCREASE OVER WW FLOW ESTIMATE)					**575,900**					**185,800**					**401,700**	**278,300**

Assumptions -

1. Circulation, check-in and similar areas were included in BOH lump sums for Hotel and Casino.
2. All dining facilities will see high usage due to proximity to major road. Dining facility usage includes kitchen use.
3. Unit flows used were based on the most conservative values found in online data, real time data from previous projects, etc.
4. Unassigned element will see similar usage as a service bar.
5. Usage for restrooms included in the other demands.
6. The swimming pool is expected to experience nominal water loss through evaporation.

Project: **Shiloh Resort and Casino Project**
Program **Alternative B**
Date: **12/7/2022**
Title: **Water Demand and Wastewater Flow Projection**

						A.M.		P.M.		Typical WEEKDAY Flows	A.M.		P.M.		Typical WEEKEND Peak Flows	WEIGHTED AVERAGE Day Flows
Element	Units	Quantity	Quantity	Unit Flow (gpd/unit)	Base Flow	Factor		Factor			Factor		Factor			
			SF	gpd/unit	gpd	%	gpd	%	gpd	gpd	%	gpd	%	gpd	gpd	gpd
CASINO																
Casino - Grade Level																
Vestibule	SF		780	0	0	0%	0	0%	0	0	0%	0	0%	0	0	0
Lobby	SF		12,110	0.0	0	30%	0	50%	0	0	70%	0	80%	0	0	0
BOH	LS	1	28,423	3,500	3,500	30%	1,050	50%	1,750	1,400	70%	2,450	100%	3,500	2,975	2,075
Loading Dock	SF		6,750	0	0	0%	0	0%	0	0	0%	0	0%	0	0	0
Subtotal					**3,500**					**1,400**					**2,975**	**2,075**
Casino - Second Floor																
Gaming Floor	SF		114,345	0.6	68,607	30%	20,582	50%	34,304	27,443	60%	41,164	90%	61,746	51,455	37,734
Casino Bar	SF		7,855	0.7	5,106	30%	1,532	50%	2,553	2,042	60%	3,063	100%	5,106	4,085	2,918
Reception Lobby	SF		1,500	0.0	0	30%	0	50%	0	0	60%	0	80%	0	0	0
Retail	SF		2,250	0.05	113	30%	34	50%	56	45	60%	68	80%	90	79	59
Unassigned	SF		15,735	0.1	1,574	30%	472	50%	787	629	60%	944	80%	1,259	1,101	832
Service Bar	SF		4,080	0.1	408	30%	122	50%	204	163	60%	245	80%	326	286	216
Men's Restroom	SF		5,680	0.0	0	0%	0	0%	0	0	0%	0	0%	0	0	0
Women's Restroom	SF		5,680	0.0	0	0%	0	0%	0	0	0%	0	0%	0	0	0
High Limits	LS	1	8,250	2,500	2,500	30%	750	50%	1,250	1,000	60%	1,500	80%	2,000	1,750	1,321
Board Room	SF		6,200	0.50	3,100	30%	930	50%	1,550	1,240	60%	1,860	80%	2,480	2,170	1,639
Breakout	SF		14,535	0.50	7,268	30%	2,180	50%	3,634	2,907	50%	3,634	80%	5,814	4,724	3,686
Ballroom	SF		12,400	1	9,300	0%	0	0%	0	0	50%	4,650	90%	8,370	6,510	2,790
BOH/Service Elevator	SF	1	11,320	2,500	2,500	0%	0	0%	0	0	0%	0	0%	0	0	0
Cage/Bank	SF		5,400	0	0	0%	0	0%	0	0	0%	0	0%	0	0	0
Bridge	SF		5,240	0	0	0%	0	0%	0	0	0%	0	0%	0	0	0
Sports Book	SF		9,900	0.7	6,435	30%	1,931	50%	3,218	2,574	50%	3,218	80%	5,148	4,183	3,263
Kitchen	SF		5,100	0.0	0	30%	0	50%	0	0	70%	0	100%	0	0	0
Restaurant 1	seats	230	7,000	70	16,100	30%	4,830	50%	8,050	6,440	60%	9,660	90%	14,490	12,075	8,855
Food Hall	seats	465	14,000	60	27,900	30%	8,370	50%	13,950	11,160	60%	16,740	90%	25,110	20,925	15,345
Coffee Shop	SF		2,750	2.6	7,150	50%	3,575	50%	3,575	3,575	90%	6,435	60%	4,290	5,363	4,341
Circulation	SF		38,629	0.0	0	0%	0	50%	0	0	50%	0	80%	0	0	0
Subtotal					**158,059**					**59,219**					**114,705**	**82,998**
Casino - Third Floor																
Restaurant 2	seats	195	5,870	70	13,650	30%	4,095	50%	6,825	5,460	60%	8,190	90%	12,285	10,238	7,508
Restaurant 3	seats	465	13,940	70	32,550	30%	9,765	50%	16,275	13,020	60%	19,530	90%	29,295	24,413	17,903
Restaurant 4	seats	175	5,290	70	12,250	30%	3,675	50%	6,125	4,900	60%	7,350	90%	11,025	9,188	6,738
Restaurant 5	seats	175	5,340	70	12,250	30%	3,675	50%	6,125	4,900	60%	7,350	90%	11,025	9,188	6,738
Kitchen	SF		8,180	0.0	0	30%	0	65%	0	0	70%	0	100%	0	0	0
Circulation	SF		16,050	0.0	0	30%	0	65%	0	0	50%	0	80%	0	0	0
BOH	LS	1	5,300	7,000	7,000	30%	2,100	65%	4,550	3,325	50%	3,500	80%	5,600	4,550	3,850
Subtotal					**77,700**					**31,605**					**57,575**	**42,735**
HOTEL[6]																
Hotel - Grade Level																
Check-In	SF		11,900	0.0	0	30%	0	50%	0	0	100%	0	100%	0	0	0
Guestrooms	rooms	100	51,885	250	25,000	30%	7,500	50%	12,500	10,000	50%	12,500	90%	22,500	17,500	13,214
Circulation	SF		5,720	0.0	0	30%	0	50%	0	0	100%	0	100%	0	0	0
BOH	LS	1	3,170	2,500	2,500	30%	750	50%	1,250	1,000	80%	2,000	50%	1,250	1,625	1,268
Subtotal					**27,500**					**11,000**					**19,125**	**14,482**
Hotel - Second Floor																
Guestrooms	rooms	100	51,885	250	25,000	30%	7,500	50%	12,500	10,000	50%	12,500	90%	22,500	17,500	13,214
Circulation	SF		5,720	0.0	0	30%	0	50%	0	0	100%	0	100%	0	0	0
BOH	LS	1	3,170	2,500	2,500	30%	750	50%	1,250	1,000	80%	2,000	50%	1,250	1,625	1,268
Subtotal			**133,450**		**27,500**					**11,000**					**19,125**	**14,482**
Hotel - Third Floor																
Spa	No. Occup	10	13,930	0.10	1,393	50%	697	50%	697	697	90%	1,254	90%	1,254	1,254	935
Subtotal					**1,393**					**697**					**1,254**	**935**
Total Area			**686,712**													
GRAND TOTAL WW FLOWS				**BASE FLOW**	**295,700**			**WEEKDAY AVERAGE FLOW**		**115,000**			**WEEKEND AVERAGE FLOW**		**214,800**	**157,800**
Calculated Peaking Factor										1.00					1.87	1.37
AVG POTABLE WATER DEMAND (20% INCREASE OVER WW FLOW ESTIMATE)					**354,900**					**138,000**					**257,800**	**189,400**

Assumptions -

1. Circulation, check-in and similar areas were included in BOH lump sums for Hotel and Casino.
2. All dining facilities will see high usage due to proximity to major road. Dining facility usage includes kitchen use.
3. Unit flows used were based on the most conservative values found in online data, real time data from previous projects, etc.
4. Unassigned element will see similar usage as a service bar.
5. Usage for restrooms included in the other demands.
6. The swimming pool is expected to experience nominal water loss through evaporation.

Project: **Shiloh Resort and Winery (Non-Gaming)**
Program **Alternative C**
Date: **12/7/2022**
Title: **Water Demand and Wastewater Flow Projection**

						A.M.		P.M.		Typical WEEKDAY Flows	A.M.		P.M.		Typical WEEKEND Peak Flows	WEIGHTED AVERAGE Day Flows
Element	**Units**	**Quantity**	**Quantity**	**Unit Flow[2] (gpd/unit)**	**Base Flow**	**Factor**		**Factor**			**Factor**		**Factor**			
			SF	**gpd/unit**	**gpd**	**%**	**gpd**	**%**	**gpd**	**gpd**	**%**	**gpd**	**%**	**gpd**	**gpd**	**gpd**
FACILITY																
Dining[1]			4,700	2.6	12,220	30%	3,666	50%	6,110	4,888	60%	7,332	90%	10,998	9,165	6,721
Kitchen			4,700	0.0	0	0%	0	0%	0	0	0%	0	0%	0	0	0
Winery[4]			20,000	-											2,112	2,112
Visitor Center	SF	5,000	2,500	0.05	125	30%	38	50%	63	50	60%	75	90%	113	94	69
Tasting Room[5]			2,500	0.30	750	30%	225	50%	375	300	60%	450	90%	675	563	413
Subtotal					**13,095**					**5,238**					**11,933**	**9,314**
HOTEL[3]																
Hotel - Grade Level																
Lobby	LS	1	8,000	5,000	5,000	30%	1,500	50%	2,500	2,000	100%	5,000	100%	5,000	5,000	3,286
Guestrooms	rooms	100	65,000	250	25,000	30%	7,500	50%	12,500	10,000	50%	12,500	90%	22,500	17,500	13,214
Subtotal					**30,000**					**12,000**					**22,500**	**16,500**
Hotel - Second Floor																
Guestrooms	rooms	100	65,000	250	25,000	30%	7,500	50%	12,500	10,000	50%	12,500	90%	22,500	17,500	13,214
Subtotal					**25,000**					**10,000**					**17,500**	**13,214**
Hotel - Third Floor																
Spa			14,000	0.10	1,400	50%	700	50%	700	700	90%	1,260	90%	1,260	1,260	940
Subtotal					**1,400**					**700**					**1,260**	**940**
Total Area			**186,400**													
GRAND TOTAL WW FLOWS				**BASE FLOW**	**69,500**				**WEEKDAY AVERAGE FLOW**	**28,000**				**WEEKEND AVERAGE FLOW**	**53,200**	**40,000**
Calculated Peaking Factor										1.00					1.90	1.43
AVG POTABLE WATER DEMAND (20% INCREASE OVER WW FLOW ESTIMATE)					**83,400**					**33,600**					**63,900**	**48,000**

Assumptions -

1. All dining facilities will see high usage due to proximity to major road. Dining facility usage includes kitchen use.
2. Unit flows used were based on the most conservative values found in online data, real time data from previous projects, etc.
3. The swimming pool is expected to experience nominal water loss through evaporation.
4. See separate table for winery calculations. Winery flow projections are not affected by time of day, but are affected by duration of crush season. The projections have been included in the water balance.
5. Assumed tasting room is 50% of the visitor center area building space.

Project: **Shiloh Resort (Non-Gaming)**
Program **Alternative C**
Date: **12/7/2022**
Title: **Water Demand and Wastewater Flow Projection - Winery**

						Crush Season			Non-Crush Season			Average Day Flows		AVERAGE Day Flows
Element	**Units**	**Quantity**	**Production**	**Efficiency[1]**	**Annual Flow**	**Factor[2]**	**Length**	**Flow**	**Factor**	**Length**		**Crush Season**	**Non-Crush Season**	
		SF	**cases/year**	**gal/case**	**gal**	**%**	**days**	**gal**	**%**	**days**	**gpd**	**gpd**	**gpd**	**gpd**
FACILITY														
Winery (Production)		20,000	15,000	4.8	72,000	90%	31	64,800	10%	334	7,200	2,090	22	2,112
Subtotal					**72,000**							**2,090**	**22**	**2,112**
Total Area			**20,000**											
GRAND TOTAL WW FLOWS				**BASE FLOW**	**72,000**				**WEEKDAY AVERAGE FLOW**			**2,100**	**100**	**2,200**
Calculated Peaking Factor												1.00	0.05	1.05
AVG POTABLE WATER DEMAND (20% INCREASE OVER WW FLOW ESTIMATE)					**86,400**							**2,600**	**200**	**2,700**

Assumptions -

1. Efficiency was assumed to be better than what is typical for a small facility due to being a new facility/infrastructure.
2. Percentage of grapes harvested during crush season is higher than typical due to relatively flat topography for the site and assumption that all grapes will be ready for harvesting around the same time.

Water Balance - Shiloh Resort and Casino Feasibility Study - Proposed (Alternative A)

Scenario: Alternative A - Option 1

August 2022 By: Jory Benitez/Angela Singer, HydroScience

INPUT
INPUT-Adjust as necessary
OUTPUT-Max Elevation

WASTEWATER INFLUENT FLOW

Daily Average Wastewater Influent Flow	**231,900**	gpd
I/I (PWWF-PDWF)	**250,452**	gpd

STORAGE DATA

Basin Volume	12.1	MG
Basin Area	4.08	acres

OTHER INPUTS

100-YR Multiplier	2.06	unitless
Pan Evap Coefficient	0.75	unitless

RECYCLED WATER DISTRIBUTION AND DISPOSAL ALTERNATIVES[2]

andscape Irrigation (Casino)	4.4	acres	Vineyards (Casino)	12.4	acres	Landscpe Irrig (TBD)	0.0	acres
Dual Plumbing	26.4	MG	Surface Water Discharge	301	MG	Additonal Turf Grass	0.0	acres

100-YEAR ANNUAL PRECIPITATION RETURN PERIOD

	Units	October	November	December	January	February	March	April	May	June	July	August	September	Water Year
No. Days		31	30	31	31	28	31	30	31	30	31	31	30	
CLIMATE INPUTS														
Precipitation	in	4.32	6.85	14.63	11.59	12.16	8.50	4.08	2.00	0.51	0.02	0.02	0.31	65.00
Pan Evaporation	in	5.72	2.48	1.66	1.53	2.15	3.79	5.82	8.90	11.00	13.22	12.06	8.67	77.00
Effective Water Surface Evaporation	in	4.29	1.40	0.93	0.86	1.21	2.13	4.37	6.68	8.25	9.92	9.05	6.50	55.57
WASTEWATER GENERATION														
Facility Wastewater Influent (ADWF)	MG	7.2	7.0	7.2	7.2	6.5	7.2	7.0	7.2	7.0	7.2	7.2	7.0	84.6
I/I Contributions	MG	0	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0	0	0	0	0.1
TOTAL Wastewater Influent	ac-ft	22.1	21.4	22.1	22.1	20.0	22.1	21.4	22.1	21.4	22.1	22.1	21.4	260.0
WWTP CONTRIBUTIONS														
Site Run-off	ac-ft	0.2	0.4	0.8	0.6	0.6	0.5	0.2	0.1	0.0	0.0	0.0	0.0	3.5
Open Storage Basin	acre	3.3	3.4	3.5	3.5	3.6	3.7	3.7	3.8	3.9	3.9	4.0	4.1	
Total Water Surface Area	acre	3.3	3.4	3.5	3.5	3.6	3.7	3.7	3.8	3.9	3.9	4.0	4.1	
Cooling Tower Evaporation/Drift Loss[5]	ac-ft	-0.05	-0.04	-0.04	-0.04	-0.04	-0.04	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.5
Total Evaporation	ac-ft	-1.2	-0.4	-0.3	-0.3	-0.4	-0.7	-1.4	-2.1	-2.7	-3.3	-3.0	-2.2	-17.8
Total Precipitation	ac-ft	1.2	1.9	4.2	3.4	3.7	2.6	1.3	0.6	0.2	0.0	0.0	0.1	19.3
Total Percolation	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RECYCLED WATER DISTRIBUTION														
Dual Plumbing	ac-ft	-6.9	-6.7	-6.9	-6.9	-6.2	-6.9	-6.7	-6.9	-6.7	-6.9	-6.9	-6.7	-81.1
Cooling Tower	ac-ft	-3.3	-2.6	-2.7	-2.7	-2.4	-2.7	-3.2	-3.3	-3.2	-3.3	-3.3	-3.2	-35.9
Landscape Irrigation (TBD)	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Landscape Irrigation (Casino)	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-1.6	-2.7	-2.9	-2.5	-1.8	-11.6
Vineyard Irrigation (Casino)	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.5	-1.3	-1.2	-0.7	-0.2	-3.9
Additional Turf Grass	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Surface Water Discharge (Creek)	ac-ft	-1.5	**-16.6**	**-16.6**	**-16.6**	**-16.6**	**-16.6**	**-16.6**	-3.1	0.0	0.0	0.0	0.0	-104.3
RAW WATER MAKE-UP														
Blend Raw Water[1]	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
MONTHLY STORAGE BALANCE														
Beginning Storage Volume	ac-ft	**0.0**	10.6	7.9	8.6	8.2	6.8	5.1	0.0	5.3	10.3	14.7	20.3	
Change in Water Volume[4]	ac-ft	10.6	-2.6	0.6	-0.3	-1.4	-1.7	-5.1	5.3	5.0	4.4	5.5	7.3	
Final Storage Volume	ac-ft	10.6	7.9	8.6	8.2	6.8	5.1	0.0	5.3	10.3	14.7	20.3	27.5	

Maximum Seasonal Storage (ac-ft) **27.5**
mg **9.0**

AVERAGE ANNUAL PRECIPITATION RETURN PERIOD

	Units	October	November	December	January	February	March	April	May	June	July	August	September	Water Year
No. Days		31	30	31	31	28	31	30	31	30	31	31	30	
CLIMATE INPUTS														
Precipitation	in	2.10	3.33	7.11	5.63	5.91	4.13	1.98	0.97	0.25	0.01	0.01	0.15	31.58
Pan Evaporation	in	5.72	2.48	1.66	1.53	2.15	3.79	5.82	8.90	11.00	13.22	12.06	8.67	77.00
Effective Water Surface Evaporation	in	4.29	1.86	1.25	1.15	1.61	2.84	4.37	6.68	8.25	9.92	9.05	6.50	57.75
WASTEWATER GENERATION														
Facility Wastewater Influent (ADWF)	MG	7.2	7.0	7.2	7.2	6.5	7.2	7.0	7.2	7.0	7.2	7.2	7.0	84.6
I/I Contributions	MG	0	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0	0	0	0	0.1
TOTAL Wastewater Influent	ac-ft	22.1	21.4	22.1	22.1	20.0	22.1	21.4	22.1	21.4	22.1	22.1	21.4	260.0
WWTP CONTRIBUTIONS														
Site Run-off	ac-ft	0.1	0.2	0.4	0.3	0.3	0.2	0.1	0.1	0.0	0.0	0.0	0.0	1.7
Open Storage Basin	acre	4.1	4.0	3.9	3.9	3.8	3.7	3.7	3.6	3.5	3.5	3.4	3.3	
Total Water Surface Area	acre	4.1	4.0	3.9	3.9	3.8	3.7	3.7	3.6	3.5	3.5	3.4	3.3	
Cooling Tower Evaporation/Drift Loss[5]	ac-ft	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.6
Total Evaporation	ac-ft	-1.5	-0.6	-0.4	-0.4	-0.5	-0.9	-1.3	-2.0	-2.4	-2.9	-2.6	-1.8	-17.3
Total Precipitation	ac-ft	0.7	1.1	2.3	1.8	1.9	1.3	0.6	0.3	0.1	0.0	0.0	0.0	10.2
Total Percolation	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RECYCLED WATER DISTRIBUTION														
Dual Plumbing	ac-ft	-6.9	-6.7	-6.9	-6.9	-6.2	-6.9	-6.7	-6.9	-6.7	-6.9	-6.9	-6.7	-81.1
Cooling Tower	ac-ft	-3.3	-3.2	-3.3	-3.3	-3.0	-3.3	-3.2	-3.3	-3.2	-3.3	-3.3	-3.2	-39.2
Landscape Irrigation (TBD)	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Landscape Irrigation (Casino)	ac-ft	-0.1	0.0	0.0	0.0	0.0	0.0	-1.0	-2.0	-2.8	-2.9	-2.5	-1.9	-13.3
Vineyard Irrigation (Casino)	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.5	-1.3	-1.2	-0.7	-0.2	-3.9
Additional Turf Grass	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Surface Water Discharge (Creek)	ac-ft	-1.5	**-18.6**	**-18.6**	**-18.6**	**-18.6**	**-18.6**	**-18.6**	-3.1	0.0	0.0	0.0	0.0	-116.1
RAW WATER MAKE-UP														
Blend Raw Water[1]	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
MONTHLY STORAGE BALANCE														
Beginning Storage Volume	ac-ft	27.5	37.1	30.7	26.2	21.2	14.9	8.8	0.0	4.5	9.5	14.3	20.3	
Change in Water Volume[4]	ac-ft	9.6	-6.5	-4.5	-5.0	-6.2	-6.1	-8.8	4.5	5.0	4.8	6.0	7.6	
Final Storage Volume	ac-ft	37.1	30.7	26.2	21.2	14.9	8.8	0.0	4.5	9.5	14.3	20.3	27.9	

Maximum Seasonal Storage (ac-ft) **37.1**
mg **12.1**

Note:
1. Blend Raw Water is the deficit in ww flow generated to meet recycled water demands, to resolve then less water would be discharged for irrigation or surface water.
2. Total available area for vineyard/spray/leach field is 17.4 acres approximately.
3. Assumed all equipment open basin/tankage would include covers and won't contribute to ww flows, confirm as more information becomes available.
4. Change in water volume negative since stored volume is available to be transferred out to distribution.
5. Cooling tower evaporation loss estimated at 1.5% of monthly water demand.

Water Balance - Shiloh Resort and Casino Feasibility Study - Proposed (Alternative A)

Scenario: Alternative A - Option 2

August 2022 By: Jory Benitez/Angela Singer, HydroScience

INPUT
INPUT-Adjust as necessary
OUTPUT-Max Elevation

WASTEWATER INFLUENT FLOW
Daily Average Wastewater Influent Flow **231,900** gpd
I/I (PWWF-PDWF) **250,452** gpd

STORAGE DATA
Tank(s) Total Volume 15.9 MG

OTHER INPUTS
100-YR Multiplier 2.06 unitless
Pan Evap Coefficient 0.75 unitless

RECYCLED WATER DISTRIBUTION AND DISPOSAL ALTERNATIVES [2]
andscape Irrigation (Casino) 4.4 acres
Dual Plumbing 26.4 MG
Vineyards (Casino) 17.4 acres
Surface Water Discharge 301 MG
Landscpe Irrig (TBD) 0.0 acres
Additonal Turf Grass 0.0 acres

100-YEAR ANNUAL PRECIPITATION RETURN PERIOD

	No. Days	31	30	31	31	28	31	30	31	30	31	31	30	
	Units	**October**	**November**	**December**	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**Water Year**
CLIMATE INPUTS														
Precipitation	in	4.32	6.85	14.63	11.59	12.16	8.50	4.08	2.00	0.51	0.02	0.02	0.31	65.00
Pan Evaporation	in	5.72	2.48	1.66	1.53	2.15	3.79	5.82	8.90	11.00	13.22	12.06	8.67	77.00
Effective Water Surface Evaporation	in	4.29	1.40	0.93	0.86	1.21	2.13	4.37	6.68	8.25	9.92	9.05	6.50	55.57
WASTEWATER GENERATION														
Facility Wastewater Influent (ADWF)	MG	7.2	7.0	7.2	7.2	6.5	7.2	7.0	7.2	7.0	7.2	7.2	7.0	84.6
I/I Contributions	MG	0	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0	0	0	0	0.1
TOTAL Wastewater Influent	ac-ft	22.1	21.4	22.1	22.1	20.0	22.1	21.4	22.1	21.4	22.1	22.1	21.4	260.0
WWTP CONTRIBUTIONS														
Site Run-off	ac-ft	0.2	0.4	0.8	0.6	0.6	0.5	0.2	0.1	0.0	0.0	0.0	0.0	3.5
Open Storage Basin	acre	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Water Surface Area	acre	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Cooling Tower Evaporation/Drift Loss[5]	ac-ft	-0.05	-0.04	-0.04	-0.04	-0.04	-0.04	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.5
Total Evaporation	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Precipitation	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Percolation	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RECYCLED WATER DISTRIBUTION														
Dual Plumbing	ac-ft	-6.9	-6.7	-6.9	-6.9	-6.2	-6.9	-6.7	-6.9	-6.7	-6.9	-6.9	-6.7	-81.1
Cooling Tower	ac-ft	-3.3	-2.6	-2.7	-2.7	-2.4	-2.7	-3.2	-3.3	-3.2	-3.3	-3.3	-3.2	-35.9
Landscape Irrigation (TBD)	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Landscape Irrigation (Casino)	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-1.6	-2.7	-2.9	-2.5	-1.8	-11.6
Vineyard Irrigation (Casino)	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.8	-1.8	-1.7	-1.0	-0.3	-5.5
Additional Turf Grass	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Surface Water Discharge (Creek)	ac-ft	-1.5	**-14.3**	**-14.3**	**-14.3**	**-14.3**	**-14.3**	**-14.3**	-3.1	0.0	0.0	0.0	0.0	-90.5
RAW WATER MAKE-UP														
Blend Raw Water[1]	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
MONTHLY STORAGE BALANCE														
Beginning Storage Volume	ac-ft	**0.0**	10.5	8.7	7.7	6.5	4.1	2.7	0.0	6.5	13.5	20.7	29.0	
Change in Water Volume[4]	ac-ft	10.5	-1.9	-1.0	-1.2	-2.4	-1.4	-2.7	6.5	7.0	7.2	8.3	9.3	
Final Storage Volume	ac-ft	10.5	8.7	7.7	6.5	4.1	2.7	0.0	6.5	13.5	20.7	29.0	38.3	

Maximum Seasonal Storage (ac-ft) **38.3**
mg **12.5**

AVERAGE ANNUAL PRECIPITATION RETURN PERIOD

	No. Days	31	30	31	31	28	31	30	31	30	31	31	30	
	Units	**October**	**November**	**December**	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**Water Year**
CLIMATE INPUTS														
Precipitation	in	2.10	3.33	7.11	5.63	5.91	4.13	1.98	0.97	0.25	0.01	0.01	0.15	31.58
Pan Evaporation	in	5.72	2.48	1.66	1.53	2.15	3.79	5.82	8.90	11.00	13.22	12.06	8.67	77.00
Effective Water Surface Evaporation	in	4.29	1.86	1.25	1.15	1.61	2.84	4.37	6.68	8.25	9.92	9.05	6.50	57.75
WASTEWATER GENERATION														
Facility Wastewater Influent (ADWF)	MG	7.2	7.0	7.2	7.2	6.5	7.2	7.0	7.2	7.0	7.2	7.2	7.0	84.6
I/I Contributions	MG	0	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0	0	0	0	0.1
TOTAL Wastewater Influent	ac-ft	22.1	21.4	22.1	22.1	20.0	22.1	21.4	22.1	21.4	22.1	22.1	21.4	260.0
WWTP CONTRIBUTIONS														
Site Run-off	ac-ft	0.1	0.2	0.4	0.3	0.3	0.2	0.1	0.1	0.0	0.0	0.0	0.0	1.7
Open Storage Basin	acre	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Water Surface Area	acre	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Cooling Tower Evaporation/Drift Loss[5]	ac-ft	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.6
Total Evaporation	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Precipitation	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Percolation	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RECYCLED WATER DISTRIBUTION														
Dual Plumbing	ac-ft	-6.9	-6.7	-6.9	-6.9	-6.2	-6.9	-6.7	-6.9	-6.7	-6.9	-6.9	-6.7	-81.1
Cooling Tower	ac-ft	-3.3	-3.2	-3.3	-3.3	-3.0	-3.3	-3.2	-3.3	-3.2	-3.3	-3.3	-3.2	-39.2
Landscape Irrigation (TBD)	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Landscape Irrigation (Casino)	ac-ft	-0.1	0.0	0.0	0.0	0.0	0.0	-1.0	-2.0	-2.8	-2.9	-2.5	-1.9	-13.3
Vineyard Irrigation (Casino)	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.8	-1.8	-1.7	-1.0	-0.3	-5.5
Additional Turf Grass	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Surface Water Discharge (Creek)	ac-ft	-1.5	**-19.7**	**-19.7**	**-19.7**	**-19.7**	**-19.7**	**-19.7**	-3.1	0.0	0.0	0.0	0.0	-122.7
RAW WATER MAKE-UP														
Blend Raw Water[1]	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
MONTHLY STORAGE BALANCE														
Beginning Storage Volume	ac-ft	38.3	48.7	40.6	33.1	25.5	16.8	9.2	0.0	6.0	12.9	20.1	28.3	
Change in Water Volume[4]	ac-ft	10.3	-8.1	-7.5	-7.6	-8.7	-7.7	-9.2	6.0	6.9	7.2	8.3	9.2	
Final Storage Volume	ac-ft	48.7	40.6	33.1	25.5	16.8	9.2	0.0	6.0	12.9	20.1	28.3	37.6	

Maximum Seasonal Storage (ac-ft) **48.7**
mg **15.9**

Note:
1. Blend Raw Water is the deficit in ww flow generated to meet recycled water demands, to resolve then less water would be discharged for irrigation or surface water.
2. Total available area for vineyard/spray/leach field is 17.4 acres approximately.
3. Assumed all equipment open basin/tankage would include covers and won't contribute to ww flows, confirm as more information becomes available.
4. Change in water volume negative since stored volume is available to be transferred out to distribution.
5. Cooling tower evaporation loss estimated at 1.5% of monthly water demand.

Water Balance - Shiloh Resort and Casino Feasibility Study - Proposed (Alternative A)

Scenario: Alternative A - Option 3

August 2022 By: Jory Benitez/Angela Singer, HydroScience

INPUT

INPUT-Adjust as necessary

OUTPUT-Max Elevation

WASTEWATER INFLUENT FLOW		
Daily Average Wastewater Influent Flow	231,900	gpd
I/I (PWWF-PDWF)	250,452	gpd
STORAGE DATA		
Basin Volume	4.9	MG
Basin Area	1.74	acres
OTHER INPUTS		
100-YR Multiplier	2.06	unitless
Pan Evap Coefficient	0.75	unitless
RECYCLED WATER DISTRIBUTION AND DISPOSAL ALTERNATIVES[2]		
andscape Irrigation (Casino)	4.4	acres
Dual Plumbing	26.4	MG
Vineyards (Casino)	15.0	acres
Surface Water Discharge	301	MG
Landscpe Irrig (TBD)	11.0	acres
Additonal Turf Grass	0.0	acres
	7.8	

100-YEAR ANNUAL PRECIPITATION RETURN PERIOD

	Units	October	November	December	January	February	March	April	May	June	July	August	September	Water Year
No. Days		31	30	31	31	28	31	30	31	30	31	31	30	
CLIMATE INPUTS														
Precipitation	in	4.32	6.85	14.63	11.59	12.16	8.50	4.08	2.00	0.51	0.02	0.02	0.31	65.00
Pan Evaporation	in	5.72	2.48	1.66	1.53	2.15	3.79	5.82	8.90	11.00	13.22	12.06	8.67	77.00
Effective Water Surface Evaporation	in	4.29	1.40	0.93	0.86	1.21	2.13	4.37	6.68	8.25	9.92	9.05	6.50	55.57
WASTEWATER GENERATION														
Facility Wastewater Influent (ADWF)	MG	7.2	7.0	7.2	7.2	6.5	7.2	7.0	7.2	7.0	7.2	7.2	7.0	84.6
I/I Contributions	MG	0	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0	0	0	0	0.1
TOTAL Wastewater Influent	ac-ft	22.1	21.4	22.1	22.1	20.0	22.1	21.4	22.1	21.4	22.1	22.1	21.4	260.0
WWTP CONTRIBUTIONS														
Site Run-off	ac-ft	0.2	0.4	0.8	0.6	0.6	0.5	0.2	0.1	0.0	0.0	0.0	0.0	3.5
Open Storage Basin	acre	1.7	1.7	1.7	1.6	1.6	1.5	1.5	1.4	1.4	1.4	1.3	1.3	
Total Water Surface Area	acre	1.7	1.7	1.7	1.6	1.6	1.5	1.5	1.4	1.4	1.4	1.3	1.3	
Cooling Tower Evaporation/Drift Loss[5]	ac-ft	-0.05	-0.04	-0.04	-0.04	-0.04	-0.04	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.5
Total Evaporation	ac-ft	-0.6	-0.2	-0.1	-0.1	-0.2	-0.3	-0.5	-0.8	-1.0	-1.1	-1.0	-0.7	-6.6
Total Precipitation	ac-ft	0.6	1.0	2.0	1.6	1.6	1.1	0.5	0.2	0.1	0.0	0.0	0.0	8.7
Total Percolation	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RECYCLED WATER DISTRIBUTION														
Dual Plumbing	ac-ft	-6.9	-6.7	-6.9	-6.9	-6.2	-6.9	-6.7	-6.9	-6.7	-6.9	-6.9	-6.7	-81.1
Cooling Tower	ac-ft	-3.3	-2.6	-2.7	-2.7	-2.4	-2.7	-3.2	-3.3	-3.2	-3.3	-3.3	-3.2	-35.9
Landscape Irrigation (TBD)	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	-0.2	-3.9	-6.7	-7.2	-6.3	-4.6	-28.9
Landscape Irrigation (Casino)	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-1.6	-2.7	-2.9	-2.5	-1.8	-11.6
Vineyard Irrigation (Casino)	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.7	-1.5	-1.5	-0.9	-0.2	-4.8
Additional Turf Grass	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Surface Water Discharge (Creek)	ac-ft	-1.5	**-15.3**	**-15.3**	**-15.3**	**-15.3**	**-15.3**	**-15.3**	-3.9	0.0	0.0	0.0	0.0	-97.4
RAW WATER MAKE-UP														
Blend Raw Water[1]	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
MONTHLY STORAGE BALANCE														
Beginning Storage Volume	ac-ft	**0.0**	10.6	8.4	8.3	7.5	5.5	3.9	0.0	1.3	1.0	0.1	1.2	
Change in Water Volume[4]	ac-ft	10.6	-2.1	-0.2	-0.8	-2.0	-1.6	-3.9	1.3	-0.3	-0.9	1.1	4.1	
Final Storage Volume	ac-ft	10.6	8.4	8.3	7.5	5.5	3.9	0.0	1.3	1.0	0.1	1.2	5.3	

Maximum Seasonal Storage (ac-ft) **10.6**
mg **3.4**

AVERAGE ANNUAL PRECIPITATION RETURN PERIOD

	Units	October	November	December	January	February	March	April	May	June	July	August	September	Water Year
No. Days		31	30	31	31	28	31	30	31	30	31	31	30	
CLIMATE INPUTS														
Precipitation	in	2.10	3.33	7.11	5.63	5.91	4.13	1.98	0.97	0.25	0.01	0.01	0.15	31.58
Pan Evaporation	in	5.72	2.48	1.66	1.53	2.15	3.79	5.82	8.90	11.00	13.22	12.06	8.67	77.00
Effective Water Surface Evaporation	in	4.29	1.86	1.25	1.15	1.61	2.84	4.37	6.68	8.25	9.92	9.05	6.50	57.75
WASTEWATER GENERATION														
Facility Wastewater Influent (ADWF)	MG	7.2	7.0	7.2	7.2	6.5	7.2	7.0	7.2	7.0	7.2	7.2	7.0	84.6
I/I Contributions	MG	0	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0	0	0	0	0.1
TOTAL Wastewater Influent	ac-ft	22.1	21.4	22.1	22.1	20.0	22.1	21.4	22.1	21.4	22.1	22.1	21.4	260.0
WWTP CONTRIBUTIONS														
Site Run-off	ac-ft	0.1	0.2	0.4	0.3	0.3	0.2	0.1	0.1	0.0	0.0	0.0	0.0	1.7
Open Storage Basin	acre	1.7	1.7	1.7	1.6	1.6	1.5	1.5	1.4	1.4	1.4	1.3	1.3	
Total Water Surface Area	acre	1.7	1.7	1.7	1.6	1.6	1.5	1.5	1.4	1.4	1.4	1.3	1.3	
Cooling Tower Evaporation/Drift Loss[5]	ac-ft	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.6
Total Evaporation	ac-ft	-0.6	-0.3	-0.2	-0.2	-0.2	-0.4	-0.5	-0.8	-1.0	-1.1	-1.0	-0.7	-6.9
Total Precipitation	ac-ft	0.3	0.5	1.0	0.8	0.8	0.5	0.2	0.1	0.0	0.0	0.0	0.0	4.2
Total Percolation	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RECYCLED WATER DISTRIBUTION														
Dual Plumbing	ac-ft	-6.9	-6.7	-6.9	-6.9	-6.2	-6.9	-6.7	-6.9	-6.7	-6.9	-6.9	-6.7	-81.1
Cooling Tower	ac-ft	-3.3	-3.2	-3.3	-3.3	-3.0	-3.3	-3.2	-3.3	-3.2	-3.3	-3.3	-3.2	-39.2
Landscape Irrigation (TBD)	ac-ft	-0.3	0.0	0.0	0.0	0.0	0.0	-2.6	-5.1	-7.0	-7.3	-6.3	-4.8	-33.2
Landscape Irrigation (Casino)	ac-ft	-0.1	0.0	0.0	0.0	0.0	0.0	-1.0	-2.0	-2.8	-2.9	-2.5	-1.9	-13.3
Vineyard Irrigation (Casino)	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.7	-1.5	-1.5	-0.9	-0.2	-4.8
Additional Turf Grass	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Surface Water Discharge (Creek)	ac-ft	-1.5	**-14.0**	**-14.0**	**-14.0**	**-14.0**	**-14.0**	**-14.0**	-1.7	0.0	0.0	0.0	0.0	-87.2
RAW WATER MAKE-UP														
Blend Raw Water[1]	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
MONTHLY STORAGE BALANCE														
Beginning Storage Volume	ac-ft	5.3	15.0	12.9	11.9	10.6	8.1	6.3	0.0	1.7	0.9	0.0	1.1	
Change in Water Volume[4]	ac-ft	9.8	-2.2	-1.0	-1.3	-2.5	-1.8	-6.3	1.7	-0.8	-0.9	1.1	3.8	
Final Storage Volume	ac-ft	15.0	12.9	11.9	10.6	8.1	6.3	0.0	1.7	0.9	0.0	1.1	4.9	

Maximum Seasonal Storage (ac-ft) **15.0**
mg **4.9**

Note:
1. Blend Raw Water is the deficit in ww flow generated to meet recycled water demands, to resolve then less water would be discharged for irrigation or surface water.
2. Total available area for vineyard/spray/leach field is 17.4 acres approximately.
3. Assumed all equipment open basin/tankage would include covers and won't contribute to ww flows, confirm as more information becomes available.
4. Change in water volume negative since stored volume is available to be transferred out to distribution.
5. Cooling tower evaporation loss estimated at 1.5% of monthly water demand.

Water Balance - Shiloh Resort and Casino Feasibility Study - Proposed (Alternative A)

Scenario: Alternative A - Option 4

August 2022 By: Jory Benitez/Angela Singer, HydroScience

INPUT
INPUT-Adjust as necessary
OUTPUT-Max Elevation

WASTEWATER INFLUENT FLOW

Daily Average Wastewater Influent Flow	**231,900**	gpd
I/I (PWWF-PDWF)	**250,452**	gpd

STORAGE DATA

Tank(s) Total Volume	5.6	MG

OTHER INPUTS

100-YR Multiplier	2.06	unitless
Pan Evap Coefficient	0.75	unitless

RECYCLED WATER DISTRIBUTION AND DISPOSAL ALTERNATIVES[2]

andscape Irrigation (Casino)	4.4	acres	Vineyards (Casino)	17.4	acres	Landscpe Irrig (TBD)	11.0	acres	
Dual Plumbing	26.4	MG	Surface Water Discharge	301	MG	Additonal Turf Grass	0.0	acres	**9.9**

100-YEAR ANNUAL PRECIPITATION RETURN PERIOD

No. Days		31	30	31	31	28	31	30	31	30	31	31	30	
	Units	**October**	**November**	**December**	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**Water Year**
CLIMATE INPUTS														
Precipitation	in	4.32	6.85	14.63	11.59	12.16	8.50	4.08	2.00	0.51	0.02	0.02	0.31	65.00
Pan Evaporation	in	5.72	2.48	1.66	1.53	2.15	3.79	5.82	8.90	11.00	13.22	12.06	8.67	77.00
Effective Water Surface Evaporation	in	4.29	1.40	0.93	0.86	1.21	2.13	4.37	6.68	8.25	9.92	9.05	6.50	55.57
WASTEWATER GENERATION														
Facility Wastewater Influent (ADWF)	MG	7.2	7.0	7.2	7.2	6.5	7.2	7.0	7.2	7.0	7.2	7.2	7.0	84.6
I/I Contributions	MG	0	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0	0	0	0	0.1
TOTAL Wastewater Influent	ac-ft	22.1	21.4	22.1	22.1	20.0	22.1	21.4	22.1	21.4	22.1	22.1	21.4	260.0
WWTP CONTRIBUTIONS														
Site Run-off	ac-ft	0.2	0.4	0.8	0.6	0.6	0.5	0.2	0.1	0.0	0.0	0.0	0.0	3.5
Open Storage Basin	acre	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Water Surface Area	acre	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Cooling Tower Evaporation/Drift Loss[5]	ac-ft	-0.05	-0.04	-0.04	-0.04	-0.04	-0.04	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.5
Total Evaporation	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Precipitation	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Percolation	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RECYCLED WATER DISTRIBUTION														
Dual Plumbing	ac-ft	-6.9	-6.7	-6.9	-6.9	-6.2	-6.9	-6.7	-6.9	-6.7	-6.9	-6.9	-6.7	-81.1
Cooling Tower	ac-ft	-3.3	-2.6	-2.7	-2.7	-2.4	-2.7	-3.2	-3.3	-3.2	-3.3	-3.3	-3.2	-35.9
Landscape Irrigation (TBD)	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	-0.2	-3.9	-6.7	-7.2	-6.3	-4.6	-28.9
Landscape Irrigation (Casino)	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-1.6	-2.7	-2.9	-2.5	-1.8	-11.6
Vineyard Irrigation (Casino)	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.8	-1.8	-1.7	-1.0	-0.3	-5.5
Additional Turf Grass	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Surface Water Discharge (Creek)	ac-ft	-1.5	**-14.3**	**-14.3**	**-14.3**	**-14.3**	**-14.3**	**-14.3**	-5.7	0.0	0.0	0.0	0.0	-92.9
RAW WATER MAKE-UP														
Blend Raw Water[1]	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
MONTHLY STORAGE BALANCE														
Beginning Storage Volume	ac-ft	**0.0**	10.5	8.7	7.7	6.5	4.2	2.9	0.0	0.0	0.3	0.3	2.2	
Change in Water Volume[4]	ac-ft	10.5	-1.8	-1.0	-1.2	-2.3	-1.3	-2.9	0.0	0.3	0.0	1.9	4.7	
Final Storage Volume	ac-ft	10.5	8.7	7.7	6.5	4.2	2.9	0.0	0.0	0.3	0.3	2.2	7.0	

Maximum Seasonal Storage (ac-ft) **10.5**
mg **3.4**

AVERAGE ANNUAL PRECIPITATION RETURN PERIOD

No. Days		31	30	31	31	28	31	30	31	30	31	31	30	
	Units	**October**	**November**	**December**	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**Water Year**
CLIMATE INPUTS														
Precipitation	in	2.10	3.33	7.11	5.63	5.91	4.13	1.98	0.97	0.25	0.01	0.01	0.15	31.58
Pan Evaporation	in	5.72	2.48	1.66	1.53	2.15	3.79	5.82	8.90	11.00	13.22	12.06	8.67	77.00
Effective Water Surface Evaporation	in	4.29	1.86	1.25	1.15	1.61	2.84	4.37	6.68	8.25	9.92	9.05	6.50	57.75
WASTEWATER GENERATION														
Facility Wastewater Influent (ADWF)	MG	7.2	7.0	7.2	7.2	6.5	7.2	7.0	7.2	7.0	7.2	7.2	7.0	84.6
I/I Contributions	MG	0	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0	0	0	0	0.1
TOTAL Wastewater Influent	ac-ft	22.1	21.4	22.1	22.1	20.0	22.1	21.4	22.1	21.4	22.1	22.1	21.4	260.0
WWTP CONTRIBUTIONS														
Site Run-off	ac-ft	0.1	0.2	0.4	0.3	0.3	0.2	0.1	0.1	0.0	0.0	0.0	0.0	1.7
Open Storage Basin	acre	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Water Surface Area	acre	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Cooling Tower Evaporation/Drift Loss[5]	ac-ft	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.6
Total Evaporation	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Precipitation	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Percolation	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RECYCLED WATER DISTRIBUTION														
Dual Plumbing	ac-ft	-6.9	-6.7	-6.9	-6.9	-6.2	-6.9	-6.7	-6.9	-6.7	-6.9	-6.9	-6.7	-81.1
Cooling Tower	ac-ft	-3.3	-3.2	-3.3	-3.3	-3.0	-3.3	-3.2	-3.3	-3.2	-3.3	-3.3	-3.2	-39.2
Landscape Irrigation (TBD)	ac-ft	-0.3	0.0	0.0	0.0	0.0	0.0	-2.6	-5.1	-7.0	-7.3	-6.3	-4.8	-33.2
Landscape Irrigation (Casino)	ac-ft	-0.1	0.0	0.0	0.0	0.0	0.0	-1.0	-2.0	-2.8	-2.9	-2.5	-1.9	-13.3
Vineyard Irrigation (Casino)	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.8	-1.8	-1.7	-1.0	-0.3	-5.5
Additional Turf Grass	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Surface Water Discharge (Creek)	ac-ft	-1.5	**-14.0**	**-14.0**	**-14.0**	**-14.0**	**-14.0**	**-14.0**	-3.8	0.0	0.0	0.0	0.0	-89.3
RAW WATER MAKE-UP														
Blend Raw Water[1]	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
MONTHLY STORAGE BALANCE														
Beginning Storage Volume	ac-ft	7.0	17.0	14.7	12.9	11.0	8.0	6.0	0.0	0.2	0.1	0.0	2.0	
Change in Water Volume[4]	ac-ft	10.1	-2.4	-1.8	-1.9	-3.0	-2.0	-6.0	0.2	-0.1	-0.1	1.9	4.5	
Final Storage Volume	ac-ft	17.0	14.7	12.9	11.0	8.0	6.0	0.0	0.2	0.1	0.0	2.0	6.4	

Maximum Seasonal Storage (ac-ft) **17.0**
mg **5.6**

Note:
1. Blend Raw Water is the deficit in ww flow generated to meet recycled water demands, to resolve then less water would be discharged for irrigation or surface water.
2. Total available area for vineyard/spray/leach field is 17.4 acres approximately.
3. Assumed all equipment open basin/tankage would include covers and won't contribute to ww flows, confirm as more information becomes available.
4. Change in water volume negative since stored volume is available to be transferred out to distribution.
5. Cooling tower evaporation loss estimated at 1.5% of monthly water demand.

Water Balance - Shiloh Resort and Casino Feasibility Study - Reduced Intensity (Alternative B)

Scenario: Alternative B - Option 1

August 2022 By: Jory Benitez/Angela Singer, HydroScience

INPUT
INPUT-Adjust as necessary
OUTPUT-Max Elevation

WASTEWATER INFLUENT FLOW
Daily Average Wastewater Influent Flow **157,800** gpd
I/I (PWWF-PDWF) **170,424** gpd

STORAGE DATA
Basin Volume 4.5 MG
Basin Area 1.61 acres

OTHER INPUTS
100-YR Multiplier 2.06 unitless
Pan Evap Coefficient 0.75 unitless

RECYCLED WATER DISTRIBUTION AND DISPOSAL ALTERNATIVES[2]
andscape Irrigation (Casino) 6.7 acres
Dual Plumbing 18.2 MG
Vineyards (Casino) 19.8 acres
Surface Water Discharge 301 MG
Landscape Irrig (TBD) 0.0 acres
Additional Turf Grass 0.0 acres

100-YEAR ANNUAL PRECIPITATION RETURN PERIOD

No. Days		31	30	31	31	28	31	30	31	30	31	31	30	
	Units	**October**	**November**	**December**	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**Water Year**
CLIMATE INPUTS														
Precipitation	in	4.32	6.85	14.63	11.59	12.16	8.50	4.08	2.00	0.51	0.02	0.02	0.31	65.00
Pan Evaporation	in	5.72	2.48	1.66	1.53	2.15	3.79	5.82	8.90	11.00	13.22	12.06	8.67	77.00
Effective Water Surface Evaporation	in	4.29	1.40	0.93	0.86	1.21	2.13	4.37	6.68	8.25	9.92	9.05	6.50	55.57
WASTEWATER GENERATION														
Facility Wastewater Influent (ADWF)	MG	4.9	4.7	4.9	4.9	4.4	4.9	4.7	4.9	4.7	4.9	4.9	4.7	57.6
I/I Contributions	MG	0	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0	0	0	0	0.1
TOTAL Wastewater Influent	ac-ft	15.0	14.6	15.0	15.0	13.6	15.0	14.6	15.0	14.5	15.0	15.0	14.5	177.0
WWTP CONTRIBUTIONS														
Site Run-off	ac-ft	0.2	0.4	0.8	0.6	0.6	0.5	0.2	0.1	0.0	0.0	0.0	0.0	3.5
Open Storage Basin	acre	1.2	1.2	1.2	1.3	1.3	1.4	1.4	1.4	1.5	1.5	1.6	1.6	
Total Water Surface Area	acre	1.2	1.2	1.2	1.3	1.3	1.4	1.4	1.4	1.5	1.5	1.6	1.6	
Cooling Tower Evaporation/Drift Loss[5]	ac-ft	-0.03	-0.03	-0.03	-0.03	-0.02	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.4
Total Evaporation	ac-ft	-0.4	-0.1	-0.1	-0.1	-0.1	-0.2	-0.5	-0.8	-1.0	-1.3	-1.2	-0.9	-6.8
Total Precipitation	ac-ft	0.4	0.7	1.5	1.2	1.3	1.0	0.5	0.2	0.1	0.0	0.0	0.0	7.0
Total Percolation	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RECYCLED WATER DISTRIBUTION														
Dual Plumbing	ac-ft	-4.7	-4.6	-4.7	-4.7	-4.3	-4.7	-4.6	-4.7	-4.6	-4.7	-4.7	-4.6	-55.8
Cooling Tower	ac-ft	-2.3	-1.8	-1.8	-1.8	-1.7	-1.8	-2.2	-2.3	-2.2	-2.3	-2.3	-2.2	-24.7
Landscape Irrigation (TBD)	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Landscape Irrigation (Casino)	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-2.4	-4.1	-4.4	-3.9	-2.8	-17.6
Vineyard Irrigation (Casino)	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.9	-2.0	-1.9	-1.1	-0.3	-6.3
Additional Turf Grass	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Surface Water Discharge (Creek)	ac-ft	-1.5	**-10.6**	**-10.6**	**-10.6**	**-10.6**	**-10.6**	**-10.6**	-3.1	0.0	0.0	0.0	0.0	-68.1
RAW WATER MAKE-UP														
Blend Raw Water[1]	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
MONTHLY STORAGE BALANCE														
Beginning Storage Volume	ac-ft	**0.0**	6.7	5.2	5.2	4.9	3.8	2.8	0.0	1.2	1.9	2.2	4.0	
Change in Water Volume[4]	ac-ft	6.7	-1.5	0.0	-0.4	-1.1	-1.0	-2.8	1.2	0.7	0.4	1.8	3.8	
Final Storage Volume	ac-ft	6.7	5.2	5.2	4.9	3.8	2.8	0.0	1.2	1.9	2.2	4.0	7.8	

Maximum Seasonal Storage (ac-ft) **7.8**
mg **2.5**

AVERAGE ANNUAL PRECIPITATION RETURN PERIOD

No. Days		31	30	31	31	28	31	30	31	30	31	31	30	
	Units	**October**	**November**	**December**	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**Water Year**
CLIMATE INPUTS														
Precipitation	in	2.10	3.33	7.11	5.63	5.91	4.13	1.98	0.97	0.25	0.01	0.01	0.15	31.58
Pan Evaporation	in	5.72	2.48	1.66	1.53	2.15	3.79	5.82	8.90	11.00	13.22	12.06	8.67	77.00
Effective Water Surface Evaporation	in	4.29	1.86	1.25	1.15	1.61	2.84	4.37	6.68	8.25	9.92	9.05	6.50	57.75
WASTEWATER GENERATION														
Facility Wastewater Influent (ADWF)	MG	4.9	4.7	4.9	4.9	4.4	4.9	4.7	4.9	4.7	4.9	4.9	4.7	57.6
I/I Contributions	MG	0	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0	0	0	0	0.1
TOTAL Wastewater Influent	ac-ft	15.0	14.6	15.0	15.0	13.6	15.0	14.6	15.0	14.5	15.0	15.0	14.5	177.0
WWTP CONTRIBUTIONS														
Site Run-off	ac-ft	0.1	0.2	0.4	0.3	0.3	0.2	0.1	0.1	0.0	0.0	0.0	0.0	1.7
Open Storage Basin	acre	1.6	1.6	1.5	1.5	1.4	1.4	1.4	1.3	1.3	1.2	1.2	1.2	
Total Water Surface Area	acre	1.6	1.6	1.5	1.5	1.4	1.4	1.4	1.3	1.3	1.2	1.2	1.2	
Cooling Tower Evaporation/Drift Loss[5]	ac-ft	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.4
Total Evaporation	ac-ft	-0.6	-0.2	-0.2	-0.1	-0.2	-0.3	-0.5	-0.7	-0.9	-1.0	-0.9	-0.6	-6.3
Total Precipitation	ac-ft	0.3	0.4	0.9	0.7	0.7	0.5	0.2	0.1	0.0	0.0	0.0	0.0	3.9
Total Percolation	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RECYCLED WATER DISTRIBUTION														
Dual Plumbing	ac-ft	-4.7	-4.6	-4.7	-4.7	-4.3	-4.7	-4.6	-4.7	-4.6	-4.7	-4.7	-4.6	-55.8
Cooling Tower	ac-ft	-2.3	-2.2	-2.3	-2.3	-2.1	-2.3	-2.2	-2.3	-2.2	-2.3	-2.3	-2.2	-26.9
Landscape Irrigation (TBD)	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Landscape Irrigation (Casino)	ac-ft	-0.2	0.0	0.0	0.0	0.0	0.0	-1.6	-3.1	-4.3	-4.4	-3.9	-2.9	-20.2
Vineyard Irrigation (Casino)	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.9	-2.0	-1.9	-1.1	-0.3	-6.3
Additional Turf Grass	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Surface Water Discharge (Creek)	ac-ft	-1.5	**-10.4**	**-10.4**	**-10.4**	**-10.4**	**-10.4**	**-10.4**	-3.1	0.0	0.0	0.0	0.0	-66.9
RAW WATER MAKE-UP														
Blend Raw Water[1]	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
MONTHLY STORAGE BALANCE														
Beginning Storage Volume	ac-ft	7.8	13.9	11.6	10.4	8.8	6.4	4.4	0.0	0.4	1.0	1.5	3.6	
Change in Water Volume[4]	ac-ft	6.1	-2.3	-1.3	-1.6	-2.4	-2.0	-4.4	0.4	0.6	0.6	2.1	3.9	
Final Storage Volume	ac-ft	13.9	11.6	10.4	8.8	6.4	4.4	0.0	0.4	1.0	1.5	3.6	7.5	

Maximum Seasonal Storage (ac-ft) **13.9**
mg **4.5**

Note:
1. Blend Raw Water is the deficit in ww flow generated to meet recycled water demands, to resolve then less water would be discharged for irrigation or surface water.
2. Total available area for vineyard field is 22 acres approximately.
3. Assumed all equipment open basin/tankage would include covers and won't contribute to ww flows, confirm as more information becomes available.
4. Change in water volume negative since stored volume is available to be transferred out to distribution.
5. Cooling tower evaporation loss estimated at 1.5% of monthly water demand.

Water Balance - Shiloh Resort and Casino Feasibility Study - Reduced Intensity (Alternative B)

Scenario: Alternative B - Option 2

August 2022 By: Jory Benitez/Angela Singer, HydroScience

INPUT
INPUT-Adjust as necessary
OUTPUT-Max Elevation

WASTEWATER INFLUENT FLOW

Daily Average Wastewater Influent Flow	157,800	gpd
I/I (PWWF-PDWF)	170,424	gpd

STORAGE DATA

Basin Volume	2.2	MG
Basin Area	0.83	acres

OTHER INPUTS

100-YR Multiplier	2.06	unitless
Pan Evap Coefficient	0.75	unitless

RECYCLED WATER DISTRIBUTION AND DISPOSAL ALTERNATIVES [2]

andscape Irrigation (Casino)	6.7	acres	Vineyards (Casino)	20.7	acres	Landscpe Irrig (TBD)	8.9	acres
Dual Plumbing	18.2	MG	Surface Water Discharge	301	MG	Additonal Turf Grass	0.0	acres

100-YEAR ANNUAL PRECIPITATION RETURN PERIOD

No. Days		31	30	31	31	28	31	30	31	30	31	31	30	
	Units	October	November	December	January	February	March	April	May	June	July	August	September	Water Year
CLIMATE INPUTS														
Precipitation	in	4.32	6.85	14.63	11.59	12.16	8.50	4.08	2.00	0.51	0.02	0.02	0.31	65.00
Pan Evaporation	in	5.72	2.48	1.66	1.53	2.15	3.79	5.82	8.90	11.00	13.22	12.06	8.67	77.00
Effective Water Surface Evaporation	in	4.29	1.40	0.93	0.86	1.21	2.13	4.37	6.68	8.25	9.92	9.05	6.50	55.57
WASTEWATER GENERATION														
Facility Wastewater Influent (ADWF)	MG	4.9	4.7	4.9	4.9	4.4	4.9	4.7	4.9	4.7	4.9	4.9	4.7	57.6
I/I Contributions	MG	0	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0	0	0	0	0.1
TOTAL Wastewater Influent	ac-ft	15.0	14.6	15.0	15.0	13.6	15.0	14.6	15.0	14.5	15.0	15.0	14.5	177.0
WWTP CONTRIBUTIONS														
Site Run-off	ac-ft	0.2	0.4	0.8	0.6	0.6	0.5	0.2	0.1	0.0	0.0	0.0	0.0	3.5
Open Storage Basin	acre	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.6	0.6	0.6	0.5	0.5	
Total Water Surface Area	acre	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.6	0.6	0.6	0.5	0.5	
Cooling Tower Evaporation/Drift Loss[5]	ac-ft	-0.03	-0.03	-0.03	-0.03	-0.02	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.4
Total Evaporation	ac-ft	-0.3	-0.1	-0.1	-0.1	-0.1	-0.1	-0.2	-0.4	-0.4	-0.5	-0.4	-0.3	-2.9
Total Precipitation	ac-ft	0.3	0.5	0.9	0.7	0.7	0.5	0.2	0.1	0.0	0.0	0.0	0.0	4.0
Total Percolation	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RECYCLED WATER DISTRIBUTION														
Dual Plumbing	ac-ft	-4.7	-4.6	-4.7	-4.7	-4.3	-4.7	-4.6	-4.7	-4.6	-4.7	-4.7	-4.6	-55.8
Cooling Tower	ac-ft	-2.3	-1.8	-1.8	-1.8	-1.7	-1.8	-2.2	-2.3	-2.2	-2.3	-2.3	-2.2	-24.7
Landscape Irrigation (TBD)	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	**-1.5**	**-1.2**	**-1.0**	**-2.5**	-3.7	-10.0
Landscape Irrigation (Casino)	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-2.4	-4.1	-4.4	-3.9	-2.8	-17.6
Vineyard Irrigation (Casino)	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.9	-2.1	-2.0	-1.2	-0.3	-6.6
Additional Turf Grass	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Surface Water Discharge (Creek)	ac-ft	-1.5	**-10.2**	**-10.2**	**-10.2**	**-10.2**	**-10.2**	**-10.2**	-3.1	0.0	0.0	0.0	0.0	-65.9
RAW WATER MAKE-UP														
Blend Raw Water[1]	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
MONTHLY STORAGE BALANCE														
Beginning Storage Volume	ac-ft	**0.0**	6.7	5.4	5.3	4.8	3.5	2.5	0.0	0.0	0.0	0.0	0.0	
Change in Water Volume[4]	ac-ft	6.7	-1.3	-0.1	-0.5	-1.3	-1.0	-2.5	0.0	0.0	0.0	0.0	0.6	
Final Storage Volume	ac-ft	6.7	5.4	5.3	4.8	3.5	2.5	0.0	0.0	0.0	0.0	0.0	0.7	

Maximum Seasonal Storage (ac-ft)	**6.7**
mg	**2.2**

AVERAGE ANNUAL PRECIPITATION RETURN PERIOD

No. Days		31	30	31	31	28	31	30	31	30	31	31	30	
	Units	October	November	December	January	February	March	April	May	June	July	August	September	Water Year
CLIMATE INPUTS														
Precipitation	in	2.10	3.33	7.11	5.63	5.91	4.13	1.98	0.97	0.25	0.01	0.01	0.15	31.58
Pan Evaporation	in	5.72	2.48	1.66	1.53	2.15	3.79	5.82	8.90	11.00	13.22	12.06	8.67	77.00
Effective Water Surface Evaporation	in	4.29	1.86	1.25	1.15	1.61	2.84	4.37	6.68	8.25	9.92	9.05	6.50	57.75
WASTEWATER GENERATION														
Facility Wastewater Influent (ADWF)	MG	4.9	4.7	4.9	4.9	4.4	4.9	4.7	4.9	4.7	4.9	4.9	4.7	57.6
I/I Contributions	MG	0	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0	0	0	0	0.1
TOTAL Wastewater Influent	ac-ft	15.0	14.6	15.0	15.0	13.6	15.0	14.6	15.0	14.5	15.0	15.0	14.5	177.0
WWTP CONTRIBUTIONS														
Site Run-off	ac-ft	0.1	0.2	0.4	0.3	0.3	0.2	0.1	0.1	0.0	0.0	0.0	0.0	1.7
Open Storage Basin	acre	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.6	0.6	0.6	0.5	0.5	
Total Water Surface Area	acre	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.6	0.6	0.6	0.5	0.5	
Cooling Tower Evaporation/Drift Loss[5]	ac-ft	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.4
Total Evaporation	ac-ft	-0.3	-0.1	-0.1	-0.1	-0.1	-0.2	-0.2	-0.4	-0.4	-0.5	-0.4	-0.3	-3.0
Total Precipitation	ac-ft	0.1	0.2	0.5	0.4	0.4	0.2	0.1	0.1	0.0	0.0	0.0	0.0	1.9
Total Percolation	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RECYCLED WATER DISTRIBUTION														
Dual Plumbing	ac-ft	-4.7	-4.6	-4.7	-4.7	-4.3	-4.7	-4.6	-4.7	-4.6	-4.7	-4.7	-4.6	-55.8
Cooling Tower	ac-ft	-2.3	-2.2	-2.3	-2.3	-2.1	-2.3	-2.2	-2.3	-2.2	-2.3	-2.3	-2.2	-26.9
Landscape Irrigation (TBD)	ac-ft	-0.2	0.0	0.0	0.0	0.0	0.0	-2.1	**-0.6**	**-1.0**	**-1.0**	**-2.5**	**-3.9**	-11.2
Landscape Irrigation (Casino)	ac-ft	-0.2	0.0	0.0	0.0	0.0	0.0	-1.6	-3.1	-4.3	-4.4	-3.9	-2.9	-20.2
Vineyard Irrigation (Casino)	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.9	-2.1	-2.0	-1.2	-0.3	-6.6
Additional Turf Grass	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Surface Water Discharge (Creek)	ac-ft	-1.5	**-8.7**	**-8.7**	**-8.7**	**-8.7**	**-8.7**	**-8.7**	-3.1	0.0	0.0	0.0	0.0	-56.7
RAW WATER MAKE-UP														
Blend Raw Water[1]	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
MONTHLY STORAGE BALANCE														
Beginning Storage Volume	ac-ft	0.7	6.7	6.0	6.1	6.0	5.0	4.6	0.0	0.0	0.0	0.0	0.0	
Change in Water Volume[4]	ac-ft	6.1	-0.7	0.0	-0.1	-0.9	-0.4	-4.6	0.0	0.0	0.0	0.0	0.3	
Final Storage Volume	ac-ft	6.7	6.0	6.1	6.0	5.0	4.6	0.0	0.0	0.0	0.0	0.0	0.4	

Maximum Seasonal Storage (ac-ft)	**6.7**
mg	**2.2**

Note:

1. Blend Raw Water is the deficit in ww flow generated to meet recycled water demands, to resolve then less water would be discharged for irrigation or surface water.
2. Total available area for vineyard 22 acres approximately.
3. Assumed all equipment open basin/tankage would include covers and won't contribute to ww flows, confirm as more information becomes available.
4. Change in water volume negative since stored volume is available to be transferred out to distribution.
5. Cooling tower evaporation loss estimated at 1.5% of monthly water demand.

Water Balance - Shiloh Resort and Casino Feasibility Study - Non-Gaming Facility (Alternative C)

Scenario: Alternative C - Option 1

August 2022 By: Jory Benitez/Angela Singer, HydroScience

INPUT-Adjust as necessary

WASTEWATER INFLUENT FLOW		
Daily Average Wastewater Influent Flow	**37,900**	gpd
I/I (PWWF-PDWF)	**40,932**	gpd

STORAGE DATA		
Basin Volume	4.3	MG
Basin Area	1.54	acres

OTHER INPUTS		
100-YR Multiplier	2.06	unitless
Pan Evap Coefficient	0.75	unitless

RECYCLED WATER DISTRIBUTION AND DISPOSAL ALTERNATIVES[2]								
andscape Irrigation (Casino)	8.3	acres	Vineyards (Casino)	43.2	acres	Landscpe Irrig (TBD)	0.0	acres
Dual Plumbing	7.0	MG	Surface Water Discharge	0.7	MG	Additonal Turf Grass	0.0	acres

100-YEAR ANNUAL PRECIPITATION RETURN PERIOD

	Units	October	November	December	January	February	March	April	May	June	July	August	September	Water Year
No. Days		31	30	31	31	28	31	30	31	30	31	31	30	
CLIMATE INPUTS														
Precipitation	in	4.32	6.85	14.63	11.59	12.16	8.50	4.08	2.00	0.51	0.02	0.02	0.31	65.00
Pan Evaporation	in	5.72	2.48	1.66	1.53	2.15	3.79	5.82	8.90	11.00	13.22	12.06	8.67	77.00
Effective Water Surface Evaporation	in	4.29	1.40	0.93	0.86	1.21	2.13	4.37	6.68	8.25	9.92	9.05	6.50	55.57
WASTEWATER GENERATION														
Facility Wastewater Influent (ADWF)	MG	1.2	1.1	1.2	1.2	1.1	1.2	1.1	1.2	1.1	1.2	1.2	1.1	13.8
Winery Wastewater Influent	MG	0.065	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.1
I/I Contributions	MG	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0.0
TOTAL Wastewater Influent	ac-ft	3.8	3.5	3.6	3.6	3.3	3.6	3.5	3.6	3.5	3.6	3.6	3.5	42.7
WWTP CONTRIBUTIONS														
Site Run-off	ac-ft	0.2	0.4	0.8	0.6	0.6	0.5	0.2	0.1	0.0	0.0	0.0	0.0	3.5
Open Storage Basin	acre	1.1	1.2	1.2	1.3	1.4	1.5	1.5	1.5	1.4	1.3	1.2	1.1	
Total Water Surface Area	acre	1.1	1.2	1.2	1.3	1.4	1.5	1.5	1.5	1.4	1.3	1.2	1.1	
Cooling Tower Evaporation/Drift Loss[5]	ac-ft	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.1
Total Evaporation	ac-ft	-0.4	-0.1	-0.1	-0.1	-0.1	-0.3	-0.6	-0.8	-0.9	-1.1	-0.9	-0.6	-6.0
Total Precipitation	ac-ft	0.4	0.7	1.5	1.3	1.4	1.0	0.5	0.2	0.1	0.0	0.0	0.0	7.2
Total Percolation	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RECYCLED WATER DISTRIBUTION														
Dual Plumbing	ac-ft	-1.8	-1.8	-1.8	-1.8	-1.6	-1.8	-1.8	-1.8	-1.8	-1.8	-1.8	-1.8	-21.4
Cooling Tower	ac-ft	-0.9	-0.7	-0.7	-0.7	-0.6	-0.7	-0.9	-0.9	-0.9	-0.9	-0.9	-0.9	-9.5
Landscape Irrigation (TBD)	ac-ft	0	0	0	0	0	0	0	0	0	0	0	0	0
Landscape Irrigation (Casino)	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	**0.0**	**0.0**	**0.0**	**0.0**	**-0.2**	-0.3
Vineyard Irrigation (Casino)	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.9	-4.4	-4.2	-2.5	-0.7	-13.7
Additional Turf Grass	ac-ft	0	0	0	0	0	0	0	0	0	0	0	0	0
Surface Water Discharge (Creek)	ac-ft	**-1.3**	**-0.2**	**-0.2**	**-0.2**	**-0.2**	**-0.2**	**-0.2**	**0.0**	0.0	0.0	0.0	0.0	-2.3
RAW WATER MAKE-UP														
Blend Raw Water[1]	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MONTHLY STORAGE BALANCE														
Beginning Storage Volume	ac-ft	**0.0**	0.0	1.8	4.9	7.6	10.3	12.5	13.2	11.8	7.4	3.0	0.5	
Change in Water Volume[4]	ac-ft	0.0	1.8	3.1	2.7	2.7	2.1	0.8	-1.5	-4.4	-4.4	-2.5	-0.5	
Final Storage Volume	ac-ft	0.0	1.8	4.9	7.6	10.3	12.5	13.2	11.8	7.4	3.0	0.5	0.0	

Maximum Seasonal Storage (ac-ft) **13.2**
mg **4.3**

AVERAGE ANNUAL PRECIPITATION RETURN PERIOD

	Units	October	November	December	January	February	March	April	May	June	July	August	September	Water Year
No. Days		31	30	31	31	28	31	30	31	30	31	31	30	
CLIMATE INPUTS														
Precipitation	in	2.10	3.33	7.11	5.63	5.91	4.13	1.98	0.97	0.25	0.01	0.01	0.15	31.58
Pan Evaporation	in	5.72	2.48	1.66	1.53	2.15	3.79	5.82	8.90	11.00	13.22	12.06	8.67	77.00
Effective Water Surface Evaporation	in	4.29	1.86	1.25	1.15	1.61	2.84	4.37	6.68	8.25	9.92	9.05	6.50	57.75
WASTEWATER GENERATION														
Facility Wastewater Influent (ADWF)	MG	1.2	1.1	1.2	1.2	1.1	1.2	1.1	1.2	1.1	1.2	1.2	1.1	13.8
Winery Wastewater Influent	MG	0.065	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.1
I/I Contributions	MG	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0.0
TOTAL Wastewater Influent	ac-ft	3.8	3.5	3.6	3.6	3.3	3.6	3.5	3.6	3.5	3.6	3.6	3.5	42.7
WWTP CONTRIBUTIONS														
Site Run-off	ac-ft	0.1	0.2	0.4	0.3	0.3	0.2	0.1	0.1	0.0	0.0	0.0	0.0	1.7
Open Storage Basin	acre	1.1	1.2	1.2	1.3	1.4	1.5	1.5	1.5	1.4	1.3	1.2	1.1	
Total Water Surface Area	acre	1.1	1.2	1.2	1.3	1.4	1.5	1.5	1.5	1.4	1.3	1.2	1.1	
Cooling Tower Evaporation/Drift Loss[5]	ac-ft	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.2
Total Evaporation	ac-ft	-0.4	-0.2	-0.1	-0.1	-0.2	-0.3	-0.6	-0.8	-0.9	-1.1	-0.9	-0.6	-6.2
Total Precipitation	ac-ft	0.2	0.3	0.7	0.6	0.7	0.5	0.3	0.1	0.0	0.0	0.0	0.0	3.5
Total Percolation	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RECYCLED WATER DISTRIBUTION														
Dual Plumbing	ac-ft	-1.8	-1.8	-1.8	-1.8	-1.6	-1.8	-1.8	-1.8	-1.8	-1.8	-1.8	-1.8	-21.4
Cooling Tower	ac-ft	-0.9	-0.9	-0.9	-0.9	-0.8	-0.9	-0.9	-0.9	-0.9	-0.9	-0.9	-0.9	-10.3
Landscape Irrigation (TBD)	ac-ft	0.0	0	0	0	0	0	0	0	0	0	0	0	0
Landscape Irrigation (Casino)	ac-ft	**0.0**	0.0	0.0	0.0	0.0	0.0	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	0.0
Vineyard Irrigation (Casino)	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.9	-4.4	-4.2	-2.5	-0.7	-13.7
Additional Turf Grass	ac-ft	0.0	0	0	0	0	0	0	0	0	0	0	0	0
Surface Water Discharge (Creek)	ac-ft	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	0.0	0.0	0.0	0.0	0.0
RAW WATER MAKE-UP														
Blend Raw Water[1]	ac-ft	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	2.5	0.4	4.0
MONTHLY STORAGE BALANCE														
Beginning Storage Volume	ac-ft	0.0	1.0	2.2	4.1	5.8	7.4	8.7	9.3	7.7	3.3	0.0	0.0	
Change in Water Volume[4]	ac-ft	1.0	1.2	1.9	1.7	1.6	1.3	0.7	-1.7	-4.4	-3.3	0.0	0.0	
Final Storage Volume	ac-ft	1.0	2.2	4.1	5.8	7.4	8.7	9.3	7.7	3.3	0.0	0.0	0.0	

Maximum Seasonal Storage (ac-ft) **9.3**
mg **3.0**

Note:
1. Blend Raw Water is the deficit in ww flow generated to meet recycled water demands, to resolve then less water would be discharged for irrigation or surface water.
2. Total available area for vineyard field is 45.3 acres approximately.
3. Assumed all equipment open basin/tankage would include covers and won't contribute to ww flows, confirm as more information becomes available.
4. Change in water volume negative since stored volume is available to be transferred out to distribution.
5. Cooling tower evaporation loss estimated at 1.5% of monthly water demand.

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APPENDIX B

Acorn Environmental
Water and Wastewater Feasibility Study
Windsor Groundwater Well Installation and Testing Project
Summary Report

TOWN OF
WINDSOR

Town of Windsor

Groundwater Well Installation and Testing Report

RMC

September 2010

TOWN OF
WINDSOR

Windsor Groundwater Well Installation and Testing Project Summary Report

Prepared by:

RMC
Water and Environment

In Association with:

E-Pur

September 2010

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List of Abbreviations

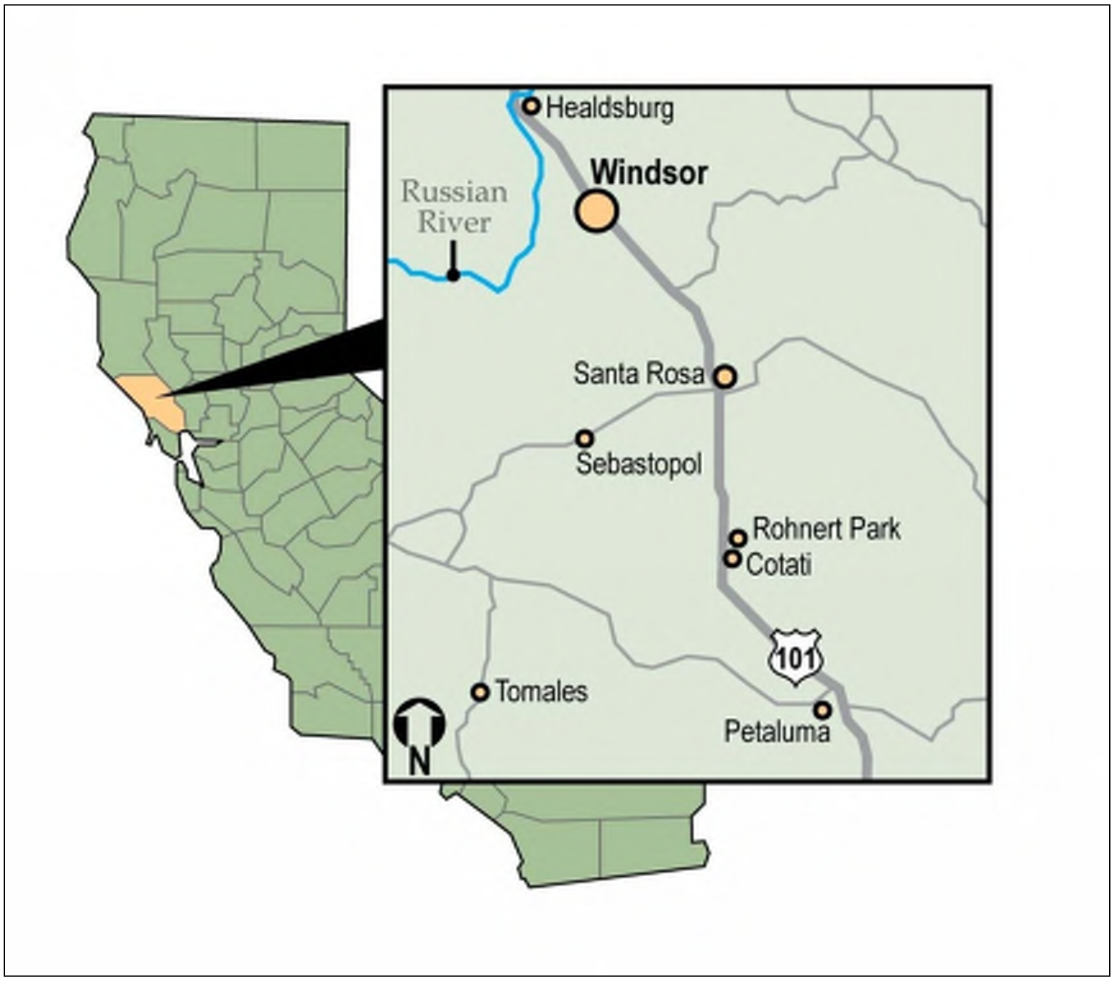
AWWA	American Water Works Association
bgs	below the ground surface
DWR	California Department of Water Resources
gpd	gallons per day
gpd/ft	gallons per day per foot
gpm	gallons per minute
GPS	Global Positioning System
mg/L	milligrams per liter
MCL	Maximum Contaminant Level
NCRWQCB	North Coast Regional Water Quality Control Board
SCWA	Sonoma County Water Agency
TOC	Total Organic Carbon
μg/L	micrograms per liter
USGS	United States Geological Survey

Chapter 1 Introduction and Background

1.1 Introduction

The Town of Windsor, California drill two exploratory boreholes and install a well in each borehole to evaluate the groundwater supply potential from the underlying unconsolidated aquifer(s) and, if possible, to provide an immediate supplemental municipal water supply for use in periods of drought or emergency. The location of Windsor, California in Sonoma County is shown on Figure 1-1, below.

Figure 1-1: Windsor Location Map



In 2007, a water supply analysis was conducted as part of the Town's Water Master Plan update. This analysis concluded that the Town of Windsor currently has enough supply capacity to meet current demands (assuming full availability of allocated supplies); however, demands are expected to exceed current supplies as early as 2008, assuming projected SCWA Russian River water allocations, continuation of Bluebird well being off-line due to water quality issues, and regulatory and permitting issues surrounding the Russian River water supplies. While the shortfall may be met through a combination of conservation and increased recycled water use, the development of off-river water supplies is considered imperative to helping the Town meet intermittent shortfalls and to potentially provide long-term supplies as part of a larger conjunctive use program. Additionally, the analysis concluded that there were two high-priority needs for the Town of Windsor that needed to be addressed as part of their water supply planning. The first identified need was to develop, as soon as possible, some off-river groundwater supply capacity to augment the current system in the event of supply curtailments such as that which occurred in 2007. The second need identified was to develop hydrogeologic data on suitable locations and depths for the future development of wellfields and groundwater basin recharge for longer-term water supply development.

In light of these results, a program was developed within the context of Windsor's Water Master Plan to provide information regarding off-river well locations for hydrogeologic data and water production capabilities. Using available hydrogeologic data, exploratory borehole and well drilling locations were selected based upon several criteria for long-term wellfield siting. Specifically, the intended production well clusters are located in areas:

- known to have productive geologic strata,
- proximate to the existing water distribution system,
- at or adjacent existing groundwater wells with seniority of usage,
- currently owned by the Town (to minimize program costs), and
- near surface water bodies or storm water conveyances, if possible, to ease start up issues.

From these criteria, several viable locations were identified for exploratory drilling and well construction, two of which currently contain Town-owned wells. These two sites are Esposti Park and the Bluebird-Well area; the locations of these wells are depicted on **Error! Reference source not found.**.

The intent of the well drilling program is to evaluate the thickness and productivity of the deeper sedimentary units in the Windsor area at these existing well locations (along with the better-known shallow sedimentary units), and to provide the Town with two wells that it can use immediately to augment existing water supplies in times of shortages relating to drought and/or emergency. In addition, the information obtained on sedimentary units and their associated water quality will be used to aid in the siting and design of long-term production well(s) at these and other locations.

1.2 Drilling and Well Testing Objectives

As discussed above, the objective of the exploratory boring and well drilling program was to gather the necessary data to develop robust designs for off-river wells, to craft a long-term conjunctive use program for the Town of Windsor, and to provide the Town with two 'working' wells that could provide immediate relief to shortages resulting from periods of drought and/or emergency. In order to achieve this objective, the field program needed to maximize the hydrogeologic data collected for understanding the portion of the groundwater basin underlying the Town of Windsor and for development of a regional conceptual model of water-bearing aquifers. Therefore, data to be collected during borehole drilling included:

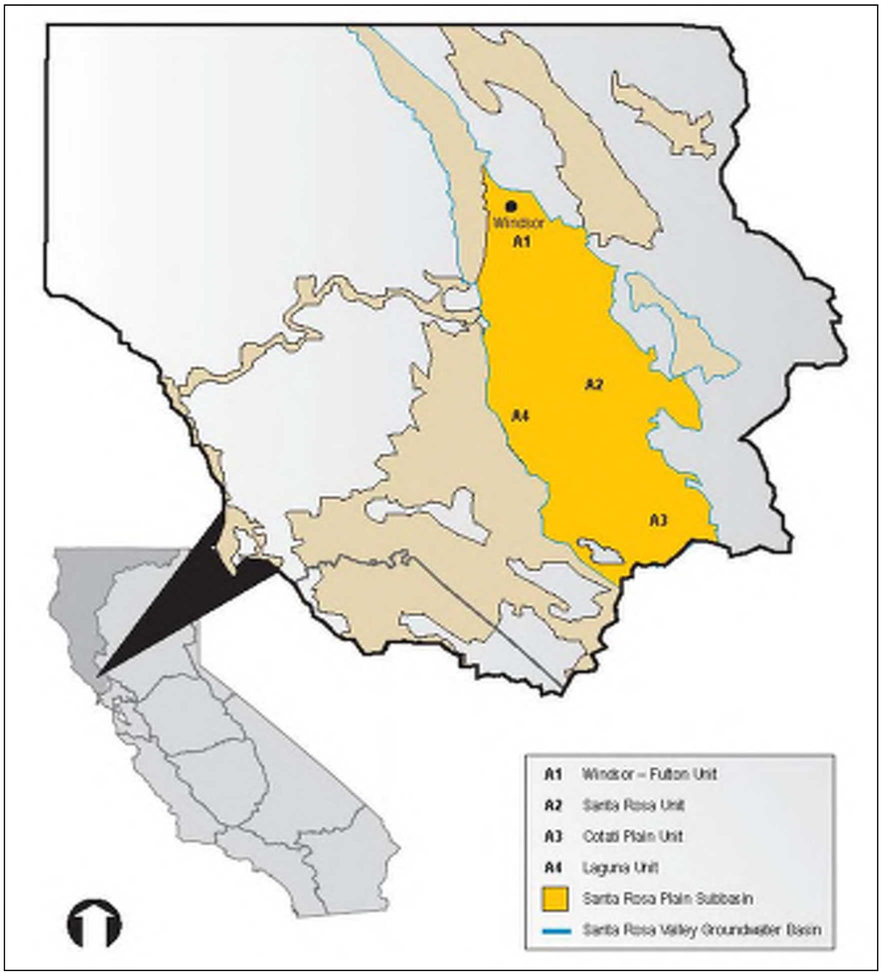
- Accurate and depth-correlated sediment data;
- Sediment samples for grain size analysis in certain intervals;
- Formation water-quality samples in the prospective production intervals for metals and ions; and,
- Geophysical data on the subsurface strata for lithostratigraphic correlation regionally.

The hydrogeological investigations documented here were to confirm the suitability of the Bluebird and Esposti Park locations for long-term production wells and to provide sufficient data for the preparation of production well designs for Windsor's short-term and long-term water supply goals. For the purposes of the drilling program, the short-term goal was to site individual supply wells capable of efficiently producing 200 gallons per minute or more of high-quality groundwater. The longer-term goals, as identified in the Water Master Plan, are to maximize the use of the groundwater basin as a long-term sustainable resource and to minimize water quality concerns such as those currently encountered in the Bluebird Well for arsenic and other metals.

1.3 Regional Hydrogeology

According to the California Department of Water Resource (DWR) *Bulletin 118*, *California's Groundwater* (2003), the Town of Windsor overlies the Santa Rosa Plain, a groundwater sub-basin of some 80,000 acres within the Santa Rosa Valley Groundwater Basin. Past work by the United States Geological Survey (USGS), however, indicates that the Town, in fact, overlies a smaller sub-basin or unit termed the Windsor-Fulton unit (Cardwell, 1958) or Windsor Storage Unit (DWR, 1975). This unit (identified herein as the Windsor-Fulton unit) is approximately 11,100 acres in size (Cardwell, 1958). The Santa Rosa Plain sub-basin and Windsor-Fulton unit are shown on Figure 1-2.

Figure 1-2: Groundwater Basin and Subbasins in the Vicinity of Windsor



Groundwater quality and availability in the Santa Rosa Plain has been the subject of several earlier investigations and is the subject of a current study by the USGS. Two principal studies, *Geology and ground water in the Santa Rosa and Petaluma Valley areas, Sonoma County* by G. T. Cardwell (1958), and Bulletin 118-4, *Evaluation of ground water resources: Sonoma County, Volume 2: Santa Rosa Plain* by the California Department of Water Resources (DWR, 1982), inform much of the current discussion herein.

1.3.1 Description of Near-Surface Geology Near Windsor

The Windsor-Fulton unit is a deep bedrock trough around a geologic syncline (a concave upward folding of consolidated and semi-consolidated rock) named the Windsor Syncline. The basin is filled with Tertiary- and Quaternary-aged uncemented and partially cemented sediment of the Glen Ellen Formation, Wilson Grove Formation, and likely the Petaluma Formation. These formations make up a single groundwater aquifer. The Windsor-Fulton unit is flanked on the east by Tertiary-aged Sonoma Volcanics and on the west by Jurassic-aged Franciscan assemblage bedrock. Recent studies by the USGS have identified that the groundwater unit is flanked on the south by a subsurface feature termed the Trenton Ridge, a geologic ‘high spot’ that runs from the Town of Trenton to the City of Santa Rosa and ‘separates’ the Windsor-Fulton unit from the remainder of the sub-basin. This “ridge” feature is defined by a gravity anomaly and is believed to be associated with thrust faulting resulting from northern compression of the area. It may form a southern boundary hydraulically to the Windsor Fulton unit within the unconsolidated deposits overlying the bedrock faulting due to offsetting of sediment beds.

The USGS historically identified three classes of geologic formations (Cardwell, 1958) beneath the Santa Rosa Plain sub-basin and Windsor-Fulton unit based upon their general water bearing properties:

1. Consolidated rocks of Jurassic and Cretaceous age which yield essentially no water (e.g. the Franciscan Formation, a group of metamorphosed sedimentary rocks west of Windsor)
2. Sedimentary and volcanic rocks of Tertiary age which are mainly secondary aquifers (e.g. the Sonoma Volcanics)
3. More recent deposits of late Tertiary age (approximately 2 million years ago) to Quaternary age (0.8 to 1.8 Million years ago)

The Class 3 formations are considered the most important for use of groundwater as a supply option beneath the Town of Windsor. The three principal Class 3 formations of interest underlying the Town are the Quaternary Glen Ellen Formation and both the late Tertiary Petaluma Formation and the similar-aged Wilson Grove (formerly Merced) Formation.

1.3.2 Unconsolidated Aquifer Characteristics

Groundwater flow in the Windsor-Fulton groundwater unit is west-southwest from the foothills of the Mayacama Mountains toward the Russian River where it would discharge. Groundwater flow in the sedimentary aquifer beneath Windsor is believed to be bounded on the east by the Healdsburg Fault zone which is a strike-slip fault that is active and offsets sedimentary beds sufficiently to impede groundwater flow. Groundwater to the south of the Windsor-Fulton groundwater unit may be bounded by the Trenton Ridge, as it marks a significant contrast in the thickness of certain sedimentary units such as the Glen Ellen Formation.

The thickness of the unconsolidated sedimentary aquifer within the Windsor-Fulton unit is not fully known. It was preliminarily described as over 1,000 feet deep in the center of the Windsor syncline (Cardwell, 1958). The western side of the groundwater unit is fault controlled; the sedimentary aquifer is thick, greater than 600 feet, and rapidly thins to less than 200 feet by the Russian River where a thin veneer of highly permeable alluvial and terrace deposits sit beneath and adjacent to the river. The eastern flank of the sedimentary aquifer is described as shallowing to perhaps 500 feet, but remaining relatively thick due to a small amount of downward displacement apparent along the Healdsburg fault zone to the east (Cardwell, 1958). Recent studies by the USGS suggest that the deeper sedimentary interval beneath the Windsor-Fulton groundwater unit, north of the Trenton Ridge, may consist of Pliocene age or older Petaluma Formation; however, this has not been confirmed by direct evidence (i.e. boring logs) in the center of the basin. Furthermore, the water bearing properties of the Petaluma Formation are quite variable to the south and it is not known whether this section of Petaluma Formation, if present, would yield appreciable quantities of groundwater to individual wells.

1.3.3 Groundwater Availability

The Santa Rosa Plain sub-basin contains a large quantity of groundwater in storage; DWR's 1982 estimates are as high as four million acre-feet in the entire Santa Rosa basin. The upper 200 feet beneath the Windsor-Fulton unit is estimated to contain 165,000 acre-feet of groundwater in storage according to USGS estimates (Cardwell, 1958). More groundwater is likely present in storage within the deeper sediments, but this has not been fully quantified; a good working estimate of the total groundwater in storage beneath the Windsor area would be around 400,000 acre-feet.

Recharge of the groundwater basin annually due to infiltration of precipitation is very limited. The entire Santa Rosa Plain Sub-basin has been estimated to receive 29,300 acre-feet of recharge annually (DWR, 1982). The Windsor-Fulton unit can reasonably be estimated to receive 10% of that recharge based upon its size and areal extent. This means that 2,930 acre-feet of water are naturally recharged to the Windsor-Fulton unit annually. This low annual recharge rate restricts how much water can be withdrawn over the longer-term without substantial decreases in the volume of groundwater in storage. Decreasing the volume of groundwater in storage adds an additional energy cost to pump the groundwater due to increased depth to water, not to mention the dewatering of wells screened in shallower aquifer intervals.

Groundwater extraction wells in the Windsor-Fulton unit produce highly varying yields depending on the lateral location of the well and the depth and length of the screened interval. The majority of groundwater wells in the area are completed at shallow depths (less than 200 feet) in the recent alluvium and the Glen Ellen Formation. Additionally, to the southwest of the center of town and west of Windsor Creek, groundwater wells appear to encounter portions of the Wilson Grove Formation (formerly named the Merced Formation) interfingered with the Glen Ellen Formation. The quantity of groundwater produced per foot of drawdown in the Glen Ellen Formation ranges from approximately 0.5 gpm/foot to more than 20 gpm/foot. The quantity of groundwater produced per foot of drawdown in the Wilson Grove Formation is generally higher than that of the Glen Ellen, ranging from 2 to 30 gpm/foot (Cardwell, 1958). The quantity of groundwater to be produced per foot of drawdown in the Petaluma Formation or deeper sediments in the Windsor-Fulton unit is unknown. In general, viable water supply wells are those that can produce more than 200 gpm, which will necessitate encountering coarse sediment packets with specific capacity at the middle- to higher-end of these known ranges in order to minimize drawdown and to increase the reliability of supply over the longer term for Windsor.

Groundwater is utilized in the Santa Rosa Plain for water supply of all types from agriculture and industry to individual domestic supply wells. The 1982 DWR study found the groundwater aquifer system to be in supply-demand equilibrium with groundwater withdrawals then totaling 29,700 acre-feet. There may be limited additional groundwater available within the Windsor-Fulton unit, absent the artificial recharge of the groundwater basin from surface water sources such as the Russian River or recycled water. The USGS and SCWA plan to evaluate active groundwater recharging with surface water as one of the conjunctive-use management options for water supply in other parts of the groundwater basin.

1.4 Organization of Document

This report describes the exploratory drilling program and data collection activities conducted at the Town of Windsor's Bluebird and Esposti Park well sites, as well as well installation and pump testing details. Specifically, this document is organized into the following chapters:

- Well Drilling and Construction in Chapter 2;
- Well Development in Chapter 3;
- Aquifer Testing in Chapter 4;
- Groundwater Quality results in Chapter 5;
- Well Surveys in Chapter 6; and,
- References at the report end.

Chapter 2 Well Drilling and Construction

Exploratory boreholes were advanced at the two identified exploration and testing locations for this project - Esposti Park and the existing Bluebird Well area (Figure 2-1) - to evaluate the water production viability of the unconsolidated sedimentary aquifer in the Windsor area. This chapter provides a summary of the exploratory drilling and well construction program that was conducted at each site. Specifically, documented herein are:

- the drilling of two exploratory borings with lithologic logging;
- collection of preliminary water-quality samples during drilling; and
- well installation.

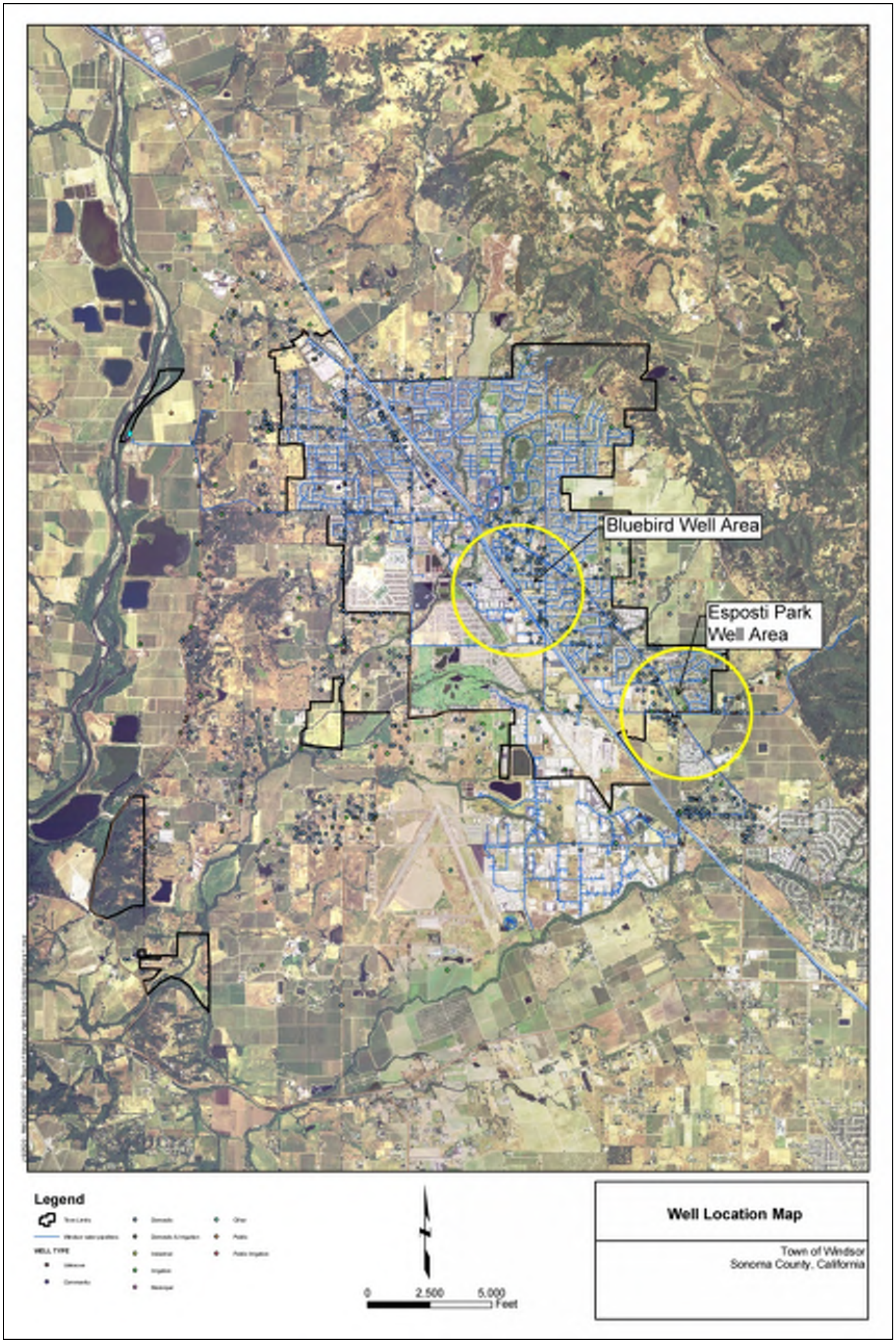
Borehole geophysical surveys that were conducted are summarized in Chapter 6 of this report, while Chapter 3 documents the well development, Chapter 4 documents the aquifer pump testing, and Chapter 5 document water quality testing conducted at each well site.

Borehole drilling and well design and installation were conducted under the oversight of John M. Lambie, California Professional Geologist (PG) Number 4607 (Expires 5/31/2011).

Lithologic samples were collected approximately every 10 feet of borehole advancement using three following methodologies:

1. Primary samples of sediment and water were placed in mason jars for the purposes of providing a total matrix sample. The samples were collected from a bucket placed beneath the cyclone separator that separates the drilling air from the water and solids driven to the surface inside the drill string. The mason jar lids were labeled according to borehole and depth interval in the field.
2. Secondary soil/sediment samples were collected using a combination of fine-meshed stainless steel screens suspended under the cyclone separator by a long metal pole for safety. These samples excluded the finest-grain-size clays in the materials coming out of the bottom of the cyclone separator. The samples were preserved in small canvas bags and labeled according to borehole and depth interval.
3. Tertiary samples were created from the secondary samples by centrifuging the samples to remove water and more fine-grained material. These tertiary samples were then dried under a heat lamp and observed under a low-power optical microscope to examine the grain textures and colors. The samples were preserved in small sample packets and labeled according to borehole depth and interval.

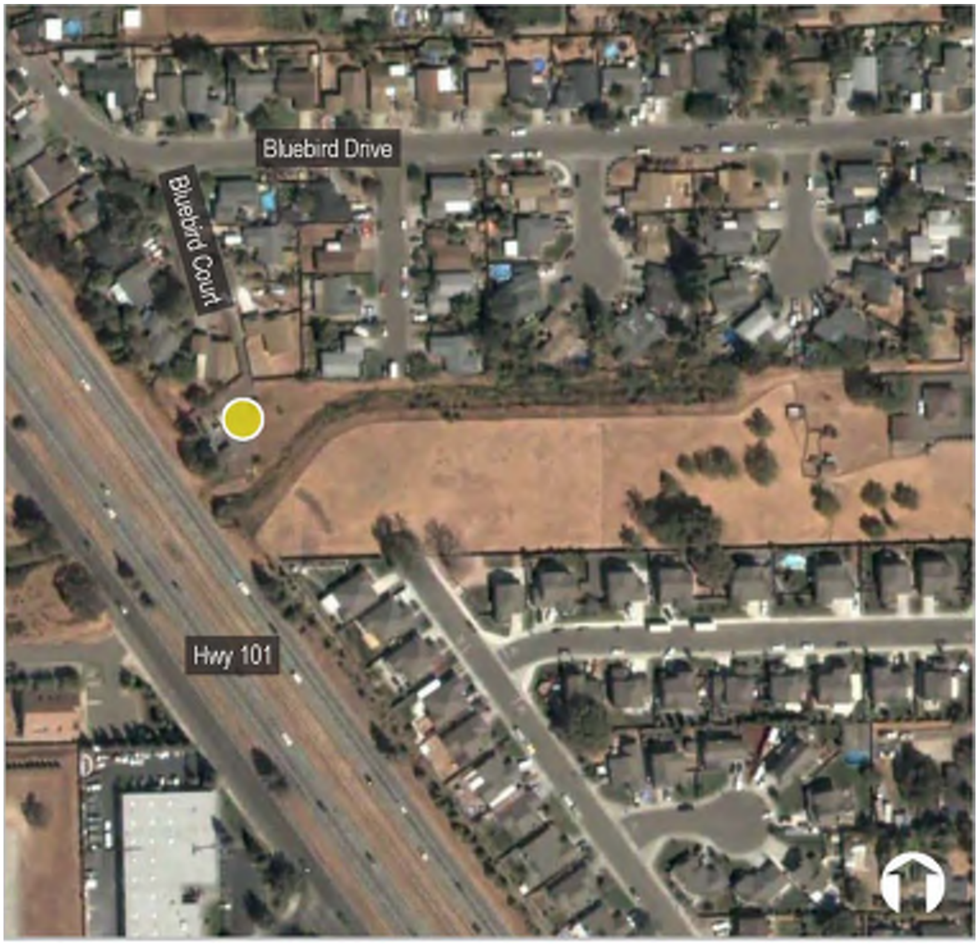
Figure 2-1: Borehole Locations in Windsor



2.1 Bluebird Well Site

Field work began at the Bluebird well site on January 25, 2010, however drilling was delayed until February 7, 2010 due to heavy rains and wet site conditions. Drilling at the Bluebird site occurred between February 7, 2010 and April 8, 2010. The following details the drilling and well installation program that occurred at this well site. The replacement Bluebird well is located as shown on Figure 2-2

Figure 2-2: Bluebird Borehole and Well Location



2.1.1 Conductor Casing and Sanitary Seal

A ¼-inch wall, 20-inch diameter conductor casing and surface sanitary seal were installed to a depth of 20 feet using a reverse-circulation air rotary drill rig. The sanitary seal consists of a 5% bentonite-cement grout mixture that was pumped into the annular space between the borehole wall and conductor casing using a tremie pipe. The cement mixture consists of approximately one part cement with about six gallons of potable water per sack of Portland cement.

2.1.2 Drilling

Borehole drilling at the Bluebird well site was conducted in multiple stages using a combination of reverse-air-circulation dual-tube and mud rotary drilling methods. First, a 6-inch diameter pilot hole was drilled between February 8, 2010 and February 21, 2010 to a total depth of 795 feet below the ground surface (bgs). Drilling at this site with reverse-air-circulation drilling was slow and difficult, and while a promising zone appeared to be present at the ~800-foot depth, a decision was made not to continue drilling using this methodology. A mud-rotary drill rig was brought to the site later during the field project, and the existing 6-inch borehole reamed to a 10-3/4-inch diameter beginning on April 3, 2010. Reaming of the existing 800-foot borehole was completed on April 8, 2010 and the borehole advanced to a total depth of 867 feet by April 8th. Drilling was deemed complete on April 8, 2010 when volcanic tuff was identified in the borehole. The Bluebird borehole was then subsequently reamed again to a nominal diameter of 16-inches using the mud-rotary drilling method between April 16 and April 21, 2010. Reaming to final diameter was completed for a total depth of 760 feet bgs. No amendments were added to the drilling fluid during pilot borehole drilling for drilling fluid property control.

Drill cutting samples were logged during pilot drilling by a California-licensed hydrogeologist. Samples were collected onsite at the point where the drill cuttings dropped out of the cyclone and into a small catch basin before exiting the shaker. The generalized lithology encountered during drilling is summarized in Table 2-1. A detailed lithologic log combined with geophysical survey results is provided in Appendix B.

Geophysical logging of the pilot borehole was conducted after reaching total depth of 867 feet bgs. Schlumberger LTD performed the logging which consisted of a suite of geophysical surveys, including:

- Gamma
- Open Hole Sonic Logging
- Single Arm Caliper
- Spontaneous Potential
- Induction Resistivity with Borehole Fluid Resistivity
- Magnetic Resonance Logging for:
    - Porosity;
    - Bound water;
    - Free water; and
    - Relative permeability
- Micro-Resistivity

Copies of the geophysical survey reports are included in Appendix C. The logs were run at vertical scales of 1-inch to 50 feet and 1-inch to 20 feet. As part of their surveys, Schlumberger performed a caliper log of the reamed borehole. The caliper log was used to estimate the volumes of gravel pack and grout necessary to fill the annular space during well construction.

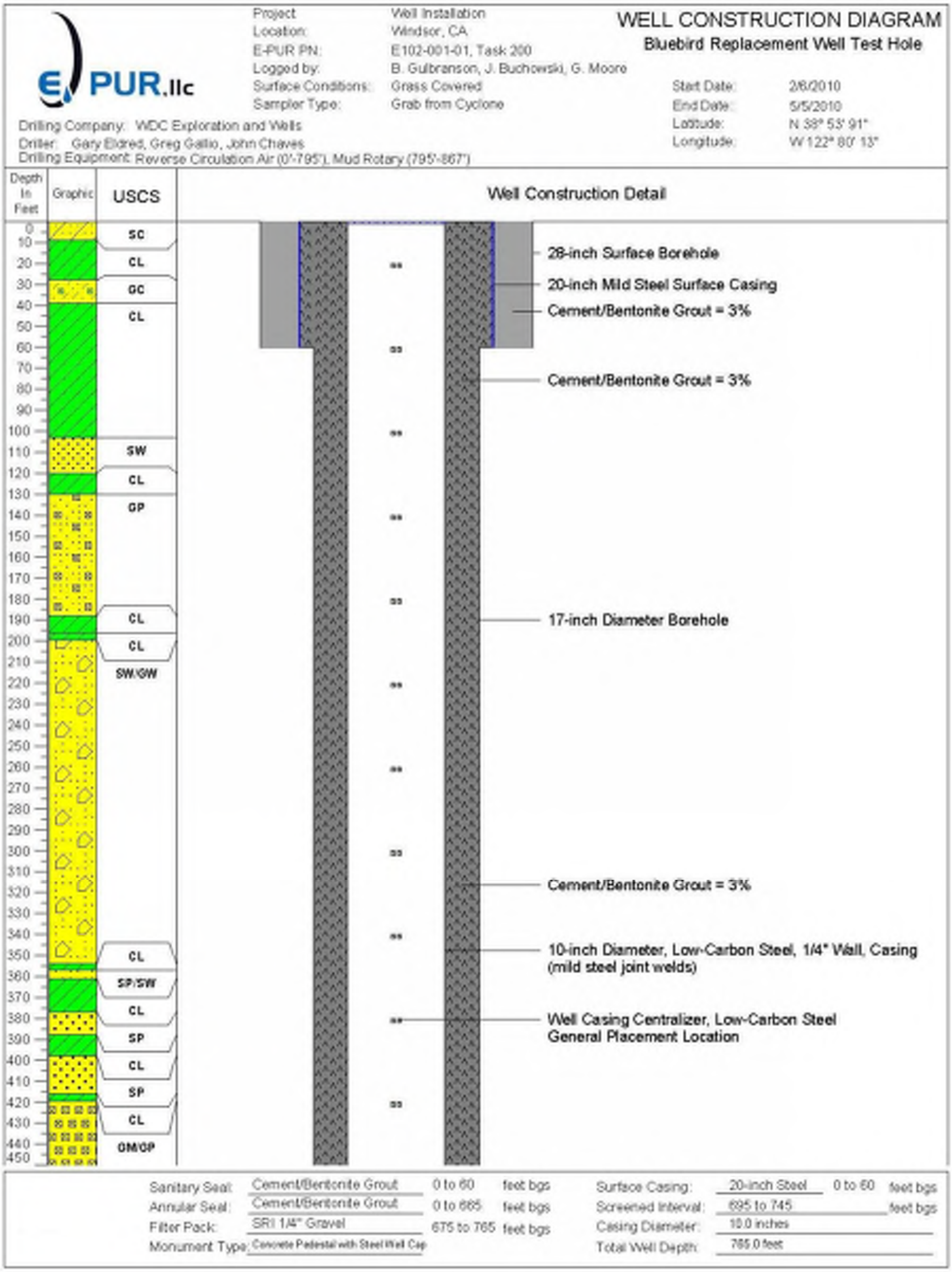
Three drill cutting samples of the pilot borehole were analyzed for grain size distribution to design the well screen filter (gravel) pack and well screen slot size. Samples were collected from the following depth intervals and analyzed by Environmental Technical Services in Petaluma, California: 550 to 580 feet bgs, 710 to 740 feet bgs, and 790 to 800 feet bgs. These samples were obtained from water-yielding formations over the anticipated interval to be screened. Grain size analysis reports are included in Appendix D.

In general, the sand and gravel units encountered during drilling are correlated with the Glen Ellen Formation. This unit consists of heterogeneous mixtures of tuffaceous clay, mud, boulder to pebbly gravel, and sand and silt deposits with interbedded conglomerates (Sweetkind et. al., 2010). The Glen Ellen Formation was deposited in a variety of nonmarine environments, including coalescing alluvial fans, fan deltas, streams and lakes, and can be differentiated from the underlying Wilson-Grove Formation by the lack of fossils as well as the sediment types and colors, and from the underlying Petaluma Formation by the materials types as the Petaluma Formation is dominated by deposits of moderately to weakly consolidated silty to clayey mudstone along with local beds and lenses of poorly sorted sandstone (Sweetkind et. al., 2010).

Table 2-1: Bluebird Lithologic Summary

Top Depth (feet)	Bottom Depth (feet)	Lithology
0	10	Clayey sand with trace gravel
10	28	Clayey sand to sandy clay with trace gravel
28	40	Gravel and sand with little clay
40	103	Brown sandy clay
103	120	Gravel and sand varying from gravel to sand
120	130	Brown stiff clay
130	188	Gravel and sand, variably colored
188	199.5	Gray to brown sandy clay
199.5	354	Variably colored medium sand with gravel to gravel with sand.
354	377	Light to dark gray sandy clay
377	388	Poorly sorted sand, variably colored
388	398	Dark gray sandy clay
398	416	Poorly sorted sand, fine to coarse
416	419	Dark gray sandy clay
419	450	Gravel with sand, grading to sand with trace gravel
450	470	Medium to light gray clay
470	511	Sand with trace gravel
511	516	Gray clay
516	580	Sand and gravel, variably colored. Increasing sand with depth
580	584	Gray clay
584	608	Sand with gray clay and gravel
608	650	Clayey sand to sandy clay
650	685	Fine sand with clay stringers
685	695	Clay with sand stringers
695	745	Sand with gravel
745	790	Medium gray clay
790	797	Thin stringy sand and gravel
797	867	Clay

Figure 2-3: Bluebird Boring Log and Well Construction Diagram

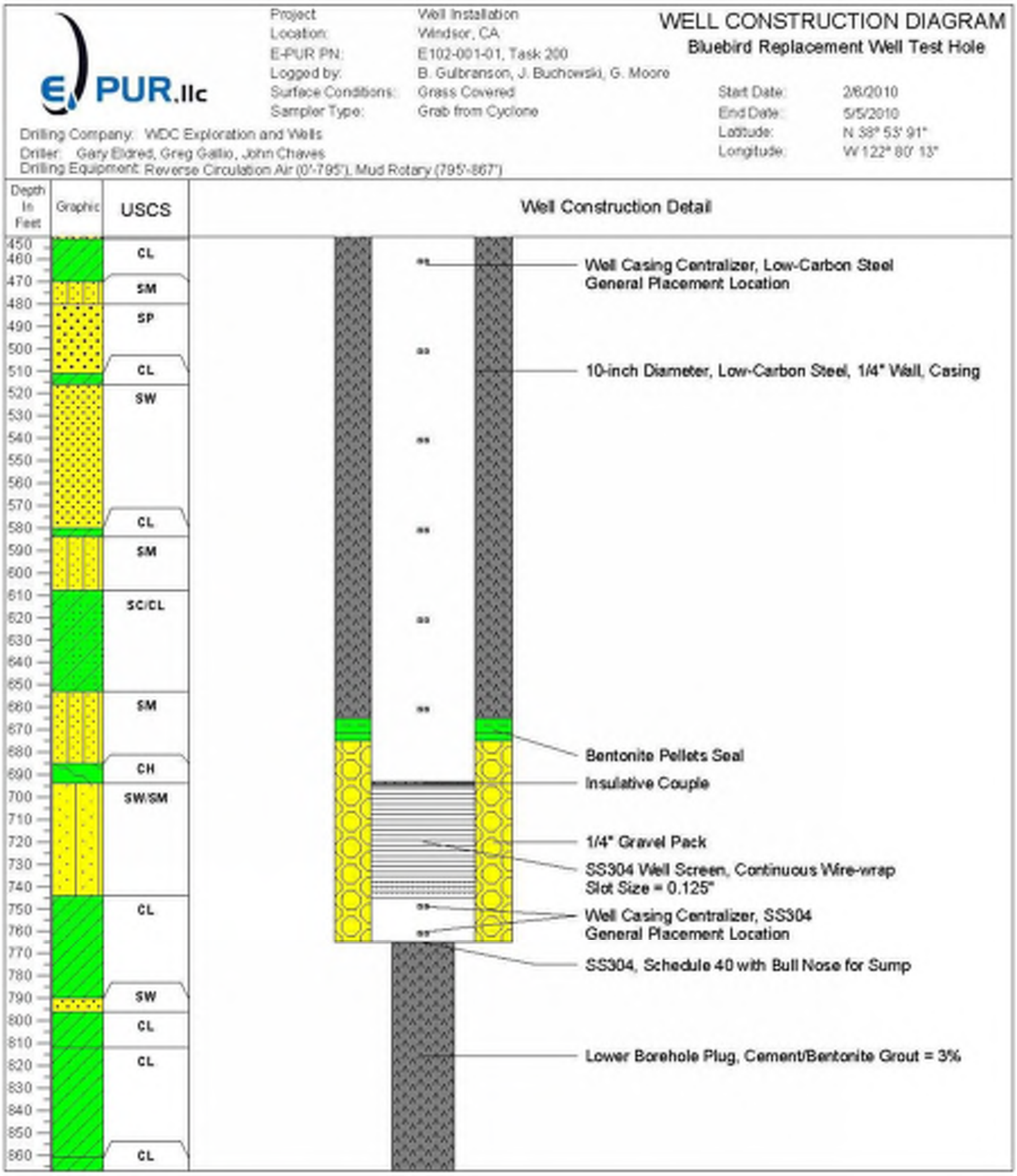


WELL CONSTRUCTION DIAGRAM
Bluebird Replacement Well Test Hole

Project: Well Installation
Location: Windsor, CA
E-PUR PN: E102-001-01, Task 200
Logged by: B. Gulbranson, J. Buchowski, G. Moore
Surface Conditions: Grass Covered
Sampler Type: Grab from Cyclone
Drilling Company: WDC Exploration and Wells
Driller: Gary Eldred, Greg Gallio, John Chaves
Drilling Equipment: Reverse Circulation Air (0'-795'), Mud Rotary (795'-867')
Start Date: 2/6/2010
End Date: 5/5/2010
Latitude: N 38° 53' 91"
Longitude: W 122° 80' 13"

Sanitary Seal: Cement/Bentonite Grout 0 to 60 feet bgs
Annular Seal: Cement/Bentonite Grout 0 to 685 feet bgs
Filter Pack: SRI 1/4" Gravel 675 to 765 feet bgs
Monument Type: Concrete Pedestal with Steel Well Cap
Surface Casing: 20-inch Steel 0 to 60 feet bgs
Screened Interval: 695 to 745 feet bgs
Casing Diameter: 10.0 inches
Total Well Depth: 765.0 feet

Figure 2-3: Bluebird Boring Log and Well Construction Diagram (cont'd)



WELL CONSTRUCTION DIAGRAM
Bluebird Replacement Well Test Hole

Project: Well Installation
Location: Windsor, CA
E-PUR PN: E102-001-01, Task 200
Logged by: B. Gulbranson, J. Buchowski, G. Moore
Surface Conditions: Grass Covered
Sampler Type: Grab from Cyclone
Start Date: 2/6/2010
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Latitude: N 38° 53' 91"
Longitude: W 122° 80' 13"
Drilling Company: WDC Exploration and Wells
Driller: Gary Eldred, Greg Gallio, John Chaves
Drilling Equipment: Reverse Circulation Air (0'-795'), Mud Rotary (795'-867')

2.1.3 Well Construction

The as-built well construction is shown on Figure 2-3. Well casing and screen materials were installed in the borehole on April 27 and 28, 2010. Gravel pack was installed on April 28, 2010 and the bentonite seal was installed on April 29, 2010. Well grouting occurred on April 29 and 30, 2010.

The well was completed using a 10-inch diameter screen and casing. The well casing from the ground surface to a depth of 695 feet consists of 10-inch diameter, ¼-inch wall, low-carbon steel casing. A special insulative coupling was placed between the upper low carbon steel casing and the lower stainless steel casing/screen materials. Casing and screen joints were welded during installation with a minimum of two passes per circumference. Centralizers were installed at approximately 40-foot intervals (except over screened sections) to center the casing and screen in the borehole. The centralizers were made of the same material (i.e. low carbon or stainless) as the casing to which the centralizers were attached.

The well screen and casing were designed to withstand the collapse pressures expected to be encountered within the borehole during installation, development and use. The detailed screen design was performed by E-Pur based on the screen depth and slot size specifications detailed in the project specifications. The ¼-inch wall thickness used in the construction of the Bluebird replacement well is consistent with the thickness recommended by State of California *Standards for Water Well Construction* (DWR Bulletins 74-81 and 74-90) for 10-inch casing to be set to depths to 1,000 feet.

The well screen was designed to screen the permeable sand and gravel zones identified during borehole advancement. Intervals to be screened were selected based soil types, field observations and depth-specific water quality samples collected during boring advancement. A total screen length of 50 feet was installed over a single interval from 695 to 745 feet bgs. The screen consists of stainless steel continuous wire-wrap construction with a 0.125 inch slot size.

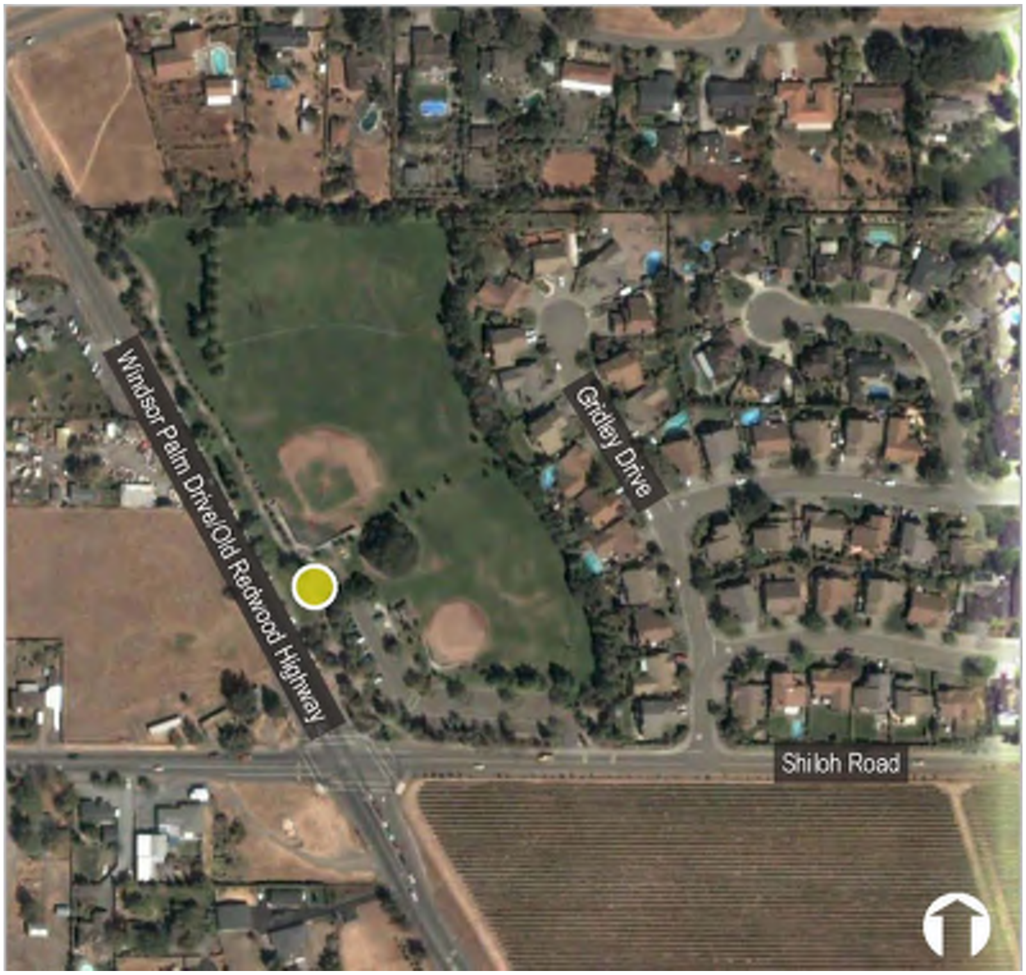
The screen filter pack consists of ¼-inch SRI Supreme gravel material. The gravel pack was place in the annual space between the borehole and well casing using a tremie pipe and potable water. A 10 foot bentonite seal was placed on top of the gravel pack. This was followed by a hot patch (short lift of 5% bentonite/cement grout) which was allowed to set for 24 hours before the remaining annual space was placed with the same material to prevent potential collapse of the well casing. All annular seal grouting was placed using a tremie pipe. The placement of the annual seal was witnessed by a Sonoma County Health Department inspector.

The wellhead was fabricated after completion of the well development. Wellhead finishing consisted of a concrete pad around the well casing and a locking cap on top. The well construction details are show in Figure 2-3.

2.2 Esposti Park Well Site

Field work began at the Esposti Park well site on February 23, 2010 with drilling concluding on March 22, 2010. The following details the drilling and well installation program that occurred at this well site. The replacement Esposti Park well is located as shown on Figure 2-4.

Figure 2-4: Esposti Park Borehole and Well Location



2.2.1 Conductor Casing and Sanitary Seal

A ¼-inch wall, 20-inch diameter mild steel conductor casing and surface sanitary seal were installed to a depth of 30 feet using a reverse-circulation air rotary drill rig. The sanitary seal consists of a 5% bentonite-cement grout mixture that was pumped into the annular space between the borehole wall and conductor casing using a tremie pipe. The cement mixture consists of approximately one part cement with about six gallons of potable water per sack of Portland cement.

2.2.2 Drilling

Borehole drilling at the Esposti Park well site was conducted in two stages using the reverse-air-circulation dual-tube drilling method. First, a 6-inch diameter pilot hole was drilled to a total depth of 1,040 feet bgs. Second, the borehole was reamed using the mud-rotary drilling method to a nominal diameter of 16-inches for a total depth of 675 feet bgs. The pilot borehole was drilled from February 23, 2010 to March 2, 2010. The borehole was reamed from March 11, 2010 to March 22, 2010. No amendments were added to the drilling fluid during pilot borehole drilling for drilling fluid property control.

Drill cutting samples were logged during pilot drilling by a California-licensed hydrogeologist. Samples were collected onsite at the point where the drill cuttings dropped out of the cyclone and into a small catch basin before exiting the shaker. The generalized lithology encountered during drilling is summarized in Table 2-2. A detailed lithologic log combined with geophysical survey results is provided in Appendix B.

Geophysical logging of the pilot borehole was conducted after reaching total depth of 867 feet bgs. Schlumberger LTD performed the logging which consisted of a suite of geophysical surveys, including:

- Gamma
- Open Hole Sonic Logging
- Single Arm Caliper
- Spontaneous Potential
- Induction Resistivity with Borehole Fluid Resistivity
- Magnetic Resonance Logging for:
    - Porosity;
    - Bound water;
    - Free water; and
    - Relative permeability
- Micro-Resistivity

Copies of the geophysical survey reports are included in Appendix C. The logs were run at vertical scales of 1-inch to 50 feet and 1-inch to 20 feet. As part of their surveys, Schlumberger performed a caliper log of the reamed borehole. The caliper log was used to estimate the volumes of gravel pack and grout necessary to fill the annular space during well construction.

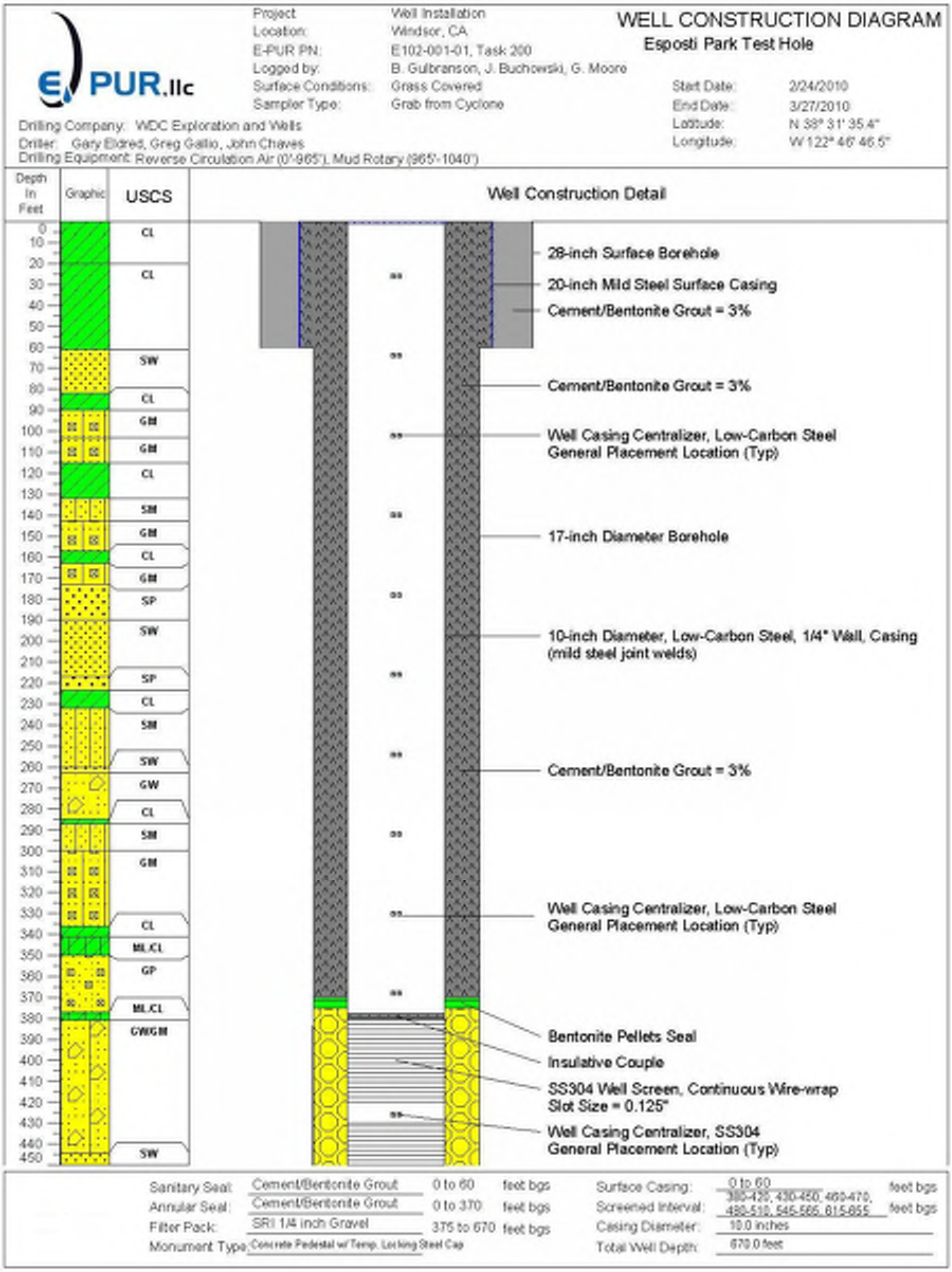
Five drill cutting samples of the pilot borehole were analyzed for grain size distribution to design the well screen filter (gravel) pack and well screen slot size. Samples were collected from the following depth intervals and analyzed by Environmental Technical Services in Petaluma, California: 390 to 400 feet bgs, 400 to 420 feet bgs, 420 to 440 feet bgs, 550 to 580 feet bgs, and 580 to 600 feet bgs. The samples were obtained from water-yielding formations over the anticipated interval to be screened. Appendix D contains copies of the geotechnical laboratory report.

In general, the sand and gravel units encountered during drilling correlate with the Glen Ellen Formation. This unit consists of heterogeneous mixtures of tuffaceous clay, mud, boulder to pebbly gravel, and sand and silt deposits with interbedded conglomerates (Sweetkind et. al., 2010). The Glen Ellen Formation was deposited in a variety of nonmarine environments, including coalescing alluvial fans, fan deltas, streams and lakes, and can be differentiated from the underlying Wilson-Grove Formation by the lack of fossils as well as the sediment types and colors, and from the underlying Petaluma Formation by the materials types as the Petaluma Formation is dominated by deposits of moderately to weakly consolidated silty to clayey mudstone along with local beds and lenses of poorly sorted sandstone (Sweetkind et. al., 2010).

Table 2-2: Esposti Park Lithologic Summary

Top Depth (feet)	Bottom Depth (feet)	Lithology
0	60	Light brown sandy clay
60	82	Variably colored well-sorted sand
82	90	Light gray sandy clay
90	115	Poorly sorted medium gravel, variably-colored; grading to green gray with depth
115	132	Dark gray-green silty clay
132	152	Gray-green sand with rare cobble; poorly sorted. Increasing coarseness with depth
152	163	Light brown sandy clay
163	223	Gray-green sand with rare cobble; poorly sorted. Increasing coarseness with depth to fine-to-medium sand
223	232	Light gray silty clay
232	336	Poorly sorted sand with rate pebbles. Increasing coarseness. Changing to gravel with sand and then to medium sand with pebbles
336	350	Light gray sandy clay. Light brown volcanic ash identified starting at 341 feet bgs
350	377	Variably colored gravel and sand. Grades from fine to medium. Some volcanic ash.
377	381	Ash predominant with sand and gravel
381	650	Variably-colored gravel and sand. Some ash interspersed at intervening layers. Interspersed clay with sand and gravel between 510 and 520 feet bgs.
650	700	Interbedded clay and ash with some sand. Trending to tan clay with depth
700	736	Gravel and sand
736	804	Dark gray micaceous clay with layers of sand ranging from fine to medium.
804	826	Gray-green fine to medium sand. Abundant ash starting at 810 feet bgs.
826	832	Light gray sandy clay
832	841	Sand and gravel
841	854	Dark gray fat clay
854	862	Poorly sorted sand with gravel, variably colored
862	970	Dark gray fat clay
970	1030	Silty sands to poorly sorted sand
1030	1040	Clay

Figure 2-5: Esposti Park Boring Log and Well Construction Diagram



WELL CONSTRUCTION DIAGRAM
Esposti Park Test Hole

Project: Well Installation
Location: Windsor, CA
E-PUR PN: E102-001-01, Task 200
Logged by: B. Gulbranson, J. Buchowski, G. Moore
Surface Conditions: Grass Covered
Sampler Type: Grab from Cyclone
Drilling Company: WDC Exploration and Wells
Driller: Gary Eldred, Greg Gallio, John Chaves
Drilling Equipment: Reverse Circulation Air (0'-965'), Mud Rotary (965'-1040')
Start Date: 2/24/2010
End Date: 3/27/2010
Latitude: N 38° 31' 35.4"
Longitude: W 122° 46' 46.5"

Sanitary Seal: Cement/Bentonite Grout 0 to 60 feet bgs
Annular Seal: Cement/Bentonite Grout 0 to 370 feet bgs
Filter Pack: SRI 1/4 inch Gravel 375 to 670 feet bgs
Monument Type: Concrete Pedestal w/ Temp. Locking Steel Cap
Surface Casing: 0 to 60 feet bgs
Screened Interval: 380-420, 430-450, 460-470, 480-510, 545-565, 615-655 feet bgs
Casing Diameter: 10.0 inches
Total Well Depth: 670.0 feet

Figure 2-5: Esposti Park Boring Log and Well Construction Diagram (cont'd)

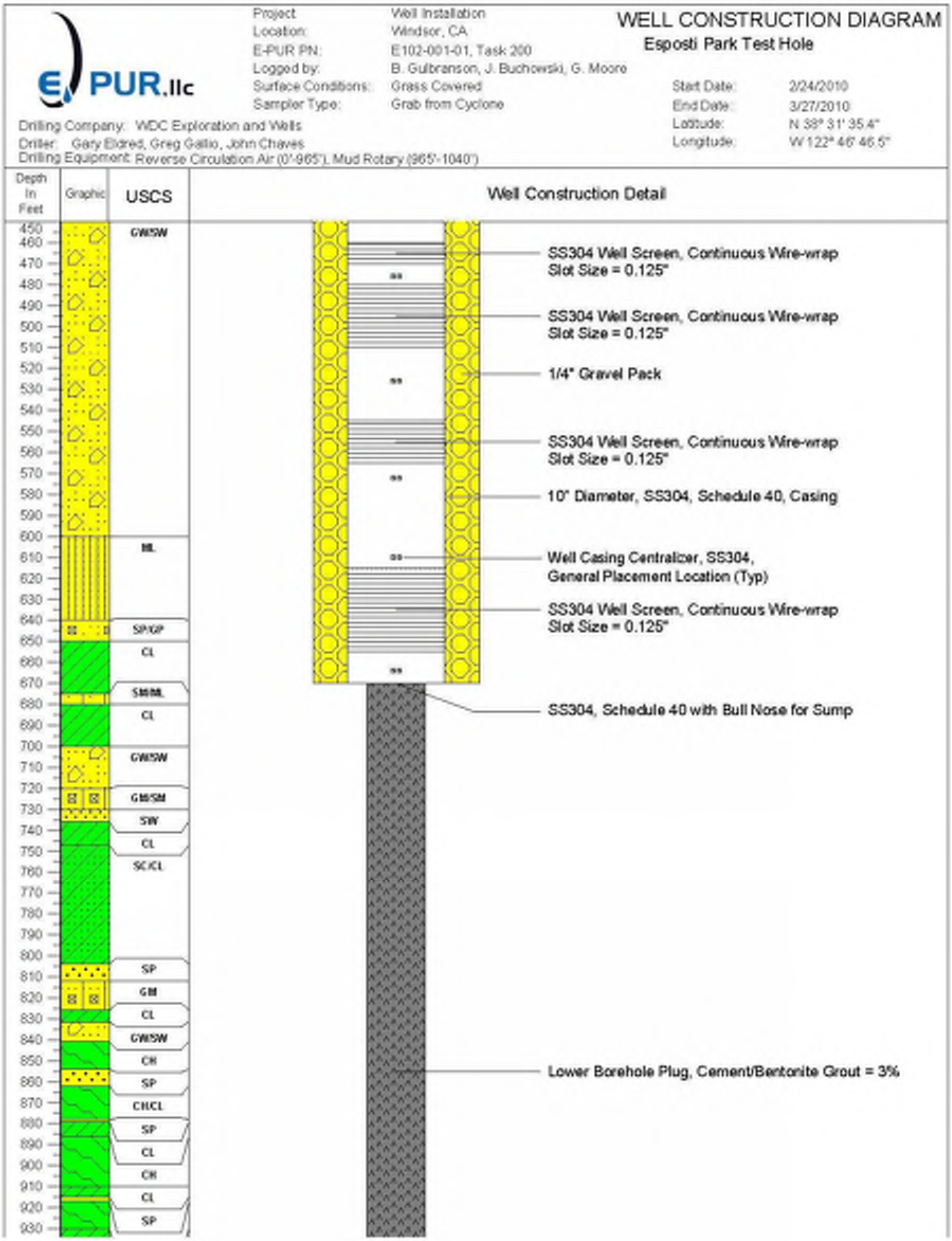
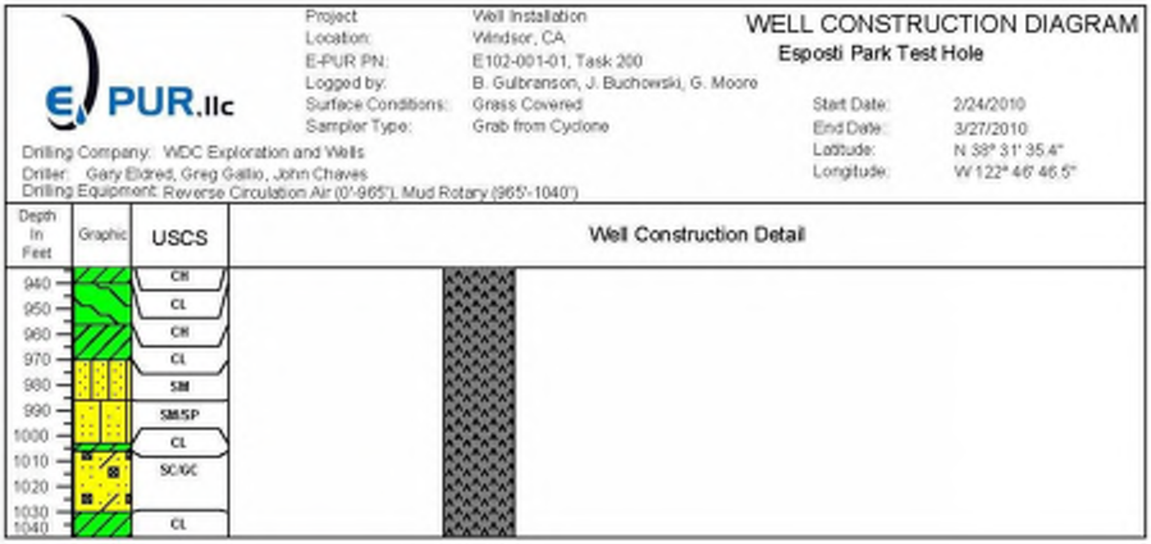


Figure 2-5: Esposti Park Boring Log and Well Construction Diagram (cont'd)



WELL CONSTRUCTION DIAGRAM
Esposti Park Test Hole

Project: Well Installation
Location: Windsor, CA
E-PUR PN: E102-001-01, Task 200
Logged by: B. Gulbranson, J. Buchowski, G. Moore
Surface Conditions: Grass Covered
Sampler Type: Grab from Cyclone

Start Date: 2/24/2010
End Date: 3/27/2010
Latitude: N 38° 31' 35.4"
Longitude: W 122° 46' 46.5"

Drilling Company: WDC Exploration and Wells
Driller: Gary Eldred, Greg Gallio, John Chaves
Drilling Equipment: Reverse Circulation Air (0'-965'), Mud Rotary (965'-1040')

2.2.3 Well Construction

The as-built well construction is shown on Figure 2-5. Well casing and screen materials were installed in the borehole on March 24 and March 25, 2010. Gravel pack was installed on March 25, 2010 and the bentonite seal was installed on March 26, 2010. Well grouting occurred on March 26 and 27, 2010.

The well was completed using a 10-inch diameter screen and casing. The well casing from the ground surface to a depth of 380 feet consists of 10-inch diameter, ¼-inch wall, low-carbon steel casing. A special insulative coupling was placed between the upper low carbon steel casing and the lower stainless steel casing/screen materials. Casing and screen joints were welded during installation with a minimum of two passes per circumference. Centralizers were installed at approximately 40-foot intervals (except over screened sections) to center the casing and screen in the borehole. The centralizers were made of the same material (i.e. low carbon or stainless) as the casing to which the centralizers were attached.

The well screen and casing were designed to withstand the collapse pressures expected to be encountered within the borehole during installation, development and use. The detailed screen design was performed by E-Pur based on the screen depth and slot size specifications detailed in the project specifications. The ¼-inch wall thickness used in the construction of the Esposti Park replacement well is consistent with the thickness recommended by State of California *Standards for Water Well Construction* (DWR Bulletins 74-81 and 74-90) for 10-inch casing to be set to depths to 1,000 feet.

The well screen was designed to screen permeable sands and gravels with good water quality as identified by field observations, soil cuttings and depth-specific water quality samples collected during borehole advancement. A total screen length of 160 feet was installed over six intervals (Table 2-3). The screen consists of stainless steel continuous wire-wrap construction with a 0.125 inch slot size. Stainless steel blank casing ranging in length from 10 to 50 feet in length separates the screened intervals and was placed opposite lower permeability strata within the more permeable strata.

Table 2-3: Esposti Park Screened Intervals and Lengths

Screened Interval Depths (feet below ground surface)	Screen Length (feet)
380 to 420	40
430 to 450	20
460 to 470	10
480 to 510	30
545 to 565	20
615 to 655	40
Total Length	**160**

The screen filter pack consists of ¼-inch SRI Supreme gravel material. The gravel pack was place in the annual space between the borehole and well casing using a tremie pipe and potable water.

A 10.5 foot bentonite seal was placed on top of the gravel pack. This was followed by a hot patch (short lift of 5% bentonite/cement grout) which was allowed to set for 24 hours before the remaining annual space was placed with the same material to prevent potential collapse of the well casing. All annular seal grouting was placed using a tremie pipe. The placement of the annual seal was witnessed by a Sonoma County Health Department inspector.

The wellhead was fabricated after completion of the well development. Wellhead finishing consisted of a concrete pad around the well casing and a locking cap on top. The well construction details are show in Figure 2-5.

Chapter 3 Well Development

Both the Bluebird and Esposti Park wells were developed in two phases by WDC. The first phase consisted of surge block and airlift development using the same drill rig used to drill and construct the well. The second phase consisted of pump and surge development using a temporary test pump. RMC and E-Pur hydrologists and hydrogeologists periodically monitored the progress of the development.

3.1 Bluebird Well Development

Dispersant (NW-220 by US Filter) was added to the Bluebird well on May 3, 2010, two days following well sealing. The dispersant was allowed to sit in the well overnight, and bailing and surging began on the Bluebird well on May 4, 2010. Airlift equipment was installed in the well on May 5, 2010 with surge block and airlift development beginning thereafter. Development of the Bluebird well via airlifting was completed on May 10, 2010.

The heavy drilling fluids in the bottom of the well were initially removed by bailing and airlifting for several hours from the bottom of the well. Development was then performed using a surge block consisting of a double swab separated by a 10- to 20-foot section of perforated drill pipe. Development began at the top of the screened interval by vigorously swabbing a 40-foot section of screen and then airlifting from the top 10-foot section of that 40-foot swabbed section. This was repeated several times. Then the same 40-foot section of screen was again swabbed and airlifting water performed from the next-lower 10-foot section of the 40-foot swabbed section. This procedure was repeated until each 10-foot section of the 40-foot section was covered. A 40-foot section of the drill pipe was then added and the same procedure repeated for the next 40-foot lower section of screen. Several airlift/swab passes were performed across the screen until approximately 160 hours of development were completed.

The airlift development equipment was removed from the Bluebird well on May 11, 2010 and a pump installed in the well. Pumping of the Bluebird well occurred between May 12, 2010 and May 14, 2010. During this period, the discharge rate of the well dropped considerably, indicating that the well screen and/or filter pack was clogged and that additional development would be required before aquifer testing could reasonably proceed. However, due to wet weather, discharges to the Town’s sanitary system were not allowed (holding ponds at the wastewater treatment plant were at capacity), and the ability to discharge to an adjacent stormwater drainage disallowed under the North Coast Regional Water Quality Control Board’s 2009 *General Permit for Low Threat Discharges to Surface Waters in the North Coast Region* (this permit does not allow for surface discharges after May 15th). Therefore, no additional development was conducted on the Bluebird well prior to site demobilization.

3.2 Esposti Park Well Development

As with the Bluebird well, dispersant (NW-220 by US Filter) was added to the Esposti Park well on March 28, 2010 following well sealing. The dispersant was allowed to sit in the well overnight, and bailing and surging began on the Esposti Park well on March 30, 2010. Airlift equipment was installed in the well on March 31, 2010; surge block and airlift development began on April 1, 2010 and is completed on April 15, 2010.

The surge and airlift development method used on the Bluebird well was also used on the Esposti Park well. As with the Bluebird well, multiple airlift/swab passes were required before the well was considered to be sufficiently developed via airlifting. In total, approximately 160 hours of surge/airlift development were completed on the Esposti Park well.

Airlift development was then followed by pump development occurring between April 27, 2010 and April 28, 2010. During this period, the well was pumped at approximately 450 to 500 gpm for approximately 10 hours, and then allowed to recover in anticipation of aquifer testing. The Esposti Park well was not pumped at its maximum rate due to discharge limitations on the Town's sanitary sewer system and the onsite filtration/storage capacity.

Chapter 4 Aquifer Testing

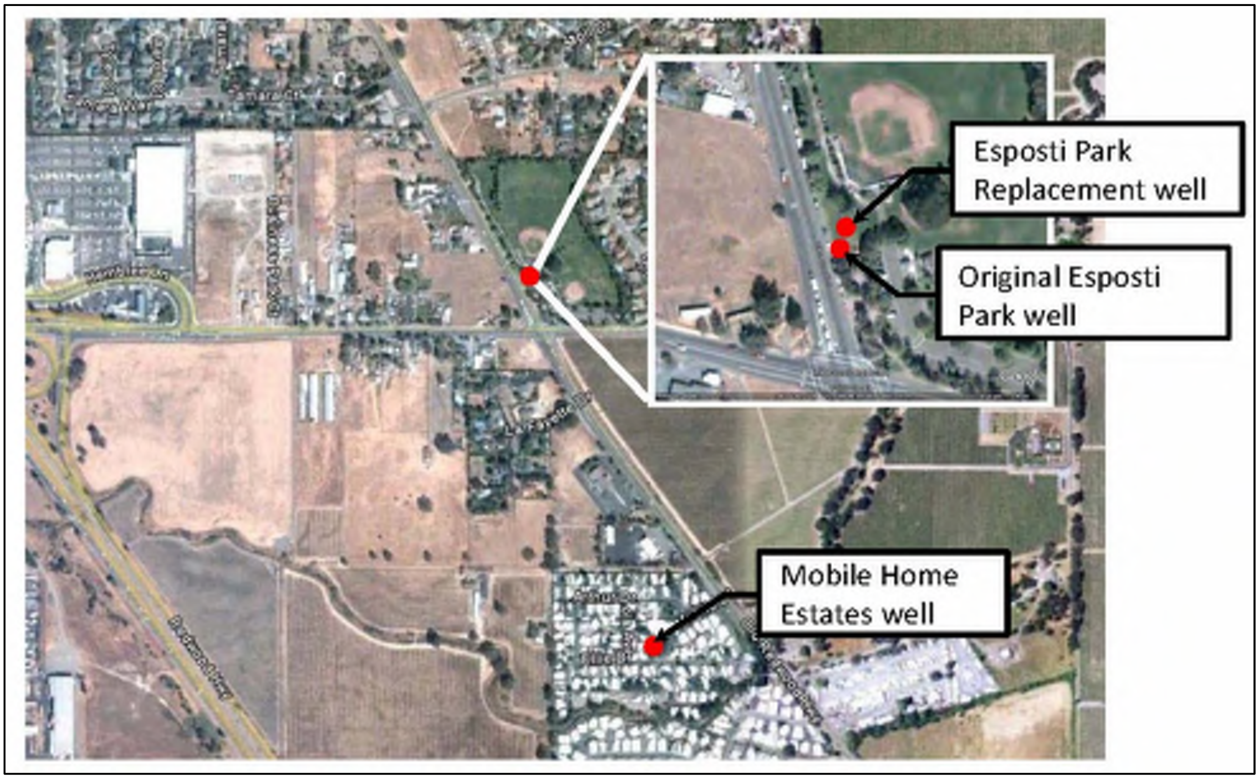
As scoped in the project specifications, aquifer testing of both the Bluebird and Esposti Park wells was to be conducted, consisting of an 8-hour step-rate discharge test and a 24-hour constant-rate discharge test. Dynamic profiling of both wells was also to occur during the constant rate testing, providing spinner flowmeter logging data. Additionally, depth-specific water quality sampling was to be performed as part of the dynamic profile testing to be conducted.

Constant-rate pump testing was performed as planned on the Esposti Park well. However, as described in Chapter 3, the Bluebird well pumping rate dropped considerably during pump development to such a rate that aquifer testing could not reasonably proceed without additional well development occurring first. And as is described in Chapter 3, circumstances at the time of the field project made additional development on the Bluebird well impossible at that time; as such, aquifer testing was not performed on the Bluebird replacement well.

4.1 Background Water Level

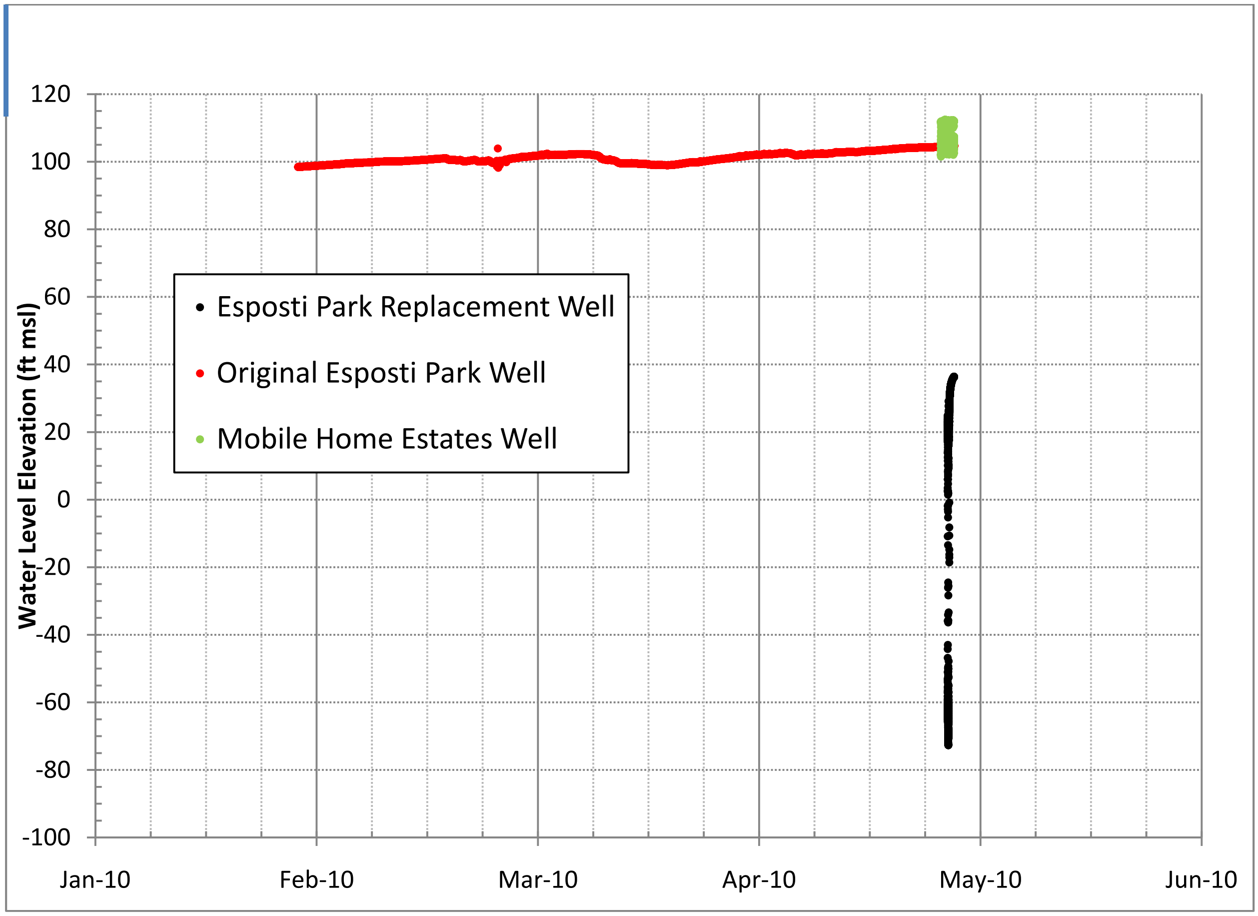
Background and pumping groundwater levels were monitored during the Esposti Park aquifer testing with water levels measured in the pumping well (the Esposti Park replacement well), the original Esposti Park well, and at the water supply well serving Mobile Home Estates (located at 5761 Old Redwood Highway, Santa Rosa, California). Figure 4-1 shows the location of the two monitoring wells relative to the pumping well, the Esposti Park replacement well. Hydrographs for all wells during the test period are provided in Appendix E.

Figure 4-1: Monitoring Wells for Esposti Park Aquifer Pumping Tests



An Instrumentation Northwest Smart Sensor PT2X pressure transducer was installed in the original Esposti Park well at the beginning of the project in January. The transducer was set at 98.89 feet bgs with approximately 60 feet of water above the transducer. Groundwater elevations were read continuously throughout the well installation, development and testing program. Additional pressure transducers (both Insitu Troll 700 transducers) were installed in the replacement Esposti Park well and in the water supply well serving Mobile Home Estates in anticipation of the aquifer testing to be performed in the replacement well. The Mobil Home Estates transducer was installed on April 26, 2010 approximately 21 feet bgs, while the Replacement Esposti Park transducer was installed on April 27, 2010 at approximately 132 feet bgs. Background groundwater level data collected prior to the constant-rate discharge testing in the Esposti Park replacement well are shown in Figure 4-2.

Figure 4-2: Background Groundwater Level Data – Esposti Park Monitoring Wells



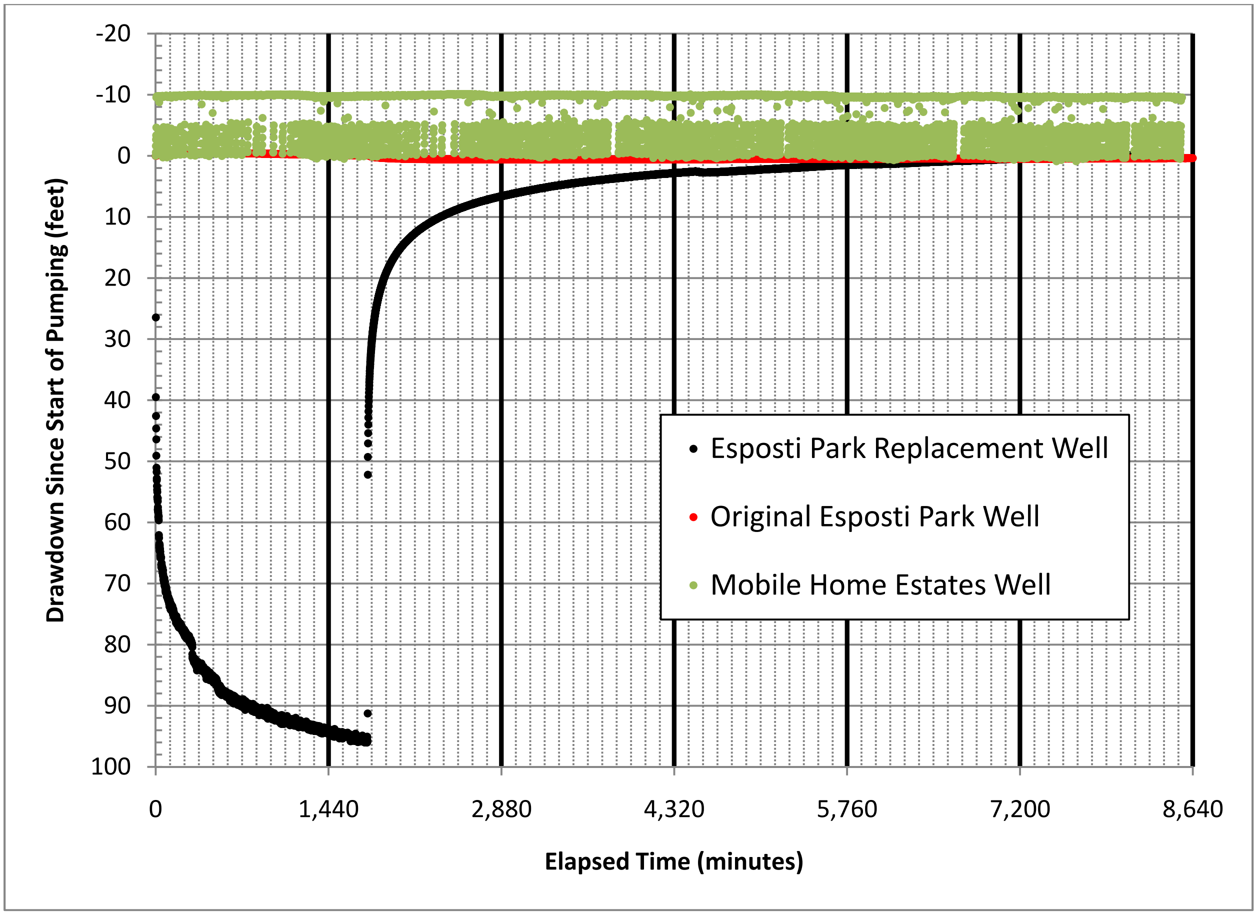
Changes in groundwater levels in the Esposti Park replacement well, as shown in the figure above, are the results of test pumping in the that well prior to commencement of the constant-rate pump testing. As can be seen in the figure above, the original Esposti Park well and the Mobile Home Estates well do not appear to be affected by pumping in the replacement Esposti Park well.

4.2 Constant-Rate Discharge Testing

Constant-rate discharge testing was performed on the Esposti Park well from April 28 to April 29, 2010 to evaluate the transmissivity and storativity of the screened aquifer(s). Pumping on the well began the morning of April 28th with a pumping rate around 400 gpm. The well was pumped overnight at a constant rate to allow water levels to reach steady-state condition. Dynamic profiling was then conducted on April 29th simultaneously with the constant rate pumping test. The dynamic profile testing consisted of spinner log testing and depth-specific water quality testing. The constant-rate pumping test and dynamic profiling was completed the afternoon of April 29th, but groundwater elevation monitoring was continued for several days to ensure capture of well recovery.

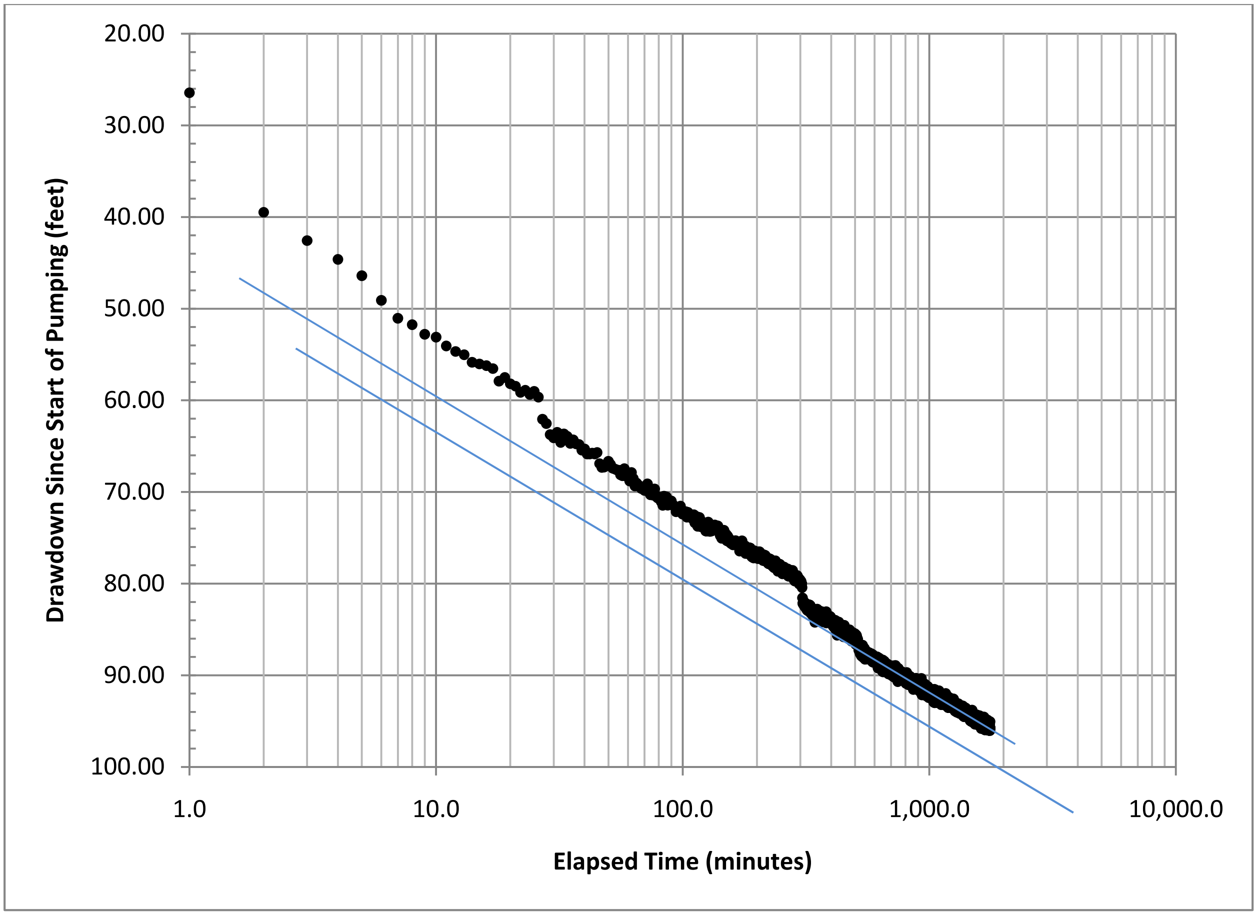
Groundwater drawdown data was plotted simultaneously with observation well data. These data are presented in Figure 4-3. As can be seen from these data, neither the original Esposti Park well nor the Mobile Home Estates well appear to be impacted by pumping in the Esposti Park replacement well. This indicates that the replacement well is screened over aquifer zones that are hydraulically separate from the two observation wells and/or that a pumping rate of 400 gpm in the replacement well is too small to impact the observation wells. As the data recorded in the two observation wells do not show any impacts that can be attributed to pumping in the Esposti Park replacement well, these data were not used in calculating the transmissivity and storativity of the zones screened by the Esposti Park replacement well. And as no relevant observation well data were available, a storativity value was not calculated for the Esposti Park replacement well.

Figure 4-3: Groundwater Level Data – Esposti Park Pumping and Monitoring Wells



Groundwater level data recorded in the Esposti Park replacement well during the constant-rate aquifer test were plotted on a separate graph and analyzed to calculate a transmissivity value. These data are presented in Figure 4-4. Drawdown during pumping appears to be sensitive to slight variations in pumping rate. Although no correction as made for these variations in pumping, to trend lines presented by the data were analyzed.

Figure 4-4: Groundwater Level Data – Esposti Park Replacement Well



Transmissivity is calculated using the Cooper-Jacob method (Cooper and Jacob, 1946) for pumping drawdown data:

$$T = \frac{264Q}{\Delta s}$$

Where: T = Transmissivity (gallons/day/feet [gpd/ft])

Q = Pumping rate (gallons per minute [gpm])

Δs = Water level drawdown (feet) per log cycle of time, t (min) since pumping started (from Figure 4-4)

The best-fit straight lines, shown in Figure 4-4, have the same slope and result in a transmissivity of 6,600 gpd/ft calculated using a pumping rate of 400 gpm and a drawdown of 16 feet per log cycle. Further, based on the data presented in Figure 4-4, Esposti Park replacement well specific capacity appears to be between approximately 4 and 6 gpm/ft, depending upon the length of the data set used in the calculation.

4.3 Dynamic Profile Testing

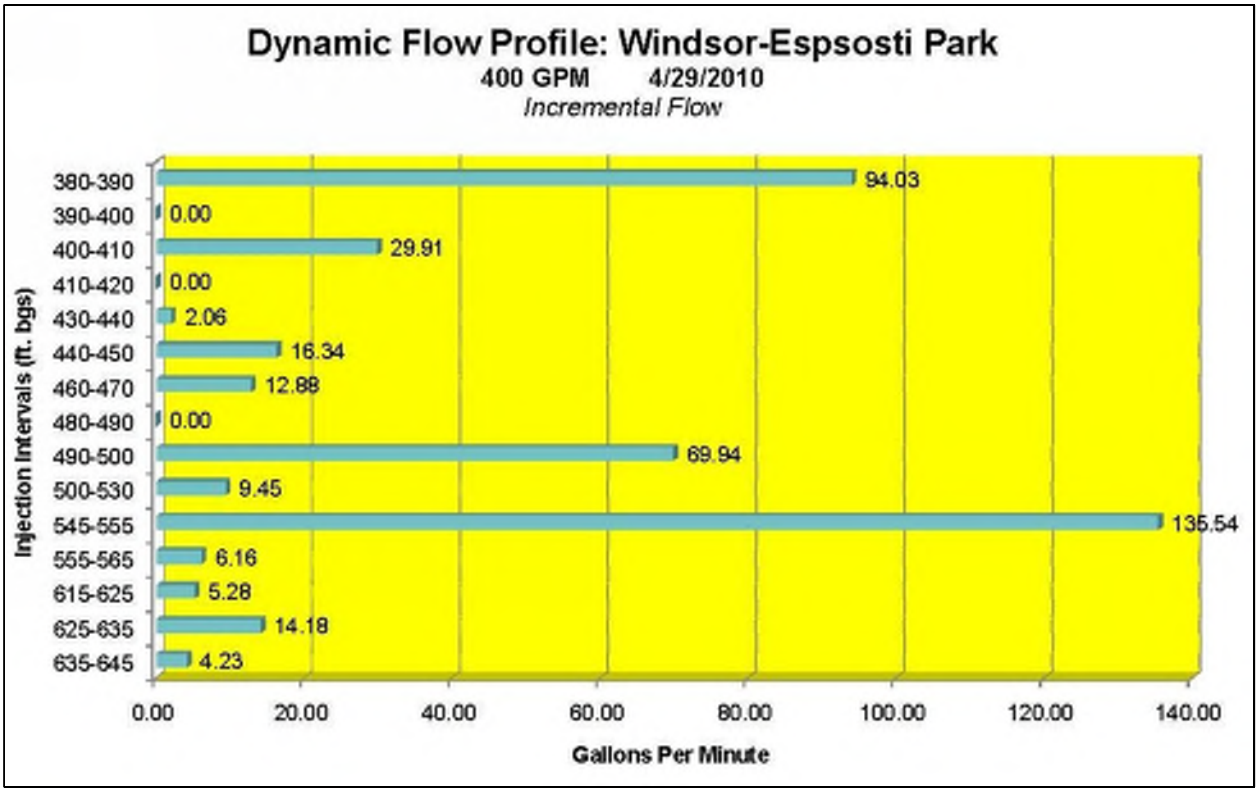
Dynamic profile testing was performed on the Esposti Park replacement well by BESST, Inc. concurrently with the constant-rate pumping testing. Dynamic Flow Profile and Water Quality Analysis testing is generally a two-part procedure in which flow rates across the screened portions of the well are first determined, and then water quality samples are collected at the same general locations. Specifically, in the first part of the test, fluorescence dye (NSF standard 60/ fluorescent red, FWT 50 Liquid concentrate) was injected at 10-foot intervals over the screened portion of the Esposti Park replacement well, and the time required for the dye to reach indicator meters at the surface was measured to estimate the approximate dynamic flow contribution by depth and screened interval. Then, a specially-designed sampling apparatus was used to collect depth-specific water samples from the same depths as measured previously during the flow testing. The water samples were sent to Brelje and Race Analytical Laboratory in Santa Rosa, California for analysis for general minerals, metals, nitrogen compounds, Total Organic Carbon, Total Dissolved Solids, and pH. Two composite water samples were also collected at the pumphead during testing in order to provide composited data for comparison; these samples were analyzed by Brelje and Race Analytical Laboratory for Source Chemical Monitoring Requirements for potable water quality as set forth by the California Department of Public Health. These analyses included:

- Inorganics
- Asbestos
- Nitrate/Nitrite
- Secondary Standards
- Radioactivity
- Volatile Organic Chemicals
- Synthetic Organic Chemicals

The results of depth-specific water quality analyses with respects to screened intervals are discussed in Chapter 5 of this report

As described in BESST’s report (included as Appendix G), the majority of flow entering the Esposti Park replacement well from the surrounding aquifer is coming from three primary intervals: between 380 and 390 feet bgs (~23.5%), between 490 and 500 feet bgs (~17.5%) and between 545 and 555 feet bgs (~33.9%). These results are show below in Figure 4-5. As shown on the well’s geologic log (Appendix B), these zones correspond with gravel with sand and/or sandy gravel layers.

Figure 4-5: Esposti Park Replacement Well – Incremental Flow Analysis



Chapter 5 Groundwater Quality

Groundwater samples were collected at both the Esposti Park and Bluebird well sites during borehole advancement. In general, two types of water quality samples were collected from each borehole: those for metals analyses to evaluate potential potability issues and those for isotope analysis for evaluate potential water-quality potability issues and to provide baseline on groundwater age and genesis. These samples were termed borehole water quality samples and conjunctive use water quality samples, respectively. For the purposes of this report, only borehole water quality samples are discussed.

Borehole water quality samples were collected following a written sampling protocol that provided a means for the consistent application of sampling procedures. The sampling protocol, entitled "Groundwater Filtration Protocol", was developed by the Merced County Division of Environmental Health for water quality sample collection, and included definition of sampling groups, site naming convention and abbreviations, labeling convention, sample collection order, instructions for field parameter collection, instructions for sampling and borehole purging procedures prior to sample collection, and chain of custody instructions. In general, samples were collected per Table 5-1.

Table 5-1: Borehole Water Quality Sample Collection Protocol

Analytes	Collection Procedure Summary	Container
Calcium, magnesium, sodium, potassium, iron, manganese, arsenic, chromium, mercury	1. Using the Groundwater Filtration Protocol developed by the Merced County Division of Environmental Health, place one gallon of sample in temporary holding container in an iced cooler and let rest for 12 hours. 2. Filter supernatant from cooled holding container through a 0.45 micron filter and place in an unpreserved container. (Sample preservation was performed in the laboratory.) 3. Store each filtered sample in an iced cooler at approximately 4 degrees Celsius out of direct sunlight. 4. Record each sample on the Chain of Custody.	1 x ½ gallon, plastic bottle
pH, total alkalinity, bicarbonate, boron, total dissolved solids, hardness	1. Carefully pour the sample into the ½ quart bottle. 2. Store each sample in an iced cooler at approximately 4 degrees Celsius. 3. Record each sample on the Chain of Custody.	1 x ½ quart, plastic bottle
Chloride, fluoride, sulfate, nitrate	1. Carefully pour the sample into the ½ quart bottle. 2. Store each sample in an iced cooler at approximately 4 degrees Celsius. 3. Record each sample on the Chain of Custody.	1 x ½ pint, plastic bottle

Analytes	Collection Procedure Summary	Container
Total organic carbon	1. Carefully pour the sample water into two, pre-preserved (with phosphoric acid) 40 milliliter VOA vials. 2. Store each sample in an iced cooler at approximately 4 degrees Celsius. 3. Record each sample on the Chain of Custody.	2 x 40 milliliter VOA

Each sample collected was recorded on the Chain of Custody (COC) form in the field. The COC form allows custody tracking of each sample, from the time of collection, through transport, and to the final release of custody to the laboratory. The COC form documents the date and time of the sample collection, the name of the person(s) collecting the sample, matrix type, total number of containers submitted, and the analyses requested. The COC form was signed and dated each time the custody of the samples changed.

Additional depth-specific and composite groundwater samples were also collected at the Esposti Park well during constant-rate aquifer testing. Additional groundwater samples were collected from the Bluebird well site during well development in anticipate of obtaining coverage under the North Coast Regional Water Quality Control Board's (NCRWQCB's) *General Permit for Low Threat Discharges* (2009).

Depth-specific water quality samples were collected using a method developed by the United States Geological Survey (USGS) and currently licensed to BESST, Inc. A decontaminated "clean" hose on a motorized reel is pressurized with nitrogen. The leading end of the hose has a foot valve which is in the closed position under positive hose pressure. The hose is lowered down the well to the desired sample depth, where the nitrogen pressure is released. Water within the well column enters the hose because the hydrostatic pressure exerted by the water column is greater than the pressure in the hose, which is no under atmospheric pressure. The water level rises in the hose until it equilibrates with the well water column. After repressurizing the hose with nitrogen and forcing the foot valve to close, the hose is reeled up to the ground surface. The water sample is transferred from the pressurized hose into the appropriate sample containers by manipulating the end valve. The hose is decontaminated by running distilled/deionized water through it prior to re-insertion in the well.

These data collect activities are discussed below, with summary tables showing analytical results and associated drinking water standards (Maximum Contaminant Levels or MCLs). Copies of laboratory reports are included in Appendix F.

5.1 Bluebird Water Quality Data

In general, borehole water quality samples were collected every 100 feet during borehole advancement. At the Bluebird well site, borehole water quality samples were collected at 180, 220, 320, 340, 440 and 700 feet bgs. Although sampling was attempted at other intervals, field conditions did not yield sufficient water for sampling. A sample of tanked water used during drilling advancement was also collected; this field blank was submitted as being collected from 710 feet bgs to the analytical laboratory. Water quality samples were submitted to Brelje and Race Analytical Laboratory of Santa Rosa, California for analysis for metals and general minerals, nitrates and total organic carbon (TOC). Table 5-2 summarizes the analytical results for the borehole water quality samples.

Table 5-2: Bluebird Borehole Water Quality

			Depth (feet below ground surface)						
Analyte	**Units**	**MCL**	**180**	**220**	**320**	**340**	**440**	**700**	**Field Blank**[a]
Field Measurements									
pH	Unitless		7.08	7.83	7.38	7.33	7.89	8.11	--
Conductivity	mS/m		25.4	26.2	31.1	31.1	37.1	30.7	--
Turbidity	NTU		202	--	597	136	942	--	--
Dissolved Oxygen	g/L		6.15	7.84	1.81	6.54	8.11	7.46	--
Temperature	^{o}C		12.55	16.63	18.41	20.38	23.95	22.67	--
Oxygen Reduction Potential	mV		64	34	-254	-41	82	47	--
Laboratory Analyses									
Hardness as $CaCO_3$	mg/L		97	100	93	87	73	130	170
Calcium	mg/L		14	15	16	15	14	23	30
Magnesium	mg/L		15	16	13	12	9.2	17	22
Sodium	mg/L		22	23	30	39	54	19	13
Potassium	mg/L		3	4.3	9.1	12	20	6.1	11
Total Alkalinity as $CaCO^3$	mg/L		82	120	140	150	180	180	160
Bicarbonate	mg/L		100	150	170	190	220	220	190
Sulfate	mg/L	250/500/600 [b]	5.3	2.5	7.2	3.7	6.9	14	16
Chloride	mg/L	250/500/600 [b]	39	21	20	20	21	14	11
Nitrate as N	mg/L	10	8.5	<2.0	8.6	<2.0	<2.0	9.5	10
Fluoride	mg/L	2	0.51	0.36	0.38	0.35	0.31	0.27	0.25
pH	unitless		6.6	7.2	7.6	7.6	7.8	8	7
Total Dissolved Solids	mg/L	500/1,000/ 1,500 [b]	220	240	220	250	300	280	200
Boron	mg/L		<0.1	0.18	0.33	0.16	0.32	0.29	0.17
Arsenic	µg/L	10	<2.0	<2.0	<2.0	9	16	<2.0	<2.0
Total Chromium	µg/L	50	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Iron	µg/L	300[c]	3200	<100	<100	<100	360	<100	<100
Manganese	µg/L	50[c]	1800	850	760	460	480	440	<20
Mercury	µg/L	2; 0.05[d]	0.024	0.038	0.058	0.014	<0.012	0.018	0.013
Total Organic Carbon	mg/L		1.1	0.56	1.5	0.31	0.54	1.4	0.36

Notes:

a. Reported as sample from 710 feet bgs in analytical report.
b. Secondary MCL – Recommended/Upper/Short Term
c. Secondary MCL
d. Water Quality Objective for mercury under the California Toxics Rule

In anticipation of conducting long-term aquifer pumping for hydraulic testing, additional water quality samples were collected from the Bluebird replacement well during development as required by the NCRWQCB for receipt of a discharge permit under the Board’s *General Permit for Low Threat Discharges* (2009). This permit was required to allow the extracted water during hydraulic testing to be discharged to the adjacent stormwater drainage instead of the local sanitary sewer system, as the existing sanitary sewer in Bluebird Court does not have the capacity required to safely accept the anticipated discharges. Per the NCRWQCB, water samples were analyzed for metals (as listed in the Low Threat Discharge Permit), cyanide, nitrate as N, and hardness. As well development was underway during the sampling, the water samples were analyzed both as total concentrations and dissolved concentrations, in order to determine what, if any, portion of the detectable concentration may be the result of sediment-borne constituents. These water samples were collected on May 7, 2010 and were analyzed by McCampbell Analytical Laboratory in Pittsburg, California.

The results of the May 7, 2010 sampling round unexpectedly yielded elevated concentrations of arsenic (both in total and dissolved form). As these data were completely counter to borehole water quality samples collected from this well at the same zone, additional water quality samples were collected from the Bluebird replacement well on May 12, 2010 and analyzed for both total and dissolved arsenic. Additional analyses were also conducted during the May 12 sampling even to confirm the anticipated concentrations of mercury in the replacement well discharges. The results of the May 7 and May 12, 2010 sampling events are summarized in Table 5-3.

As can be seen by comparing the Bluebird well site borehole water quality data with those collected from the constructed replacement well during development, arsenic concentrations have increased considerably. Assuming that all data are valid, the elevated arsenic concentrations are most likely the result of a sudden change in the oxidation conditions of groundwater near the well due to the introduction of oxygen during well development. Such a condition can be alleviated by completing the development of the well to remove fine-grained turbidity and doing additional well development using more aggressive development methods such as pumping to ensure the introduction of formation water into the well. As groundwater returns towards its natural oxidation condition, arsenic concentrations should decrease substantially.

Table 5-3: Bluebird Development Water Quality for Permit

		Field Blank-Dissolved	**Field Blank-Total**	**BB-1-Dissolved**	**BB-1-Total**	**BB-2-Dissolved**	**BB-2-Total**	**BB-1-Dissolved**	**BB-1-Total**	**BB-2-Dissolved**	**BB-2-Total**
Date	Units	5/7/2010	5/7/2010	5/7/2010	5/7/2010	5/7/2010	5/7/2010	5/12/2010	5/12/2010	5/12/2010	5/12/2010
Antimony	µg/L	<0.5	<0.5	0.26	0.32	0.27	0.33	--	--	--	--
Arsenic	µg/L	<0.5	<0.5	410	440	420	450	360	400	340	420
Barium	µg/L	<5	<5	61	82	46	83	--	--	--	--
Beryllium	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	--	--	--	--
Cadmium	µg/L	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	--	--	--	--
Copper	mg/L	<0.5	<0.5	<0.5	6.7	<0.5	3.2	--	--	--	--
Lead	µg/L	<0.5	<0.5	0.1	1.9	<0.5	1.5	--	--	--	--
Mercury	µg/L	<0.025	<0.025	0.031	0.066	0.027	0.05	0.073	0.16	0.06	0.19
Nickel	µg/L	<0.5	<0.5	0.29	7.5	0.25	5.2	--	--	--	--
Selenium	µg/L	<0.5	<0.5	0.13	0.23	0.14	0.22	--	--	--	--
Thallium	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	--	--	--	--
Zinc	µg/L	<5	<5	11	35	5.8	38	--	--	--	--
Hardness as CaCO3	mg/L	<1	<1	32	46	27	41	--	--	--	--
Total Cyanide	µg/L	--	<1	--	<1	--	<1	--	--	--	--
Nitrate as N	mg/L	--	<1	--	<1	--	<1	--	--	--	--
Nitrate as NO3	mg/L	--	<1	--	<1	--	<1	--	--	--	--
Hexachrome	µg/L	--	<1	--	<1	--	<1	--	--	--	--

Notes:

a. Reported as sample from 710 feet bgs in analytical report.
b. Secondary MCL – Recommended/Upper/Short Term
c. Secondary MCL
d. Water Quality Objective for mercury under the California Toxics Rule

5.2 Esposti Park Water Quality Data

As with the Bluebird well site, borehole water quality samples were collected every 100 feet during borehole advancement at the Esposti Park well site. Specifically, borehole water quality samples were collected at 200, 285, 400, 600, and 736 feet bgs. Although sampling was attempted at other intervals, field conditions did not yield sufficient water for sampling. Water quality samples were submitted to Brelje and Race Analytical Laboratory for analysis for metals and general minerals, nitrates and total organic carbon (TOC). Table 5-4 summarizes the analytical results for the borehole water quality samples.

Table 5-4: Esposti Park Borehole Water Quality

			Depth (feet below ground surface)				
Analyte	**Units**	**MCL**	**200**	**285**	**400**	**600**	**736**
Field Measurements							
pH	Unitless		6.67	8.36	8.64	8.9	6.42
Conductivity	mS/m		45.8	35.4	45.6	42.4	56.7
Turbidity	NTU		354	--	--	--	589
Dissolved Oxygen	g/L		5.64	7.12	8.22	7.49	7.32
Temperature	^{o}C		18.94	21.84	19.96	20.54	14.47
Oxygen Reduction Potential	mV		4	154	229	90	177
Laboratory Analysis							
Hardness as $CaCO_3$	mg/L		150	99	140	120	110
Calcium	mg/L		23	15	24	23	22
Magnesium	mg/L		23	15	20	16	14
Sodium	mg/L		42	40	51	54	87
Potassium	mg/L		8	6.9	14	19	27
Total Alkalinity as $CaCO^3$	mg/L		210	160	230	230	290
Bicarbonate	mg/L		260	190	280	280	350
Sulfate	mg/L	250/500/600 [a]	12	8.4	17	12	18
Chloride	mg/L	250/500/600 [a]	20	25	25	14	21
Nitrate as N	mg/L	10	<2.0	<2.0	<2.0	8.5	8.5
Fluoride	mg/L	2	0.4	0.39	0.36	0.33	0.3
pH	unitless		7.2	7.5	7.9	7.9	8
Total Dissolved Solids	mg/L	500/1,000/1,500 [a]	300	260	360	310	430
Boron	mg/L		0.14	0.13	0.28	0.31	0.45
Arsenic	µg/L	10	<2.0	<2.0	2.1	7.3	39
Total Chromium	µg/L	50	<1.0	<1.0	<1.0	<1.0	2.1
Iron	µg/L	300 [b]	<100	<100	<100	<100	1200
Manganese	µg/L	50 [b]	1600	910	860	580	440
Mercury	µg/L	2	0.17	<0.012	0.014	0.014	0.017
Total Organic Carbon	mg/L		3.9	0.74	0.33	0.4	0.66

Footnotes:

a. Secondary MCL - Recommended/Upper/Short Term

b. Secondary MCL

As part of the dynamic profile testing that was conducted on the Esposti Park replacement well (and described in Section 4.3 of this report), depth-specific water quality samples were collected over each screened interval of the well. These samples were labeled DP-1 to DP-6, starting from the uppermost screened interval in the replacement well. Depth-specific water quality samples were submitted to Brelje and Race Analytical Laboratory for analysis; the results of the analyses are summarized in Table 5-5, below.

Table 5-5: Esposti Park Depth-Specific Water Quality Results

			Depth (feet below ground surface)						
Analyte	**Units**	**MCL**	**DP-1**	**DP-2**	**DP-3**	**DP-4**	**DP-5**	**DP-6**	**Dup**
Aluminum	µg/L		<50	<50	<50	<50	<50	<50	<50
Ammonia as N	mg/L		0.3	<0.20	0.3	<0.20	<0.20	<0.20	<0.20
Antimony	µg/L		<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0
Arsenic	µg/L	10	45	94	83	84	97	100	85
Barium	µg/L		200	160	170	170	170	200	170
Beryllium	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Bicarbonate	mg/L		290	280	280	280	290	340	280
Boron	mg/L		0.31	0.36	0.35	0.35	0.34	0.4	0.35
Bromide	mg/L		0.086	0.07	0.068	0.074	0.067	0.085	0.07
Cadmium	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Calcium	mg/L		23	19	19	20	19	20	20
Carbonate	mg/L		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Chloride	mg/L	250/500/600 [a]	18	11	11	11	11	16	11
Total Chromium	µg/L	50	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cobalt	µg/L		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Copper	µg/L		<50	<50	<50	<50	<50	<50	<50
Fluoride	mg/L	2	0.39	0.43	0.38	0.36	0.35	0.36	0.61
Hydroxide	mg/L		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Iron	µg/L	300 [b]	<100	<100	<100	<100	<100	<100	<100
Lead	µg/L		<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Magnesium	mg/L		16	11	11	11	11	11	11
Manganese	µg/L	50 [b]	800	630	630	650	630	680	660
Mercury	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Molybdenum	µg/L		6.7	8.8	9	8.9	9.3	13	9.4
Nickel	µg/L		<10	<10	<10	<10	<10	<10	<10
Nitrate	mg/L	10	<2.0	<2.0	<2.0	<2.0	8.3	<2.0	<2.0
Nitrite as N	mg/L		<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40
pH	--		8.0	7.8	7.9	8.0	7.9	7.5	7.7
Potassium	mg/L		17	19	19	20	20	24	21
Selenium	µg/L		<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Silica	mg/L		87	91	92	93	91	96	93
Silver	µg/L		<10	<10	<10	<10	<10	<10	<10
Sodium	mg/L		50	52	52	54	54	80	54

Analyte	Units	MCL	Depth (feet below ground surface)						
			DP-1	DP-2	DP-3	DP-4	DP-5	DP-6	Dup
Strontium	µg/L		150	120	120	120	120	130	120
Sulfate	mg/L	250/500/600 [a]	13	9.9	10	9.8	11	18	9.8
Thallium	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Tin	µg/L		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Total Kjeldahl Nitrogen as N	mg/L		1.1	1.5	1.5	1.1	1.1	1.1	1.1
Total Alkalinity (as $CaCO_3$)	mg/L		240	230	230	230	240	280	230
Total Dissolved Solids	mg/L	500/1,000/1,500 [a]	360	340	340	340	340	420	340
Total Hardness (as CaCO3)	mg/L		120	93	93	95	93	95	95
Total Organic Carbon	mg/L		4.8	7.5	5.5	9.3	4.4	4.7	4.5
Zinc	µg/L		<50	<50	<50	<50	<50	<50	<50

Footnotes:

a. Secondary MCL - Recommended/Upper/Short Term

b. Secondary MCL

c. DP-1 is from the screened interval between 380 and 420 feet bgs. DP-2 is from the screened interval between 420 and 450 feet bgs. DP-3 is from the screened interval between 460 and 470 feet bgs. DP-4 is from the screened interval between 480 and 510 feet bgs. DP-5 is from the screened interval between 545 and 565 feet bgs. DP-6 is from the screened interval between 614 and 655 feet bgs.

These analytical results are also presented in graphical form in BESST's report, included in Appendix G of this report.

In addition to the depth-specific water quality samples, two composite samples were collected from the Esposti Park replacement well. These samples were analyzed for the suite of parameter required by the California Department of Public Health for certifying municipal supply wells. These samples were also submitted to Brelje and Race Analytical Laboratory for analysis. Table 5-6 summarizes the results of these analyses.

Table 5-6: Esposti Park Composite Water Quality Results

Analyte	Units	MCL	Composite-1	Composite-2	Field Blank
Aluminum	µg/L		<50	<50	
Antimony	µg/L		<6.0	<6.0	
Arsenic	µg/L	10	56	61	<2.0
Barium	µg/L		200	200	<100
Beryllium	µg/L		<1.0	<1.0	
Bicarbonate	mg/L		280	280	
Cadmium	µg/L		<1.0	<1.0	
Calcium	mg/L		22	20	
Carbonate	mg/L		<1.0	<1.0	
Chloride	mg/L	250/500/600[a]	17	16	
Total Chromium	µg/L	50	<1.0	<1.0	
Copper	µg/L		<50	<50	
Fluoride	mg/L	2	0.37	0.39	
Hydroxide	mg/L		<1.0	<1.0	
Iron	µg/L	300[b]	<100	<100	
Lead	µg/L		<5.0	<5.0	
Magnesium	mg/L		15	14	
Manganese	µg/L	50[b]	750	790	<20
Mercury	µg/L		<1.0	<1.0	
Nickel	µg/L		<10	<10	
Nitrate	mg/L	10	<2.0	<2.0	
pH	--		7.6	7.6	
Selenium	µg/L		<5.0	<5.0	
Silver	µg/L		<10	<10	
Sodium	mg/L		54	48	
Sulfate	mg/L	250/500/600[a]	12	12	
Thallium	µg/L		<1.0	<1.0	
Specific Conductance	µmhos/cm		510	500	
Total Alkalinity (as $CaCO_3$)	mg/L		230	230	
Total Dissolved Solids	mg/L	500/1,000/1,500 [a]	340	340	
Total Hardness (as CaCO3)	mg/L		120	110	
Zinc	µg/L		<50	<50	
Color	units		5	5	
Odor	TON		<1.0	<1.0	
Turbidity	NTU		0.21	0.47	
MBAS	mg/L		<0.05	<0.05	
Perchlorate	µg/L		<4.0	<4.0	
Asbestos	MFL		0	0	
Gross Alpha	pCi/L		1.49	0.349	

Analyte	Units	MCL	Composite-1	Composite-2	Field Blank
Nitrogen-Phosphorous Pesticides (EPA Method 507)	μg/L		ND	ND	
Chlorinated Acids (Herbicides) (EPA Method 515.3)	μg/L			ND	
Organohalide Pesticides (EPA Method 505)	μg/L			ND	
N-methyl-carbamoyloximes & carbanates (EPA Method 531.1)	μg/L		ND	ND	
Endothall (EPA Method 548.1)	μg/L		ND	ND	
Diquat (EPA Method 549.2)	μg/L		ND	ND	
EDB (EPA Method 504.1)	μg/L			ND	
Regulated Organic Chemicals	μg/L		ND	ND	

Footnotes:

a. Secondary MCL - Recommended/Upper/Short Term
b. Secondary MCL

As was observed in the Bluebird well, groundwater samples from the Esposti Park well as collected following well installation and development contained significantly larger concentrations of total arsenic than those collected during borehole advancement. And as with the Bluebird well, assuming that all data are valid, the elevated arsenic concentrations are most likely the result of a sudden change in the oxidation conditions of groundwater near the well due to the introduction of oxygen during well development. Such a condition can be alleviated by completing the development of the well to remove fine-grained turbidity and doing additional well development using more aggressive development methods such as pumping to ensure the introduction of formation water into the well. As groundwater returns towards its natural oxidation condition, arsenic concentrations should decrease substantially.

Other changes in water quality between those collected during borehole advancement and those collected during aquifer testing include the follows:

- The chloride concentrations dropped. Borehole chloride concentrations were typically around 20 mg/L whereas the chloride concentrations from aquifer testing samples ranged around 11 mg/L.
- The mercury concentrations dropped. Borehole mercury concentrations ranged from non-detect to around 0.017 μg/L whereas mercury concentrations in aquifer testing samples were all non-detect.
- Total organic carbon (TOC) concentrations increased somewhat from borehole concentrations ranging around less than one mg/L, whereas TOC concentrations in water samples collected during aquifer testing ranged from 4.4 to 9.3 mg/L.

Chapter 6 Well Surveys

Borehole deviation surveys were conducted during the reaming of both the Bluebird and Esposti Park boreholes prior to replacement well construction. Deviation surveying was completed by E-Pur and is documented in Section 6.1. In addition, caliper surveys were completed in both replacement wells as part of a series of geophysical surveys conducted in each replacement well. The geophysical surveys were completed by Schlumberger, Ltd and are documented in Section 6.2.

Following well construction, both replacement wells were geo-located using Global Positioning Surveys (GPS) to determine the wells' longitude and latitude, as well as the top of the casing elevation. These surveys were performed by Winzler and Kelly and the survey results are documented in Section 6.3.

6.1 Plumbness and Alignment

Borehole plumbness and alignment were checked periodically during borehole reaming and prior to well installation to ensure construction of a relative plumb well. Open boreholes were tested using during reaming using the SureShot "Survey-While-Drilling" system. These tools provided the inclination data necessary to ensure that the completed borehole did not exceed two-thirds of the borehole diameter per 100 foot of length, as specified in AWWA A100-06 and in the project work plan. These specifications translate roughly to a deviation of 10.5 inches in 100 feet. Collecting these data during borehole reaming allowed the WDC to control the drill stem such that the completed borehole met required specifications.

6.1.1 Bluebird Replacement Well

As previously noted, the Bluebird borehole was reamed twice during the field construction period: first from a diameter of 6 inches to a diameter of 10-3/4 inches (completed between April 3, 2010 and April 7, 2010) and then from a diameter of 10-3/4 inches to a completed nominal diameter of 16 inches between April 12, 2010 and April 21, 2010. During the first reaming pass, the borehole was checked frequently to ensure that it was within alignment specifications. During the first alignment surveys, conducted on April 3, 2010, the Bluebird borehole had a plumbness of 0.5^o from vertical at a depth of 307 feet, and a plumbness reading of 0.8^o from vertical at a depth of 427 feet bgs. At 727 feet bgs, the borehole deviation was 0.5^o from vertical.

6.1.2 Esposti Park Replacement Well

The Esposti Park borehole was reamed from 6 inches in diameter to a nominal diameter of 16 inches between March 11, 2010 and March 22, 2010. Initial plumbness measurements of the borehole indicated that it was 2.5^o from vertical. At 589 feet bgs, the borehole was found to be 3.25^o from vertical. In order to improve the borehole alignment, the drill bit was tripped out and a third collar added to the drill stem to steady the drill and improve alignment. Successive measurements of the borehole plumbness indicated that the borehole was between 1.4^o and 2.5^o from vertical. As reaming continued, the borehole alignment improved with the borehole deviation varying from 1.9^o to 2.1^o from vertical by the time total depth was completed.

6.2 Geolocation Survey

A field survey was conducted at the Bluebird and Esposti Park replacement well sites using Global Positioning System (GPS) equipment on June 28, 2010 to establish the location of the two new wells. The field survey established a benchmark at each pump pedestal of the replacement wells.

The basis for the survey of the positions is a map entitled "Control Survey 1996 A.R.M. Monitoring Program for the Russian River", filed on August 28, 1996 in Book 554 of Maps, pages 28-32, of the Sonoma County Records. Point E coordinate values and elevation were held for the survey. Listed benchmark elevations are in NAVD ’88. Coordinate values shown below are California State Plane Coordinate Zone 2 (NAD ’83).

6.2.1 Bluebird Replacement Well

The benchmark location for the Bluebird replacement well is the chiseled corner at the northerly corner of the wellhead slab. The coordinate for this well are as follows:

N 1959115.4041 E 6332436.6130 Elevation = 118.34

Lat = 38^{o} 32’ 20.306185” N Long = 122^{o} 48’ 05.144352” W

6.2.2 Esposti Park Replacement Well

The benchmark location for the Esposti Park replacement well is the chiseled corner at the northerly corner of the wellhead slab. The coordinate for this well are as follows:

N 1954509.6739 E 6338689.6507 Elevation = 140.93

Lat = 38^{o} 31’ 35.316839” N Long = 122^{o} 46’ 45.948870” W

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Appendix A - *Summary of Field Program Oversight*

Appendix B - Detailed Boring Logs and Geophysical Survey Results

Appendix C - Geophysical Survey Results

Appendix D - Grain Size Analysis

Appendix E - Aquifer Pump Test Field Data

Appendix F - Analytical Laboratory Reports

Appendix G - BESST, Inc. Dynamic Profiling Report

Appendix H - Winzler and Kelly Survey Report

APPENDIX C

Acorn Environmental
Water and Wastewater Feasibility Study
Esposti Supply Well Redevelopment, Pumping Test and Treatment Feasibility Study

Town of Windsor and Windsor Water District

Esposti Supply Well

Redevelopment, Pumping Test and Treatment Feasibility Study

October 3, 2017

Town of Windsor and Windsor Water District
Esposti Supply Well
Redevelopment, Pumping Test, and Treatment Feasibility Study

Project No. 11110001/10

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PROFESSIONAL CERTIFICATION

This report was prepared under the professional supervision of Kent O'Brien. The findings, recommendations, specifications, and / or professional opinions presented in this report were prepared in accordance with generally accepted professional geologic practice, and within the scope of the project.

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Executive Summary

The Town of Windsor and Windsor Water District (Town) installed the Esposti Supply Well in 2010. This investment was part of an effort by the Town to broaden the portfolio of water supply options in response to requirements from the Sonoma County Water Agency to obtain alternative supplies that are not reliant on withdrawals from the Russian River. The goal of the well installation project of 2010 included replacing both the Bluebird Well and the Esposti Irrigation Well with two new wells that would produce water of higher quality and production volume reliability.

In 2010, the Town installed pilot borings at both Esposti Park and the Bluebird Well site. Initial analytical testing of water samples collected from depth-specific aquifer zones from both of these pilot borings indicated acceptable water quality in select zones. Based on these data and the interpretation of acceptable water quality, the Town proceeded with new wells at both the Esposti Park (Esposti Supply Well) and Bluebird Well site.

The Esposti Supply Well is 10-inches in diameter with a depth of 670 feet below the ground surface (bgs). Shortly after installation in 2010, the well was developed and tested for production capacity and water quality. Results of this testing indicated that concentrations of both manganese and arsenic were much higher than expected and exceeded drinking water standards. Subsequently, the well sat idle because of a decrease in water demand due to a downturn in the economy and conservation efforts in addition to the elevated manganese and arsenic concentrations in the well.

The goals of the 2016 work were to redevelop the Esposti Supply Well, perform a pumping test, test water quality, and evaluate treatment options. The 2016 redevelopment work increased the production capacity by 27% and removed residual drilling mud remaining in the boring after construction of the well. The pumping test confirmed the water quality, established an understanding of the geochemistry, evaluated pumping yields, tested the sewer capacity, and provided a basis for performing a treatment pilot test. However, the findings of this work indicate that bringing the Esposti Supply Well into production as a potable supply well could be costly and require significant space for treatment equipment.

Esposti Supply Well Pumping Limits

The Esposti Supply Well's recommended pumping rate is 400 gallons per minute (gpm). Pumping at a rate of 800 gpm is possible, but is not sustainable for more than a day due to hydrogeologic limitations to aquifer permeability. The groundwater production from the Esposti Supply Well is from confined aquifer units located below 380 bgs. Pumping from the confined aquifer did not result in a significant effect on the overlying shallow groundwater. The production aquifer is a moderate to low permeable clay/silt/sand system. The aquifer is not a single unit but rather a series of sand layers interbedded with silts/clay layers. An aquifer transmissivity of 4,141 gallons per day per foot (gpd/ft) is most representative for long-term pumping. A storage coefficient was not calculated during this work. Hydraulic conductivity (permeability, K) at 47 gpd/ft^2 is most representative of the aquifer. The aquifer production characteristics are consistent with descriptions of the Glen Ellen Formation provided in Department of Water Resources (DWR) reports and are consistent with the previous aquifer testing reported shortly after well installation in 2010.

Water Quality

The Esposti Supply Well produces water that meets all of the requirements for drinking water with the exception of arsenic and manganese. The 2016 concentration of arsenic was 0.057 milligrams per liter (mg/L) [57 micrograms per liter (µg/L)] and manganese was 0.860 mg/L (860 µg/L). These concentrations are significantly above the drinking water standards of 0.010 mg/L and 0.050 mg/L, respectively. The 2016 testing also confirms that these elevated concentrations of arsenic and manganese are repeatable and consistent in the context of the Esposti Supply Well, screened across multiple aquifer zones. The concentration results for arsenic and manganese identified in 2016 are similar to concentrations in samples collected from the Esposti Supply Well in 2010 after installation and development. Our conclusion regarding the discrepancy in water quality results between the pilot boring and final Esposti Supply Well is that the groundwater samples collected from the pilot boring were not representative of actual groundwater quality due to sample collection techniques employed during drilling the pilot boring.

Testing of the layered aquifer zones identified a pattern where arsenic concentrations increase with increasing depth and that manganese concentrations decrease with increasing depth, although all concentrations exceed drinking water standards. Samples collected from the Esposti Irrigation Well, screened 100 to 300 ft bgs, indicated a concentration of arsenic at 0.013 mg/L (13 µg/L) and manganese at 1.5 mg/L (1,500 µg/L). During isolation testing of the 1st screen section of the Esposti Supply Well (384 to 420 ft bgs), arsenic was found at a concentration of 0.035 mg/L (35 µg/L) and manganese at a concentration of 0.910 mg/L (910 µg/L).

The temperature of the extracted groundwater also increases with continued pumping and this increasing temperature corresponds to an increasing concentration of arsenic. This trend and other trending parameters indicated that as pumping continues an increasing proportion of the extracted groundwater derives from deeper zones in the aquifer system.

Esposti Supply Well Treatment

The most feasible option for water treatment is a two-step process; the first step removes manganese through catalytic oxidation (greensand filtration) and the second step removes arsenic through media adsorption. An alternative treatment approach using iron coprecipitation with greensand filtration in a one-step process; however, requires a large backwash tank and management of waste iron flocculent. Both the backwash tank and management of iron flocculent waste present significant site challenges that reduce one-step process viability in comparison to the two-step process described above. Therefore, the one-step process approach is not recommended.

The minimum treatment compound size for the two-step process is 40 feet by 45 feet with a 12-foot maximum treatment vessel height. While the two-step process requires occasional backwashing at the maximum capacity rate and direct discharge to the Shiloh Road sewer branch, will avoid a backwash tank and on-site waste management. Locating the treatment system in the northwest corner of Esposti Park would provide the least impact on the park, but requires the longest underground piping connections. The northwest location was used in the cost analysis because it is the furthest from the well and has the longest piping runs. The estimated capital cost, including installation, for this system is $2,123,000 with an annual cost of $367,000 assuming a flow rate of 400 gpm and an annual production of 324 acre-ft/year (operating 24/7 for 6 months/year, dry season only).

Implementation Considerations

The sewer collection system can accept up to 800 gpm of short-term flow during dry weather. The maximum fill level of the sewer line immediately downgradient from the discharge location was 60% of pipe full. Treatment requires maximizing the discharge volume to the sewer and a permanent solution to preventing surcharge of sewer is required.

The Esposti Supply Well operation with treatment was described in both the Water Master Plan and the associated programmatic Environmental Impact Report (EIR). However, an initial study (IS) is recommended to identify which impact areas may need to be re-evaluated and the appropriate level of environmental documentation to be prepared. At a minimum, it is anticipated that aesthetics (visual), noise, and traffic impacts may be different for a treatment system constructed and operated as described herein (versus as described in the programmatic EIR). Assuming that no additional significant and unavoidable impacts are identified as part of the IS, a mitigated negative declaration (MND) will be sufficient for meeting the requirements of the California Environmental Quality Act (CEQA).

The potential for managed aquifer recharge utilizing the Esposti Supply Well is limited by the low hydraulic conductivity of the aquifer, poor native water quality, and the well design. Of these considerations, the first two are the most restrictive and expensive to overcome.

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1. Introduction

On behalf of the Town of Windsor (Town), GHD Inc. (GHD) in conjunction with Hazen and Sawyer (Hazen) and RMC Inc. (RMC) have prepared this *Esposti Supply Well Redevelopment, Pumping Test, and Treatment Feasibility Study* (Report). The Esposti Supply Well project site (Site) is located in Esposti Park, southeast of the Town Center, at the intersection of Shiloh Road and Old Redwood Highway. Figure 1 identifies the location of the Town of Windsor and Esposti Park. The Esposti Supply Well is separate from the Esposti Irrigation Well located 30 feet to the south.

The Esposti Irrigation Well is used to supply irrigation water to the park. Figure 2 provides an aerial photo illustrating the location of the Site in Esposti Park.

The Town installed the Esposti Supply Well in 2010. This investment was part of an effort by the Town to broaden the portfolio of water supply options in response to requirements from the Sonoma County Water Agency to obtain alternative supplies that are not reliant on withdrawals from the Russian River.

The Town's water supply options had also been constrained by the removal of the Town's Bluebird Well (Figure 1) from production due to elevated arsenic concentrations. While the Bluebird Well was operational, the concentration of arsenic in the water varied between 20 and 40 micrograms per liter (µg/L). In 2006, the State of California reduced the drinking water standard for arsenic from 50 µg/L to 10 µg/L. In response to this change, the Town removed the Bluebird Well from service and the 400 gallons per minute (gpm) of production capacity was no longer available to the Town. The Town also recognized that the existing Esposti Irrigation Well located in Esposti Park did not have the production capacity for reliance as an emergency or peak demand well. The goal of the well installation project of 2010 included replacing both the Bluebird Well and the Esposti Irrigation Well with two new wells that would produce water of higher quality and production volume reliability.

1.1 Background

In 2010, the Town installed pilot borings at both Esposti Park and the Bluebird Well site. Initial analytical testing of water samples collected from depth-specific aquifer zones from both of these pilot borings indicated acceptable water quality in select zones during the drilling phase. New wells were designed for both locations to target extraction from aquifers that had test results indicating acceptable water quality. Based on these data and the interpretation of acceptable water quality, the Town proceeded with new wells at both the Bluebird Well site and Esposti Park (Esposti Supply Well).

The Esposti Supply Well is 10-inches in diameter, constructed with 382 feet of low-carbon steel blank upper casing, and six well screen sections separated by various lengths of stainless steel blank casing. The Esposti Supply Well has a reported depth of 670 feet below the ground surface (bgs). Shortly after installation in 2010, the well was developed using a combination of airlifting and pump development. The maximum flow rate extracted from the well during this development was 500 gallons per minute (gpm). A constant-rate (24 hours in duration at 400 gpm) pumping test was then conducted on the well. Development and pump-test water was discharged into the Town's sanitary sewer system. During both the well development and pumping tests, the Esposti Supply

Well appeared to be productive, but the development and testing activities were cut short due to high spring rainfall and limited storage capacity at the Town's wastewater treatment facility. After construction, the Esposti Supply Well's groundwater contained higher than expected concentrations of arsenic and manganese. Subsequently, the well sat idle because of a decrease in water demand due to a downturn in the economy and conservation efforts in addition to the elevated arsenic concentration in the well.

In an effort to have a reliable off-river backup water source, the Town issued a Request for Proposals for the Esposti Water Supply Reliability Well Redevelopment and Treatment Feasibility Project (RFP, November 2015). The RFP included redeveloping and pump testing the Esposti Supply Well in order to improve performance and better understand the water quality and hydraulic properties of the well. In addition, the RFP included preparing a Feasibility Study to evaluate treatment and operational options for water production and completing a pilot test for the most feasible of proposed treatment methods to prepare for a future basis of design report and compliance with Division of Drinking Water loan funding requirements.

1.2 Purpose of this Report

This Report describes the redevelopment and pumping test of the Esposti Supply Well in addition to evaluating the cost of bringing the well into production. The redevelopment work increased the production capacity and removed residual drilling mud remaining in the boring after construction of the well. This residual drilling mud could hinder permeability and affect water sample results. The pumping test confirmed the water quality, established an understanding of the geochemistry, evaluated pumping yields, tested the sewer capacity for later engineering studies, and provided a basis for performing a treatment pilot test. However, the findings of this work indicate that bringing the Esposti Supply Well into production as a potable supply well could be costly and require significant space for treatment equipment. A treatment pilot test was not completed as part of this work until other feasible options could be evaluated. If it is determined that equipping the Esposti Supply Well for treatment is preferred over other options, then a pilot test will be pursued. This Study provides a screening level of potential treatment and operational options for the Town's consideration. These options provide the Town with a point of comparison to other water supply options such as recycled water or drilling a well in an alternative location.

1.3 Summary of Findings

Below is a summary of findings from the well redevelopment, pump testing activities, and key findings for developing production at the Esposti Supply Well Site. Each of these findings are addressed in detail in various sections of this Report.

1.3.1 Key findings of the well redevelopment and pumping test:

- Pumping the Esposti Supply Well at a flow rate of 800 gpm for 28 hours produced a drawdown of 195 feet (tested May 16-17, 2016).
- The measured specific capacity after 1, 4, 8, and 24 hours of pumping at 800 gpm were 5.5, 4.9, 4.7, and 4.3 gallons per minute per foot (gpm/ft) of drawdown, respectively.

- Transmissivity ranged from 4,141 gallons per day per foot (gpd/ft) to 7,822 gpd/ft. The lower of these values is most representative of the long-term pumping transmissivity. Storage coefficient was not calculated during this work.
- Hydraulic conductivity (permeability, K) ranged from 47 gpd/ft^2 to 89 gpd/ft^2. The lower of these two values is most representative of the aquifer.
- The Esposti Supply Well's recommended pumping rate is 400 gpm. Pumping at a rate of 800 gpm is possible but is not sustainable for more than a day due to hydrogeologic limitations to aquifer permeability.
- Pumping from the confined aquifer did not result in a significant effect on the overlying shallow groundwater system as measured at the Esposti Irrigation Well and the Mobile Home Estates Well. The production aquifer is a moderate to low permeable clay/silt/sand system, which stratified with interbedded clay layers (hydrogeologically confined). The aquifer is not a single unit but rather a series of sand layers interbedded with silts/clay layers.
- The aquifer production characteristics are consistent with descriptions of the Glen Ellen Formation provided in the California Department of Water Resources (DWR) reports and are described in Section 2.
- The sewer collection system can accept a significant volume of flow during dry weather. A flow of 800 gpm was discharged to the sewer for a period of 28 hours. The maximum fill level of the sewer line immediately downgradient from the discharge location was 60% of pipe full. During this test, a sewer plug was installed to prevent flow down the Old Redwood Highway branch of the sewer and all of the flow was sent down the Shiloh Road branch.
- The Esposti Supply Well produces water that meets all of the requirements for drinking water with the exception of arsenic and manganese. At the end of pumping the Esposti Supply Well at 800 gpm for 28 hours (28-hour pumping test), the concentration of arsenic was 0.057 milligrams per liter (mg/L) [57 micrograms per liter (µg/L)] and manganese was 0.860 mg/L (860 µg/L).
- On September 21, 2016, a zone-specific pumping test was performed (8-hour zone pumping test). This test consisted of pumping from only the uppermost (1st) well screen section (384 to 424 feet below top of casing). This test was performed using an inflatable packer between the 1st and 2nd well screen zones. The specific capacity of this uppermost (1st) well screen section (inclusive of flow bypassing the packer through the well filter pack) was calculated at 2.7, 2.5, and 2.4 gpm/ft measured after 1, 4, and 8 hours, respectively.
- An arsenic concentration of 0.035 mg/L (35 µg/L) and a manganese concentration of 0.910 mg/L (910 µg/L) were in groundwater samples collected at the end of the 8-hour zone pumping test.
- The maximum recommended pumping rate for the uppermost (1st) well screen interval is 250 gpm (inclusive of flow bypassing the packer). If flow bypassing the packer is removed

from the well capacity, the estimated maximum pumping rate is 175 gpm from the uppermost (1st) well screen. The sustainability of these pumping rates was not evaluated due to the short duration of the pumping test (8-Hour Zone Pumping Test).

- Samples collected from the Esposti Irrigation Well, screened 100 to 220 feet and 240 to 300 feet bgs, indicate a concentration of arsenic at 0.013 mg/L (13 µg/L) and manganese at 1.5 mg/L (1,500 µg/L).

1.3.2 Key findings for developing production at the Esposti Supply Well:

- As a potable water supply well, the most feasible flow rate for the Esposti Supply Well is 400 gpm. The 400 gpm flow rate is a function of well construction and aquifer limitations. Short-term (less than one day) pumping rates as high as 800 gpm are achievable but not sustainable due to aquifer limitations.
- The most feasible option for water treatment is a two-step process; the first step removes manganese through catalytic oxidation (greensand filtration) and the second step removes arsenic through media adsorption. An alternative treatment using iron coprecipitation is potentially feasible, but requires a large backwash tank and management of waste iron flocculent. Both the backwash tank and management of iron flocculent waste present significant site impact challenges.
- The minimum treatment compound size is 40 feet by 45 feet with a 12-foot maximum treatment vessel height for the most feasible option. The estimated capital cost, including installation, for this system is $2,123,000 with an annual cost of $367,000 assuming a flow rate of 400 gpm and an annual production of 324 acre-ft/year (operating 24/7 for 6 months/year).
- An alternative use of the Esposti Supply Well is as a replacement for the existing Esposti Irrigation Well or irrigation of nearby Town owned landscaping or fields.

1.4 Report Structure

This Report has seven sections, as described below:

Section 1 – Introduction: This section provides a summary of the background, purpose of this report, and a summary of findings.

Section 2 – Description of Project Area Hydrogeology: This section describes the regional and local hydrogeology.

Section 3 – Description of Project Site Infrastructure and Project Permits: This section describes the existing well site, power, and sewer capacity available. This section also describes the permits obtained as part of this project.

Section 4 – Esposti Supply Well Redevelopment Activites: This section describes the well redevelopment to remove clay and fine-grained material from the well. Also included here are the findings from the short-term testing of the pumping equipment prior to the aquifer pumping tests.

Section 5 – Pumping Tests: This section describes the setup for the Esposti Supply Well May 2016, 28-hour pumping test at 800 gpm and the September 2016, 8-hour zone pumping test at 300 gpm:

This section presents the results of the analysis of the water samples collected and hydraulic characteristics of the well.

Section 6 – Esposti Supply Well Treatment Feasibility: This section describes the screening level costs and site configuration requirements to bring the Esposti Supply Well into production as a potable supply well.

Section 7 – Scope and Limitations: This section references the scope of this investigation and outlines the expected uses and limitations of this Report.

2. Description of Project Area Hydrogeology

2.1 Hydrogeology of the Project Site

According to the DWR Bulletin 118, California's Groundwater (2003, updated in 2014), the groundwater basin underlying the Town is the Santa Rosa Plain, a sub-basin (DWR number 1-55.01) of the Santa Rosa Valley Basin (DWR, 2003). The Santa Rosa Plain drains toward the Russian River and is part of the North Coast Hydrologic Region. The Santa Rosa Plain Sub-basin is the largest basin in the County and underlies the most populated areas of the County. The Windsor hydrogeologic subarea is located in the northern portion of the Santa Rosa Plain and underlies the Town of Windsor (Windsor Subarea).

The Town of Windsor overlies the Windsor-Fulton unit, a sub-basin approximately 11,100 acres in size within the larger Santa Rosa Valley Groundwater Basin (Cardwell, 1958). The three most important geologic units for groundwater supplies within the Windsor-Fulton unit include the three Late Tertiary-Quaternary aged sedimentary deposits: Glen Ellen Formation, Petaluma Formation, and Wilson Grove Formation. Appendix A provides selected figures from publicly available geologic reports referenced in this section.

The basement rocks (Mesozoic age, up to 67 million years old), underlying the Santa Rosa Plain sediments, yield little to no groundwater (Herbst et al., 1982). Conversely, the relatively thick sequence of sediments and younger volcanic flows overlying bedrock do store and yield significant volumes of groundwater. However, the water bearing sediments of the Santa Rosa Plain have variable properties concerning how much water can be pumped from the wells completed in different areas of the watershed.

The Quaternary (the last 2.6 million years) Alluvium in the Windsor Subarea generally consists of eroded materials from the hills that flank the east and west sides of the valley. The majority of the sediments include clay, silt, sand, gravel, cobbles, and boulders. The Quaternary Alluvium ranges from a few feet thick along the edges of the valley and increases to at least 600 feet thick beneath portions of Town, at the valley center where Highway 101 passes through. Groundwater production in the Quaternary Alluvium generally ranges from 1 to 650 gpm due to wide range of clay, silt, and degree of compaction occurring within this formation.

Underlying Quaternary Alluvium is the Glen Ellen Formation, which in the Windsor hydrogeologic subarea ranges from approximately 100 to 150 feet thick. The Glen Ellen Formation generally consists of clay-rich creek and river deposits (silt, sand, and gravel) ranging in age from approximately 110,000 to 5.3 million years old. Although some minor intervals of the Glen Ellen Formation are relatively permeable and can yield high quantities of groundwater, this formation generally has limited production due to its clay-rich and relatively compacted and cemented properties. Therefore, the Glen Ellen Formation constructed wells generally yield in the tens to a few hundred gpm.

The Petaluma Formation (approximately 1.8 to 23 million years old) underlies the majority of the Glen Ellen at thicknesses ranging up to 3,000-feet in the Windsor hydrogeologic subarea. The

Petaluma Formation is principally comprised of weakly to moderately consolidated mudstone with minor lenses of sandstone. Due to the overall fine-grained nature of the Petaluma Formation, wells completed to this portion of the subsurface yield less than the Glen Ellen Formation and the Quaternary Alluvium.

The *Groundwater Well Installation and Testing Report*, prepared by RMC and E-PUR in 2010 (2010 Installation Report) for the Esposti and Blue Bird Supply Wells, determined that the sand and gravel units encountered in the Esposti Supply Well correlate well with the Glen Ellen Formation. The Glen Ellen Formation is a heterogeneous unit mixed with tuffaceous clay, mud, and boulders to pebbly gravel, and sand and silt deposits with interbedded conglomerates (Sweetkind et al., 2010). The 2010 Installation Report determined that the screened aquifer is confined or semi-confined, with a transmissivity of 6,600 gpd/ft, measured at a flow rate of 400 gpm. This is similar to the GHD findings where the screened aquifer (384 to 659 feet bgs, in six separate screen sections) has a confined aquifer transmissivity of 7,822 gpd/ft for short-term pumping and 4,141 gpd/ft for long-term pumping, measured at a flow rate of 800 gpm.

3. Description of Project Site Infrastructure and Project Permits

This section describes the existing well site, power, and available sewer capacity. This section also describes the permits obtained and the California Environmental Quality Act (CEQA) analysis performed in preparation for the fieldwork.

3.1 Esposti Supply Well Construction

The Esposti Supply Well was installed in 2010 after depth-specific water and soil sample collection from the pilot boring. After evaluation of the pilot boring analytical results the well screen was designed, the pilot boring was over-reamed, and the well installed. The well was constructed using 10-inch diameter casing and screen. The upper portion of the well was constructed using low-carbon steel casing (+3 to 380 feet bgs) while stainless steel screen (SS304 type) and stainless steel blank casing was used to screen six separate screen sections zones reportedly starting at 380 feet bgs and ending at 655 feet bgs. The well was constructed within a 20-inch diameter, mild steel conductor casing to 60 feet bgs. Appendix B provides well construction logs for the Esposti Supply Well, the Esposti Irrigation Well and the Bluebird Well. Videos performed during the current project observed the top of the screen at 384 feet and the bottom of visible screen at 656 feet as measured from the top of the casing. Taking into consideration the distance between ground surface and the top of the casing, the correlation between the reported construction and the observations from the video are good. As discussed later in this report, gravel fill obstructs the lower portion of the last screen section.

In 2010 after well development, groundwater samples collected from the Esposti Supply Well contained significantly higher concentrations of arsenic than depth-specific samples collected during the installation of the pilot boring prior to well construction. The arsenic concentration in the well after development ranged from 0.056 to 0.061 mg/L. This was unexpectedly high given that the depth-specific samples collected during well drilling at 400 and 600 feet bgs were 0.0021 and 0.0073 mg/L respectively. This nearly ten-fold discrepancy in sample results between the depth-specific pilot boring sampling (during drilling) and sampling after well construction is one of the reasons that the current project included aggressive redevelopment and extensive analysis of samples from the Esposti Supply Well.

A concrete pedestal protects the wellhead and a steel locking lid controls access to the inside of the well. There are no trees or overhead power lines that could interfere with maintenance equipment. The location of the Esposti Supply Well is approximate 40 feet east from Old Redwood Highway and 29 feet north from the Esposti Irrigation Well. The location of the well is adjacent to the parking lot, ball fields, and restroom facilities. It is also highly visible from both Old Redwood Highway and two nearby sidewalks. This central location and high visibility are addressed in the evaluation for treatment system location (Section 6).

3.2 Esposti Park Infrastructure

Described in this section are access to electrical power, sewer discharge capacity, and space availability.

3.2.1 Electrical Power

Power availability at the site is limited to 100-amp single phase 240 VAC. This is adequate to power the pump in the Esposti Irrigation Well, but was insufficient to run the 6-inch and 8-inch pumps used for the May and September 2016 pumping tests.

PG&E power is located on overhead poles across Old Redwood Highway. An electrical contractor was contacted by Weeks Drilling & Pump Co. (Weeks) of Sebastopol, California (contractor to GHD) to identify the level of effort required to bring higher load service power to the Esposti Supply Well location. Sufficient electric power to run the 6-inch and 8-inch pumps used for this project could not be brought in on a temporary basis using a typical construction power drop pole without incurring a delay to accommodate PG&E. Bringing higher load power into the Site would require a design evaluation inclusive of investigating the details of available power from the overhead lines. Estimated costs for designing and installing adequate electrical power have been included in the treatment feasibility study.

3.2.2 Sewer Discharge

Park staff identified cleanouts near the restroom and indicated that the size of the sewer lateral pipes were unlikely to accept the high flows from the well testing. GIS files provided by the Town indicate that the lateral running from the restroom to the sewer main in Shiloh Road is 6-inch. RMC identified the nearest high capacity drop inlet point as manhole S130A, located in Shiloh Road off of the southwest corner of Esposti Park (in the westbound Shiloh Road right hand turn lane). The invert at the bottom of manhole S130A in Shiloh Road is approximately eight (8) feet below street grade. Appendix C provides a copy of maps identifying the location of sewer manholes.

RMC collaborated with GHD to assess the sewer capacity and provide recommendations for well discharge testing. RMC provided the recommendation to use manhole S130A for the discharge of well test water. Appendix C provides copy of RMC's (Draft) April 29, 2016 Technical Memorandum. Appendix C also provides copies of field notes from sewer discharge observations taken by Town personnel during test discharges on May 9, 11, and 16, 2016.

Table 1 compares RMC's calculated pipe flow with the field observations. The observed percentage of full pipe was less than calculated. A portion of this discrepancy is attributed to the actual observed base flow that was less than the base flow built into the calculations. In general, the correlation between the calculated and observed pipe flow is good considering the qualitative nature of the observations and the variability in discharge volume from the well during these tests.

A key finding of an RMC sewer flow simulations was that during high flow conditions without the plug, flow partitioning would route some flow down the north-flowing Old Redwood Highway sewer main, potentially leading to exceedances in sewer capacity. The use of the Shiloh Road main sewer line for discharge of pumping test water was based on the simulation and recommendation for a plug in the north-draining main of sewer manhole S130. This plug prevented discharge from flowing towards the north to the Old Redwood Highway sewer main.

On August 23, 2016, Town staff directly observed subsequent temporary discharges at manhole S130 without a plug installed in the north flowing sewer under Old Redwood Highway at this sewer manhole. At a discharge rate of 400 gpm into manhole S130A nearly 80% of the flow was observed to flow down Shiloh Road, while 20% appeared to flow north through the Old Redwood Highway sewer main. It appears that further increases in discharge volume would continue to partition, sending partial flows in through both sewer mains.

Table 1 Comparison of Calculated Sewer Flow with Observation

Flow Added	Total Flow	Velocity	Freeboard	d/D	Observed % Of Full Pipe		
gpm	*gpm*	*fps*	*inch*	*in/in* as %			
Baseline (0 gpm added)	132	2.29	9.36	22	small base flow observed at 10% to 15% full pipe		
50	182	2.52	8.88	26			-
100	232	2.71	8.46	29.5	-	-	-
200	332	2.99	7.74	35.5	-	-	20
300	Not Calculated				30	30	30
400	Not Calculated				45	-	-
500				50.5	40	-	35
600	732	3.67	5.34	55.5	50	-	40
700	Not Calculated				55	-	45
800				65	60	50	50
900	Not Calculated				65	-	60
1,000				75	-	-	-

Notes:

- Observed % of Full Pipe is relative and approximate due to judgement by field personnel. Data presented is compiled from different days and from different observers. Base flow on all days was low to very low.
- These calculations assume flow is routed down Shiloh Rd by placing a plug in the north-draining sewer main at manhole S130.

The key finding is that the hydraulic simulation had an apparent good correlation with observed sewer flow along Shiloh Road. However, when discharging flow into manhole S130A in excess of 400 gpm, direct observations at manholes S130 and S374 are recommended to assess partitioning of flow. Access to both of these manholes requires traffic control.

3.3 Permits Obtained for Pumping Test

Two permits where obtained during the performance of this work. In addition, RMC evaluated compliance with CEQA at the project level and for the pumping test. These permits are outlined below:

3.3.1 Sewer Discharge Permit

Appendix D provides a copy of the sewer discharge application prepared by GHD and the resulting sewer discharge permit issued by the Town.

3.3.2 Street Encroachment Permit

Appendix E provides a copy of the Town’s Encroachment Permit prepared and received by Weeks.

3.4 Project CEQA Analysis

3.4.1 CEQA Analysis for Aquifer Pumping Tests

As part of the preparation for the aquifer pumping tests, RMC evaluated performance of the tests under CEQA. Based on this analysis, the pumping tests were found to be categorically exempt under CEQA. Per the CEQA handbook, a Class 6 Categorical Exemption “… consists of basic data collection, research, experimental management, and resource evaluation activities which do not result in a serious or major disturbance to an environmental resource. These may be strictly for information gathering purposes, or as part of a study leading to an action which a public agency has not yet approved, adopted, or funded.” As such, this test was considered exempt.

3.4.2 Project Level CEQA for Esposti Supply Well

In September 2011, Horizon Water and Environment LLC, prepared a Water Master Plan Update Program Environmental Impact Report (EIR). This evaluation included a programmatic EIR for the Water Master Plan and a project level evaluation of the replacement of the Esposti Park Irrigation Well with the Esposti Supply Well operating at a minimum of 270 gpm to a maximum of 1,000 gpm. Section 6.7 provides analyses of specific aspects of CEQA that need to be addressed if the Esposti Supply Well is brought into production.

4. Esposti Supply Well Redevelopment Activities

Redevelopment of the Esposti Supply Well was performed to ensure the removal of all residual drilling mud from the well prior to the pumping tests. This was necessary to ensure that water quality samples collected were representative of aquifer water quality and accurate testing of hydraulic characteristics. The generation of large volumes of water during the redevelopment process also provided an opportunity to test the sewer for maximum capacity by direct field observations during discharges.

The following were performed during this redevelopment:

- Downhole videos,
- Passive spinner log survey,
- Double swab jetting/pumping of the screen sections,
- Bailing of the bottom material in the casing, and
- Short-term, progressively increasing-flow pumping tests.

Two well videos were performed. The first was performed in conjunction with a passive spinner log to document the condition of the well prior to development on April 18, 2016 (Appendix F). The second video was performed on May 4, 2016, after a wire-line sediment bailer became trapped in the well on May 2, 2016 (Appendix G). The results of these videos are discussed in Sections 4.2 and 4.3.1, respectively.

The discussion below summarizes the timeline for activities performed as part of the redevelopment of the Esposti Supply Well. Appendix H provides copies of field reports in date order. Appendix I provides copies of technical information and photos of equipment (i.e. downhole tools, pumps, and packer) used during well development and pumping tests.

4.1 Field Activities

This chronological summary of fieldwork during the well redevelopment activities includes the downhole videos, and short-term, progressively increasing flow tests. This section also discusses the findings and conclusions from these events.

- April 16, 2016, an inflatable sewer plug is inserted into manhole S130, by the Town to ensure no sewer flow from the project activities could go north through the Old Redwood Highway sewer main.
- April 18, 2016, West Coast Well Logging Services (West Coast) performed a high definition video log and static spinner log of the Esposti Supply Well,

- April 19 to 26, 2016, GHD identified manholes along Shiloh Road to assess sewer capacity and select monitoring points in preparation for discharging Esposti Supply Well development water and aquifer water to the sanitary sewer.
- April 20, 2016, GHD collects a grab water sample from the well using a disposable bailer and no purging.
- April 21, 2016, GHD installed transducers in the Bluebird Well, Esposti Irrigation Well, and the Mobile Home Estates Well (Figure 1 and Figure 2) to monitor groundwater elevations for the duration of the project.
- April 21 to 29, 2016, GHD oversaw Weeks single swab and dual swab (isolated airlift) tool cleaning of all six screen sections of the Esposti Supply Well. Water samples were collected on April 26, 28, and 29 as the dual swab with airlift development progressed from the upper screens down to the lower screens.
- May 2, 2016, Weeks used a 10-foot long, 8-inch diameter bailer with a bottom check flap to remove gravel material from the bottom of the well. This bailer became trapped in the sediment/gravel and the wire line attached to the bailer snapped. Unable to retrieve, the bailer remains in the well.
- May 4, 2016, West Coast confirmed by video that the bailer was trapped at the bottom of the well. The decision was made between the Town, Weeks, and GHD to leave the bailer at the bottom of the well.
- May 6, 2016, set transducers in Esposti Supply Well.
- May 9, 2016,
  - Sewer capacity test from 200 to 400 gpm.
  - Esposti Supply Well pumped at a consistent 400 gpm for 4 hours and 35 minutes.
  - Esposti Supply Well surged up to 1,000 gpm for brief periods.
  - Samples collected from Esposti Supply Well discharge at 10:50 (flow at 400 gpm) and at 15:35 (during surging between zero and 1,000 gpm).
- May 10, 2016, sewer capacity test from 400 to 800 gpm.
- May 11, 2016, sewer capacity test at 900 gpm.

4.2 Results of Pre-redevelopment Downhole Video and Static Spinner Log

The April 18, 2016, video of the Esposti Supply Well indicated that the original well construction as reported in 2010 was correct. However, the well construction was reported in 2010 with reference from the ground surface, and the well actually starts approximately 3 feet above the ground surface (with the concrete pad and blank casing). The well is constructed with 20-inch diameter, mild steel conductor casing to 60 feet bgs. Inside the conductor, a 10-inch diameter, low-carbon blank steel casing, was constructed down to the first screened interval starting at 384 feet below top of casing (BTOC). A dielectric insulator coupler was used between the low-carbon steel blank casing above and the stainless steel (SS304 type) screened and blank intervals below. Appendix F presents the video report of findings from West Coast.

The April 18, 2016, static spinner log identified a downward flow of groundwater at approximately 5 gpm moving between the 1st screened section (384-424 ft BTOC) and the 4th screened section (484-500 ft BTOC). Appendix F presents the Static Spinner Log report of findings from West Coast.

4.3 Results of Short-Term Pumping During Well Redevelopment

This section summarizes the redevelopment effort conducted on the well. Ten groundwater samples were collected during the redevelopment process to identify changes in water quality during redevelopment. Redevelopment consisted of surge pumping, air lifting water and suspended sediment, dual swab jetting/pumping the discrete screened intervals, and bailing the bottom sediment.

Table 2 below summarizes the groundwater analytical results from the Esposti Supply Well over time during redevelopment. Analytical reports are included in Appendix J.

Table 2 Analytical Results From Sampling During Well Development

Sample ID	Date	Iron Diss.[1]	Iron Total	Mn Diss.[1]	Mn Total	As Diss.[1]	As Total	Comments
		mg/L[2]						
ESW-4-20-08:23								Sample by bailer of static water in well
ESW-4-26-11:50		<0.10			---	0.003		Sample during development by swab
ESW-4-28-11:40		<0.10			---	0.018		Sample during development by swab
ESW-4-29-11:45		<0.10			---	0.016		Sample during development by swab
ESW-5-9-10:50		<0.10			---	0.026		Sample during 400 gpm pumping
ESW-5-9-15:35		<0.10			---	0.016		Sample during surging zero to 1,000 gpm
ESW-5-10-10:09		<0.10			1.0	0.029		Sample at end of short 800 gpm run
ESW-5-11-10:44		<0.10			---	0.028		Sample at 800 gpm
ESW-5-11-15:38		<0.10			---	0.038		Sample at 900 gpm
ESW-5-11-16:42		<0.10			1.0	0.041		Sample at end of 90 minutes at 900 gpm

Notes:
1 = Analyzed as Dissolved (filtered before adding acid preservative).
2 = Milligrams per Liter (parts per million)
<0.10 = Less than laboratory detection limit.
--- = not analyzed

4.3.1 Surge Pumping During Well Development

April 21 to 29, 2016, GHD oversaw Weeks single swab and dual swab (isolated airlift) tool cleaning of all six screened sections of the Esposti Supply Well. Groundwater samples were collected on April 26, 28, and 29, 2016, as the dual swab with airlift redevelopment progressed from the upper screens down to the lower screens. Analysis of these groundwater samples was performed to monitor changes in water quality during redevelopment. The screens were swabbed until clear water was observed returning (airlifted) to the surface. Development water was initially contained in several 20,000-gallon storage tanks, then filtered and discharged to the sanitary sewer at 50 gpm. Suspended silt and fine sand were observed in the jetting tool discharge, no gravel pack materials were observed in the discharge. Redevelopment of each screen was considered complete when the discharge was observed to be free of silt and sand. The final screen cleaning depth was completed with a soft landing at 656 feet bgs (final depth measurement based on number of 21-foot pipe sections for the jetting tool).

As presented on Table 2 above, the groundwater samples were analyzed for arsenic, iron, and manganese. Concentrations of dissolved iron were not detected. However, concentrations of both dissolved arsenic and manganese were above drinking water standards when redevelopment efforts finished. Dissolved manganese remained near 1.0 mg/L to the end of redevelopment. Concentrations of dissolved arsenic were relatively low (0.0044 mg/L) upon initiation of redevelopment activities and increased a full order of magnitude in concentration at termination of redevelopment (0.041 mg/L). The lowest concentrations of arsenic were collected during development of the uppermost screen section. Later zone testing confirmed that the uppermost screen interval has lower concentrations of arsenic when compared to the deeper portions of the well. The above Table 2 summarizes the groundwater analytical results from the Esposti Supply Well over time during redevelopment. Analytical reports are included in Appendix J.

On May 2, 2016, GHD observed Weeks use a 10-foot long, 8-inch diameter check valve bailer, to remove gravel and sediment material from the bottom of the well. First retrieval was approximately 1.0 feet of soft sediment with ¼-inch filter pack underlying the sediment for a total of approximately 1.5 feet of fill removed. Subsequent retrievals 2 through 4 were nearly 100% ¼-inch filter pack for an approximate total of 4 feet of material removed. When bailer retrieval number five could not be retrieved with the single winch pulley, a second powered pulley was connected to assist in lifting the bailer. The wire to the bailer snapped and the line was retrieved without the bailer.

On May 4, 2016, GHD observed West Coast using a high definition down-hole camera and confirmed the total depth to the top of the material in the well to be 654 feet deep. GHD analyzed the video and did not see any damage to the well casing or a difference from the April 18, 2016, video completed before the bailer was used in the well. Additionally, Weeks' bailer, with approximately 77 feet of cable, was observed at the bottom of Esposti Supply Well. GHD recommended that the bailer be left in place rather than retrieve it and risk potential damage to the well casing. The West Coast video report is provided in Appendix G. The filter pack observed in the bottom of the well casing may be the result of adding ballast to straighten the well during construction and not removed during the initial well development activities or some other intentional event. The filter pack covers a portion of the lower screen, but does not appear to be the result of damage to the well casing or screen. However, the cause of the filter pack in the bottom of the well is unknown.

On May 6, 2016, GHD installed transducers and Weeks installed an 8-inch pump. Then on May 7, 2016, GHD along with the Town, started observing downgradient manhole numbers S374, S375, S375A, and S376 in Shiloh Road. After approximately 33 minutes of discharging to the Town's sewer manhole S130 at rates ramping up to 800 gpm, the pump shut off due to amperage exceedance tripping the circuit breaker. Weeks attempted a second pumping effort with surging flow rates up to 1,000 gpm discharged to the sewer with the same pump failure result. Weeks then subsequently reconfigured the pump wiring with larger current (amperage) capacity wire.

On May 8, 2016, GHD and the Town observed manholes for 90 minutes while pumping to sewer at initial discharge rates of 400 gpm. This rate was then ramped up to a maximum discharge rate of approximately 890-910 gpm for the majority of the observation period. This test confirmed that discharge to the Town's sewer at manhole S130A has a dry season capacity that roughly corresponds to the sewer model values.

Two short-term pumping tests were performed as part of well redevelopment to verify that the well was clear of sediment and verify that the pumping rate selected for the long duration pumping test (24 hours or longer) was as high as it could reasonably be and sustained at a constant rate for at least 24 hours. These short-term pumping tests are discussed below.

4.3.2 400 GPM Pumping For 4.5 Hours

On May 9, 2016, a short-term pumping test was conducted at a flow rate of 400 gpm to verify completion of well development and to provide a comparison with the 400 gpm pumping test performed in 2010. The 400-gpm flow was discharged to the storage tanks and the storage tanks discharged through a bag filter to sewer manhole S130 at a rate of 300 gpm. The bag filter needed cleaning upon initial discharge from the tanks to the filter. After cleaning the filters, the discharge from the tanks, through the filter, to the sewer resumed at 300 gpm (while continuing to pump the well at 400 gpm). Storage tank capacity was reached after 4.5 hours of pumping the Esposti Supply Well and the 400-gpm short-term pump test was terminated. After the 4.5 hours of pumping the Esposti Supply Well, total groundwater drawdown measured from static water level was 66.1 feet for a calculated specific capacity of 6.1 gpm/ft.

Samples of pumped groundwater were collected at the start of the 400-gpm test period. Samples were again collected at the end of the day after the completion of pumping at 400 gpm and additional surge pumping was performed by running the pump in quick bursts from 0 gpm to 1,000 gpm and back to 0 gpm.

Table 2 summarizes the groundwater analytical results from the Esposti Supply Well over time during redevelopment. Analytical reports are included in Appendix J.

4.3.3 900 GPM Pumping for 1.5 Hours

On May 10, 2016, GHD oversaw Weeks conduct a brief troubleshooting effort and test pumping at rates of 400-800 gpm, while GHD collected a groundwater sample. Analytical results of dissolved arsenic, iron, and manganese from May 10 were comparable to results of samples collected the day prior. The field measured indicator parameters of temperature and pH both were generally increasing over time, while electrical conductivity (EC) and total dissolved solids (TDS) were generally stable after the first well casing water was purged. These indicator parameter data suggest that warmer and slightly higher pH water moves up through the well casing from the lower formation through the associated lower well screens over time while pumping.

On May 11, 2016, GHD oversaw Weeks perform pumping for approximately 3.5 hours at pump rates ranging from 400 to 910 gpm in order to determine the maximum pump rate test the Esposti Supply Well could feasibly sustain for the planned 24 hour test. After approximately 90 minutes of pumping at 900 gpm, the pump flow rate began to decrease while total drawdown also continued to increase (223+ feet); therefore, it was determined that the 24-hour pump test flow rate should be 800 gpm, not 900 gpm or 1,000 gpm.

Groundwater analytical results of dissolved arsenic, iron, and manganese concentrations from May 11, 2016, were compared to prior analytical results and found that the concentration of arsenic and manganese were generally increasing as the pumping and redevelopment progressed. The field indicator parameters were comparable to that of days prior.

Table 2 summarizes the groundwater analytical results from the Esposti Supply Well over time during redevelopment. Analytical reports are included in Appendix J.

5. Pumping Tests

Two pumping tests were performed on the Esposti Supply Well during this investigation. The first was a 28-hour pumping test performed at a flow rate of 800 gpm. The second test isolated the upper most screen zone for pumping at a rate of 300 gpm for a period of eight (8) hours.

5.1 Pumping Test Field Activities

The chronological summary of fieldwork is provided below for ease of reference. Findings and conclusions from the different events are discussed in later sections of this Report.

- May 16-17, 2016, 800 gpm pumping test starts at 6:05 AM on May 16, 2016, and ends at 10:05 AM on May 17, 2016. This test is referred to as the “28-hour pumping test” (Sections 5.2 through 5.6).
- August 23, 2016, active spinner log while pumping at 400 gpm (Section 5.7).
- August 26, 2016, 8 hours of pumping at 400 gpm with top of packer at 436 BTOC (incorrectly placed within second screen zone; therefore, resulting data is not presented in this Report and pumping test was repeated on September 21, 2016).
- September 21, 2016, 8 hours of pumping at 300 gpm with top of packer at 425 feet BTOC (between 1st and 2nd screen zones). This test is referred to as the “8-hour zone pumping test” (Sections 5.8 through 5.12).

The Esposti Supply Well 28-hour pumping test was performed to comply with the requirements of both the State Water Resources Control Board and the Division of Drinking Water Programs for obtaining a permit to operate the Esposti Supply Well as part of a municipal water supply system. The goals of the pumping test were to evaluate the effect of pumping on the confined production aquifer and the overlying unconfined shallow groundwater. This pumping test was performed at a constant pumping rate of 800 gpm for a period of 28 hours (drawdown testing) and the recovery period was monitored for approximately one and a half additional days. During the drawdown test and the recovery period, pressure transducers were used to monitor the water elevation in a total of four wells. These wells consisted of the Esposti Supply Well, Esposti Irrigation Well, Bluebird Well, and the Mobile Home Estates Well. The Church Well was not used because of its current congested well casing (recently relined) and the risk of entangling the water level measuring equipment.

5.2 28-Hour Pumping Test Setup

This section describes setting up the pumping well and observation wells with water level monitoring equipment and compiling of site-specific data needed to perform the analysis of the data collected during the 28-hour pumping test (800 gpm). The 28-hour pumping test extracted from the entire well without the use of zone isolating packers. The purpose of this test was to induce the maximum flow given the well construction constraints and the constraints on the groundwater discharge to the sewer. For the purpose of this test, the limiting factor for selecting 800 gpm as the test flow rate was the expected well drawdown and pump capacity. Based on previous short-term pumping, a pumping rate of 900 gpm quickly results in drawdowns in excess of 200 feet. The dry weather sewer capacity was not the primary limiting factor, although by coincidence 800 gpm is near the limit of dry weather capacity for the sewer line.

5.2.1 28-Hour Pumping Test - Water Handling Equipment

The pump used to facilitate the 28-hour pumping test was a Grundfos 8-inch 100-hp submersible pump. Appendix I provides a copy of the pump curve. The intake of the pump was set at 360 feet below the top of the casing, which is 24 feet above the top of the upper-most screen and approximately 320 feet below the elevation of static water level.

Two 20,000-gallon temporary tanks where on site and previously used during redevelopment for groundwater containment. Two additional tanks were brought on site to handle the higher flow rates of the pumping tests. Water processing prior to discharge consisted of four (4) 20,000-gallon temporary tanks provided by Rain-for-Rent to remove sediment and provide buffering storage for high flow testing. These tanks were followed by a diesel operated transfer pump and a bag filter assembly to remove remaining fine silt and clay.

A sample port was located at the wellhead after the flow meter and consisted of a ¼-inch diameter brass tube operated by a ball valve. Photographs of the tanks and wellhead assembly are provided in Appendix I.

5.2.2 28-Hour Pumping Test - Observation Wells

The aquifer test was performed by pumping the Esposti Supply Well and monitoring the three wells to which the Town had access. The locations of the wells associated with the aquifer test are shown on Figure 1 (Bluebird, Esposti Supply Well, Esposti Irrigation Well, and Mobile Home Estates). Figure 2 provides and aerial view of the Esposti Park area. The Bluebird Well is completed from 695 to 745 bgs and is representative of the confined aquifer system. The Esposti Irrigation Well and the Mobile Home Estates Well are both completed in aquifer zones shallower than those screened by the Esposti Supply Well. Well logs for the Esposti Supply Well, Bluebird Well (Replacement 2010), and the Esposti Irrigation Well are provided in Appendix B. A drawing comparing the construction of the Esposti Supply Well and the Esposti Irrigation Well is also provided in Appendix B.

Pumping from the Esposti Irrigation Well was temporarily halted during Esposti Supply Well test pumping periods. The Mobile Home Estates Well operated under their normal operating schedule and pumped water as demands required. Neither wells could be shut down for the duration of the project due to the associated water supply demands. The Bluebird Well is not operational and does not have a pump installed in it.

There is a well at the church located south of the Esposti Park on Old Redwood Highway (see Figure 2). This well was inspected prior to the test but could not be used because the well casing was too crowded with power wires serving the submersible pump. The vineyard across Shiloh Road to the south of Esposti Park has a well for irrigation; however, due to lack of access it was not monitored during this project.

5.2.3 28-Hour Pumping Test - Well Construction Summary

Copies of the available DWR 188 well logs (Bluebird Well, Esposti Supply Well, and Esposti Irrigation Well) are provided in Appendix B. No well log is available for the Mobile Home Estates Well; therefore, the construction details including pump setting, total depth, and screen interval are unknown. A summary of the construction of the monitored wells used in this test are provided in Table 3.

Table 3 Well Construction Summary

Well ID	Measuring Point Elevation (feet above mean sea level)	Well Diameter, Casing Thickness, and Slot Size	Top and Bottom of Perforation Intervals (feet) and Measured Depth (feet)	Sand/Gravel Pack Interval and Grade Sizing (inches or Sieve Size)	Seal Interval (feet)
Esposti Supply Well	140.93 Wellhead Slab Surface to NAVD 88	10-inch Diameter, #304 Stainless Steel Casing, 0.125-inch Slots		371-670	Cement 0-370 Bentonite 370-371
Installed March 27, 2010				¼-inch Gravel Pack	
Esposti Irrigation Well	140.0 Portal near ground Surface Estimated From Google Earth	8-inch Diameter, 200 Gauge Steel Casing, 0.032-inch Slots		55-300	Cement 0-50 Bentonite 50-55
Installed August 23, 1989				8-16 Sieve	
Bluebird Well	118.34 Wellhead Slab Surface to NAVD 88	10-inch Diameter, 1/4-inch Low Carbon Steel Casing, 0.125-inch Slots		675-765	0-665
Installed, May 5, 2010				¼-inch Gravel Pack	
Mobile Home Estates Well	135.0 Top of Casing Near Ground Surface Estimated From Google Earth	6-inch Diameter, Steel Casing (thickness unknown), Slot Size Unknown		Unknown	Unknown
Unknown				Unknown	

Notes:
TD = Reference point for well total depth in this column is ground surface

5.2.4 28-Hour Pumping Test - Flow Rates and Discharge Location

The aquifer test was performed at a constant flow rate of 800 gpm for 28 hours. The flow rate of 800 gpm was selected because this is the maximum sustainable flow rate by the 8-inch pump and higher flow rates resulted in too much drawdown. Based on review of available pumps, the pump used for this test is representative of the largest capacity pump that would fit into the well casing and operate over the range of expected hydraulic heads. During well redevelopment, pumping was conducted at flow rates of 200, 300, 400, 800, 900, and 1,000 gpm. Although these pumping rates were conducted over a period of days, the information was used to verify that 800 gpm was the highest sustainable pumping rate at a reasonable drawdown for the test. Short term testing at 900 and 1,000 gpm resulted in an unsustainable groundwater drawdown observed in the well. These high flow rates resulted in pump shut-off due to too much power draw.

5.2.5 28-Hour Pumping Test - Setup for Observation Wells

Seven pressure transducers were used during the Esposti Supply Well aquifer-pumping test to record the water elevation changes in the wells monitored. Three of these transducers were installed in the Esposti Supply well, a single transducer was installed in each of the three observation wells, and one barometric pressure transducer was on site for the duration of the project to correct water level data from atmospheric pressure changes. Table 4 below identifies the transducers used to monitor water levels in each well.

Table 4 Water Level Measurement Equipment in Each Well 28-Hour Pumping Test

Well	Function of Well During Test	Transducer Used Serial #	Frequency of Data Record (minutes)
	Pumping Well (Malfunctioned prior to Pump Test)	In-Situ vented Troll 700 431953	
	Pumping Well (Replacement Unit for Malfunctioned unit# 431953)	In-Situ vented Troll 700 337530	1
	Pumping Well (Backup unit)	Solinst non-vented F650 82060899	1
	Observation Well Confined Aquifer	Solinst non-vented F65 20371	1
	Observation Well Confined Aquifer	Solinst non-vented F15 19828	1
	Observation Well Assumed Unconfined Aquifer	Solinst non-vented F30 20188	1
	Barometric correction data to apply to non-vented transducer data sets.	Solinst non-vented 19657	1

5.2.6 28-Hour Pumping Test - Measured Elevations and Distance to Pumping Well

During the data analysis, the recorded pressure head by the transducer was converted to water elevation by adding the recorded pressure head to the elevation of the transducer set into the well casing. All wells were monitored manually during the test using an electronic depth-to-water meter to verify that the transducers were correctly measuring groundwater elevations. Pressure head data was also corrected to account for atmospheric affects by subtracting recorded barometric pressure from each of the recorded pressure head measurements; except for the In-Situ transducers, which are "vented" and automatically corrected to account for atmospheric pressure. A summary of the wells used to observe groundwater elevation changes during the test and the distances between each observation well and the Esposti Supply Well is provided in Table 5.

Table 5 Elevation and Distance of Monitoring Points 28-Hour Pumping Test

Well	Date of Trans ducer Install	Estimated Elevation of Ground Surface (feet msl) [1]	Elevation of Measuring Reference Point (feet msl) [1]	Depth of Transducer Installation Below Reference Point (feet)	Trans ducer Elevation (feet msl) [1]	Pressure Head Above Transducer Prior to Start of Aquifer Test (feet) [3]	Elevation of Ground water Prior to Start of Aquifer Test	Distance to Esposti Supply Well (feet)
Esposti Supply Well			143 (Top of Casing)			287.7		
Esposti Irrigation Well			140 (Port in Casing Side)			37.8		29.5 (Measured)
Bluebird Well			120 (Top of Casing)			10.1		7,767 (Estimated)
Mobile Home Estates Well			135 (Top of Casing Near Ground Level)			22.4		1,715 (Estimated)
Barometer [2] (Baro-logger)			141			2.6		32 (Estimated)

Notes:

1 = Survey was not conducted prior to project activities, however, Esposti Supply Well and Bluebird Well concrete footings were surveyed by Winzler & Kelly, July 2010, and that data used to estimate those associated top of casing elevations. All other wellhead elevations are estimates based on Google Earth Professional Software.

2 = Barometer was secured adjacent to Esposti Irrigation Well in an open top safety cone.

3 = For the transducers in wells, this value presented here is barometrically corrected.

5.3 28-Hour Pumping Test Operation

The pump test on the Esposti Supply Well was conducted for 28 hours to evaluate the effect of pumping the aquifer. The adjacent Esposti Irrigation Well was shut off on the day prior to the start of the pump test. Once the pump test started it ran continuously for 28 hours, and at the end of the test the groundwater was allowed to recover continuously without turning on the Esposti Irrigation Well. Groundwater elevation data for all wells is graphed on Figure 4. Below is a summary of the start-up and running conditions of the test:

Pre-Test Preparation

1. Installed the pump into the Esposti Supply Well, June 15, 2015.
2. Installed the transducers in the three observation wells and Esposti Supply Well between the dates of April 21, 2016 and May 12, 2016.
3. All transducers were synchronized and recording in the wells by 12:21 PM on May 12, 2016.

Start/End of 28-Hour Pumping Period

1. Pumping of the Esposti Supply Well started at 6:05 AM, May 16, 2016 at 800 gpm.
2. Sampling and parameter monitoring during the test was kept at a steady 800 gpm by manually operating the flow control valve at least once every hour.
3. End of pumping at 10:05 AM May 17, 2016.

Groundwater Recovery Period

1. Start of recovery period 10:05 AM May 17, 2016.
2. End of recovery period and data record at 8:50 AM May 19, 2016.

5.4 28-Hour Pumping Test Analytical Results and Analysis

Samples were collected on intervals as summarized in this section. All laboratory analysis was performed through Alpha Analytical, a California Certified Laboratory. Field measurement of water quality parameters of temperature, pH, oxidation-reduction potential (ORP), EC, and TDS were made frequently using a Myron Ultrameter^{TM}. In addition, visual observations were noted on the daily field and data sheets. This information is provided in daily work sheets and data collection forms, which are provided in Appendix H.

5.4.1 28-Hour Pumping Test - Results of Water Sample Analysis During Test

Water samples were collected during the aquifer test to monitor changes in water quality. These samples were analyzed for arsenic, iron, and manganese (Table 6). Field parameters were collected frequently at start-up and during sustained pumping.

Table 6 Analytical Results From 28-Hour Pumping Test

Sample ID	Date	Iron Diss.[1]	Iron Total	Mn Diss.[1]	Mn Total	As Diss.[1]	As Total	Sample time after start
		mg/L[2]						
ESW-5-16-06:06						0.0095	0.016	1 min
ESW-5-16-06:07		<0.10	4.10	1.0	1.0	0.0081	0.013	2 min
ESW-5-16-06:12		<0.10	0.98	1.0	1.0	0.018	0.020	7 min
ESW-5-16-13:00		---	0.10	---	0.88	---	0.044	415 min
ESW-5-16-18:00		---	<0.10	---	0.87	---	0.049	715 min
ESW-5-16-24:00		---	0.11	---	0.85	---	0.052	1,075 min
ESW-5-17-04:00		---	<0.10	---	0.88	---	0.053	1,315 min
ESW-5-17-10:00		---	<0.10	---	0.86	---	0.057	1,675 min
MCL in mg/L[2]			**0.300**		**0.050**		**0.010**	

Notes:
1 = Analyzed as Dissolved.
2 = Milligrams per Liter (parts per million)
<0.10 = Less than laboratory detection limit.
--- = not analyzed

5.4.2 28-Hour Pumping Test - Water Sample Analysis at End of Pumping

Groundwater samples were collected immediately prior to shut down. These samples are representative of the groundwater extracted from the aquifer under normal operating conditions and analyzed for Title 22 constituents and other compounds that can affect treatability. Table 7 is a summary of key analytical results. A comparative summary is provided in Table A presented in Appendix K. As shown in Table 7 the water meets all of the analytical standards for drinking water under Title 22 with the important exceptions of arsenic and manganese. Extracted groundwater would require treatment for arsenic and manganese prior to distribution. The analytical reports related to sampling of the Esposti Supply Well are provided in Appendix J.

Table 7 Analytical Results From Final Sample 28-Hour Pumping Test May 17, 2016 at 10:00 AM

Constituent	Analytical Method	Entire Well Pumping at 800 gpm for 28 Hours (mg/L[1])	State MCL Drinking Water Standard Units in mg/L (Unless Otherwise Noted)
Aluminum	EPA 200.8	<0.050	1.0
Antimony	EPA 200.8	<0.006	0.006
Arsenic	EPA 200.8	**0.057**	0.010
Barium	EPA 200.8	0.150	1.0
Beryllium	EPA 200.8	<0.001	0.004
Cadmium	EPA 200.8	<0.001	0.005
Calcium	EPA 200.7	22	
Chromium (Total)	EPA 200.8	<0.010	0.05
Chromium (Hexavalent)	EPA 200	<0.001	0.01
Copper	EPA 200.8	<0.050	1.0 (SMCL)
Iron	EPA 200.7	<0.100	0.3 (SMCL)
Lead	EPA 200.7	<0.005	0.015
Magnesium	EPA 200.7	16	
Manganese	EPA 200.8	**0.860**	0.05 (SMCL)
Mercury	EPA 245.1	<0.001	0.002
Nickel	EPA 200.8	<0.010	0.1
Selenium	EPA 200.8	<0.005	0.05
Silver	EPA 200.8	<0.010	0.1 (SMCL)
Sodium	EPA 200.7	53	
Thallium	EPA 200.8	<0.001	0.002
Uranium	EPA 200.8	<1.0 pCi/L	20 pCi/L
Vanadium	EPA 200.8	<0.003	0.05 (NL)
Zinc	EPA 200.8	<0.050	5.0 (SMCL)
Aggressive Index	AWWA	11.68 NU	
Ammonia as NH_3	SM4500/H3N	<0.50	
Bicarbonate	SM2320B	270	
Carbonate	SM2320B	<5.0	
Color	SM2120B	<5.0 CU	15 Units (SMCL)
Cyanide (Total)	10-204-001X	<0.10	0.2
Hydroxide	SM2320B	<5.0	
MBAS, calculated as LAS, mw 340	SM5540C	<0.050	0.5 (SMCL)
Odor	EPA 140.1	<1.0 T.O.N.	
Perchlorate	EPA 314.0	<0.004	0.006
pH	SM4500-H+B	7.60 pH Units	
Phosphate (Total)	SM4500-PE	1.4	
Specific Conductance (EC)	SM2510B	520 uS/cm	900 uS/cm (SMCL)

Constituent	Analytical Method	Entire Well Pumping at 800 gpm for 28 Hours (mg/L^1)	State MCL Drinking Water Standard Units in mg/L (Unless Otherwise Noted)
	SM4500SD		
	SM4500-SiO2 C		
	SM2540C		500 (SMCL)
	SM2130B		5 NTU (SMCL)
	SM2320B		
	SM2340B		
	EPA 300.0		250 (SMCL)
	EPA 300.0		
	EPA 300.0		10
	EPA 300.0		1.0
	EPA 300.0		250 (SMCL)
	EPA 524.2		
	EPA 507		
	EPA 504.1		
	EPA 504.1		
	EPA 515.1		
	EPA 525.2		
	EPA 547		0.7
	EPA 549.2		0.02

Notes:
1 = Some analytical results are reported in units of µg/L these have been converted to mg/L for ease of comparison with water quality standards
NA = Not analyzed
MCL = Maximum Contaminant Level
SMCL = Secondary Maximum Contaminant Level
NL = Notification Level

5.4.3 28-Hour Pumping Test - Results of Field Parameter Monitoring

Parameters of temperature, pH, ORP, EC, and TDS were monitored frequently during the test. The monitoring was more frequent during pumping startup and parameters were always measured and recorded concurrent with sample collection. The raw data is available along with site visit reports in Appendix H. Review of the data indicates that ORP and temperature changed with the increasing duration of pumping. In particular, temperature increases as pumping progresses. Multiple starts and stops of the pump during this test indicate that the initial water temperature is cooler than water temperature after a few minutes of pumping. This trend is shown on Figure 5 providing a plot of both temperature and drawdown with increasing time. This change in temperature implies that the water from the upper screened zone is cooler than the water originating from deeper screens in the well.

The average of the last five field parameter measurements collected at the end of the 28-hour pumping test was calculated. These average values are presented in Table 8. The values for pH and TDS are very similar to laboratory results. Laboratory analysis for temperature and conductivity were not requested.

Table 8 Average of Last Five Field Parameter Measurements Near End of the 28-Hour Pumping Test

Well	Temp[1] (ºF)	pH	Cond. (µS)	TDS (ppm)
Esposti Supply Well	**77.2/80.3**	**7.65**	**533**	**352**

Note:
1 = Temperature measured at wellhead / temperature in well by transducer, respectively
ºF = Degrees Fahrenheit
µS/cm = microsiemens per centimeter
mg/L = milligrams per liter

5.5 28-Hour Pumping Test Drawdown Results and Analysis

Using the data collected during the test, the hydraulic aquifer property of transmissivity (T) was calculated. Transmissivity is directly related to the permeability of the aquifer material and will be useful in future studies of aquifer sustainability and recharge.

5.5.1 Calculation of Transmissivity

Transmissivity (T) was calculated using the data from the pumping results from the aquifer test from May 16 to 17, 2016, and analysis using the time-drawdown method. The pump test drawdown and time data for the Esposti Well is graphed in Figure 5 on semi-log scale along the time axis.

As shown in Figure 5, the slope of the line drawn through the data up until a pumping time of 660 minutes (11 hours of pumping) is represented by Line A. At 660 minutes, the line changes slope indicating a sharp decrease in the transmissivity (i.e., more drawdown for the same pumping rate). The line representing this slope is identified as Line B. The calculations determining transmissivity are calculated for both lines because the data suggest that the transmissivity near the well is higher than further away from the well. This change in slope of the drawdown rate during pumping is interpreted here to be a hydrogeologic boundary. Hydrogeologic boundaries are distinct areas within the aquifer when abrupt changes in the overall aquifer properties occur. In this case the hydrogeologic boundary is a decrease in transmissivity. Because of this, long duration pumping will cause more drawdown in the well.

The calculations and analysis were performed using modified non-equilibrium equations derived from Cooper and Jacob (1946) as described by Driscoll (1986).

Transmissivity (T **)** was calculated using time-drawdown data from the Esposti Supply Well plotted on a semi-log scale (Figure 5) using the equation:

$$T = \frac{264Q}{\Delta s}$$ for T in units of gallons per day per foot (gpd/ft)

Where:

Q = pumping rate in gpm (800 gpm)

Δs = change in drawdown over distance (one log cycle on semi-log graph = 27 feet)

T = transmissivity in gpd/ft

For Line A, which represents the aquifer prior to 660 minutes (11 hours) of pumping, using the Δs value of 27 feet, the transmissivity (T) was calculated at a value of 7,822 gpd/ft.

For Line B, which represents the aquifer after 660 minutes (11 hours) of pumping, using the Δs value of 51 feet, the transmissivity (T) was calculated at a value of 4,141 gpd/ft.

For comparison, the transmissivity that was calculated in the RMS's 2010 Installation Report was 6,600 gpd/ft. The 2010 transmissivity was calculated after pumping for 24 hours at a flow rate of 400 gpm. This flow rate of 400 gpm did not extract enough water to test the transmissivity of the aquifer further away from the Esposti Supply Well. For planning purposes in this report the lower value of transmissivity at 4,141 gpd/ft is used because it is more representative of longer duration pumping that is likely under operational conditions.

5.5.2 Calculation of Hydraulic Conductivity (Permeability, K)

Hydraulic conductivity (also known as permeability or K) is calculated from the transmissivity if the thickness of the aquifer is known or estimated. In this case, the aquifer is highly stratified and clay layers restrict vertical flow. Therefore, flow towards the Esposti Supply Well is dominantly horizontal and through the layers that are screened. As described in Section 5.7 the flow from the well is derived from approximately 88 feet of screen rather than the entire 160 feet of screen available in the well. The calculation of hydraulic conductivity (permeability or K) is provided below:

$$K = \frac{T}{b}$$ in units of gpd/ft^2

Where:

Transmissivity (T) = ranges from 4,141 gpd/ft to 7,822 gpd/ft

Aquifer Thickness (b) = Assumed to be the water transmitting portion of the screen or 88 feet of relatively permeable aquifer material

This results in a hydraulic conductivity that ranges from 47 gpd/ft^2 to 89 gpd/ft^2. According to Driscoll, 1986, these values for hydraulic conductivity (permeability or K) are typical of fine sands and silts. These low hydraulic conductivity values do not correlate to the Unified Soil Classification System (USCS) soil descriptions (well-graded gravel and well-graded sand) provided in the RMC's 2010 Installation Report. However, these low hydraulic conductivity values do correlate to the resistivity log (E-log) provided in RMC's 2010 Installation Report. A copy of the log for the Esposti Supply Well is provided in Appendix B

5.5.3 Calculation of Storage Coefficient

Storage coefficient is calculated from data collected at an observation well that is constructed within the same aquifer unit. The Bluebird Well is completed in the deeper aquifer only. There was no measured effect at the Bluebird Well during the pumping test. Therefore, no Storage coefficient has been calculated.

5.5.4 Calculation of Specific Capacity

Specific capacity as described by Driscoll (1986) is calculated by dividing the flow rate by the measured drawdown:

$$Sc = \frac{Q}{s} \text{ in units of gpm/ft}$$

Where:

Sc = Specific capacity
Q = pumping flow rate in gpm (800 gpm)
s = drawdown, change in elevation of pressure head in the pumping well

Specific capacity is time dependent because the pressure head in the pumping well will continue to decline as long as the well is in operation. Specific capacity is also flow rate dependent because higher flow rates have a larger head loss due to turbulent flow. Because of these factors, Specific capacity requires context of both the flow rate and duration of pumping in order to make a meaningful comparison.

Table 9 Calculations of Specific Capacity Esposti Supply Well

Year of Test	Duration of Pumping (hours)	Flow Rate (gpm)	Drawdown (feet)	Specific Capacity (gpm/ft)	Notes
2010	4.5	400	83	4.8	
2016	4.5	400	66	6.1	
2016	1	800	146	5.5	
2016	4	800	163	4.9	
2016	8	800	169	4.7	
2016	24	800	187	4.3	
2016	28	800	192	4.2	Recommended value for long-term planning regardless of pumping flow rate because of aquifer limitations

From a practical standpoint, the drawdown is measured after a relatively short duration of pumping, such as one hour. This allows for measuring Specific capacity throughout the life of the well to evaluate for the rate of well plugging. Table 10 below provides a summary of the commonly used hydraulic aquifer and well properties.

Table 10 Summary of Aquifer Properties

Transmissivity in gpd/ft	Estimated Storage Coefficient (dimensionless)	Specific Capacity gpm/ft
4,141	Not Calculated	5.5 at 1 hour
		4.3 at 24 hours

5.6 28-Hour Pumping Test – Analysis of Pumping Rate Limits

GHD has evaluated the upper limit of well pumping rate based on the construction of the well and aquifer properties. This section provides an analysis of the maximum efficient pumping rate. If a well is pumped at too high of a flow rate, the excessive turbulence can cause premature well failure and add to the pumping cost. Flow rate limiting factors related to the Esposti Supply Well consist of the effects of high velocity water moving into and through the casing and the effects of lowering (dewatering) the water table in the vicinity of the well. High velocity flow leads to an increase in turbulence, which in turn causes additional pressure head losses as the water converges towards the well. Thus, four evaluations were performed:

1. Entrance velocity limitation;
2. Up-hole velocity limitation;
3. Dewatering limitation; and
4. Annular space velocity limitation.

5.6.1 Entrance Velocity Limitation

Well screen entrance velocity is the speed at which water is entering the casing. If the entrance velocity is too high, excessive encrustation may result. Based on recommendations presented by Driscoll (1986), the maximum entrance velocity through the screen is 0.1 feet per second (ft/sec). The calculation below provides the maximum flow rate from the well before the average entrance velocity exceeds the recommended 0.1 ft/sec:

$$Q = VA$$

Where:

V = entrance velocity equal to 0.1 ft/sec (maximum)

A = open area of the entire length of screen (29 ft^2) Note

Q = maximum pumping rate in (ft^3/sec) without exceeding entrance velocity (result of calculation is 2.9 ft^3/sec)

Note: The well log indicates a 10-inch diameter well with a 160-foot screen interval, well screen slots are 0.125 inches at 34% open area = 29 ft^2 of open area.

Using the equation above, the maximum pumping rate before exceeding the 0.1 ft/sec entrance velocity limit is 1,301 gpm. However, as discussed below the active spinner log data indicates that approximately 45% of the available screen is not producing significant water. This implies that only 55% of the 1,301 gpm is realistically available. Therefore, this criterion is set at 55% of 1,301 gpm or 715 gpm.

5.6.2 Up-hole Velocity Limitation

Up-hole velocity is the speed of the water in the well casing as it moves into the pump. It is desirable to keep the up-hole velocity below 5 ft/sec because of turbulence in the flow causes pressure head loss. The cross sectional area of the 10-inch diameter casing of the Esposti Supply Well is 0.545 ft^2. The maximum desirable flow rate is calculated by multiplying the cross sectional area by 5 ft/sec.

$$Q = VA$$

Where:

V = entrance velocity equal to 5 ft/sec (maximum)

A = open area of the entire length of the casing (0.545 ft^2)

Q = maximum pumping rate in (ft^3/sec) without exceeding up-hole velocity (result of calculation is 2.7 ft^3/sec)

Using the equation above, the maximum pumping rate before exceeding the 5 ft/sec up-hole velocity limit is 1,211 gpm.

5.6.3 Dewatering Limitation

The rate of the Esposti Supply Well should be limited such that the aquifer near the well does not dewater by more than 80% of the saturated thickness. This criterion is more relevant to shallow unconfined aquifers and is not applicable to the Esposti Supply Well. If the aquifer is dewatered more than 80% of the saturated aquifer thickness, there could be in increase in turbulent flow within the aquifer and a reduction in the effective transmissivity. The limit to flow rate based on these criteria can be calculated by using the aquifer properties calculated above together with estimates of the expected duration of continuous operation of the well. The top of the screen is at 383 feet BTOC and static groundwater is at approximately 40 feet bgs. Pumping the water down to the top of the screen would require 343 feet of drawdown, which is far in excess of the capacity of pumps that are available for this size casing. In addition, this would put excessive compression stress on the casing and incur a high risk of casing collapse.

5.6.4 Annular Space Velocity Limitation

The water velocity in the annular space between the motor of a submersible pump and the well casing can be analyzed in a manner similar to the up-hole velocity discussed above. In this case, the maximum desirable velocity of 5 ft/sec is used here because of turbulence in the flow causes pressure head loss. The cross sectional area of the 10-inch diameter casing of the Esposti Supply Well is 0.545 ft^2. The diameter of the largest pump and motor is 7.5 inches which results in a cross sectional area of 0.310 ft^2. Subtracting these two areas results in the cross sectional area through which the groundwater flows around the motor and up into the intake of the pump (0.235 ft^2). The maximum desirable flow rate is calculated by multiplying the cross sectional area by 5 ft/sec.

$$Q = VA$$

Where:

V = entrance velocity equal to 5 ft/sec (maximum)

A = open area between the submersible motor and casing (0.235 ft^2)

Q = maximum pumping rate in (ft^3/sec) without exceeding a velocity of 5 ft/sec in the annular space (result of calculation is 1.175 ft^3/sec)

Using the equation above, the maximum pumping rate before exceeding the 5 ft/sec annular space velocity limit is 527 gpm (1.175 ft^3/sec). Based on this calculation the diameter of the pump relative to the diameter of the casing may be a limiting factor in the theoretical maximum flow rate.

5.6.5 Summary of Well Flow Rate Limitations and Pumping Rate Recommendation

The pumping rate limits are summarized in the table below:

Table 11 Summary of Pumping Rate Limiting Factors Espoisti Supply Well

Limitation	Flow Rate in gpm
Entrance Velocity	
Up-hole Velocity	1,211
Dewatering Limitation	Not Applicable
Annular Space Velocity Limit – cross section area between the submersible motor and the well casing.	527

Note:
A long-term (>24 hours) flow rate of 400 gpm (75% of 527) is appropriate given the flow rate limiting factors, reductions in well efficiency that will occur with age, and the hydrogeologic boundary that reduces Transmissivity.

An appropriate design flow rate is taken as 75% of the most restrictive of the rate limiting factors. This provides a design safety factor of 25% to account for reduced well efficiency over time or hydrogeologic limitations that become apparent after long duration pumping. Therefore, the flow rate for design purposes for the Esposti Supply Well is 400 gpm (75% of 527 gpm).

5.7 Results of Active Spinner Log

As discussed in Section 4.2, the April 2016 static spinner log (no pumping) identified approximately 5 gpm of downward groundwater flow between 1st screened zone (384-423 ft BTOC) and the 4th screened section (484-510 ft BTOC). This downward flow may be the result of spring recharge increasing groundwater elevations in the shallow aquifer. The natural flow of water between these zones may change direction seasonally due to summer pumping in the shallow aquifer. This natural movement of groundwater indicates that the 1st and 4th screen zones are separate hydrogeological units.

The purpose of the active spinner log was to identify the relative contribution to well production from each of the separate screen zones. On August 23, 2016, GHD oversaw West Coast perform an active spinner log (active pumping) during an almost 4 hour, 400 gpm pumping period. A 6-inch pump extracted groundwater while the spinner tool was lowered into the well. The rate of spin of the spinner tool impeller is proportional to the velocity of water in the well casing. This data is used to calculate the flow contribution of each of the screen zones.

The results of this spinner log are provided in Figure 6. The active spinner log indicates significant flow contribution to the total well yield through the 1st screen interval (36% of total flow), the 4th screen (22% of total flow) interval, and 5th screen (28% of total flow) interval. The 2nd, 3rd, and 6th screened sections were collectively 11% of the total flow from the screens, this means that approximately 45% of the screened aquifer is not transmitting water into the well casing. This appears to be a result of low permeability aquifer material within the 2nd, 3rd, and 6th screened sections rather than a well development problem. Appendix F presents the Static and Active Spinner Log reports of findings from West Coast.

5.8 8-Hour Zone Pumping Test Field Setup

The 8-hour, 300 gpm pumping test extracted groundwater from the 1st screened interval of the well using a zone-isolating packer installed in the underlying blank section of screen at approximately 425 feet BTOC to the top of the packer. The purpose of this test was to induce the maximum sustained flow from this upper well screen section and collect representative water quality samples from this zone of the aquifer.

5.8.1 8-Hour Zone Pumping Test - Water Handling Equipment

The pump used to operate the 8-hour zone pumping test was a Grundfos 6-inch 50-hp submersible pump. Appendix I provides a copy of the pump curve. The intake of the pump was set at 342 feet BTOC, which is 42 feet above the top of the upper-most screen and approximately 300 feet below the elevation of static water level.

GHD did not collect or evaluate observation well data for the 8-hour zone pumping test because distance drawdown calculations were evaluated during the 28-hour 800 gpm pumping test, and those previous results indicated no effects on observation wells from the Esposti Supply Well pumping. However, GHD did install transducers in the Esposti Supply Well above and below the packer to measure pressure changes caused by hydraulic communication through the gravel pack between the 1st screened interval and the underlying screened intervals.

Pumped water was discharged to manhole S130 without the use of storage tanks or filtration. The water was clear and turbidity free. Groundwater samples were collected from the sample port, which consisted of a ¼-inch diameter brass tube operated by a ball valve located at the wellhead after the flow meter.

5.9 8-Hour First Screen Zone Pumping Test Operation

The 8-hour zone pumping test was conducted to evaluate the water quality and flow rate of the 1st screen section where lower concentrations of arsenic were found during zone sampling in 2010. The Esposti Irrigation Well was shut off the day before the 8-hour zone pumping test. Once the test started it ran continuously for 8 hours, and at the end of the test, the groundwater was allowed to recover continuously (Figure 7). A summary of the start-up and running conditions of the test is provided below:

Pre-Test Preparation

1. Installed the pump into the Esposti Supply Well, August 19, 2016.
2. Installed the transducers in the Esposti Supply Well on August 19 and 20, 2016.
3. All transducers were actively recording synchronously in the well by 11:30 AM on August 19, 2016.
4. On August 20, 2016, GHD and Weeks ran a preliminary pump test for 20 minutes to confirm that the zone-test flow rate and direct discharge were appropriate. The pump produced a maximum flow rate of 375 gpm with the discharge pipe flow valve wide open and a gradual decline below 375 gpm was noted. GHD concluded that the 8-hour zone test would be conducted at 300 gpm.

Start/End of 8-Hour First Screen Zone Test

1. Pumping of the Esposti Supply Well started at 7:00 AM, August 21, 2016 at 300 gpm.
2. The pumping rate was held at a steady 300 gpm by manually operating the flow control valve at least once every hour.
3. Sampling and parameter monitoring was conducted frequently during the first hour of pumping, then every ½ hour thereafter.
4. End of Pumping at 3:00 PM August 21, 2016.

Groundwater Recovery Monitoring

1. Start of the groundwater recovery period began at 3:00 PM August 21, 2016, depth-to-water values were manually collected for one hour by Weeks, and groundwater recovery transducer data was collected.
2. End of recovery period and data record at 9:30 AM August 22, 2016.

5.10 8-Hour First Screen Zone Pumping Test Analytical Results and Analysis

Sample results are summarized in this section. All laboratory analysis was performed through Alpha Analytical. Field measurements of water quality parameters of temperature, pH, ORP, EC, and TDS were made frequently using an Myron Ultrameter^{TM}. In addition, visual observations were noted on the field sheets. This information is provided in daily work sheets and data collection forms, which are provided in Appendix H.

5.10.1 8-Hour First Screen Zone Pumping Test - Results of Sample Analysis During Test

Water samples were collected during the 8-hour zone test to monitor changes in water quality over time after continuous pumping. These samples were analyzed for arsenic, manganese, and iron in addition to frequent analysis of field parameters at start-up and during sustained pumping (Table 12). The 8-hour zone test total arsenic concentration and time data for the Esposti Supply Well are graphed in Figure 8 on semi-log scale along the time axis. As Figure 8 indicates, arsenic concentrations decline linearly when plotted on semi-log scale. This implies that the water recovered during this test is a mixture of high-arsenic water and low-arsenic water. First water extracted is actually high-arsenic water that upwelled into the 1st zone from deeper in the well when the well was not pumping. As the 1st zone pumping continued, water high in arsenic, was cleared out and water more representative of 1st zone (low in arsenic) increased. The 1st zone pumping did not continue long enough to reach a final concentration of arsenic, but GHD's estimation is that arsenic in the first zone could be expected to range between 0.010 and 0.020 mg/L.

Table 12 8-Hour Zone Pumping Test Results of Samples During Test (September 21, 2016)

Sample ID	Date	Iron Diss.[1]	Iron Total	Mn Diss.[1]	Mn Total	As Diss.[1]	As Total	Sample time after start
		mg/L[2]						
ESW-9-21-07:01	9/21/2016	---	1.70	---	0.86	---	0.058	1 min
ESW-9-21-07:05	9/21/2016	---	3.40	---	1.10	---	0.052	4 min
ESW-9-21-08:00	9/21/2016	---	0.26	---	0.86	---	0.043	59 min
ESW-9-21-11:00	9/21/2016	---	0.19	---	0.91	---	0.038	239 min
ESW-9-21-15:00	9/21/2016	---	0.14	---	0.91	---	0.035	479 min
MCL mg/L			**0.300**		**0.050**		**0.010**	

Notes:

1 = No samples were analyzed as dissolved (filter before adding acid preservative).
2 = Milligrams per Liter (parts per million)
NA = Not applicable
<0.10 = Less than laboratory detection limit.
--- = Not analyzed

5.10.2 8-Hour First Screen Zone Pumping Test - Water Sample Analysis at End of Pumping

Samples of extracted groundwater were collected immediately prior to shut down. These samples represent a mixture of water from the 1st screen zone and the rest of the underlying well screens. The key results are summarized below in Table 13. Table A (Appendix K) provides a comparison of analytical results. As shown in Table 13 the water does not meet the drinking water standard for arsenic and manganese. Additionally, it is notable that silica was relatively high (86 mg/L). High silica concentrations complicate the treatment of arsenic by adsorptive media. Analytical results are included in Appendix J.

Table 13 Analytical Results From Final Sample 8-Hour Zone Pumping Test (September 21, 2016 at 3:00 pm)

Constituent	Analytical Method	Upper Zone Pumping at 300 gpm for 8 Hours (mg/L[1])	State MCL Drinking Water Standard Units in mg/L (Unless Otherwise Noted)
Arsenic	EPA 200.8	**0.035**	0.010
Calcium	EPA 200.7	23	
Chromium (Total)	EPA 200.8	<0.008	0.05
Chromium (Hexavalent)	EPA 200	<0.001	0.01
Iron	EPA 200.7	0.140	0.3 (SMCL)
Magnesium	EPA 200.7	18	
Manganese	EPA 200.8	**0.910**	0.05 (SMCL)
Potassium	EPA 200.7	14	
Sodium	EPA 200.7	52	
Phosphate (Total)	SM4500-PE	1.2	
Silica	SM4500-SiO2 C	86	
Total Alkalinity as $CaCO_3$	SM2320B	220	
Chloride	EPA 300.0	22	250 (SMCL)
Nitrate as N	EPA 300.0	<0.20	10
Nitrite as N	EPA 300.0	<0.20	1.0
Total Nitrogen	SM4500-N	<1.0	
Total Kjeldahl Nitrogen	SM4500-NorgB	<1.0	
Sulfate as SO_4	EPA 300.0	14	250 (SMCL)
Tannins & Lignins	SM5550B	<0.50	
Total Suspended Solids	SM2540D	3.5	
Total Organic Carbon	SM5310C	<0.300	

Notes:
1 = Some analytical results are reported in units of µg/L these have been converted to mg/L for ease of comparison with water quality standards
NA = Not analyzed
MCL = Maximum Contaminant Level
SMCL = Secondary Maximum Contaminant Level
NL = Notification Level

5.10.3 8-Hour First Screen Zone Pumping Test - Results of Field Parameter Monitoring

Parameters of temperature, pH, EC, TDS, and ORP were monitored frequently during the test. The monitoring was more frequent during pumping test startup and parameters were measured concurrent with sample collection. The raw data is available along with site visit reports in Appendix H. Review of the data indicates that temperature increases with increasing duration of pumping. This trend is shown on Figure 9 that provides a plot of temperature above and below the packer with increasing time. This change in temperature implies that the water from the formation associated with the 1st screen is cooler than the water from deeper in the well. It also implies that the extracted water is a mixture with a significant contribution of water bypassing the packer through the filter pack. Table 14 below presents an average of the last 5 measurements collected for parameters during the 8-hour zone test. ORP was not stable enough to provide a single value to represent extracted groundwater.

Table 14 Average of Last Five Measurements Near the End of the 8-Hour Pumping Test For Each Field Parameter

Well	Temp (ºF)	pH	EC (µS/cm)	TDS (mg/L)
Esposti Supply Well	**79**	**7.28**	**532**	**365**

Notes:
ºF = Degrees Fahrenheit
µS/cm = microsiemens
mg/L = milligrams per liter

5.11 8-Hour First Screen Zone Pumping Test Drawdown Results and Analysis

Figure 7 shows the pressure head drawdown associated with groundwater above and groundwater below the packer. The occurrence of a pressure change below the packer indicates that there was a hydraulic connection between the 1st screen zone and the lower parts of the well through the filter pack. This likely resulted in some flow of groundwater through the filter pack from the lower part of the well and into the 1st screen zone during pumping. The hydraulic aquifer property of Transmissivity was not calculated because the volume of water bypassing the packer through the filter pack can only be estimated and this would affect the calculated value. Storage coefficient can only be calculated from data collected using data from an observation well that is constructed within the same aquifer unit. There was no observation well available during this test. Therefore, no Storage coefficient was calculated.

5.11.1 Calculation of Specific Capacity

Specific capacity, as described by Driscoll (1986) and discussed above in Section 5.5.4, is calculated by dividing the flow rate by the measured drawdown. The 300 gpm zone test specific capacity after 1, 4, and 8 hours was 2.7, 2.5, and 2.4 gpm/ft, respectively. This value represents what the 1st screened interval with flow bypassing the packer can produce in gpm for every foot of groundwater drawdown. Therefore, the final specific capacity value of 2.4 gpm/ft in the Esposti Supply Well with the packer set between the 1st and 2nd screen intervals is likely an over estimate if applied to only the 1st screen zone.

5.12 8-Hour First Screen Zone Pumping Test Rate Analysis

Similar to that previously discussed in Section 5.6 and subsections, GHD has evaluated the pumping rate limit for the 1st screen zone with a packer in place. This analysis is useful for evaluating the feasibility of pumping from only the 1st screen or constructing a new well in the

Esposti Park area with a screen restricted to the interval of 384 to 424 feet bgs. Flow rate limiting factors related to this analysis consist of the effects of high velocity water moving through the screen and the casing. Equation details and thorough definitions of pump rate analysis are included in Section 5.6 and briefly below. Four evaluations were performed:

1. Entrance velocity limitation;
2. Up-hole velocity limitation;
3. Dewatering limitation; and
4. Annular space velocity limitation.

5.12.1 Entrance Velocity Limitation

Well screen entrance velocity is the speed at which water is entering the casing, where the maximum entrance velocity through the screen is 0.1 feet per second (ft/sec). The flow rate from the well that can be extracted before the average entrance velocity exceeds the recommended 0.1 ft/sec is calculated using the equation below:

$$Q = VA$$

Where:

V = entrance velocity equal to 0.1 ft/sec (maximum)

A = open area of the entire length of screen (7.3 ft^2) $^{\text{Note}}$

Q = maximum pumping rate in (ft^3/sec) without exceeding entrance velocity (result of calculation is 0.73 ft^3/sec)

Note: The well log indicates a 10-inch diameter well with a 40-foot 1st screen interval, well screen slots were 0.125 inches at 34% open area = 7.3 ft^2 of open area.

Using the equation above, the maximum rate at which the well could be pumped before exceeding the 0.1 ft/sec entrance velocity limit is 0.73 ft^3/sec = 328 gpm.

5.12.2 Up-hole Velocity Limitation

It is desirable to keep the up-hole velocity below 5 ft/sec because of turbulence in the flow causes pressure head loss. The cross sectional area of the 10-inch diameter casing of the Esposti Supply Well is 0.545 ft^2. The maximum desirable flow rate is calculated by multiplying the cross sectional area by 5 ft/sec.

$$Q = VA$$

Where:

V = entrance velocity equal to 5 ft/sec (maximum)

A = open area of the entire length of the casing (0.545 ft^2)

Q = maximum pumping rate in (ft^3/sec) without exceeding up-hole velocity (result of calculation is 2.7 ft^3/sec)

Using the equation above, the maximum rate at which the well could be pumped before exceeding the 5 ft/sec up-hole velocity limit is 1,211 gpm.

5.12.3 Dewatering Limitation

Pumping the water down to the top of the screen would require 343 feet of drawdown, which puts the well at risk of casing collapse. This limit does not apply.

5.12.4 Annular Space Velocity Limitation

The water velocity in the annular space between the motor of a submersible pump and the well casing can be analyzed in a manner similar to the up-hole velocity discussed above. In this case, the maximum desirable velocity of 5 ft/sec will be used because of turbulence in the flow causes pressure head loss. The cross sectional area of the 10-inch diameter casing of the Esposti Supply Well is 0.545 ft^2. The diameter of the 8-hour zone test pump and motor is 6 inches, which results in a cross sectional area of 0.0.196 ft^2. Subtracting these two areas results in the cross sectional area through which the groundwater flows around the motor and up into the intake of the pump (0.349 ft^2). The maximum desirable flow rate is calculated by multiplying the cross sectional area by 5 ft/sec.

$$Q = VA$$

Where:

V = entrance velocity equal to 5 ft/sec (maximum)

A = open area between the submersible 6- inch motor and casing (0.349 ft^2)

Q = maximum pumping rate in (ft^3/sec) without exceeding a velocity of 5 ft/sec in the annular space (result of calculation is 1.75 ft^3/sec)

Using the equation above, the maximum rate at which the well could be pumped before exceeding the 5 ft/sec annular space velocity limit is 783 gpm (1.75 ft^3/sec). Based on this calculation the diameter of the 6-inch pump relative to the diameter of the casing will not be a limiting factor in flow rate.

5.12.5 Summary of Well Flow Rate Limitations and Pumping Rate Recommendation

The pumping rate limits are summarized in the table below:

Table 15 Summary of Pumping Rate Limiting Factors 1st Screen Zone Esposti Supply Well

Limitation	Flow Rate in gpm
Entrance Velocity	
Up-hole Velocity	1,211
Dewatering Limitation	Not Applicable
Annular Space Velocity Limit – cross section area between the submersible motor and the well casing.	783

Note:
A long-term (>24 hours) flow rate of 250 gpm (75% of 328) is appropriate given the flow rate limiting factors, reductions in well efficiency that will occur with age, and the hydrogeologic boundary that reduces Transmissivity for the Esposti Supply Well with a 1st zone isolation packer.

An appropriate design flow rate is taken as 75% of the most restrictive of the rate limiting factors. This provides a design safety factor to account for reduced well efficiency over time or hydrogeologic limitations that become apparent after long duration pumping. Therefore, the flow rate for design purposes for the 1st screen zone when using a packer is 250 gpm (75% of 328 gpm). The contribution to flow due to packer bypass is difficult to estimate. However, considering the large increase in temperature above the packer under pumping conditions (Figure 9) packer bypass could be half of the flow. Therefore, it is estimated that the 1st screen zone can produce no more than 175 gpm (half of 250 gpm).

5.13 Esposti Irrigation Well Sampling

The Esposti Irrigation Well analytical results provide data for comparison to the analytical results from pumping the entire the Esposti Supply Well or just the upper screen of the Esposti Supply Well. The Esposti Irrigation Well operates during the spring, summer, and fall to supply irrigation water to the park. The well operates with very frequent start and stop cycles. The Esposti Irrigation Well is not metered and flow rate and total volume pumped data was not available during this test. Depth-to-water measurements were difficult to collect because of wellhead obstacles. The transducer was not placed deep enough in the well to monitor the large swings in water level caused by pump operation. When the well is pumping, the water elevation in the well drops below the elevation of the transducer.

5.13.1 Esposti Irrigation Well Water Quality

The Esposti Irrigation Well is located approximately 29 feet south of the Esposti Supply Well with two screened intervals from 100 to 220 and 240 to 300 feet bgs (Figure 2). GHD sampled the Esposti Irrigation Well and analyzed for selected Title 22 water quality parameters as a comparison with the Esposti Supply Well 8-hour pumping zone test (1st zone , 383 feet to 423 feet BTOC) and the results of the 28-hour pumping test. The Esposti Irrigation Well was running normally and the Esposti Supply Well was not pumped at the time of sample collection. The results of sampling of the Esposti Irrigation Well are summarized below in Table 16 and the lab reports are included in Appendix J. As shown in Table 16 the water meets all of the analytical standards for drinking water under Title 22 with the exception of arsenic and manganese. A comparison between the Esposti Supply Well and the Esposti Irrigation Well is available in Table A provided in Appendix K.

Table 16 Analytical Results from Sample of Esposti Irrigation Well September 6, 2016 at 10:45 AM

Constituent	Analytical Method	Esposti Irrigation Well (mg/L[1])	State MCL Drinking Water Standard Units in mg/L (Unless Otherwise Noted)
Arsenic	EPA 200.8	**0.013**	0.010
Cadmium	EPA 200.8	<0.001	0.005
Calcium	EPA 200.7	**19**	
Chromium (Total)	EPA 200.8	<0.010	0.05
Chromium (Hexavalent)	EPA 200	<0.001	0.01
Iron	EPA 200.7	<0.1	0.3 (SMCL)
Magnesium	EPA 200.7	**19**	
Manganese	EPA 200.8	**1.5**	0.05 (SMCL)
Potassium	EPA 200.7	**7.1**	
Sodium	EPA 200.7	**31**	
Vanadium	EPA 200.8	<0.003	0.05 (NL)
Phosphate (Total)	SM4500-PE	**0.95**	
Silica	SM4500-SiO2 C	**85**	
Total Alkalinity as $CaCO_3$	SM2320B	**150**	
Chloride	EPA 300.0	**27**	250 (SMCL)
Nitrate as N	EPA 300.0	<0.20	10
Nitrite as N	EPA 300.0	<0.20	1.0
Total Nitrogen	SM4500-N	<1.0	
Total Kjeldahl Nitrogen	SM4500-NorgB	<1.0	
Sulfate as SO_4	EPA 300.0	**9.2**	250 (SMCL)

Notes:
1 = Some analytical results are reported in units of µg/L these have been converted to mg/L for ease of comparison with water quality standards
NA = Not analyzed
MCL = Maximum Contaminant Level
SMCL = Secondary Maximum Contaminant Level
NL = Notification Level

5.13.2 Esposti Irrigation Well Water Quality Discussion

The results of the Esposti Irrigation Well sampling represent shallow water quality from the subsurface at depths from approximately 100 to 300 feet bgs. This is 80+ feet shallower than the Esposti Supply Well's 1st screen interval. An arsenic concentration of 0.013 mg/L and high manganese concentration of 1.5 mg/L would require treatment if considered for potable use. The flow rate limitations and age of the Esposti Irrigation Well make it unsuitable as a municipal supply well.

5.14 Esposti Park Area – Summary of Aquifer Pumping Rate and Water Quality Expectations

During meetings with the Town, the concept of installing multiple new shallow wells in the Esposti Park area was considered as an alternative to bringing the Esposti Supply Well online. These concepts were discussed based on the lower concentration of arsenic in the shallower aquifer system. Although analyzing the option of new wells was not part of the scope of work of this project, much of the data presented in this Report is usable for addressing new well concepts with respect to the pumping rate and water quality. Three of these new well concepts are outlined below:

1) A new well completed with a screened interval from 100 to 300 feet bgs (similar to existing Esposti Irrigation Well). This well would be expected to yield up to 200 gpm with arsenic up to 0.015 mg/L and manganese up to 1.5 mg/L. Treatment for both would be required.

2) A new well completed with one screened interval from 385 to 425 feet bgs (similar to existing Esposti Supply Well 1st screen interval). This well would be expected to yield up to 175 gpm with arsenic up to 0.035 mg/L and manganese up to 1.0 mg/L. Treatment for both would be required.

3) A new well completed with screens within the interval from 100 to 425 feet bgs (similar to combining the existing screen of the Esposti Irrigation Well together with the 1st screen interval of Esposti Supply Well). This well would be expected to yield up to 300 gpm with arsenic up to 0.025 mg/L and manganese of up to 1.25 mg/L. Treatment for both would be required.

These concepts are provided here to capture the results of analysis from this project and may be useful as a starting point for other groundwater related projects. The three concepts presented above are not provided as recommended alternative projects but for discussion purposes only.

5.15 Esposti Park Area Managed Aquifer Recharge Potential

The potential for managed aquifer recharge in the Esposti Park area utilizing the Esposti Supply Well is limited by the low hydraulic conductivity of the aquifer, poor native water quality, and physical attributes of the Esposti Supply Well as it was constructed. The hydraulic conductivity of the aquifer is relatively low because it consists of a high percentage of silts and clays. The small pore size of silt and clay aquifers make them very susceptible to clogging during the injection of water. The hydraulic conductivity for the Esposti Supply Well varies between 47 gpd/ft^2 to 89 gpd/ft^2. The lowest hydraulic conductivity referenced in Payne 2005 (Aquifer Storage and Recovery, second edition) is 40 gpd/ft^2. Payne identified this test well as having very rapid clogging when compared to other wells in aquifers with higher hydraulic conductivities. When operating an aquifer recharge system, frequent back flushing of the well is required to remove clogging material. Back flushing is completed by pumping the well at twice the injection rate and discharging this water to waste. Therefore, if injection is performed at a rate of 400 gpm then back flushing at a rate of 800 gpm could be expected.

Poor native water quality is a significant economic barrier to recharge by well injection. Injected water must be treated to a very high standard to remove bacteria, organics, and suspended matter. When it is recovered, it will contain both arsenic and manganese and will require treatment before use. The Esposti Supply Well was not constructed as an injection well, which is a limiting factor for its use for injecting water. While the cement well seal meets the requirements of a drinking water well it is unlikely to maintain a tight seal under injection pressures. Concrete seals tend to shrink away from the boring wall leaving a small gap or weak separation that can form a conduit for high-pressure water to migrate back up to the surface. A modern injection well has a seal design that minimizes seal bypass by high-pressure injected water. In summary, cost effective application of managed aquifer recharge in the Esposti Park area is unlikely to be successful.

6. Esposti Supply Well Treatment Feasibility

6.1 Esposti Supply Well Treatment Feasibility Overview

The goal of this treatment feasibility analysis is to identify key constraints and establish a planning level cost for implementing treatment for the Esposti Supply Well. This evaluation of treatment feasibility consists of a seven-step process summarized below:

- Develop a treatment system operating concept that considers water quality, flow rate, annualized operation pumping volumes, site use restrictions, and existing infrastructure limitations.
- Evaluate potential treatment options at a concept level relative to cost and fatal flaws. Summarize a short list of viable treatment alternatives.
- Evaluate and compare viable treatment alternatives for cost and application constants.
- Develop a concept level configuration of the most likely treatment option.
- Evaluate alternatives for siting this treatment system and configuration at Esposti Park.
- Develop a desktop cost analysis of the most likely treatment alternative and siting at Esposti Park.
- Compare the most viable treatment system alternative with the CEQA evaluations prepared in 2010.

6.2 Treatment System Operating Parameter Concept

The treatment system operating parameter concept developed here is based on the 28-hour pumping test, the 2010 Installation Report prepared by RMC, and discussions with the Town regarding likely operational preferences. Table 17 summarizes the key design parameters used in this evaluation. This table summarizes the most likely operational and water quality parameters of the Esposti Supply Well based on the results of this test. If the Town chooses to advance the Esposti Supply Well to the predesign stage, the parameters provided in Table 17 should be provided to the treatment equipment manufacturers for evaluation prior to pilot testing.

Table 17 Esposti Supply Well Characteristics and Design Parameters

System Operation & Parameters	
Longer-term (>24 hours) Steady State Flow Capacity (for use in pre-design)	400 gpm
Transmissivity	4,141 gpd/ft
Specific Capacity	4.2 gpm/ft
High Season Runtime	100% (24/7 during high demand months)
Annual Well Utilization	50% (Off during low demand months)
Disinfection	
Disinfectant	Sodium Hypochlorite
Discharge Point	Distribution
Well Pump	
Operation Type	On or off, non-variable flow rate, full flow only
Pressure at System Input	120 psig
Wastewater Handling	
Backwash Discharge Available?	Yes
Discharge Point	Sewer
Zero Discharge Required?	No
Treatment Options	
Bypass/Blend OK?	Yes
Spare Capacity Required?	No
Use of CO_2, HCl, H_2SO_4 or NaOH OK?	Only CO_2
Process Control	
System Automation	Yes
SCADA Interface	Yes
Notes	
Summary of Water Quality	
pH	7.60
Temperature	up to 80° F
ORP (EMF)	variable
Conductivity (EC)	520 µS/cm
Tannins-Lignans	<0.50 mg/L
TDS	350 mg/L
TSS	3.5 mg/L
Turbidity	0.26 NTU

Cations	
Hardness	120 mg/L $CaCO_3$
Ammonia	<0.50 mg/L NH_3
Calcium	22 mg/L
Magnesium	16 mg/L
Sodium	53 mg/L
Anions	
Alkalinity	220 mg/L $CaCO_3$
Bicarbonate	270 mg/L $CaCO_3$
Carbonate	<5.0 mg/L $CaCO_3$
Chloride	21 mg/L
Fluoride	0.15 mg/L
Nitrate	<0.40 mg/L NO_3
Phosphate	1.4 mg/L
Silica	50 mg/L SiO_2
Sulfate	14 mg/L SO_4
Metals	
Antimony	<6.0 µg/L
Total Arsenic	57 µg/L
Copper	<50 µg/L
Iron	<100 µg/L
Lead	<5.0 µg/L
Manganese	860 µg/L
Mercury	<1.0 µg/L
Selenium	<5.0 µg/L
Vanadium	<0.003 µg/L

6.3 Potential Treatment Option Concepts

A desktop analysis of water treatment processes for the removal of both manganese and arsenic was performed. This analysis identified six treatment concepts that remove manganese and/or arsenic. Some of these processes are usually used to remove other contaminants such as high salinity. However, manganese and arsenic are non-target compounds and are removed efficiently only when in relatively low concentrations. The processes included in Table 18 removes manganese and/or arsenic in specific water treatment applications. Each treatment processes varies in complexity, cost, and operational constraints.

All of the processes listed in Table 18 remove manganese and arsenic to some degree. However, the first three listed have significant operational constraints for treating high concentrations of manganese and arsenic. These constraints and system costs make them a poor choice for the Esposti Supply Well. The last three are all proven technologies that have relevance to potential treatment of the Esposti Supply Well. Concept applications were developed for the most relevant three processes specific to the Esposti Supply Well site with all of the constraints in infrastructure and operations. For ease of comparison, Table 18 provides only the system capital cost. The cost of site preparation and water handling appurtenances is similar for each of the treatment alternatives. Operation cost is a variable between these treatment options. However, fatal flaws in three of the six treatment options remove them from detailed consideration. The operational cost among the three that are relevant is similar so that operational cost is not a decision factor. However, operation cost is included for the most viable option (Section 6.6).

Table 18 Esposti Supply Well Summary of Potential Treatment Options

Process and Relevance to Esposti Supply Well	Relative Cap. System Cost [1]	Viability Rating
Biological – This is a new technology primarily targeting multi- This process relies on living bacteria to degrade or mineralize soluble contaminants to non-soluble forms. This technology is in fewer vendors to support installations. Operation requires continuous operation is preferred. Technology is unproven for	Moderate capital ($0.9 M) cost, moderate operation cost, new technology, limited competition.	Poor – May require manganese. Instability of suppliers and do not align with
Membranes – Membrane treatment can remove manganese, contaminants. However, oxides of manganese and arsenic will backwash. Membranes cannot be shut down easily or remain discharge and has a very high power demand. The treated water	High capital cost ($1.4 M), high operation cost due to power demand and frequent maintenance.	Poor – high cost, waste brine management and operational complexity do not align with project goals.
Resin Media – Resins can remove arsenic and provides simple on-off cycling with infrequent backwash. Resin regeneration can managed. Resins are also sensitive to adsorption of non-target breakthrough curve that requires frequent sampling and a Resins are not cost-effective for manganese because of the low	Moderate capital ($0.7 M) cost, high is directly arsenic loading rate. process is required	Poor – requires removal of manganese arsenic. Resin systems management requirement. Cost and
Iron Coprecipitation – Removes manganese and arsenic. Well provide soluble iron. Oxidation of the iron produces a flocculent waste. Manganese is removed if greensand is used as a filtering	Low/Moderate capital ($0.5 M) cost, moderate operation cost. Multiple manufacturers. Sludge management can be a significate operational cost.	method. At high arsenic, the process

Process and Relevance to Esposti Supply Well	Relative Cap. System Cost [1]	Viability Rating
Catalytic Oxidation (Greensand) – Removes manganese by greensand. This is an effective treatment for manganese but results in only partial treatment of arsenic. Backwash is required reclaimed. System can be idled with a pump-to-waste cycle at	Low capital ($0.4 M) cost, moderate operation cost. Multiple manufacturers keep market competitive.	
Media Adsorption – Arsenic is removed by filtering the water Al. Removes arsenic with simple on/off cycling and infrequent reduced sampling frequency. Pilot testing is required to determine Media is not good for multiple contaminants including manganese. Subject to competing adsorption by non-target compounds.	Moderate capital ($0.4M) cost, moderate operation cost. Operation cost is proportional to actual production.	Good – simple technology to operate but media use and disposal is a significant cost item.

Notes:
1 = Relative capital system cost. This cost includes only the treatment plant. It does not include the site work or appurtenances needed for all of the treatment options. Site work and appurtenances costs are relatively similar among the options. Capital costs were obtained from phone discussions with suppliers of equipment.

6.4 Comparison of Viable Treatment Options

The review summarized in Table 18 identified three treatment methods that are relevant to the Esposti Supply Well. Two of these methods treat either arsenic or manganese, not both. Because of this, these two treatment processes are combined into a two-step process to address the water quality issues for the Esposti Supply Well. The resulting treatment concepts for the Esposti Supply Well are provided below:

- One-Step Treatment – Iron Coprecipitation (Figure 10)
  Iron coprecipitation completes treatment of both manganese and arsenic using an addition of ferric chloride ($FeCl_2$) and oxidizer to the water to form a flocculent. The formation of flocculent captures the arsenic. The flocculent is filtered out using greensand filtration such that the manganese is oxidized and retained on the greensand. This flocculent (containing arsenic) and manganese oxide is then backwashed off the filter media and sent to a backwash storage tank or direct to sewer. The concept has two potential configurations; “A” configuration that includes a backwash tank to reclaim of the backwash water (Figure 10) and “B” configuration with backwash to sewer without a backwash tank (not shown in Figure 10).
- Two-Step Treatment – Combining Catalytic Oxidation with Media Adsorption (Figure 10):
    - Catalytic Oxidation (greensand) for treatment of manganese – With this process an oxidizing chemical such as chlorine or permanganate is added to the raw water and then filtered over a bed of greensand. The oxidized manganese forms a loose chemical bond with the greensand and is removed from the water. The system is backwashed to remove the manganese and the greensand is continuously reactivated through the addition of oxidizing chemicals. There is no need to replace

the greensand except on a long-term basis (5 to 7 years) after the backwashing process physically breaks down the greensand. The cost of greensand replacement is minor.

- Media adsorption for treatment of arsenic – There are a variety of media on the market for the removal of arsenic. Treatment modeling of the specific water chemistry is required to narrow down the various media options. On-site pilot testing or testing using rapid small-scale column testing follows treatment modeling. Determining the exact media appropriate for the Esposti Supply Well is not critical to the cost analysis at this concept level evaluation.

The two treatment concepts are summarized in Table 19. For this evaluation, iron coprecipitation is considered a one-step process which removes both manganese and arsenic in a single treatment process. As an alternative, catalytic oxidation and media adsorption are combined in a two-step process to remove manganese and arsenic, respectively. The number and size of treatment vessels, backwash frequency, and cost of consumables are calculated from information provided by manufacturers of the respective equipment. Concept configurations of the two different treatment concepts is provided on Figure 10. For comparison, the configuration of the Esposti Supply Well if used as an irrigation well is provided in Figure 10.

Table 19 Comparison Between Viable Treatment Options

Process		Number of Vessels	Backwash Frequency	Consumable $/Acre Ft [1]	Notes
One Step Process[2,3]					
Iron Coprecipitation (One step Manganese and arsenic removal) with two possible configurations A and B Vessels in parallel	A -System configuration with low flow rate sewer discharge (backwash tank)	Two 10-foot diameter vessels @ 200 gpm each	Every two days @ 1,245 gpm for each vessel for 10 min. each	$510	Backwash at 1,245 gpm is in excess of sewer capacity, which requires a backwash tank of 35,000-gallons.
	B - System configuration with high flow rate sewer discharge	Three 8-foot diameter vessels @ 133 gpm each	Every two days @ 850 gpm for each vessel for 10 min. each	$510	Backwash at 850 gpm direct to sewer discharge is near limit for dry weather sewer capacity.
Two Step Process[4]					
Greensand (Step 1 - Manganese removal)	Vessels in series	One 10-foot diameter vessel @ 400 gpm	Every three days @ 900 gpm for 10 min.	$NA[5]	Backwash at 900 gpm direct to sewer discharge is near limit for dry weather sewer capacity.
Adsorptive Media (Step 2 - Arsenic removal)		One 9-foot diameter vessel @ 400 gpm	Twice a month@700 gpm for 10 min.	$652[6]	Backwash at 700 gpm only to reduce compaction within bed.

Notes:

1 = Non chlorine consumable cost includes Ferric chloride, adsorptive media, and pH control. Chlorine costs are not included because of the variables in chlorine source cost require additional analysis.
2 = Hydraulic loading during filtration 2.4 gpm/ft^2, hydraulic loading during backwash 15 gpm/ft^2
3 = Ferric chloride cost $900/ton of 40% solution, 7 mg/L dosing concentration. Cost for chlorine feed at 6.7 mg/L Cl_2 not included in consumable calculation
4 = Hydraulic loading during filtration 5.3 gpm/ft^2, hydraulic loading during backwash 11.9 gpm/ft^2
5 = Cost for chlorine feed at 2.3 mg/L Cl_2 not included in consumable calculation
6 = Cost for chlorine feed at 0.5 mg/L Cl_2 not included in consumable calculation
- Sewer has been tested in dry weather up to 900 gpm and flows at 65% of full pipe (dry weather)
- Backwash discharge in excess of sewer capacity requires backwash tank of 35,000-gallon capacity for all backwash inputs with 30% freeboard and slope bottom (20-foot base X 18 feet high). Sludge discharged to sewer at flow rate below sewer capacity over two-day period.

6.4.1 Selection of Treatment Option

The one-step treatment concept using iron coprecipitation requires a significant input of $FeCl_2$ with a resulting high volume of waste flocculent to manage. This results in either an unacceptably large backwash tank or frequent high-flow backwashing to the sanitary sewer with high iron loading to the water reclamation plant. A large backwash tank is unacceptable at Esposti Park due to significant visual impacts and site constraints. Three smaller vessels are required to reduce the backwash flow rate for the iron coprecipitation configuration B concept. Smaller tanks can be backwashed at a lower flow rate that is within the capacity of the sanitary sewer (850 gpm). However, this increases operational complexity and extends the duration of backwash operations. Backwashing with the configuration B concept is very frequent and if the sewer were temporarily unavailable (i.e., sewer infiltration by rainfall) then water treatment would cease. For these reasons, both the configuration A and configuration B of the iron coprecipitation concept are undesirable alternatives compared with the two-step process.

The two-step treatment concept has a higher system capital cost because two tanks are needed in addition to piping and controls linking two separate systems. However, each system is less complex to operate and backwash frequency is less of a critical operational necessity. The two-step treatment alternative is the most viable option for addressing the high concentrations of both manganese and arsenic with the operational parameters desired by the Town.

6.5 Treatment System Siting Options

During various meetings with the Town, areas of Esposti Park were identified as potential locations for the installation of a treatment system. These locations are very preliminary and have not been vetted for functionality relative to the location of the well, power supply, water connection, vehicular access, and sewer disposal. They have also not been vetted relative to impacts to the residences or park operations. These locations are also not the only possibilities for a system location.

Esposti Park is a high-use facility for the Town and minimizing the impact of a treatment system is key to siting the treatment facility. Three location options are presented in this report as example locations; 1) northwest location option (Figure 11), 2) southeast location option (Figure 12), and 3) well location option (Figure 13). All three of these locations require connections to water, sewer, and power. The well location option has the highest visual impact on the park because of the central location. The southeast location option is less visible from the road but is in a highly used area near the parking lot and main ballfields. The northwest location option is the least impactful on the park but requires the longest underground piping connections. The northwest location is used in the cost analysis because it is the furthest from the well and has the longest piping runs. However, the location of the compound is not expected to significantly affect the overall project cost.

6.6 Treatment Cost

This cost evaluation considers the two-step treatment process located in the northwest corner of the park. Other system configurations and locations are possible but the cost of the overall project is unlikely to change significantly unless one or more primary design options such as flow rate (400 gpm) or end use (potable) are revised.

6.6.1 Treatment Cost – Capital Investment

Table 20 provides a summary of the line item costs associated with design and construction of a treatment system for the Esposti Supply Well.

Table 20 Esposti Supply Well Treatment Capital Cost

Esposti Supply Well Capital Cost For Two Step Treatment				
Catalytic Oxidation (Mn) With Adsorptive Media (As) Conceptual Estimate for System Installation				
DESCRIPTION	**QUANTITY**		**ESTIMATE**	
	NUMBER	**UNIT**	**UNIT COST**	**TOTAL**
Preliminary Design				
Location selection, survey, geotech, visual and noise impact assessments	1	LS	$60,000	$60,000
Preliminary CEQA analysis, assume MND with traffic, GHG models, tribal consultation	1	LS	$50,000	$50,000
Preliminary DoDW application and meetings	1	LS	$12,000	$12,000
Evaluation of specific vendor designs and requirements	1	LS	$4,000	$4,000
Evaluation of power connection for site	1	LS	$4,000	$4,000
Install permanent pump for 400 gpm system and power[1]	1	LS	$25,000	$25,000
Sewer capacity evaluation, field verification, permit application[2]	1	LS	$15,000	$15,000
Pilot testing of Cat. Oxidation (Mn) - field trailer and well pumping @ 400 gpm	1	LS	$30,000	$30,000
Rapid small scale column tests (RSSCT) of 3 media (As)[3]	3	EA	$7,000	$21,000
Preliminary Design subtotal				**$221,000**
Basis of Design Report				
Report to compile predesign results and finalize treatment process	1	LS	$18,000	$18,000
Basis of Design Report subtotal				**$18,000**
Detailed System Design and Bid Package				
Prefabricated treatment plant design coordination with manufacturer[4]	1	EA	$3,500	$3,500
Site Design (site, power, and piping connections) 15% of contractor site work subtotal[5]	1	LS	$69,107	$69,107
Bid package and engineering bid support	1	LS	$8,000	$8,000
Design subtotal				**$80,607**
Permitting Final Documents				
CDPH Negotiations and Meetings due to SRF Loan	1	EA	$5,000	$5,000
CEQA Mitigated. Neg. Dec. with visual impact map and construction mitigation plan	1	EA	$22,000	$22,000
Sewer discharge permit application	1	EA	$4,000	$4,000
Permitting Document subtotal				**$31,000**

Esposti Supply Well Capital Cost For Two Step Treatment

Catalytic Oxidation (Mn) With Adsorptive Media (As) Conceptual Estimate for System Installation

DESCRIPTION	QUANTITY		ESTIMATE	
	NUMBER	UNIT	UNIT COST	TOTAL
Prefabricated Treatment Plant				
- Filter tanks (two 10-foot diameter vessels)				incl.
- Tank internal distributors				incl.
- Initial filter media				incl.
- Headers and interconnection piping				incl.
- Filter flow sensors				incl.
- Filter control panel				incl.
- Backwash controls and booster pump (no sludge handling or backwash tank)				incl.
Prefabricated Treatment Plant with shipping	1	LS	$450,000	$450,000
Sales tax at 8.25% of total				$37,125
Treatment Plant subtotal				**$487,125**
Site work and installation of prefabricated treatment plant				
Markup on purchase of prefabricated treatment plant (10%)				$48,713
Grade and soil support for treatment plant	1	LS	$30,000	$30,000
Cement pad for treatment plant and gravel access	1	LS	$12,000	$12,000
Unit Install	1	LS	$12,000	$12,000
Chemical metering and Delivery System	1	EA	$16,000	$16,000
Chemical System Install inside small prefabricated enclosure	1	LS	$11,000	$11,000
pH adjustment system (assume CO2)	1	LS	$35,000	$35,000
Process Piping inside treatment plant compound	1	LS	$55,000	$55,000
Pump booster for backwash water to sewer	1	LS	$10,000	$10,000
Backflow prevention	1	LS	$6,000	$6,000
Site Electrical Design Modifications	1	LS	$24,000	$24,000
Process Controls and Integration	1	LS	$12,000	$12,000
Fence and visual screening of treatment tank (redwood panel)	1	LS	$12,000	$12,000
Power connection (overhead, new lines)	300	FT	$100	$30,000
Raw water well to treatment plant buried in road (4-inch)	400	FT	$150	$60,000
Treated water to distribution with backflow prevention buried in road (4-Inch)	100	FT	$150	$15,000
Sewer line connection backwash tank to S130 buried in road (4-inch force)	600	FT	$120	$72,000
Contractor Site Work subtotal				**$460,713**
Contractor Site Work and Prefabricated Treatment Plant subtotal				**$947,838**
General Conditions (8%)				$75,827
Bond / Insurance (2%)				$18,957
O&P (18%)				$170,611

Esposti Supply Well Capital Cost For Two Step Treatment

Catalytic Oxidation (Mn) With Adsorptive Media (As) Conceptual Estimate for System Installation

DESCRIPTION	QUANTITY		ESTIMATE	
	NUMBER	UNIT	UNIT COST	TOTAL
Contractor site work with prefabricated treatment plant subtotal				**$1,213,232**
Construction Management (15% contractor site work subtotal)				**$69,107**
Subtotal				$1,632,946
Predesign-Level Estimating Contingency (30%)				$489,884
Predesign-Level Project Budget Estimate (2016 Dollars)				**$2,122,829**

1 - Installation of the well pump is required for pilot testing and sewer flow confirmation. The cost and use of a temporary pump is high.

2 - A detailed sewer evaluation is required to verify that the sewer capacity is available under all backwash conditions. Backwash events may be restricted to times when capacity is available.

3 - Many equipment vendors offer field pilot test services for catalytic oxidation (greensand filtration) for removal of manganese (Step 1). During the field pilot test, three-200 gallon samples of the treated water are collected and sent to UC Davis for Rapid Small Scale Column Test of media for removal of arsenic (Step 2).

4 - Design services are for the purpose of specifying the performance of the equipment package. The treatment system manufacturer will provide process and equipment design specific to their systems.

5 - Design services are for the required site work to connect the prefabricated treatment plant to the Town's distribution system. Owner/Consultant designs raw and treated water connections, waste handling, reagent storage, and dosing systems and pH control.

6.6.2 Treatment Cost – Annual Operation

Table 21 provides a summary of the line item costs associated with operation and maintenance of a two-step treatment system for the Esposti Supply Well.

Table 21 Esposti Supply Well Operation Cost

Esposti Supply Well Two Step Treatment				
Catalytic Oxidation (Mn) With Adsorptive Media (As) Conceptual Estimate for O&M				
DESCRIPTION	**QUANTITY[1]**		**ESTIMATE**	
	NUMBER	**UNIT**	**UNIT COST**	**TOTAL ANNUAL**
Monthly Costs				
Monthly non-disinfection consumable (media replacement)	6	Month	$34,575	$207,450
Monthly power due to well pump and treatment system (150hp total @ $0.15/KWhr)	6	Month	$12,150	$72,900
Disinfection	6	Month	$2,500	$15,000
Compliance reporting	6	Month	$2,500	$15,000
Labor	6	Month	$3,200	$19,200
Sampling and analysis	6	Month	$2,000	$12,000
Additional training and/or operator license	6	Month	$1,000	$6,000
Long-Term Maintenance Costs				
Catalytic oxidation (greensand plus) replacement (Mn)	0.2	Year	$35,000	$7,000
Non-routine analysis	6	Est	$500	$3,000
Equipment repair and replacement average annual	6	Month	$1,500	$9,000
Predesign-Level Annual Operation Budget Estimate			Annual Cost	**$366,550**
Assuming 324 Acre-ft./Year production [1]			$/acre-ft.	**$1,131**

1 - Assume system operation at 400 gpm 24 hours/day for 183 days/year, amortization of capital cost not included

6.7 CEQA Analysis

Replacement of the Town's existing Esposti Irrigation Well was considered as Project W-2 in both the Water Master Plan and the associated programmatic EIR. This project was proposed in the Water Master Plan to provide a renewed water supply to meet existing and future demands and evaluated at a project-level in the associated EIR.

As described in the EIR, the Esposti Supply Well was the well installed in the spring of 2010 with an anticipated production capacity between 270 and 1,000 gpm. At the time of well construction, preliminary examinations of the groundwater in the vicinity of the well indicated that water extracted from this site may require treatment to reduce naturally-occurring concentrations of manganese, iron and/or arsenic in groundwater. As such, construction and operation of a new disinfection and treatment facility at the Esposti Park site, including space for chemical storage, was anticipated and evaluated in the EIR. The treatment system and chemicals evaluated would utilize a wellhead treatment system for manganese, arsenic, and potentially iron, as well as an updated chlorination system. The treatment system would include a horizontal treatment tank approximately 4 feet in diameter and 6 feet long. The type and quantity of treatment chemicals, and the size of chemical storage tanks, would be determined after additional testing. However, use of ferric chloride (flocculation), sodium hypochlorite (disinfection), and sodium hydroxide (pH adjustment) would likely be required. The treatment system would be housed in a new pump and water treatment building constructed of concrete masonry unit with a metal roof, between 1,000 and 2,500 square feet (sq. ft.) in size and similar in appearance to the existing restroom facilities at the park. The roof would be removable so that the pump can be removed for maintenance, and the building would have an exterior designed to blend in with the park and surrounding structures. The total footprint of the replacement well and facilities at this site would not extend beyond the parcel boundary of the park.

The Esposti Park project (Project W-2), as evaluated in the EIR, assumed that during periods of maximum production the well pump would run 24 hours per day. Motor noise would be negligible at the site because pump motors would be installed below ground (submersible pump type) or within the pump and treatment building (top set motor with turbine bowls). Lighting on the exterior of the buildings would be limited to standard door lights that would be set on timers or remain off at night.

To evaluate CEQA requirements on the current work conducted for this feasibility study and described herein, a long-term production rate of 400 gpm is recommended for the Esposti Supply Well. Groundwater produced from the well contains arsenic at concentrations of approximately 0.060 mg/L and manganese at concentrations around 1.0 mg/L. These concentrations are above the drinking water standards; therefore, treatment will be required prior to use as a potable supply. Testing has indicated that a two-stage treatment process is appropriate for the site, consisting of green sand to remove manganese followed by media treatment to remove arsenic. A treatment system sized for a production rate of 400 gpm would consist of two vertical tanks, approximately 12 feet in height, for the greensand and media treatment, and one horizontal tank, approximately 9 feet in height, for a contact tank. These tanks could fit within a space approximately 40 feet by 45 feet (or approximately 1,800 sq. ft.), along with a disinfection and oxidation building and the well connection. This treatment system could be located at one of three locations within Esposti Park (as sited depending on proximity to both the drinking water distribution and sanitary collection system pipelines) in the northeast corner of the park, in the southeast corner of the park, or immediately adjacent to the Esposti Supply Well (Figures 11, 12 and 13, respectively).

As configured herein, the treatment system fits within the size parameters evaluated within the programmatic EIR; the treatment system requires 1,800 sq. ft. of space, less than the maximum 2,500 ft^2 evaluated in the EIR. However, the 12-foot tall tanks require a much larger building if the system is to be enclosed inside a structure. The size of the treatment tanks assumed in the EIR was much smaller than those needed based on the recent testing. The site locations described herein assume a fenced enclosure for the treatment system (instead of a treatment building) because access for maintenance is available from outside of the fence line within the 20-foot easement (Figure 10). This change in facility size and design was not evaluated in the programmatic EIR. If these options are to be considered, it is recommended that an initial study (IS) be conducted to identify which impact areas may need to be re-evaluated and the appropriate level of environmental documentation to be prepared. At a minimum, it is anticipated that aesthetics (visual), noise, and traffic impacts may be different for a treatment system constructed and operated as described herein (versus in the programmatic EIR). For planning purposes and assuming that no additional significant unavoidable impacts are identified as part of the IS, it is assumed that a Mitigated Negative Declaration (MND) will be sufficient for meeting the requirements of CEQA. Additionally since the completion of the program-level EIR, AB52 has gone into effect. AB52 requires consultation with interested Native American Tribes. Therefore, AB52 consultation should also be initiated as part of the CEQA process.

7. Scope and Limitations

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Figures

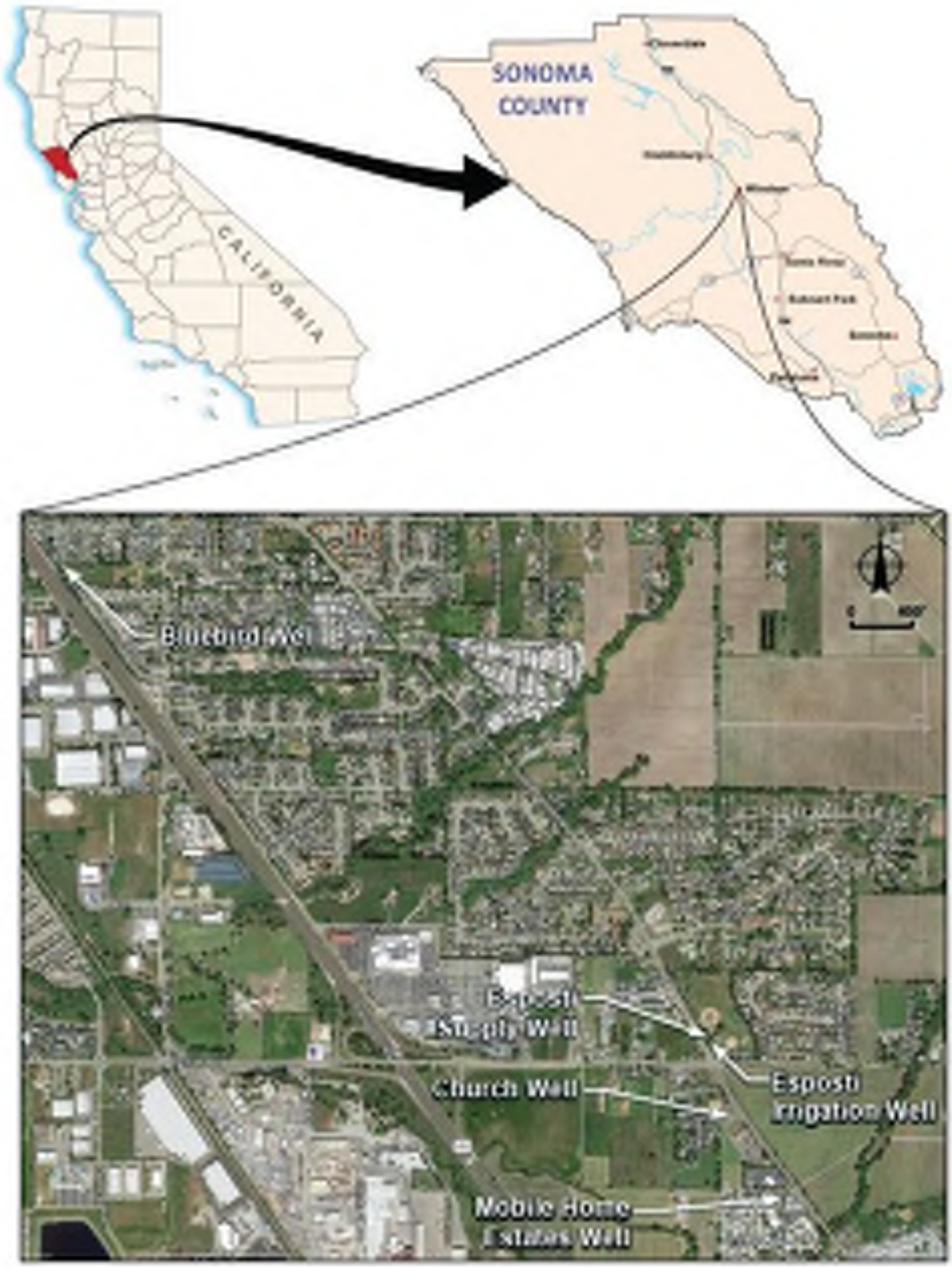


Figure 1 Site Location

Figure 2 Aerial Location Map

Figure 3 Esposti Supply Well With Camera Tool

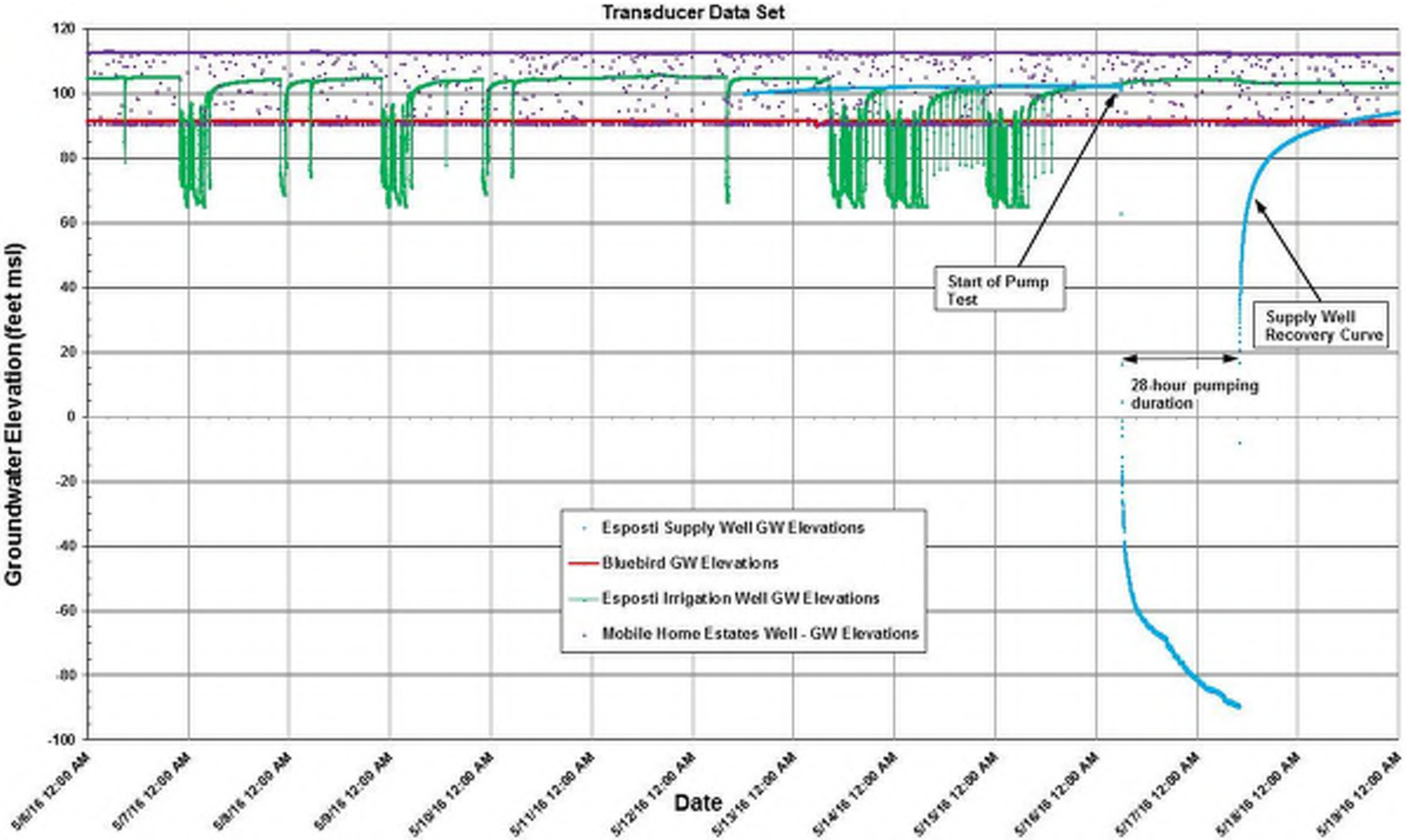


Figure 4 28-Hour Pumping Test All Wells

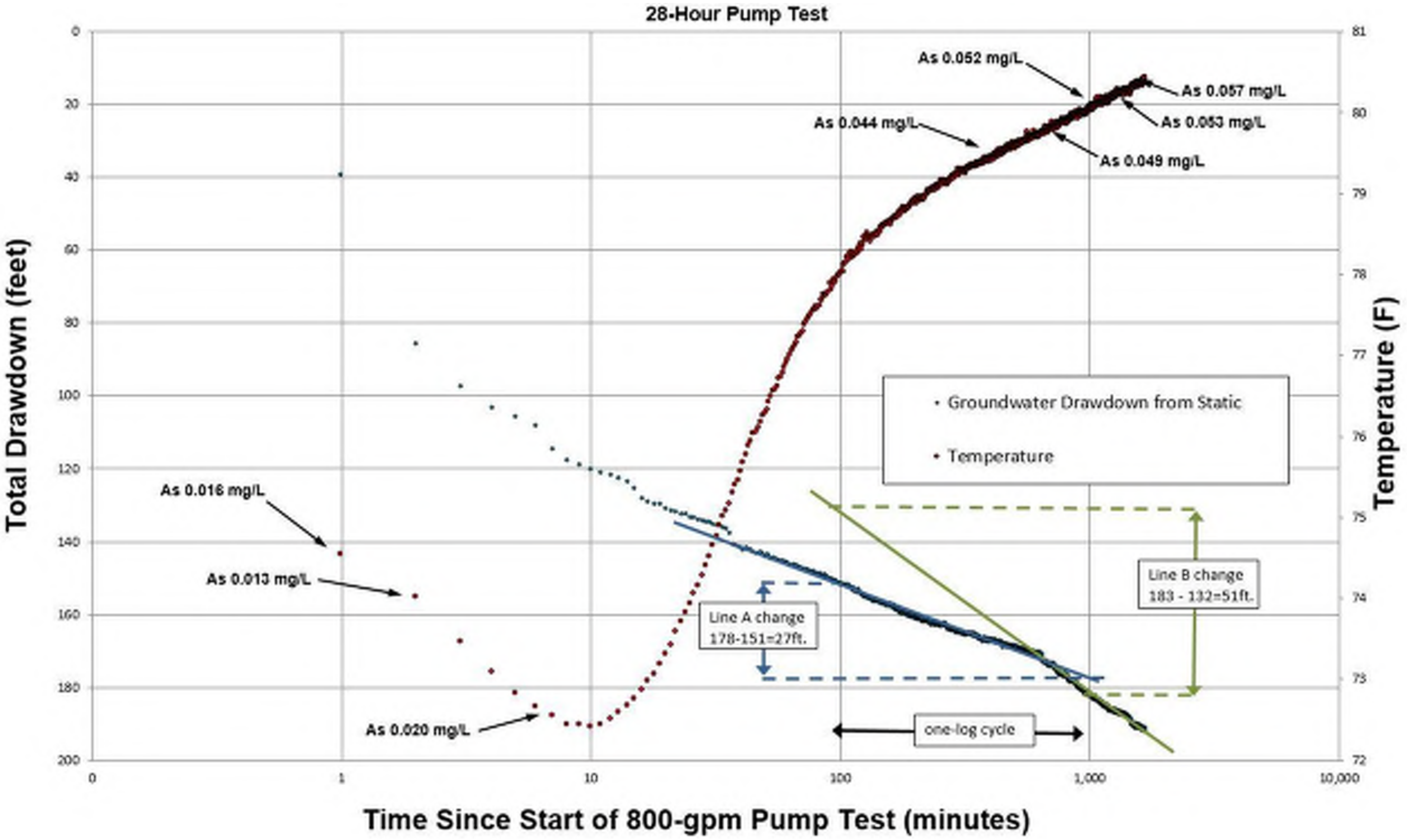


Figure 5 28-Hour Pumping Test Semi-Log Plot

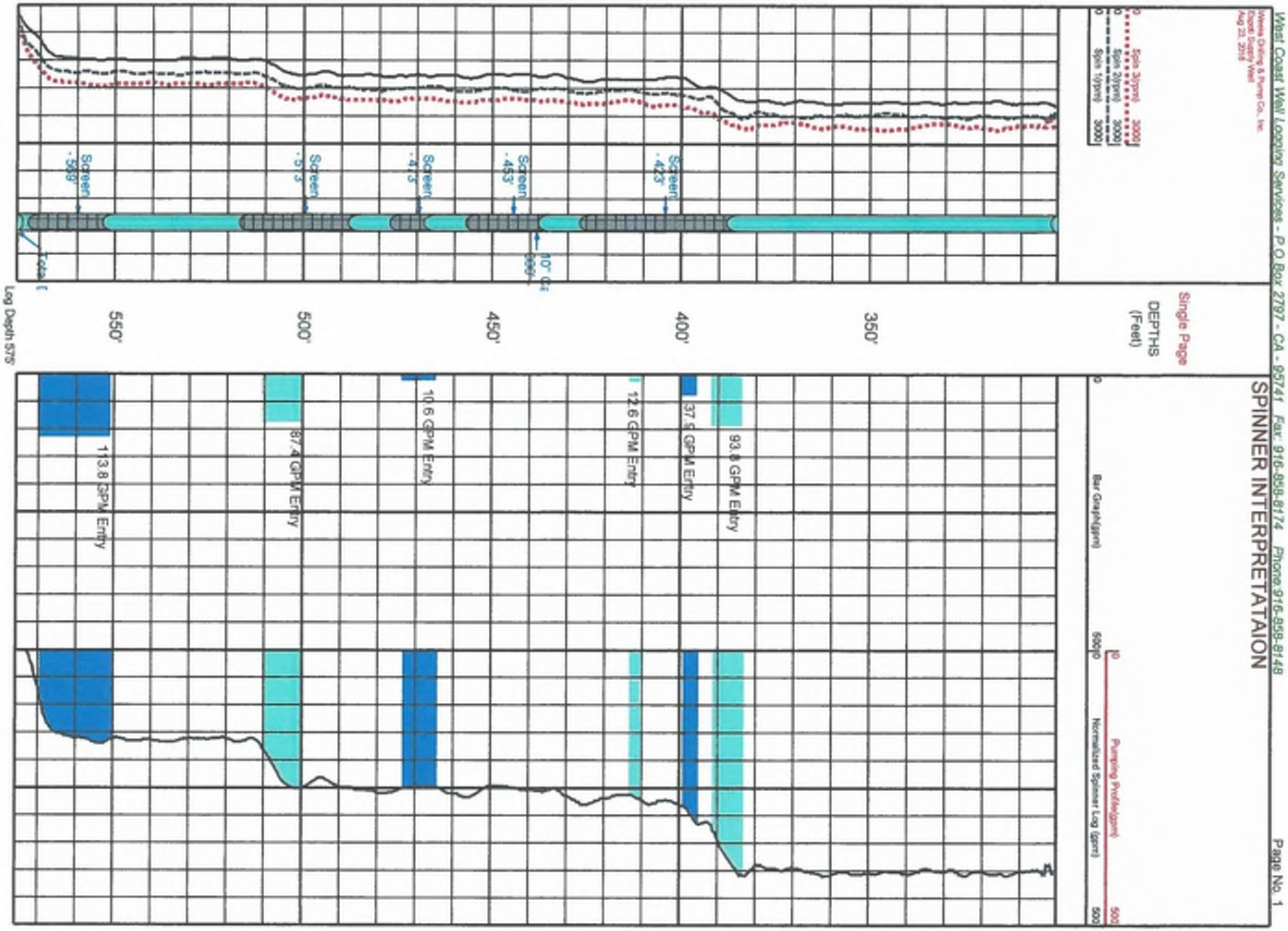


Figure 6 Active Spinner Log 400 gpm Pumping Rate

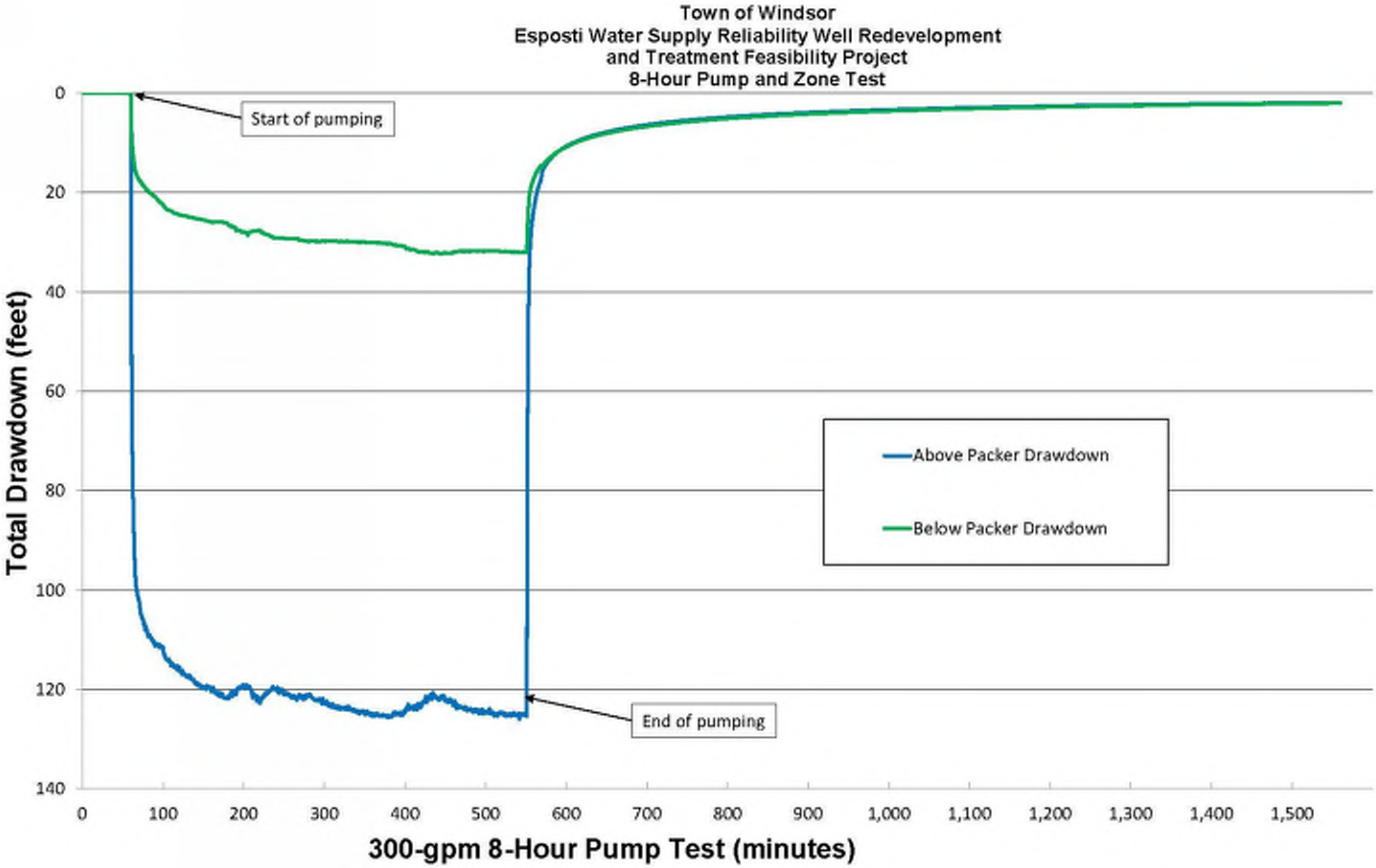


Figure 7 8-Hour First Screen Zone Test Above and Below Packer Groundwater Drawdown

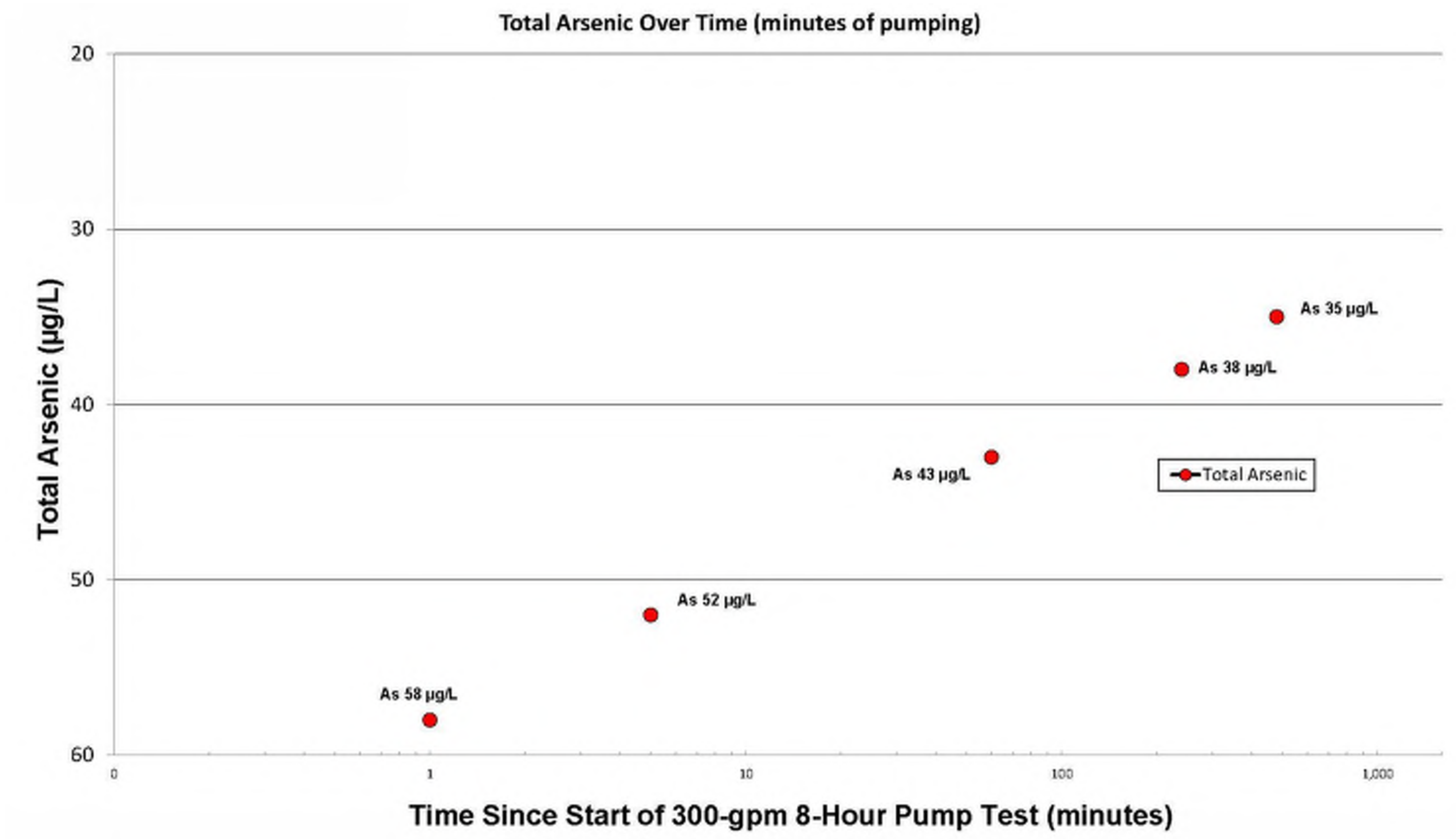
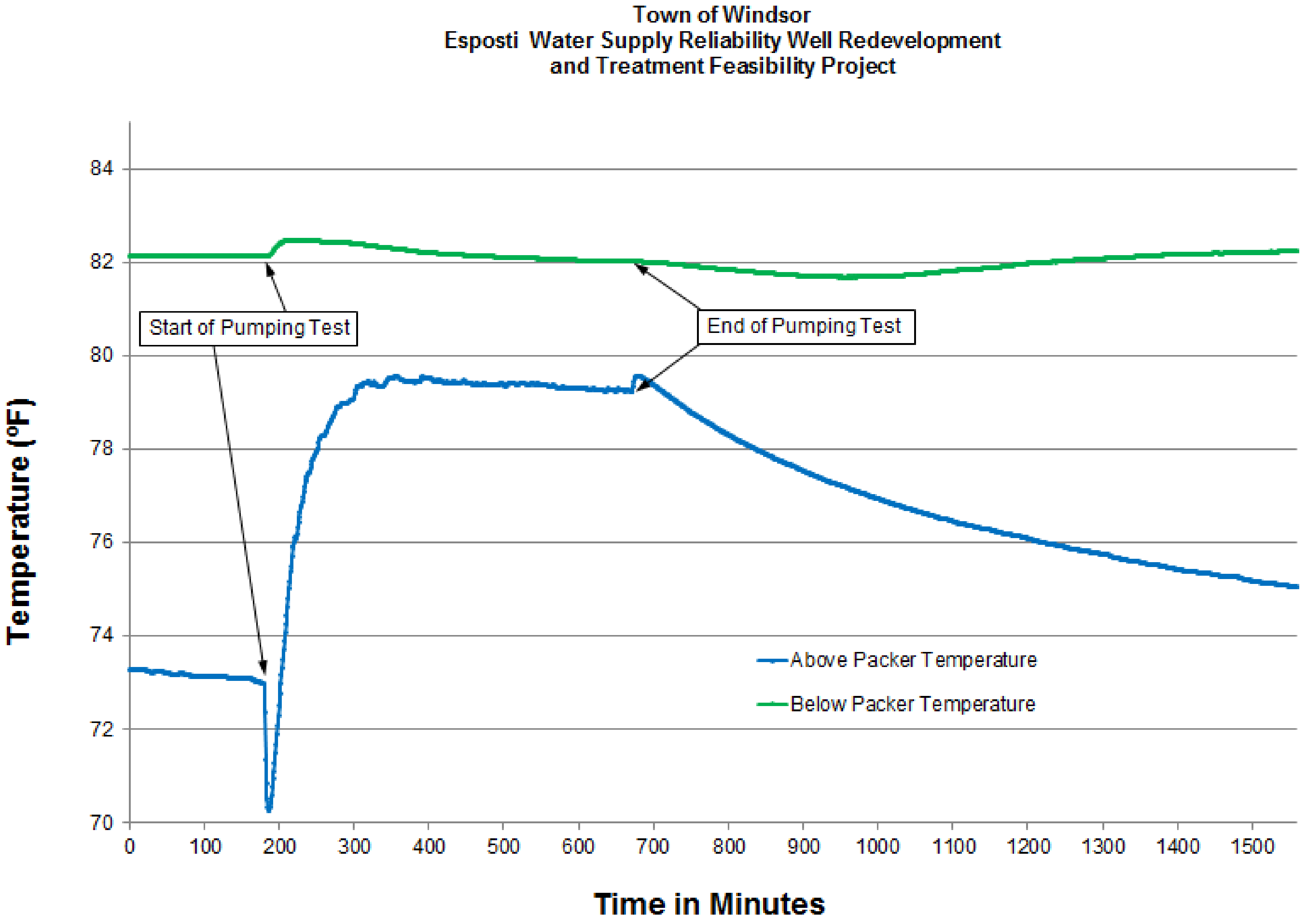
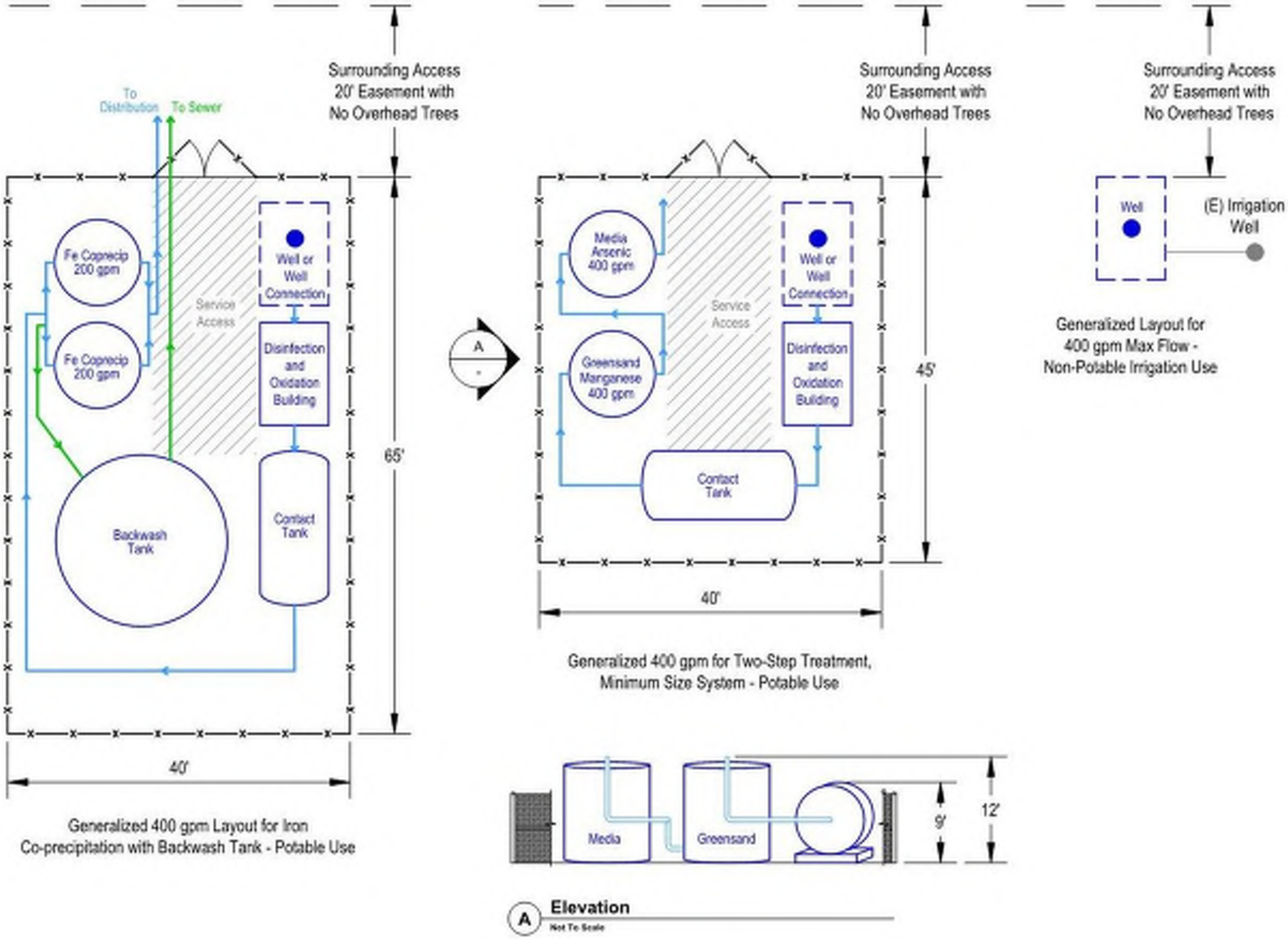


Figure 8 8-Hour First Screen Zone Test Arsenic Concentrations



Town of Windsor
Esposti Water Supply Reliability Well Redevelopment
and Treatment Feasibility Project

Figure 9 8-Hour First Screen Zone Test Temperature Above and Below Packer Groundwater Drawdown



Generalized 400 gpm Layout for Iron Co-precipitation with Backwash Tank - Potable Use

Generalized 400 gpm for Two-Step Treatment, Minimum Size System - Potable Use

Generalized Layout for 400 gpm Max Flow - Non-Potable Irrigation Use

Figure 10 Compound Options

Figure 11 System Location, Northwest Option

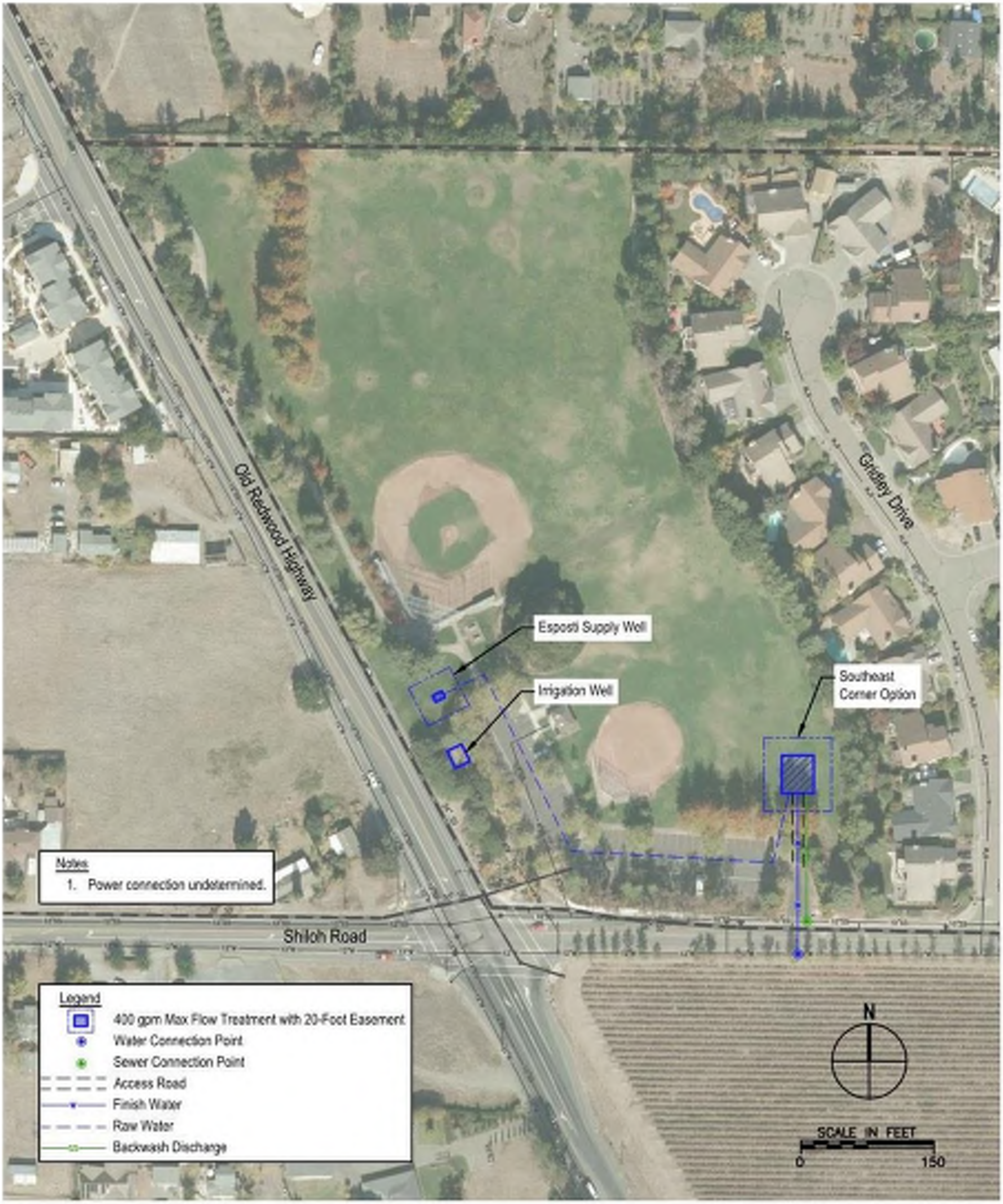


Figure 12 System Location, Southeast Option

Figure 13 System Location, Well Option

Appendices

Appendix A – Figures from Governmental Agencies Related to Esposti Well Hydrogeology

Prepared in cooperation with the Sonoma County Water Agency

Hydrologic and Geochemical Characterization of the Santa Rosa Plain Watershed, Sonoma County, California

Scientific Investigations Report 2013–5118

U.S. Department of the Interior
U.S. Geological Survey

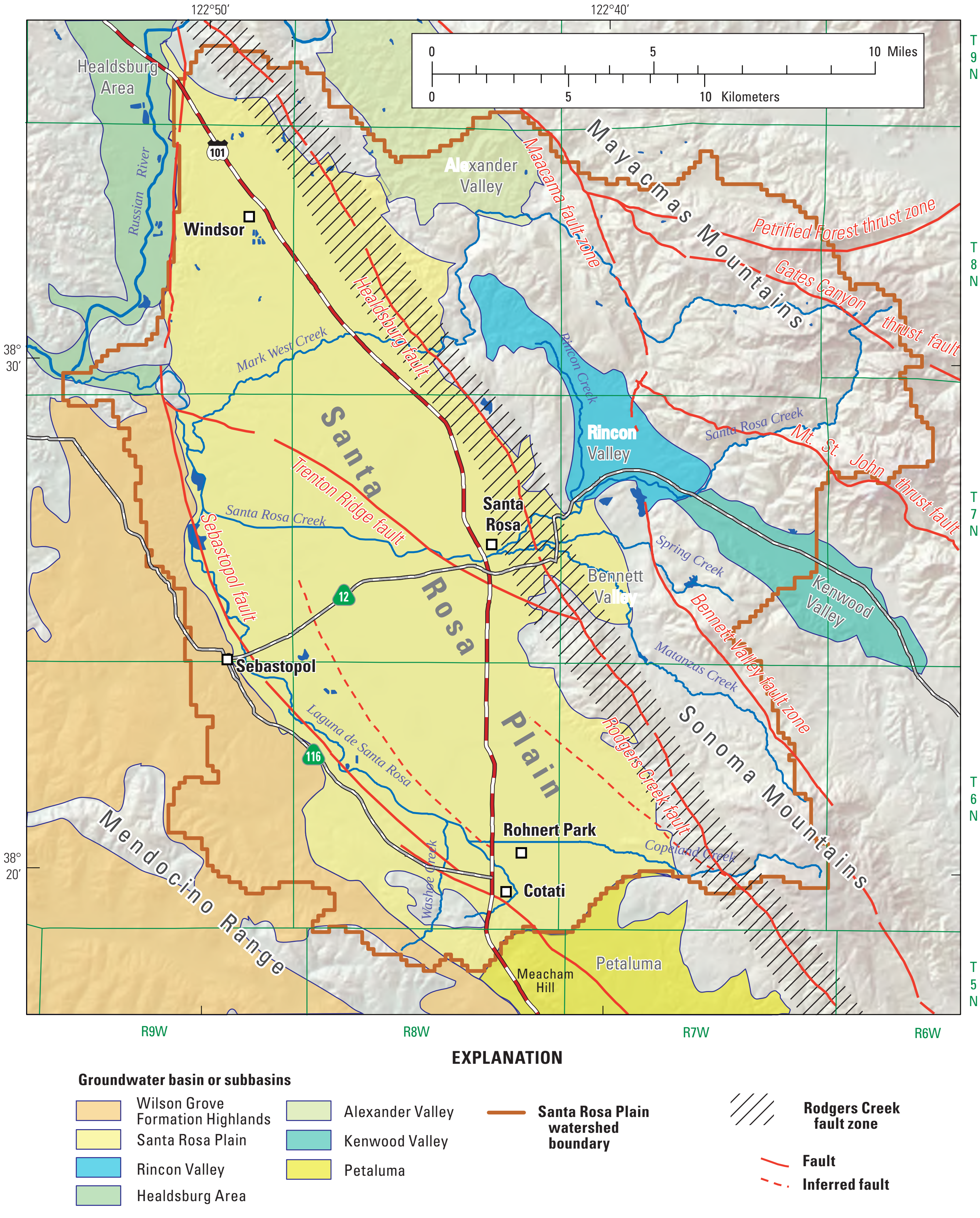
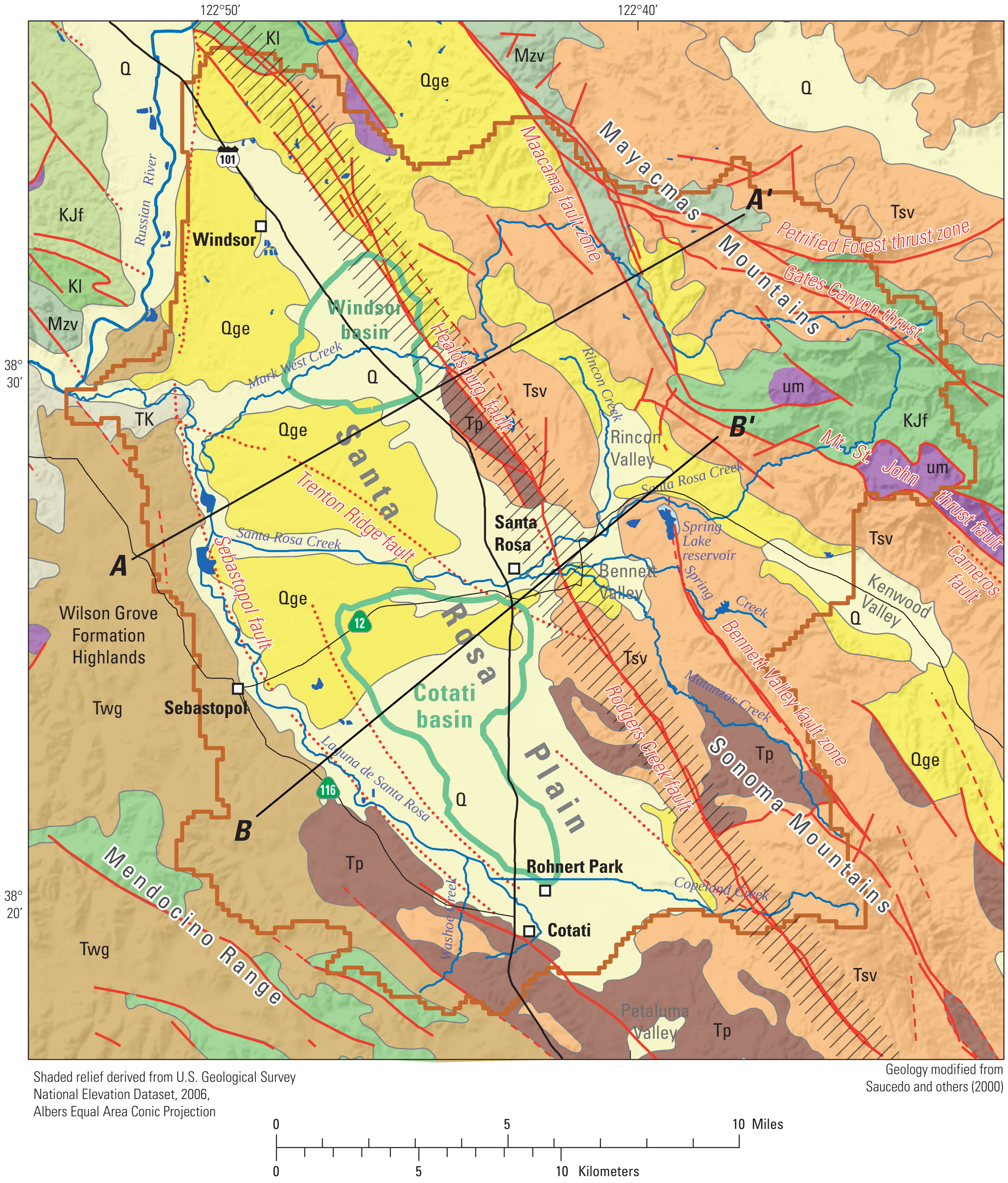


Figure 3. Santa Rosa Plain watershed boundary with groundwater subbasins, Sonoma County, California.



Shaded relief derived from U.S. Geological Survey National Elevation Dataset, 2006, Albers Equal Area Conic Projection

Geology modified from Saucedo and others (2000)

Figure 1. Santa Rosa Plain watershed, Sonoma County, California.

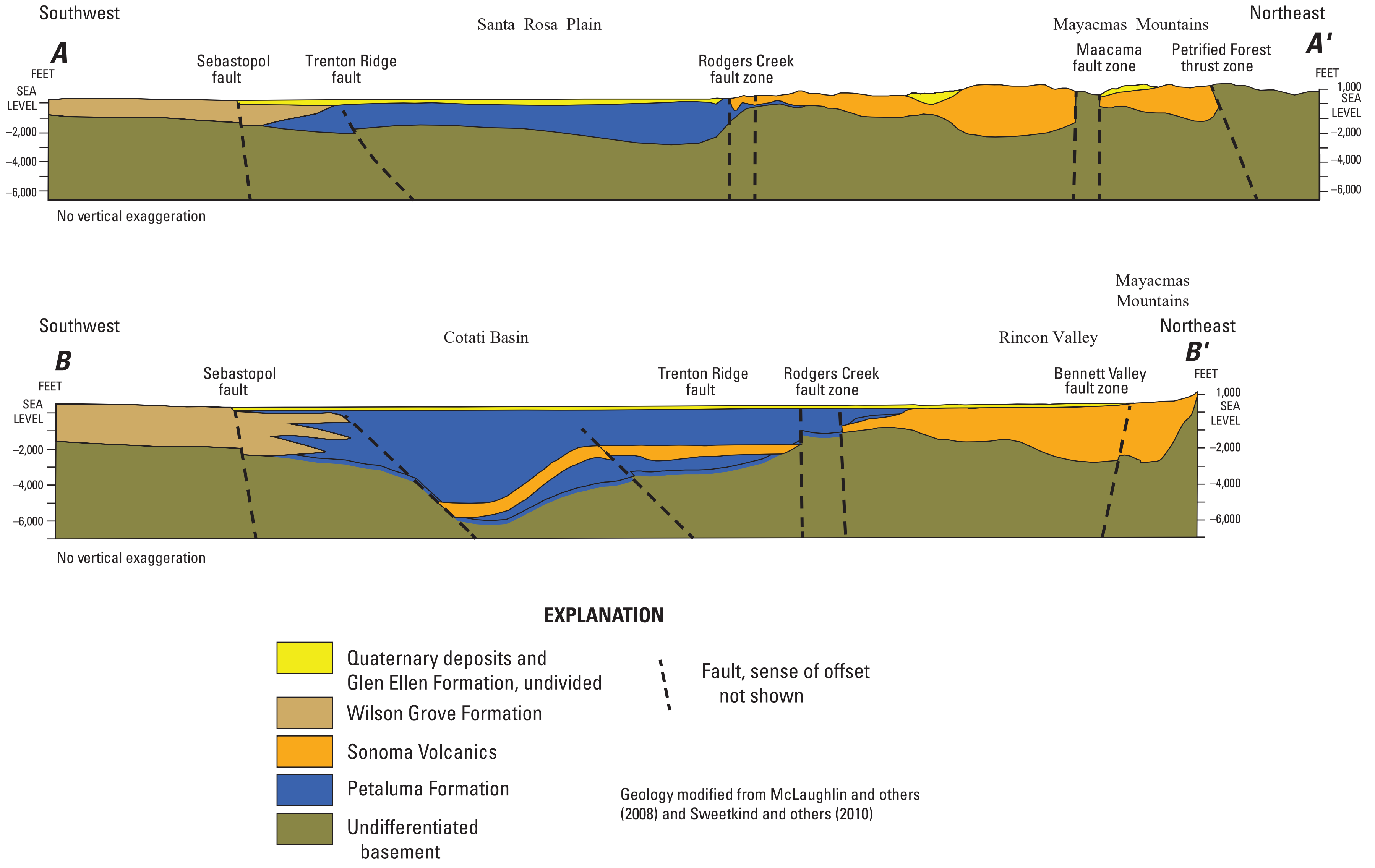


Figure 2. Interpretive geologic cross sections of the Santa Rosa Plain watershed, Sonoma County, California.

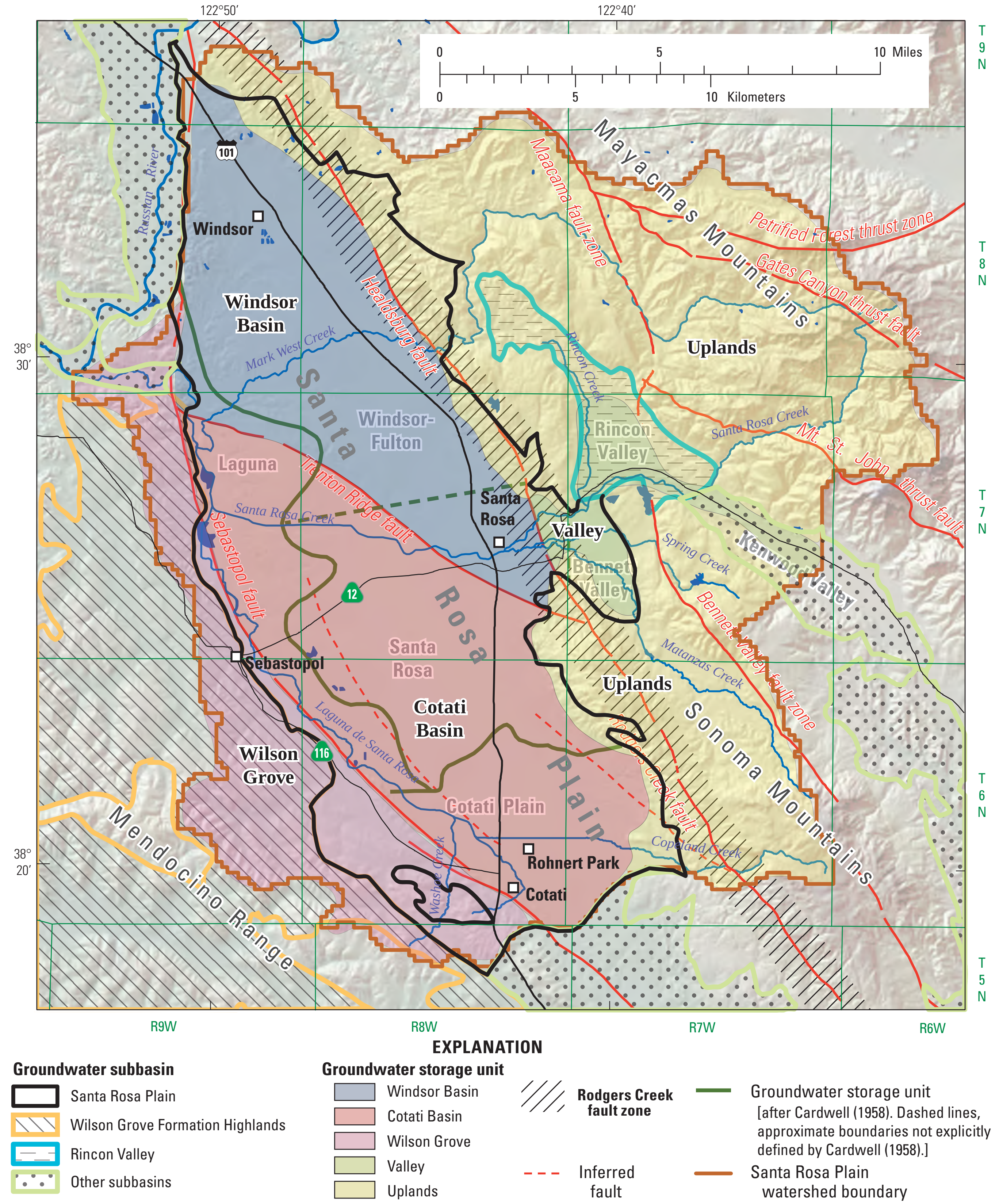


Figure 24. Groundwater basins, subbasins, and storage units in the Santa Rosa Plain watershed, Sonoma County, California.

Appendix B – Well Installation Well Logs: Esposti Supply Well, Esposti Irrigation Well and Bluebird Well

*The free Adobe Reader may be used to view and complete this form. However, software must be purchased to complete, save, and reuse a saved form.

File Original with DWR

Page 3 of 3

Owner's Well Number Esposti Park #1

Date Work Began 02/24/2010 Date Work Ended 3/27/2010

Local Permit Agency Sonoma County Permit and Resource Management Dept.

Permit Number WEL 09-0438 Permit Date 1/20/10

State of California

Well Completion Report

Refer to Instruction Pamphlet

No. e0113306

DWR Use Only – Do Not Fill In

State Well Number/Site Number

N W

Latitude Longitude

APN/TRS/Other

Geologic Log

Orientation ● Vertical ○ Horizontal ○ Angle Specify

Drilling Method Mud Rotary Drilling Fluid Bentonite mud

Depth from Surface Feet	to Feet	Description Describe material, grain size, color, etc
		SEE ATTACHED

Total Depth of Boring 1040 Feet

Total Depth of Completed Well 670 Feet

Well Owner

Name Town of Windsor

Mailing Address 9290 Old Redwood Hwy

City Windsor State CA Zip 95492

Well Location

Address 6000 Old Redwood Hwy

City Windsor County Sonoma

Latitude 38 Deg 31 Min. 35 Sec. N Longitude 122 Deg 46 Min. 46 Sec. W

Datum Decimal Lat. Decimal Long.

APN Book 163 Page 172 Parcel 018

Township Range Section

Location Sketch

(Sketch must be drawn by hand after form is printed.)

North

West

East

See Attached

South

Illustrate or describe distance of well from roads, buildings, fences, rivers, etc. and attach a map. Use additional paper if necessary. Please be accurate and complete.

Activity

● New Well

○ Modification/Repair

  ○ Deepen

  ○ Other

○ Destroy

Describe procedures and materials under "GEOLOGIC LOG"

Planned Uses

● Water Supply

  ☐ Domestic ☑ Public

  ☐ Irrigation ☐ Industrial

○ Cathodic Protection

○ Dewatering

○ Heat Exchange

○ Injection

○ Monitoring

○ Remediation

○ Sparging

○ Test Well

○ Vapor Extraction

○ Other

Water Level and Yield of Completed Well

Depth to first water 21 (Feet below surface)

Depth to Static Water Level 43 (Feet) Date Measured 04/10/2010

Estimated Yield * 400 (GPM) Test Type Constant Rate

Test Length 12.0 (Hours) Total Drawdown 79 (Feet)

*May not be representative of a well's long term yield.

Casings

Depth from Surface Feet	to Feet	Borehole Diameter (Inches)	Type	Material	Wall Thickness (Inches)	Outside Diameter (Inches)	Screen Type	Slot Size if Any (Inches)
655	670	17	Blank	304 Stainless Steel		10		
670	1,040			Cement				

Annular Material

Depth from Surface Feet	to Feet	Fill	Description
0	370	Cement	
370	371	Bentonite	
371	670	Filter Pack	1/4

Attachments

☑ Geologic Log

☑ Well Construction Diagram

☐ Geophysical Log(s)

☐ Soil/Water Chemical Analyses

☑ Other Site Map

Attach additional information, if it exists.

Certification Statement

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief

Name Tom Moreland for WDC Exploration and Wells

Person, Firm or Corporation

9580 County Road 93 B Zamora CA 95695

Address City State Zip

Signed

C-57 Licensed Water Well Contractor

7-23-10 Date Signed

283326 C-57 License Number

DWR 188 REV. 1/2006

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

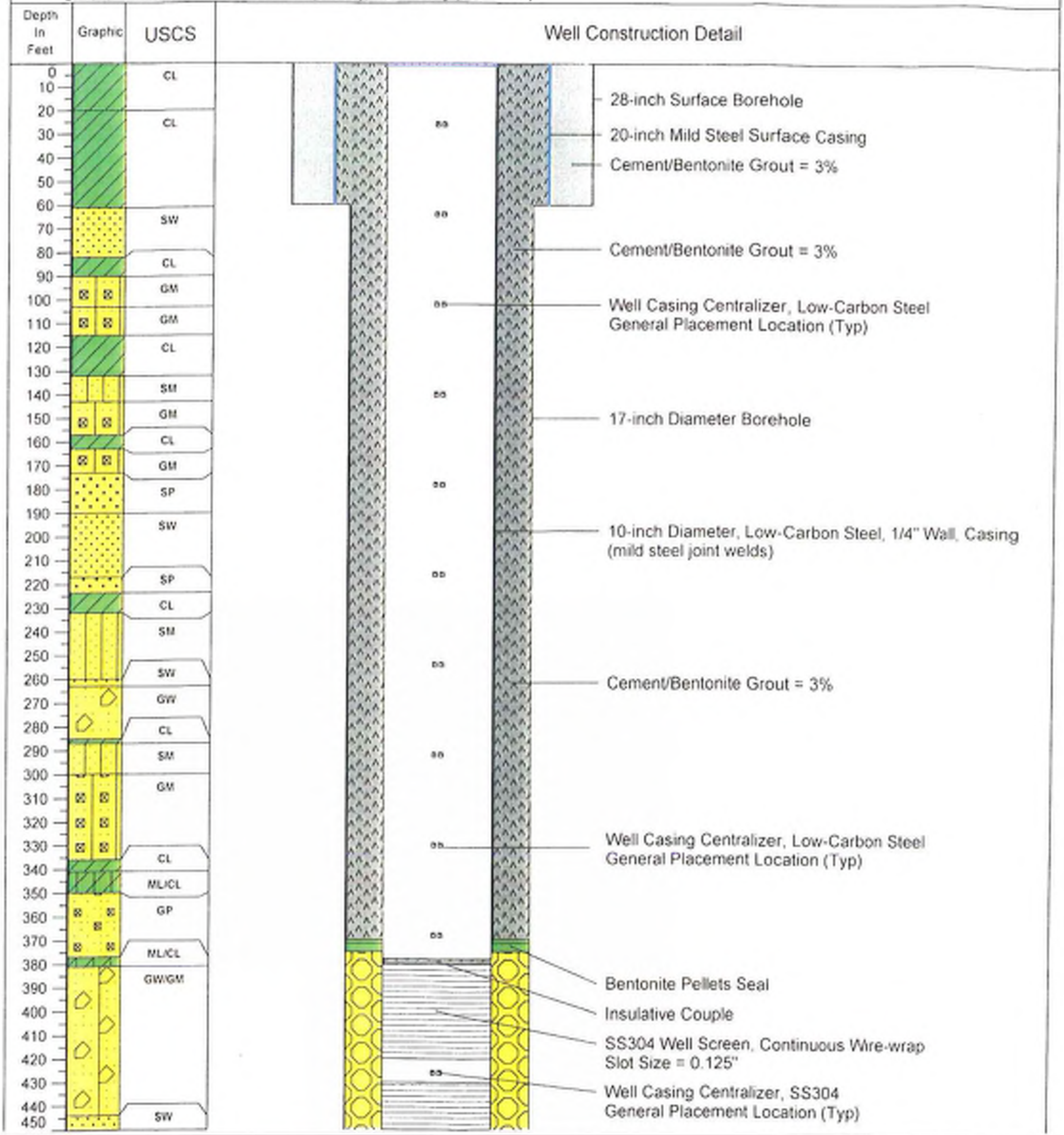
WELL CONSTRUCTION DIAGRAM
Esposti Park Test Hole

E-PUR.llc

Project: Well Installation
Location: Windsor, CA
E-PUR PN: E102-001-01, Task 200
Logged by: B. Gulbranson, J. Buchowski, G. Moore
Surface Conditions: Grass Covered
Sampler Type: Grab from Cyclone

Start Date: 2/24/2010
End Date: 3/27/2010
Latitude: N 38° 31' 35.4"
Longitude: W 122° 46' 46.5"

Drilling Company: WDC Exploration and Wells
Driller: Gary Eldred, Greg Gallio, John Chaves
Drilling Equipment: Reverse Circulation Air (0'-965'), Mud Rotary (965'-1040')



Sanitary Seal: Cement/Bentonite Grout 0 to 60 feet bgs
Annular Seal: Cement/Bentonite Grout 0 to 370 feet bgs
Filter Pack: SRI 1/4 inch Gravel 375 to 670 feet bgs
Monument Type: Concrete Pedestal w/ Temp. Locking Steel Cap

Surface Casing: 0 to 60 feet bgs
Screened Interval: 380-420, 430-450, 460-470, 480-510, 545-565, 615-655 feet bgs
Casing Diameter: 10.0 inches
Total Well Depth: 670.0 feet

WELL CONSTRUCTION DIAGRAM

Esposti Park Test Hole

E PUR.llc

Project: Well Installation
Location: Windsor, CA
E-PUR PN: E102-001-01, Task 200
Logged by: B. Gulbranson, J. Buchowski, G. Moore
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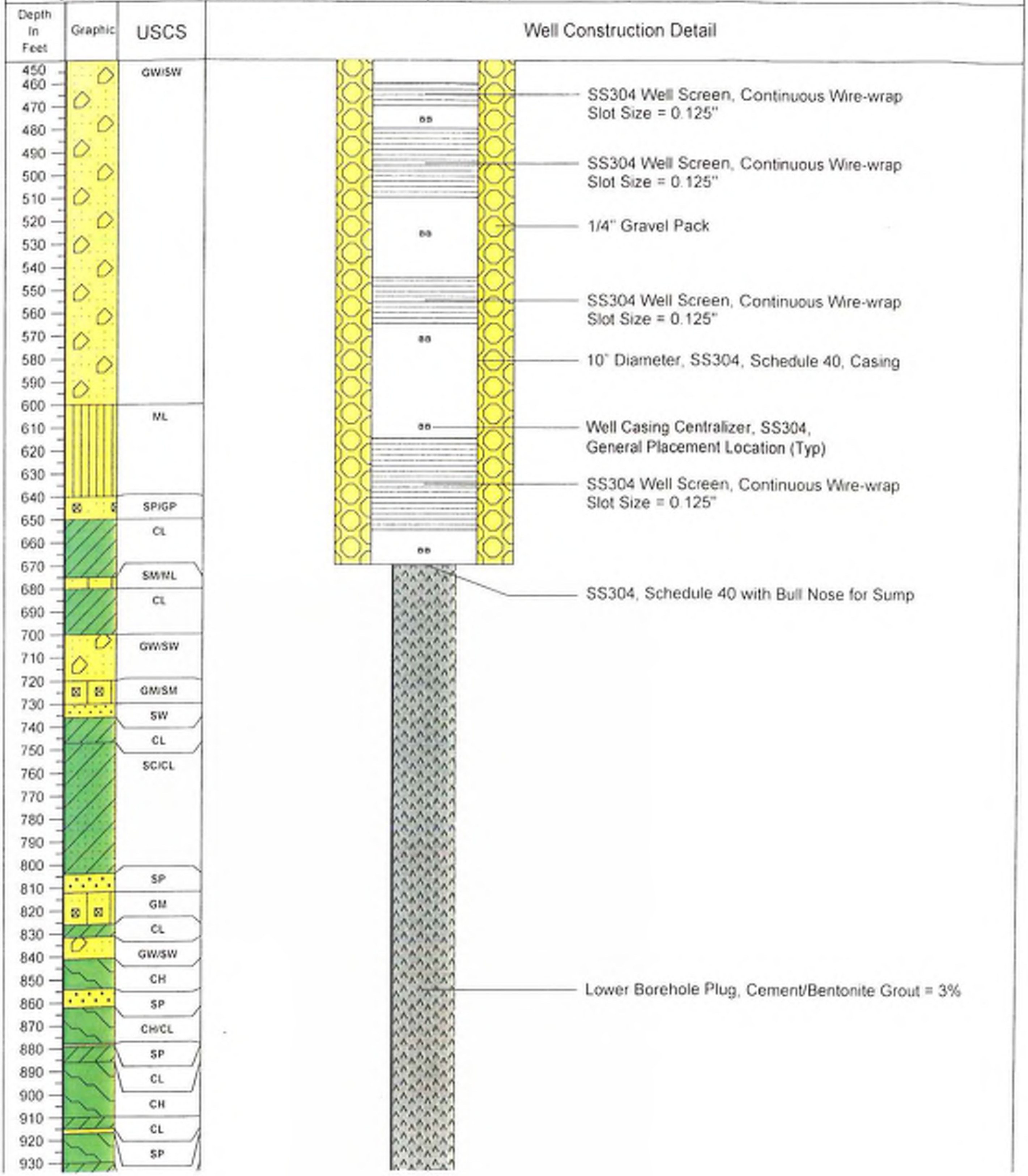


E PUR,llc

Project	Well Installation
Location:	Windsor, CA
E-PUR PN:	E102-001-01, Task 200
Logged by:	B. Gulbranson, J. Buchowski, G. Moore
Surface Conditions:	Grass Covered
Sampler Type:	Grab from Cyclone

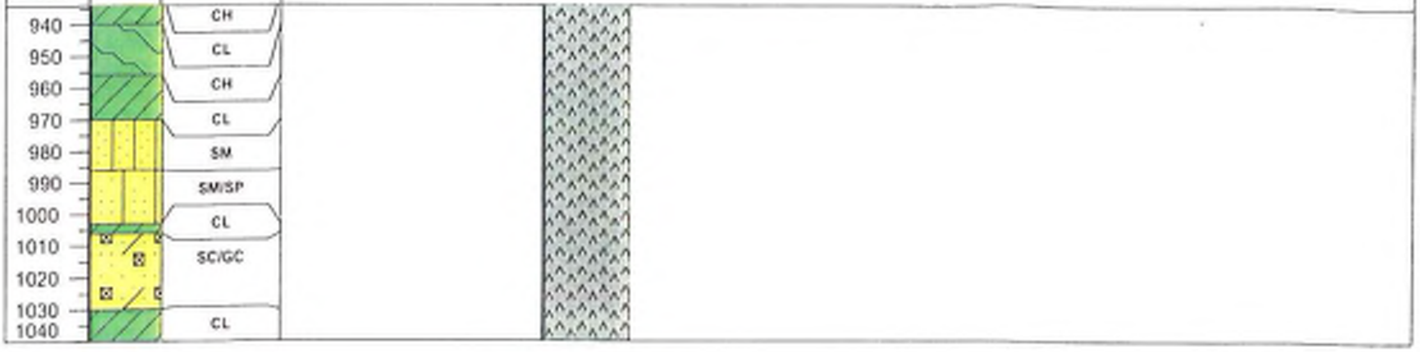
WELL CONSTRUCTION DIAGRAM

Esposti Park Test Hole

Start Date:	2/24/2010
End Date:	3/27/2010
Latitude:	N 38° 31' 35.4"
Longitude:	W 122° 46' 46.5"

Drilling Company: WDC Exploration and Wells
Driller: Gary Eldred, Greg Gallio, John Chaves
Drilling Equipment: Reverse Circulation Air (0'-965'), Mud Rotary (965'-1040')

Depth In Feet	Graphic	USCS	Well Construction Detail



E-PUR.llc

Drilling Company: WDC Exploration and Wells
Driller: Gary Eldred, Greg Gallo, John Chaves
Drilling Equipment: Reverse Circulation
Air (0-730), Mud Rotary (791-867)

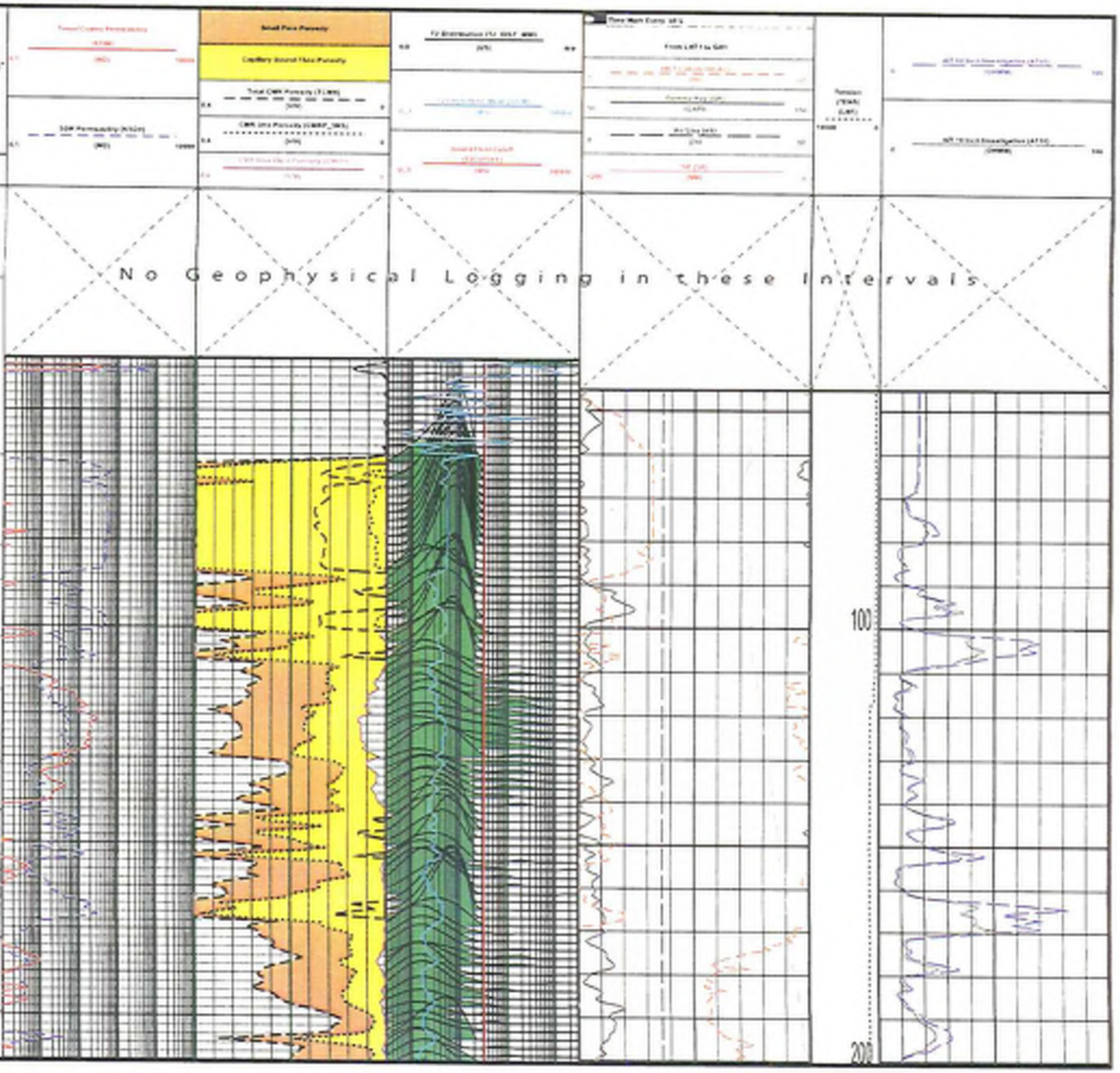
BORING LOG: Esposti Park

Esposti Park Well Test Hole

Start Date: 2/24/2010
End Date: 3/3/2010
Latitude: N 38° 31' 35.4"
Longitude: W 122° 46' 45.5"

Project: Well Installation
Location: Windsor, CA
E-PUR PM: E102-001-01, Task 200
Logged by: B. Gulbranson, J. Buchowski, G. Moore
Surface Conditions: Grass Covered
Sampler Type: Grab

Depth (feet)	Graphic	USCS	Description
0 10 20	🟩	CL	Sandy CLAY (CL) - medium to light brown, soft, plastic clay; varicolored, poorly sorted, fine to coarse, subangular to angular sand; poorly sorted, rounded fine to coarse gravel
30 40 50 60	🟩	CL	Gravelly CLAY (CL) and Sandy CLAY (CL) - light brown, very fine to coarse grained sand, subangular to angular; gravel units, fine to course, subangular to subrounded
70 80	🟨	SW	SAND (SW) - varicolored, poorly sorted, fine to coarse, subrounded to subangular sand with silty sand and silty gravel 70-71 feet; some metamorphosed quartz and feldspars
90	🟩	CL	Sandy CLAY (CL) - light gray clay with sand
100	🟨	GM	Gravelly SAND (GM) - varicolored, poorly sorted, fine to medium, angular to subrounded sand; some, varicolored, poorly sorted, fine to coarse, angular to subrounded gravel; little silt. Gravel clasts metasedimentary sandstone to quartzite
110	🟨	GM	Sandy GRAVEL (GM) - varicolored changing to green/gray, poorly sorted, fine to medium, rounded to subangular gravel, some sand; little silt. Green fine grained basalt clasts
120 130	🟩	CL	Silty CLAY (CL) - dark gray/green, plastic clay; with silt and fine sand
140	🟨	SM	Silty SAND (SM) - gray/green, poorly sorted, rounded to subrounded, fine sand; fine, subangular to subrounded gravel, with rare cobble
150	🟨	GM	Silty GRAVEL (GM) - as above with fine gravel to coarse sand, varicolored
160	🟩	CL	Sandy CLAY (CL) - light brown, clay; sand
170	🟨	GM	Silty GRAVEL (GM) - varicolored, unsorted to poorly sorted, fine, subangular to subrounded gravel with rare cobble; units of silty sand, fine to medium grained, angular to subrounded
180 190	🟨	SP	SAND (SP) - varicolored, subrounded to rounded, fine to medium sand, abundant well rounded and frosted quartz
200	🟨	SW	Sand (SW) - fine to coarse sand, well graded, similar in angularity and color to above.



E-PUR.llc

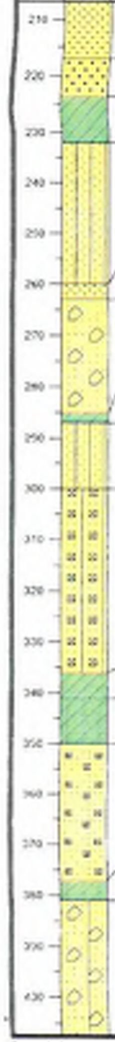
Drilling Company: WDC Exploration and Wells
Driller: Gary Eldred, Greg Gallo, John Chavez
Drilling Equipment: Reverse Circulation
Air (0-795'), Mud Rotary (795-867')

BORING LOG: Esposti Park

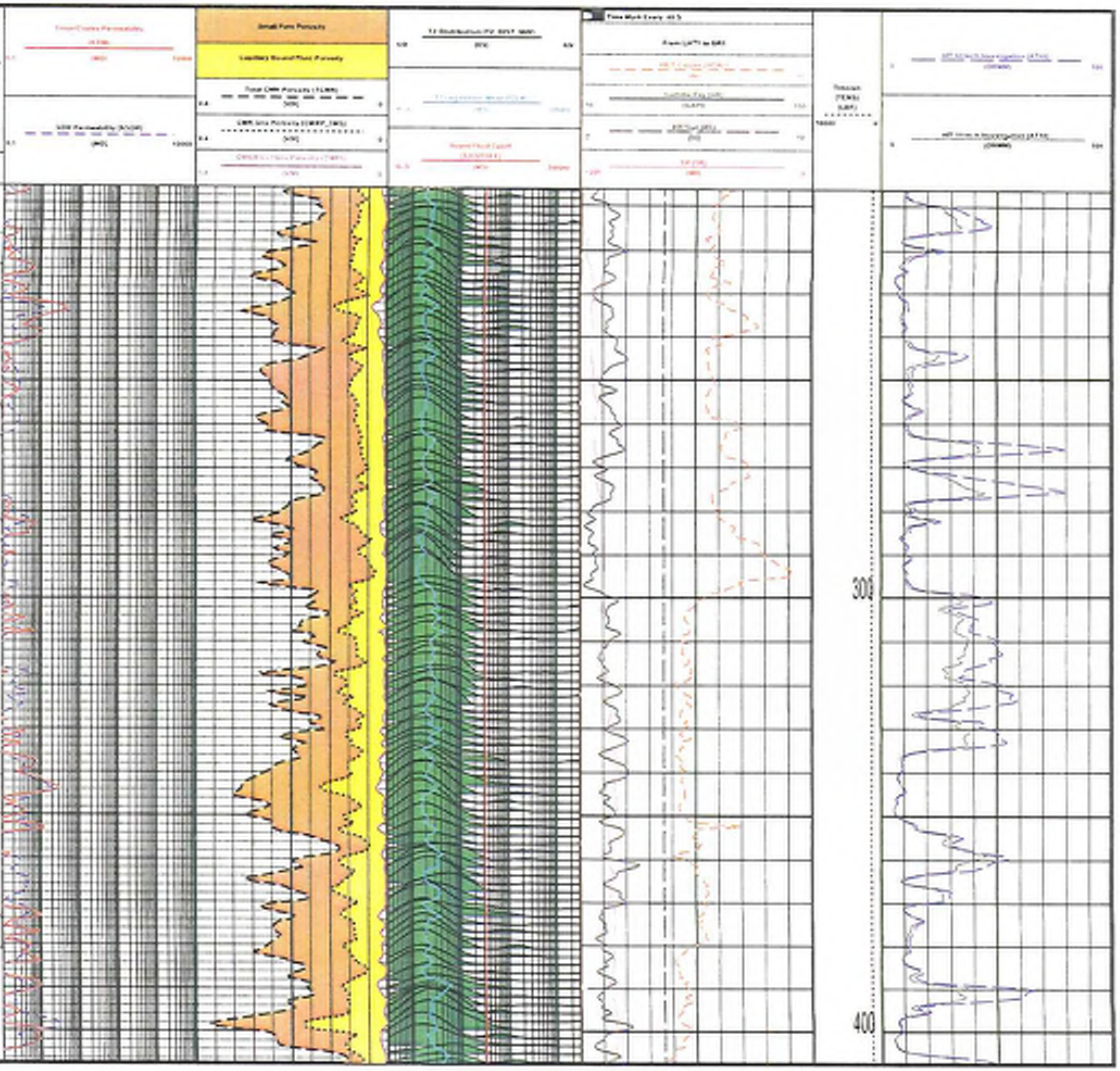
Espocti Park Well Test Hole

Start Date: 2/24/2010
End Date: 3/3/2010
Latitude: N 38° 31' 35.4"
Longitude: W 122° 46' 46.5"

Project: Well Installation
Location: Windsor, CA
E-PUR PN: E102-001-01, Task 200
Logged by: B. Gulbranson, J. Buchowski, C. Moore
Surface Conditions: Grass Covered
Sampler Type: Grab



USCS	Description
SP	Sand (SP) - varicolored, fine to medium, poorly graded sand
CL	Silty CLAY (CL) - light gray clay; with silt
SM	Silty SAND (SM) - varicolored, poorly sorted, rounded to subrounded to subangular sand; few to little silt (ash); some gravel units
SW	Sand (SW) - varicolored, poorly sorted, fine to coarse grained, subrounded to subangular sand
GW	GRAVEL (GW) - red stained gravel with sand, poorly sorted, subrounded to subangular, few obsidian clasts
CL	Sandy CLAY (CL) - light gray clay; fine sand
SM	Silty SAND (SM) - gray, rounded to subrounded, fine sand, abundant milky frosted quartz; abundant rhyolite with red staining on some grains; increasing coarseness to gravel with depth
GM	Silty GRAVEL (GM) - as above with fine gravel and some sand
CL	Sandy CLAY (CL) - light gray clay; sand
ML/CL	SILT and CLAY (ML/CL) - light brown, tan/buff, friable, fine ash; trace fine gravel
GP	GRAVEL with SAND (GP) - varicolored, subrounded to rounded to subangular, fine to medium gravel, moderately well sorted, fine to coarse, subangular to subrounded sand
ML/CL	SILT and CLAY (ML/CL) - light green gray, ash, some clear to frosted sand; pale green fine sand
GW/GM	GRAVEL with SAND (GW/GM) - varicolored, moderately well sorted, fine to coarse, subrounded gravel, some angular to subangular sand Abundant volcanics at 400 feet



E-PUR.llc

Drilling Company: WDC Exploration and Wells
Driller: Gary Eldred, Greg Gallo, John Chavez
Drilling Equipment: Reverse Circulation
Air (0-795'), Mud Rotary (795-867')

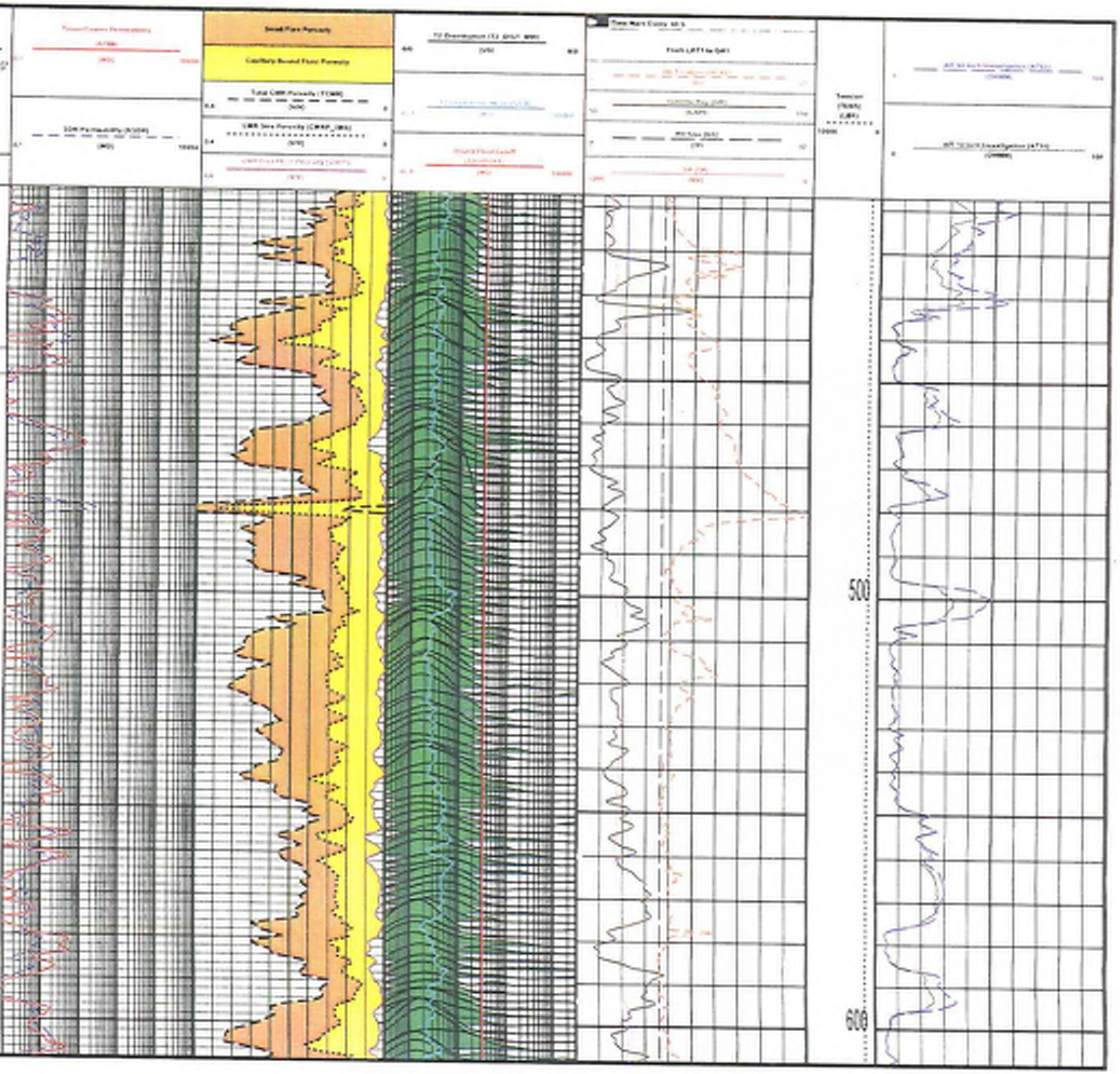
BORING LOG: Esposti Park

Esposti Park Well Test Hole

Start Date: 2/4/2010
End Date: 3/3/2010
Latitude: N 38° 31' 35.4"
Longitude: W 122° 46' 46.5"

Project: Well Installation
Location: Windsor, CA
E-PUR PM: E102-001-01, Task 200
Logged by: B. Gulbranson, J. Buchowski, G. Moore
Surface Conditions: Grass Covered
Sampler Type: Grab

Depth (feet)	USCS	Description
410–445		
445	SW	SAND (SW) - well graded sand, with little ash; stringer of clay at 450 feet
450	GW/SW	Sandy GRAVEL (GW) to Gravelly SAND (SW) - varicolored, fine to coarse grained sand and gravel
465		Stringer of clay at 460 feet
480		Trace of clay at 480 feet
510		Interbedded clay unit with sand and gravel at 510 to 513 feet
520		Trace obsidian at 520 feet
545		Lost circulation at 545 feet
580		Trace of clay at 580 feet;
600	ML	Sandy SILT (ML) - gray, friable, silt (xx%); light gray, angular to subrounded, medium sand



E-PUR,llc

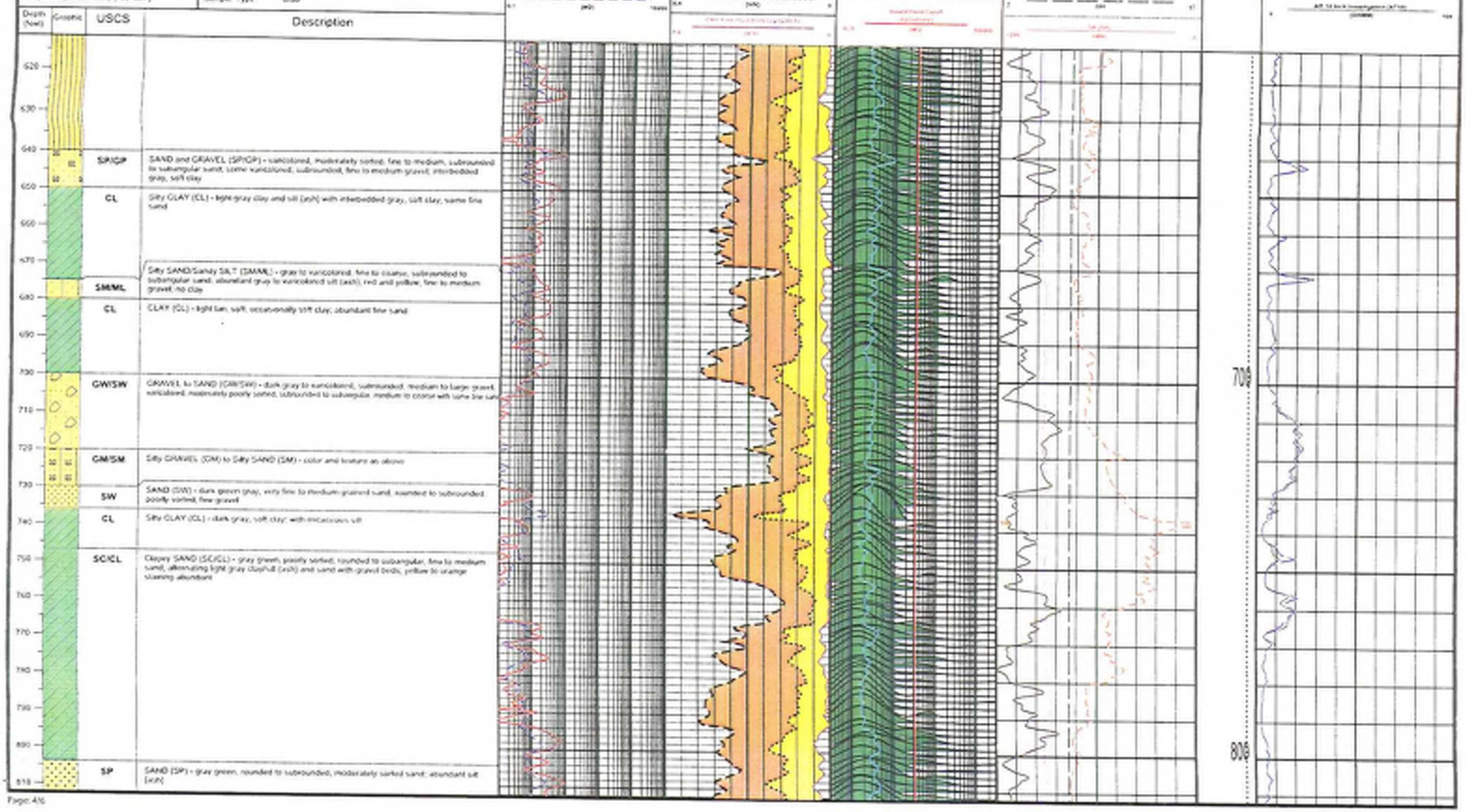
Drilling Company: WDC Exploration and Wells
Driller: Gary Eldred, Greg Gallo, John Chaves
Drilling Equipment: Reverse Circulation
Air (0'-795'), Mud Rotary (795'-867')

BORING LOG: Esposti Park

Esposti Park Well Test Hole

Start Date:	2/24/2010
End Date:	3/3/2010
Latitude:	N 38° 31' 35.4"
Longitude:	W 122° 40' 46.5"
Project:	Well Installation
Location:	Windsor, CA
E-PUR PN:	E102-001-01, Task 200
Logged by:	B. Gulbranson, J. Buchowski, C. Moore
Surface Conditions:	Grass Covered
Sampler Type:	Grab

USCS	Description
SP/GP	SAND and GRAVEL (SP/GP) - varicolored, moderately sorted, fine to medium, subrounded to subangular sand; some varicolored, subrounded, fine to medium gravel; interbedded gray, soft clay
CL	Silty CLAY (CL) - light gray clay and silt (ash) with interbedded gray, soft clay; some fine sand
SM/ML	Silty SAND/Sandy SILT (SM/ML) - gray to varicolored, fine to coarse, subrounded to subangular sand; abundant gray to varicolored silt (ash); red and yellow, fine to medium gravel; no clay
CL	CLAY (CL) - light tan, soft, occasionally stiff clay; abundant fine sand
GW/SW	GRAVEL to SAND (GW/SW) - dark gray to varicolored, subrounded, medium to large gravel; varicolored, moderately poorly sorted, subrounded to subangular, medium to coarse with some fine sa
GM/SM	Silty GRAVEL (GM) to Silty SAND (SM) - color and texture as above
SW	SAND (SW) - dark green gray, very fine to medium grained sand, rounded to subrounded, poorly sorted, few gravel
CL	Silty CLAY (CL) - dark gray, soft clay; with micaceous silt
SC/CL	Clayey SAND (SC/CL) - gray green, poorly sorted, rounded to subangular, fine to medium sand, alternating light gray clay/silt (ash) and sand with gravel beds; yellow to orange staining abundant
SP	SAND (SP) - gray green, rounded to subrounded, moderately sorted sand; abundant silt (ash)



E-PUR.llc

Drilling Company: WDC Exploration and Wells
Driller: Gary Eldred, Greg Gallo, John Chaves
Drilling Equipment: Reverse Circulation
Air (0'-795'), Mud Rotary (795'-867')

BORING LOG: Esposti Park

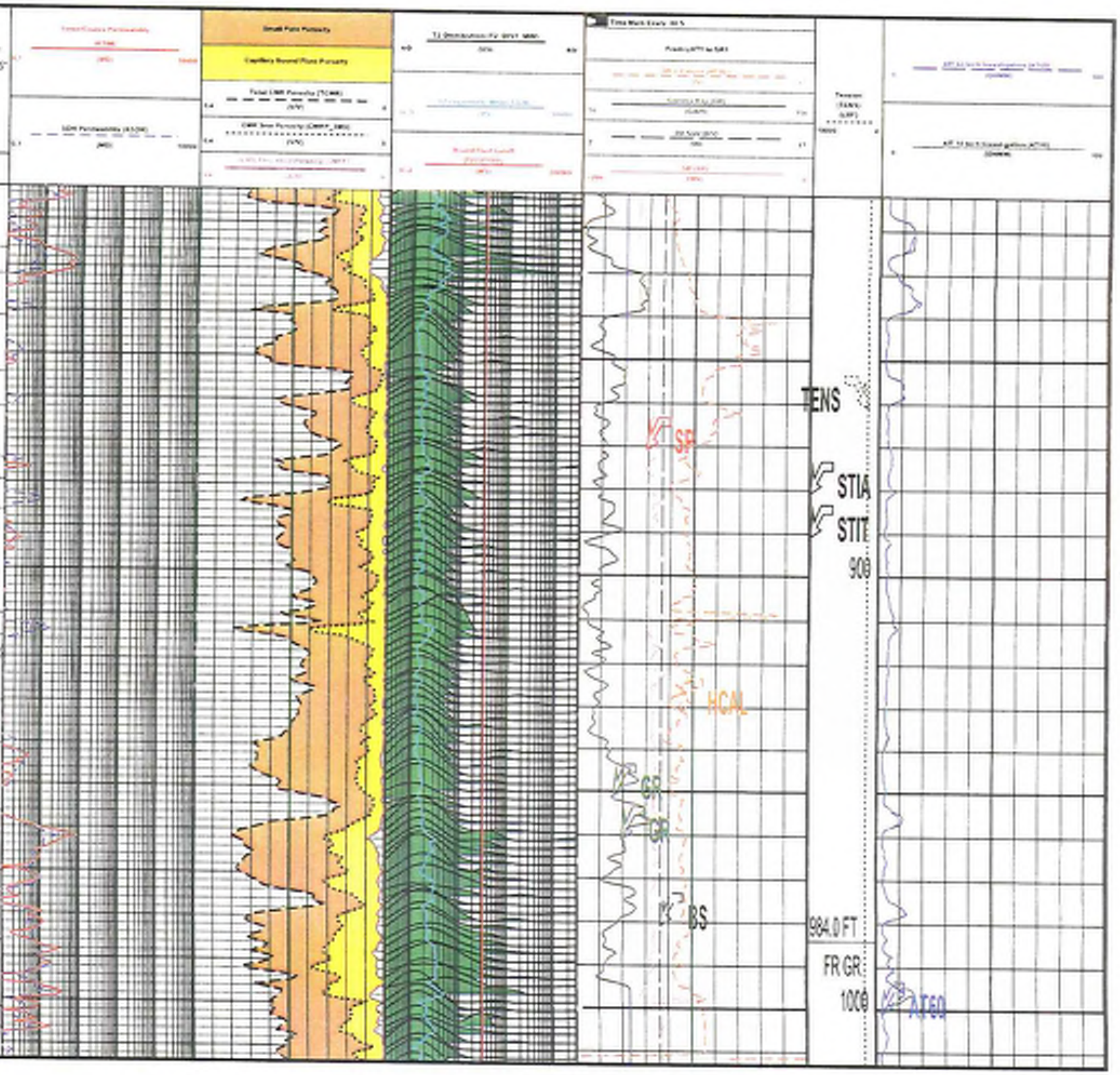
Esposti Park Well Test Hole

Start Date: 2/24/2010
End Date: 3/3/2010
Latitude: N 38° 31' 35.4"
Longitude: W 122° 46' 46.5"

Project: Well Installation
Location: Windsor, CA
E-PUR PN: E103-001-01, Task 200
Logged by: B. Gulbranson, J. Buchowski, C. Moore
Surface Conditions: Grass Covered
Sampler Type: Grab

Depth (feet): 820, 830, 840, 850, 860, 870, 880, 890, 900, 910, 920, 930, 940, 950, 960, 970, 980, 990, 1000, 1010

USCS	Description
GM	Silty GRAVEL (GM) with Sand - gray green, rounded to subrounded, medium to coarse gravel, predominantly volcanics, intermediate to felsic rhyolite clasts
CL	Sandy CLAY (CL) - light gray clay with sand
GW/SW	Silty GRAVEL (GW) to SAND (SW) - varicolored, fine to medium, subrounded to rounded sand; angular to subrounded, medium to coarse gravel
CH	CLAY (CH) - dark gray to brown, plastic clay
SP	SAND (SP) - gray green to varicolored, moderately sorted, subrounded to angular sand little gray green to varicolored gravel
CH/CL	CLAY (CH/CL) - dark gray, fat clay grading to a light gray brown, plastic clay with sand
SP	SAND (SP) - sand with gravel and cobbles
CL	CLAY (CL) - light gray, plastic clay with occasional interbedded sand stringers
CH	CLAY (CH) - dark gray to brown, dense plastic clay
CL	Sandy CLAY (CL) - brown clay, with sand
SP	SAND (SP) - light gray, fine sand with silt
CH	CLAY (CH) - gray brown to green gray, highly plastic clay; minor fine sand/silt, obsidian; hard slow drilling
CL	Sandy CLAY (CL) - gray green
CH	CLAY (CH) - green gray, fat clay, some silt, plastic clay with small obsidian
CL	Sandy CLAY (CL) - tan brown clay, sand
SM	Silty SAND (SM) - green gray, fine sand with silt (ash)
SM/SP	SAND (SM/SP) - moderately sorted, rounded sand with silt (ash), minor clay layer; trace coarse sand at 980 feet; flowing sand
CL	Sandy CLAY (CL) - light gray, soft clay, minor fine sand, becoming very dense with depth
SC/GC	Sand CLAY and Clayey Gravel (SC/GC) - gray, rounded to subrounded, fine sand, minor fine gravel, some clay; intercalated, hard slow drilling



E PUR.llc

Drilling Company: WDC Exploration and Wells
Driller: Gary Eldred, Greg Gullo, John Chaves
Drilling Equipment: Reverse Circulation
Air (0-795), Mud Rotary (795-867)

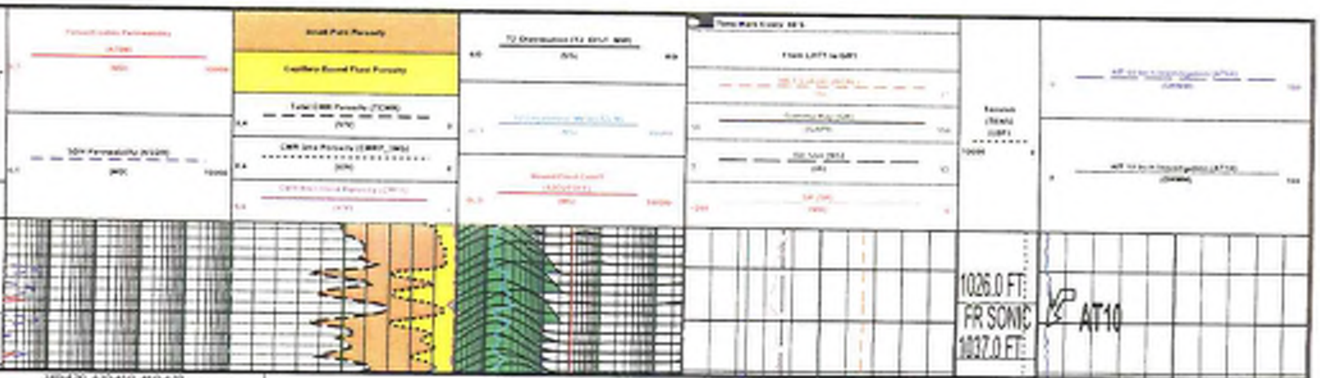
BORING LOG: Esposti Park

Esposti Park Well Test Hole

Start Date: 2/24/2010
End Date: 3/3/2010
Latitude: N 38° 31' 35.4"
Longitude: W 122° 46' 46.5"

Project: Well Installation
Location: Windsor, CA
E-PUR PN: E102-001-01, Task 200
Logged by: B. Gulbranson, J. Buchowski, G. Moore
Surface Conditions: Grass Covered
Sampler Type: Grab

Depth (feet)	Graphic	USCS	Description
1020			
1030		CL	Sandy CLAY (CL) - soft clay; some sand; intercalated, hard slow drilling; Bottom of Boring
1040			



Page 6/6

Surface Seal: Sanitary Seal (Grout) 0 to 60 feet bgs
Annulous Seal: Grout 0 to 370 feet bgs
Filter Pack: SRI 1/4 inch Gravel 375 to 670 feet bgs
Monument Type: Temporary well cap to feet bgs

Screened Interval: 380-420, 430-450, 460-470, 480-510, 545-565, 615-655 feet bgs
Casing Diameter: 10.0 inches
Total Boring Depth: 1040.0 feet
Total Well Depth: 670.0 feet

Geophysical Log Notes:
Geophysical logging by Schlumberger (Bakersfield, CA)
CMR - Combinable Magnetic Resonance Tool
SP - Spontaneous Potential

Lithologic Log Notes:
UCS Unified Soil Classification System (Visual-Manual Method)

38 31' 35.316839" N 122 46' 45.948870" W

WINZLER & KELLY

Ref: 02520-09001
(RMC# 143.012B)

July 7, 2010

Craig Scott
Town of Windsor
P.O. Box 100
Windsor, CA 95492

Re: Windsor Well Installation –Well Locations-Bluebird Site and Esposti Park Site

Dear Mr. Scott:

As requested, Winzler & Kelly performed a field survey utilizing GPS equipment on June 28, 2010 to establish the locations of two new wells. This field survey established a benchmark at each pump pedestal of the new wells, one located at the Bluebird Site and one located at the Esposti Park Site.

The basis for the survey of the positions is the map titled "CONTROL SURVEY 1996 A.R.M. MONITORING PROGRAM FOR THE RUSSIAN RIVER" filed August 28, 1996 in Book 554 of Maps, at Pages 28-32, Sonoma County Records. Point E coordinate values and elevation were held for the survey. Listed benchmark elevations are NAVD '88. Coordinate values are California State Plane Coordinates Zone 2 (NAD '83).

Bluebird Site Well
Chiseled square at N'ly corner well head slab.
N 1959115.4041 E 6332436.6130 Elev. = 118.34
Lat = 38° 32' 20.306185" N Long = 122° 48' 05.144352" W

Esposti Park Site Well
Chiseled square at N'ly corner well head slab.
N 1954509.6739 E 6338689.6507 Elev. = 140.93
Lat = 38° 31' 35.316839" N Long = 122° 46' 45.948870" W

Winzler & Kelly appreciates the opportunity to provide surveying services for the Town of Windsor for this project and we look forward to serving the Town in the future..

Sincerely,
WINZLER & KELLY

Richard Maddock, PLS 8131

◆ 495 Tesconi Circle, Santa Rosa, CA 95401-4696 ◆
tel 707.523.1010 fax 707.527.8679
www.w-and-k.com
◆

FIGURE 3:WELL CONSTRUCTION DIAGRAM

Bluebird Replacement Well Test Hole

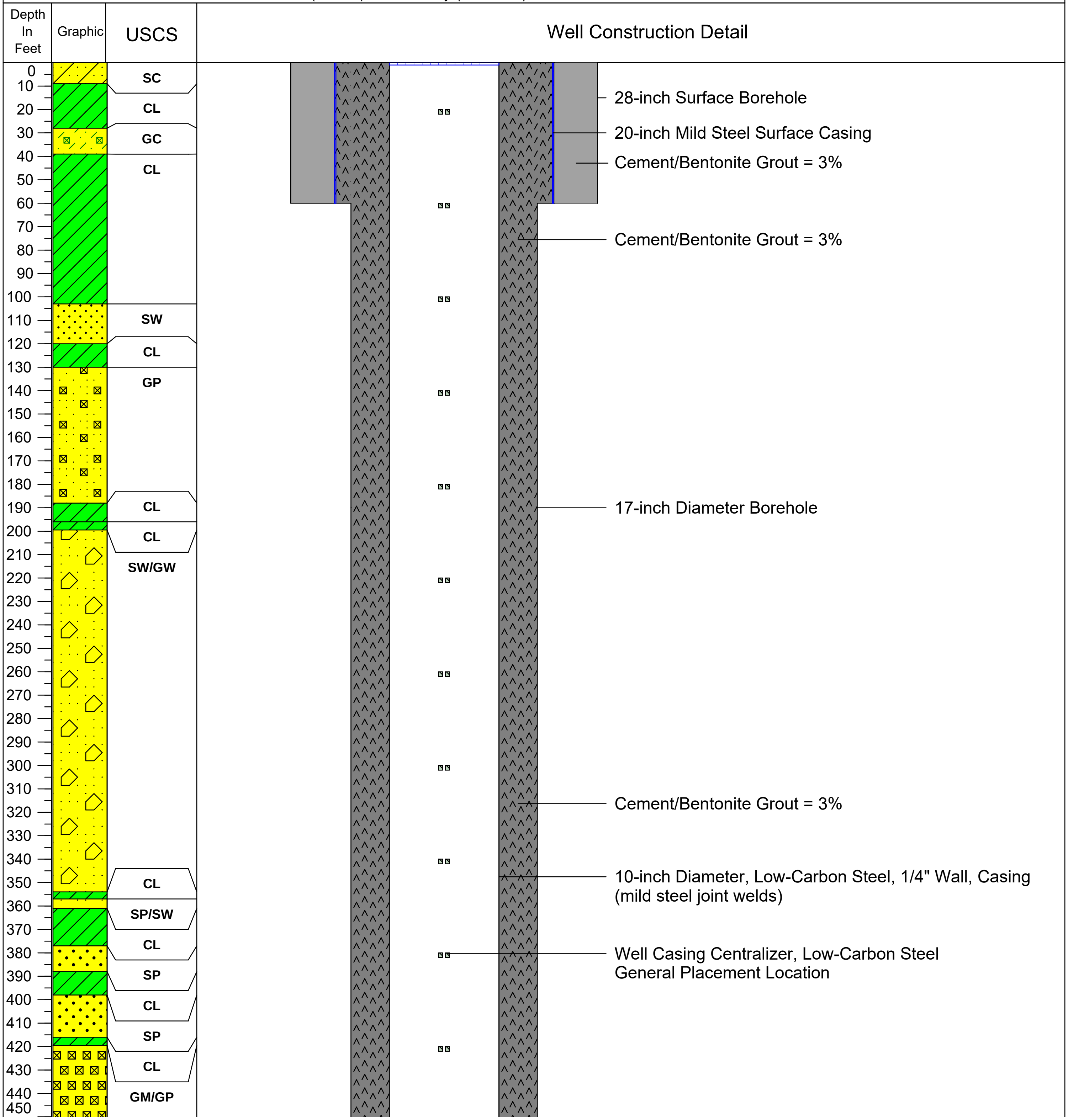
Project	Well Installation
Location:	Windsor, CA
E-PUR PN:	E102-001-01, Task 200
Logged by:	B. Gulbranson, J. Buchowski, G. Moore
Surface Conditions:	Grass Covered
Sampler Type:	Grab from Cyclone

Start Date:	2/6/2010
End Date:	5/5/2010
Latitude:	N 38° 53' 91"
Longitude:	W 122° 80' 13"

Drilling Company: WDC Exploration and Wells

Driller: Gary Eldred, Greg Gallio, John Chaves

Drilling Equipment: Reverse Circulation Air (0'-795'), Mud Rotary (795'-867')



Sanitary Seal:	Cement/Bentonite Grout	0 to 60	feet bgs	Surface Casing:	20-inch Steel	0 to 60	feet bgs
Annular Seal:	Cement/Bentonite Grout	0 to 665	feet bgs	Screened Interval:	695 to 745		feet bgs
Filter Pack:	SRI 1/4" Gravel	675 to 765	feet bgs	Casing Diameter:	10.0 inches		
Monument Type:	Concrete Pedestal with Steel Well Cap			Total Well Depth:	765.0 feet		

FIGURE 3: WELL CONSTRUCTION DIAGRAM

Bluebird Replacement Well Test Hole

Project	Well Installation
Location:	Windsor, CA
E-PUR PN:	E102-001-01, Task 200
Logged by:	B. Gulbranson, J. Buchowski, G. Moore
Surface Conditions:	Grass Covered
Sampler Type:	Grab from Cyclone

Start Date:	2/6/2010
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Latitude:	N 38° 53' 91"
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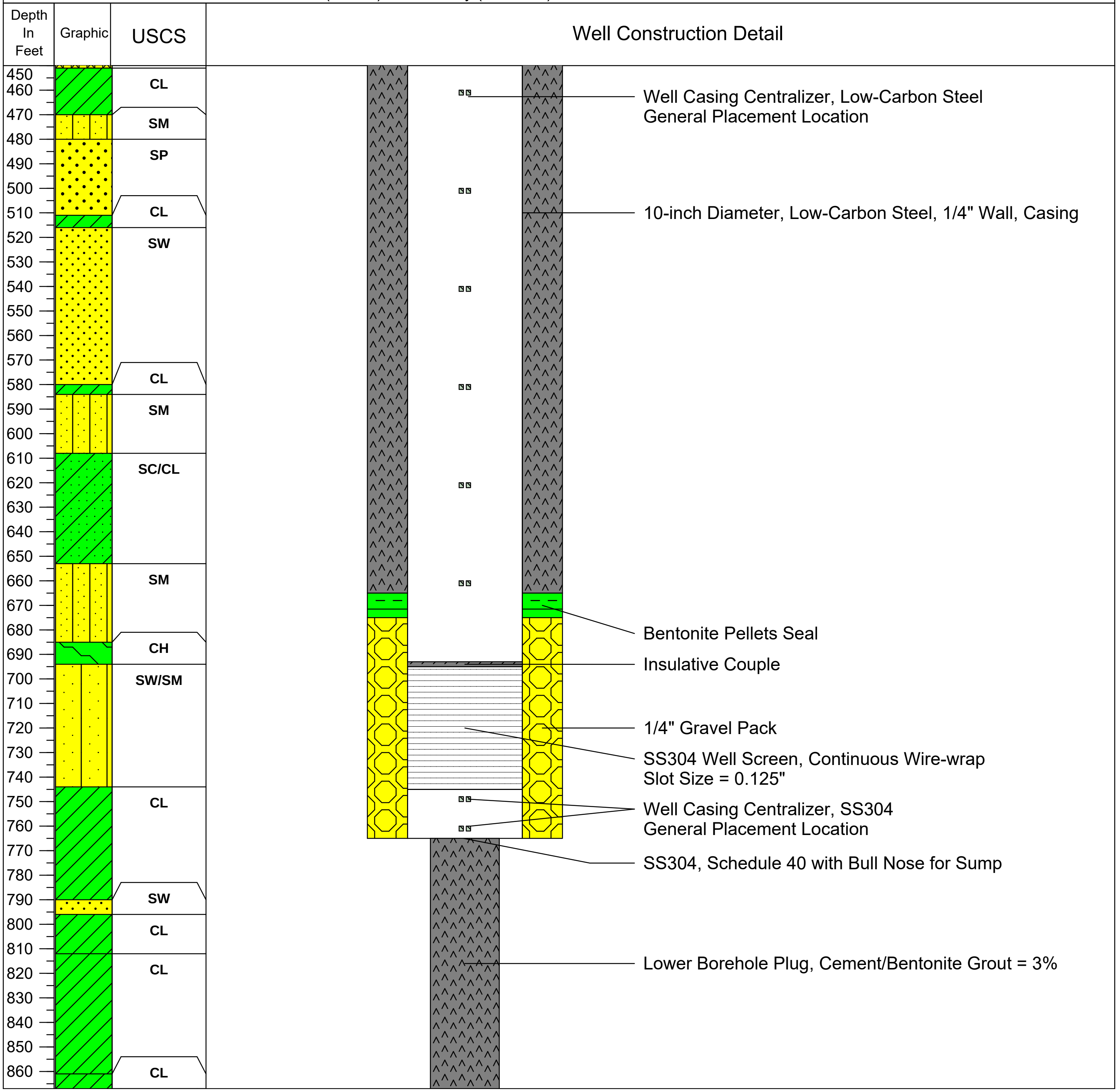
Drilling Company: WDC Exploration and Wells

Driller: Gary Eldred, Greg Gallio, John Chaves

Drilling Equipment: Reverse Circulation Air (0'-795'), Mud Rotary (795'-867')



ESPOSTI PARK

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

WATER WELL DRILLERS REPORT

ORIGINAL
File with DWR

Do not fill in

No. 291794

State Well No. ____
Other Well No. ____

Notice of Intent No. ____
Local Permit No. or Date ____ A.P.#65-222-20

(1) OWNER: Name County of Sonoma(Parks)
Address 2403 Professional Dr.
City Santa Rosa, Ca. ZIP ____

(2) LOCATION OF WELL (See instructions):
County Sonoma Owner's Well Number ____
Well address if different from above 6000 Shiloh Rd.
Township Santa Rosa, Range ____ Section ____
Distance from cities, roads, railroads, fences, etc. ____

WELL LOCATION SKETCH

(3) TYPE OF WORK:
New Well XX ☐ Deepening ☐
Reconstruction ☐
Reconditioning ☐
Horizontal Well ☐
Destruction ☐ (Describe destruction materials and procedures in Item 12)

(4) PROPOSED USE:
Domestic ☐
Irrigation xx ☐
Industrial ☐
Test Well ☐
Municipal ☐
Other ☐
(Describe)

(5) EQUIPMENT:
Rotary XX ☐ Reverse ☐
Cable ☐ Air ☐
Other ☐ Bucket ☐

(6) GRAVEL PACK:
Yes XX No ☐ Size 8 X 16
Diameter of bore ____
Packed from 55 to 300 ft.

(7) CASING INSTALLED:
Steel ☐ Plastic XX Concrete ☐

From ft.	To ft.	Dia. in.	Gage or Wall
0	300	8	#200

(8) PERFORATIONS:
Type of perforation or size of screen .032 Screen

From ft.	To ft.	Slot size
100	220	
240	300	

(9) WELL SEAL:
Was surface sanitary seal provided? Yes XX No ☐ If yes, to depth 55 ft.
Were strata sealed against pollution? Yes ☐ No ☐ Interval ____ ft.
Method of sealing ready mix

(10) WATER LEVELS:
Depth of first water, if known ____ ft.
Standing level after well completion 55 ft.

(11) WELL TESTS:
Was well test made? Yes XX No ☐ If yes, by whom? ____
Type of test Pump ☐ Bailer ☐ Air lift ☐
Depth to water at start of test XX ft. At end of test 135 ft.
Discharge 230 gal/min after 24 hours Water temperature ____
Chemical analysis made? Yes ☐ No ☐ If yes, by whom? ____
Was electric log made? Yes ☐ No ☐ If yes, attach copy to this report

(12) WELL LOG: Total depth 300 ft. Completed depth ____ ft.

from ft.	to ft.	Formation (Describe by color, character, size or material)
0	-5	top soil
5	-17	brown clay
17	-20	brown clay and gravel
20	-34	brown cemented gravel
34	-50	sandy brown clay
50	-54	fine gravel
54	-70	brown clay/gravel streaks
70	-79	brown clay
79	-93	blue clay
93	-100	brown clay
100	-111	blue gravel
111	-135	blue clay and gravel
135	-147	fine blue gravel
147	-163	brown clay and gravel
163	-195	gravel
195	-215	brown clay and gravl strk
215	-243	" " " " "
243	-280	gravel
283	-300	Sandy brown clay/grvl str

Work started 8/17/89 19__ Completed 8/23/89 19__

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

Signed John Jepsen (Well Driller)
NAME LES PETERSEN DRILLING & PUMP, INC. (Person, firm, or corporation) (Typed or printed)
Address 5434 Old Redwood Highway
City Santa Rosa, Ca. 95403 ZIP ____
License No. 261084 Date of this report 9/12/89

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

STATE OF CALIFORNIA
DEPARTMENT OF HEALTH SERVICES

WELL DATA

(1) System Name: Town of Windsor System Number: 49-017

(2) Source of Information: Town of Windsor

Collected by: Michael L. Cave Jr. Date:

(3) Number or Name	Esposti Well
Date drilled	8-17-89 to 8-23-89
(4) Location: Neighborhood	6000 Old Redwood Hwy, Windsor, CA 95492
Distance to: Sewer	
Sewage disposal	
Abandoned well	NA
Nearest property line	
Plot plan on file?	Yes
(5) Housing: Type	NA
Condition	
Pit depth (if any)	
Floor (material)	
Drainage	
(6) Well Depth	300 FT
(7) Casing: Depth	300 FT
Diameter	8 inch
Type	PVC 200
Height above floor	0
Distance to highest perforations.	100 FT
Sanitary sealed (yes or no)	Yes
Sanitary surface seal(yes or no)	Yes
Gravel pack (yes or no)	Yes 8 x 16
Second casing depth	NA
Second casing diameter	NA
Annular seal (depth)	
(8) Impervious Strata: Thickness	NA
Depth to	NA
(9) Water Levels: Static	55 FT
When pumping	135 FT
(10) Pump: Make	Goulds
Type	Submersible
Capacity, g.p.m.	260 GPM at 60 PSIG
Lubrication	Product
Power	230 VAC, 3 Phase
Auxiliary power	
Controlled by	Manual HOA Switchs & Irrigation Timer System
Discharge to	Distribution System Irrigation Park
(11) Frequency of Use	Irrigation & Emergency stand-by
(12) Flood Hazard	No
(13) Well log on file?	Attached
(14) Remarks and Defects (Use other side if necessary)	

Client

Job Number

Sheet of

Project

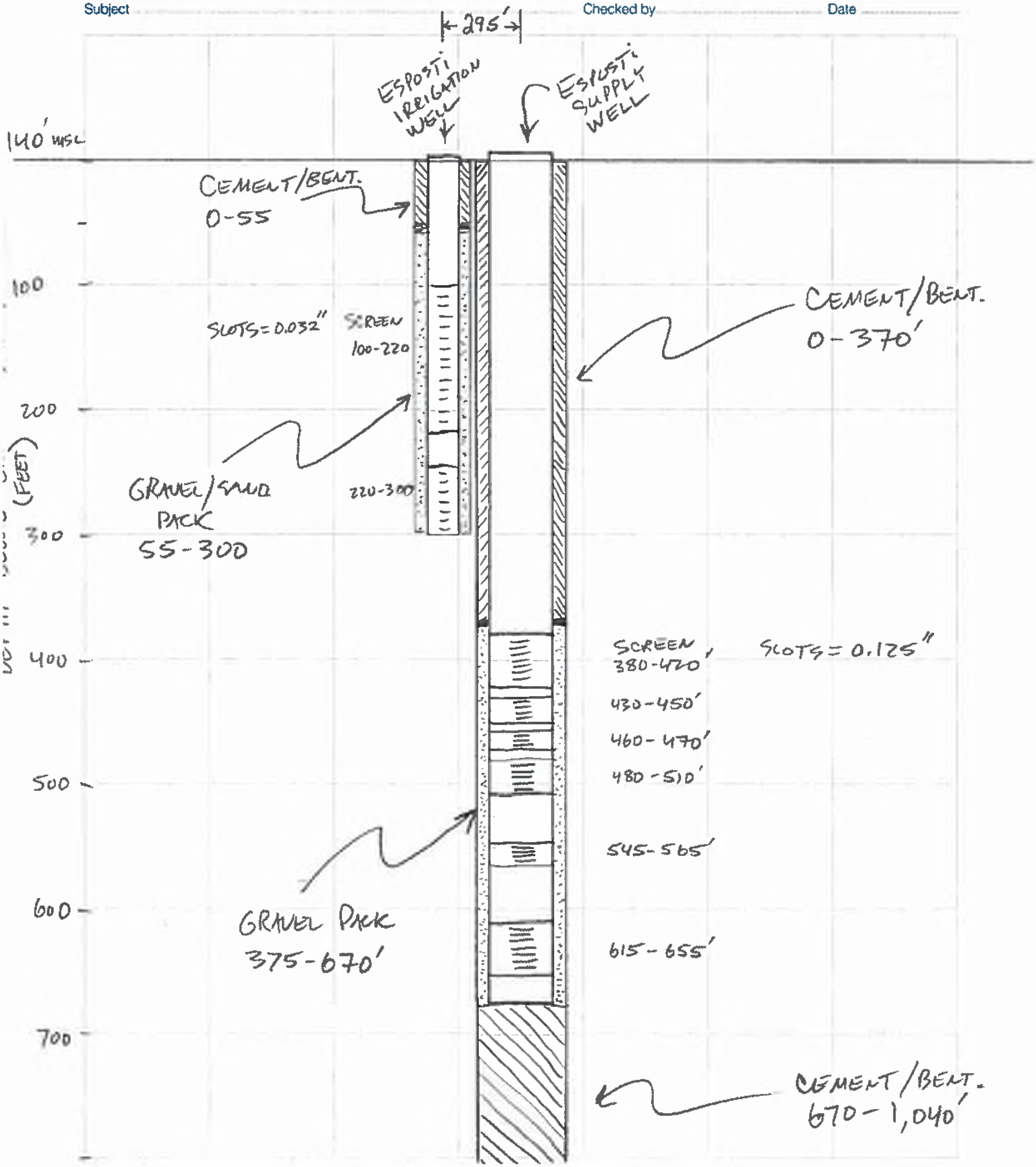
Sheets by

Date

Subject

Checked by

Date



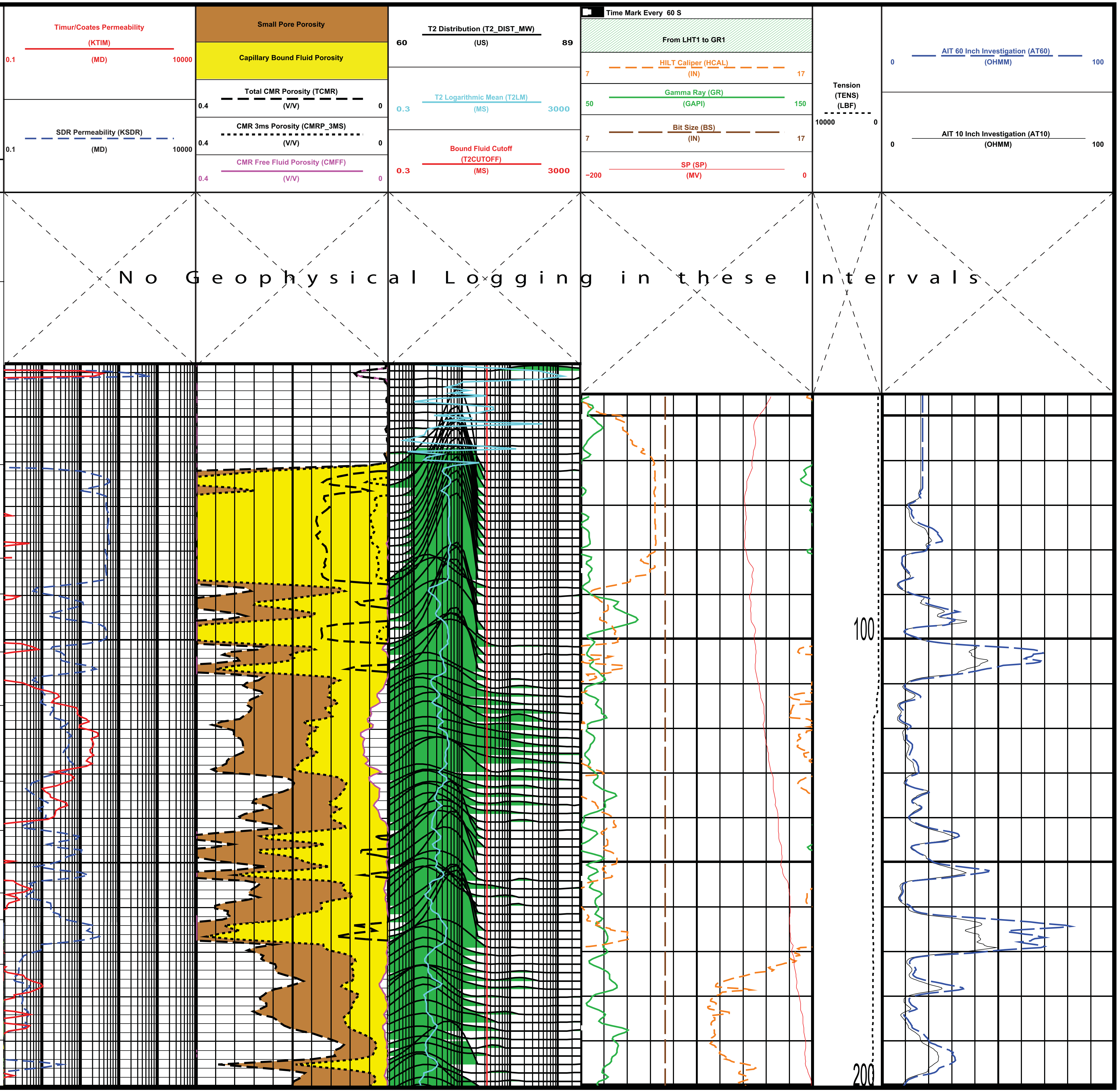
E PUR.llc

Drilling Company: WDC Exploration and Wells
Driller: Gary Eldred, Greg Gallio, John Chaves
Drilling Equipment: Reverse Circulation
Air (0'-795'), Mud Rotary (795'-867')

BORING LOG: Esposti Park
Esposti Park Well Test Hole

Start Date:	2/24/2010
End Date:	3/3/2010
Latitude:	N 38° 31' 35.4"
Longitude:	W 122° 46' 46.5"
Project	Well Installation
Location:	Windsor, CA
E-PUR PN:	E102-001-01, Task 200
Logged by:	B. Gulbranson, J. Buchowski, G. Moore
Surface Conditions:	Grass Covered
Sampler Type:	Grab

Depth (feet)	Graphic	USCS	Description
0 10	🟩	CL	Sandy CLAY (CL) - medium to light brown, soft, plastic clay; varicolored, poorly sorted, fine to coarse, subangular to angular sand; poorly sorted, rounded fine to coarse gravel
20 30 40 50 60	🟩	CL	Gravelly CLAY (CL) and Sandy CLAY (CL) - light brown, very fine to coarse grained sand, subangular to angular; gravel units, fine to coarse, subangular to subrounded.
70 80	🟨	SW	SAND (SW) - varicolored, poorly sorted, fine to coarse, subrounded to subangular sand with silty sand and silty gravel 70-71 feet; some metamorphosed quartz and feldspars.
	🟩	CL	Sandy CLAY (CL) - light gray clay with sand
90 100	⊠ ⊠	GM	Gravelly SAND (GM) - varicolored, poorly sorted, fine to medium, angular to subrounded sand; some, varicolored, poorly sorted, fine to coarse, angular to subrounded gravel; little silt. Gravel clasts metasedimentary sandstone to quartzite
110	⊠ ⊠	GM	Sandy GRAVEL (GM) - varicolored changing to green/gray, poorly sorted, fine to medium, rounded to subangular gravel; some sand; little silt. Green fine grained basalt clasts
120 130	🟩	CL	Silty CLAY (CL) - dark gray/green, plastic clay; with silt and fine sand
140	🟨	SM	Silty SAND (SM) - gray/green, poorly sorted, rounded to subrounded, fine sand; fine, subangular to subrounded gravel; with rare cobble
150	⊠ ⊠	GM	Silty GRAVEL (GM) - as above with fine gravel to coarse sand, varicolored
160	🟩	CL	Sandy CLAY (CL) - light brown, clay; sand
170	⊠ ⊠	GM	Silty GRAVEL (GM) - varicolored, unsorted to poorly sorted, fine, subangular to subrounded gravel; with rare cobble; units of silty sand, fine to medium grained, angular to subrounded.
180	🟨	SP	SAND (SP) - varicolored, subrounded to rounded, fine to medium sand; abundant well rounded and frosted quartz
190 200	🟨	SW	Sand (SW) - fine to coarse sand, well graded, similar in angularity and color to above.



E PUR, llc

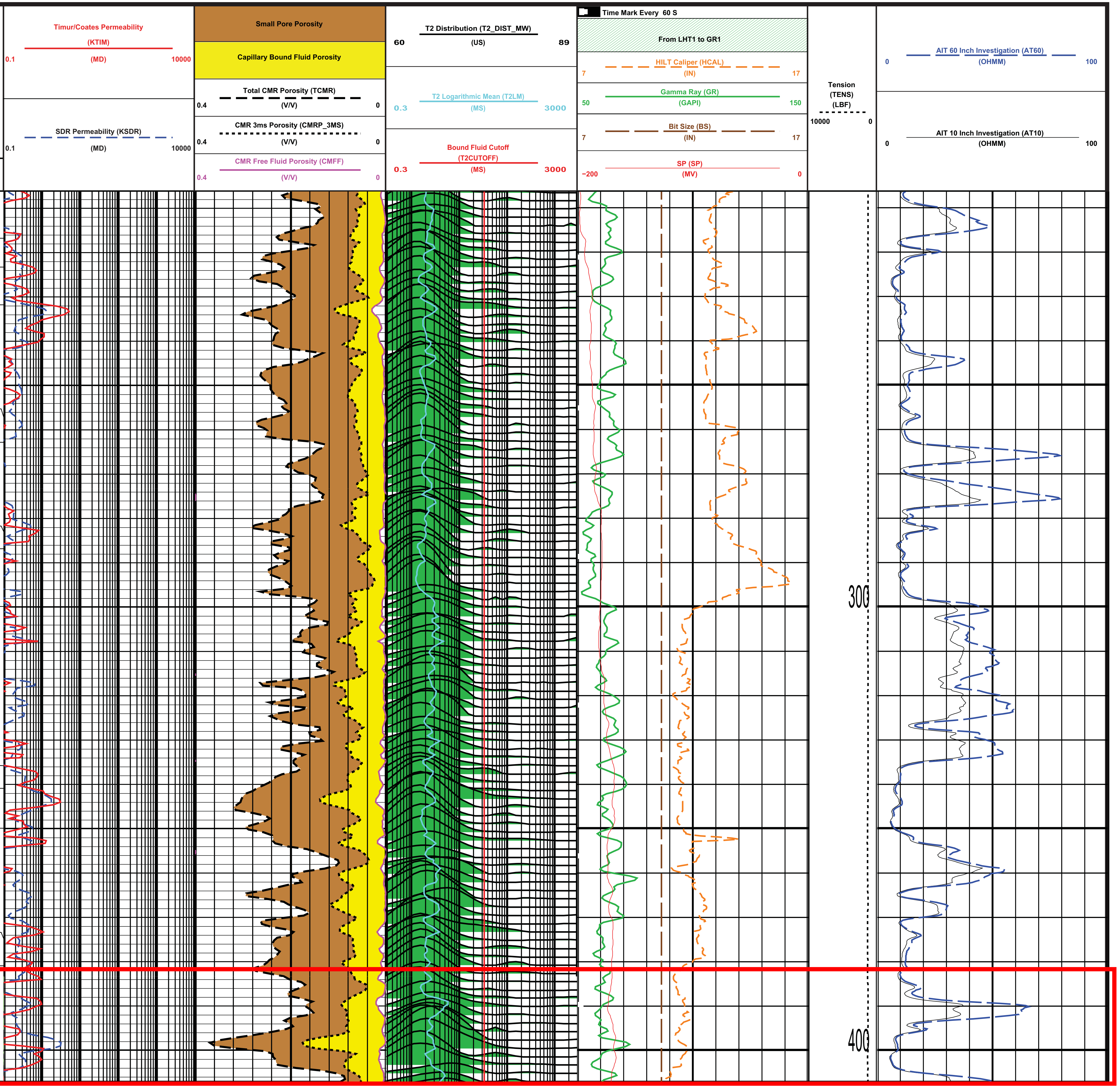
Drilling Company: WDC Exploration and Wells
Driller: Gary Eldred, Greg Gallio, John Chaves
Drilling Equipment: Reverse Circulation
Air (0'-795'), Mud Rotary (795'-867')

BORING LOG: Esposti Park
Esposti Park Well Test Hole

Start Date: 2/24/2010
End Date: 3/3/2010
Latitude: N 38° 31' 35.4"
Longitude: W 122° 46' 46.5"

Project: Well Installation
Location: Windsor, CA
E-PUR PN: E102-001-01, Task 200
Logged by: B. Gulbranson, J. Buchowski, G. Moore
Surface Conditions: Grass Covered
Sampler Type: Grab

Depth (feet)	Graphic	USCS	Description
210			
220		SP	Sand (SP) - varicolored, fine to medium, poorly graded sand
230		CL	Silty CLAY (CL) - light gray clay; with silt
240 250		SM	Silty SAND (SM) - varicolored, poorly sorted, rounded to subrounded to subangular sand; few to little silt (ash); some gravel units
260		SW	Sand (SW) - varicolored, poorly sorted, fine to coarse grained, subrounded to subangular sand
270 280		GW	GRAVEL (GW) - red stained gravel with sand, poorly sorted, subrounded to subangular, few obsidian clasts
		CL	Sandy CLAY (CL) - light gray clay; fine sand
290		SM	Silty SAND (SM) - gray, rounded to subrounded, fine sand, abundant milky frosted quartz; abundant rhyolite with red staining on some grains; increasing coarseness to gravel with depth
300 310 320 330		GM	Silty GRAVEL (GM) - as above with fine gravel and some sand
340		CL	Sandy CLAY (CL) - light gray clay; sand
		ML/CL	SILT and CLAY (ML/CL) - light brown, tan/buff, friable, fine ash; trace fine gravel
350 360 370		GP	GRAVEL with SAND (GP) - varicolored, subrounded to rounded to subangular, fine to medium gravel; moderately well sorted, fine to coarse, subangular to subrounded sand
380		ML/CL	SILT and CLAY (ML/CL) - light green gray, ash, some clear to frosted sand, pale green fine sand
390 400		GW/GM	GRAVEL with SAND (GW/GM) - varicolored, moderately well sorted, fine to coarse, subrounded gravel; some angular to subangular sand Abundant volcanics at 400 feet



BORING LOG: Esposti Park

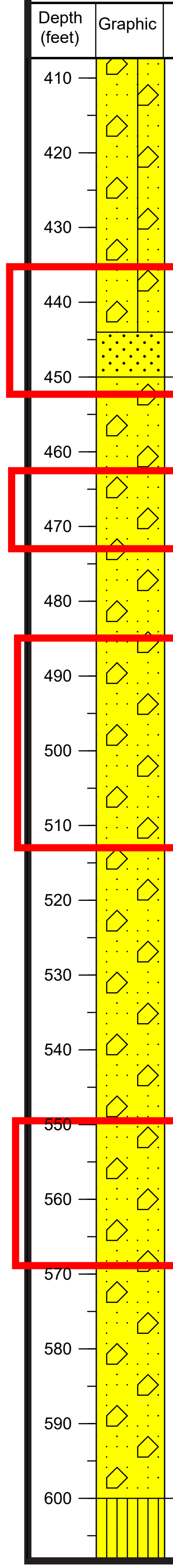
Esposti Park Well Test Hole

E-PUR, llc

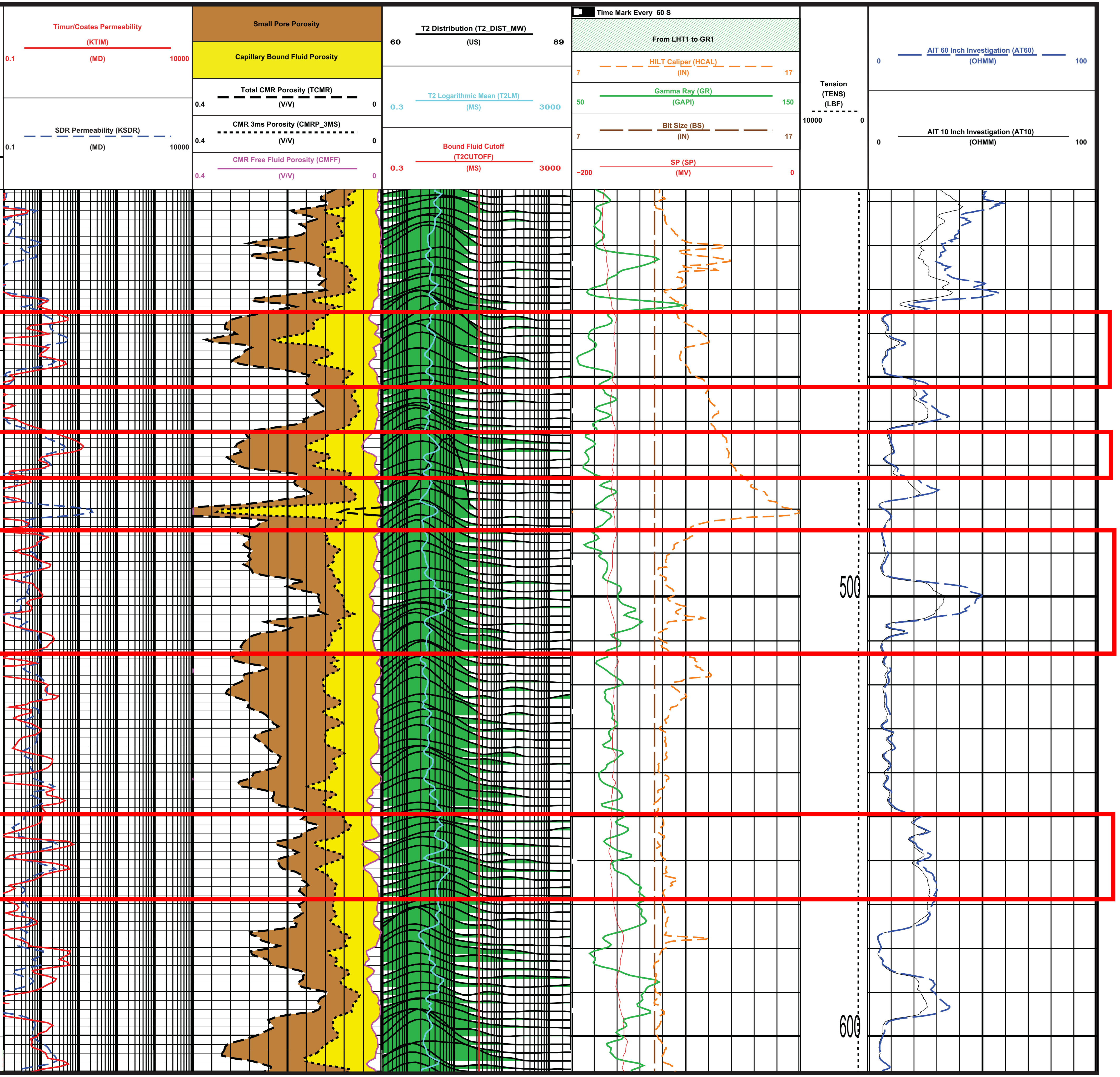
Drilling Company: WDC Exploration and Wells
Driller: Gary Eldred, Greg Gallio, John Chaves
Drilling Equipment: Reverse Circulation
Air (0'-795'), Mud Rotary (795'-867')

Project	Well Installation
Location:	Windsor, CA
E-PUR PN:	E102-001-01, Task 200
Logged by:	B. Gulbranson, J. Buchowski, G. Moore
Surface Conditions:	Grass Covered
Sampler Type:	Grab

Start Date:	2/24/2010
End Date:	3/3/2010
Latitude:	N 38° 31' 35.4"
Longitude:	W 122° 46' 46.5"



USCS	Description
SW	SAND (SW) - well graded sand, with little ash; stringer of clay at 450 feet
GW/SW	Sandy GRAVEL (GW) to Gravelly SAND (SW) - varicolored, fine to coarse grained sand and gravel
	Stringer of clay at 465 feet
	Trace of clay at 480 feet
	Interbedded clay unit with sand and gravel at 510 to 513 feet
	Trace obsidian at 520 feet
	Lost circulation at 545 feet
	Trace of clay at 580 feet;
ML	Sandy SILT (ML) - gray, friable, silt (ash); light gray, angular to subrounded, medium sand



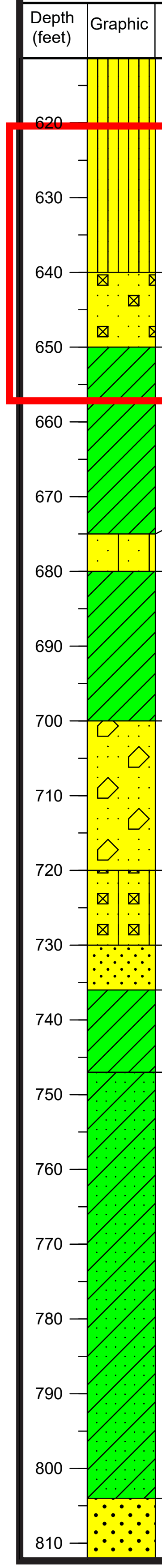
E-PUR,llc

Drilling Company: WDC Exploration and Wells
Driller: Gary Eldred, Greg Gallio, John Chaves
Drilling Equipment: Reverse Circulation
Air (0'-795'), Mud Rotary (795'-867')

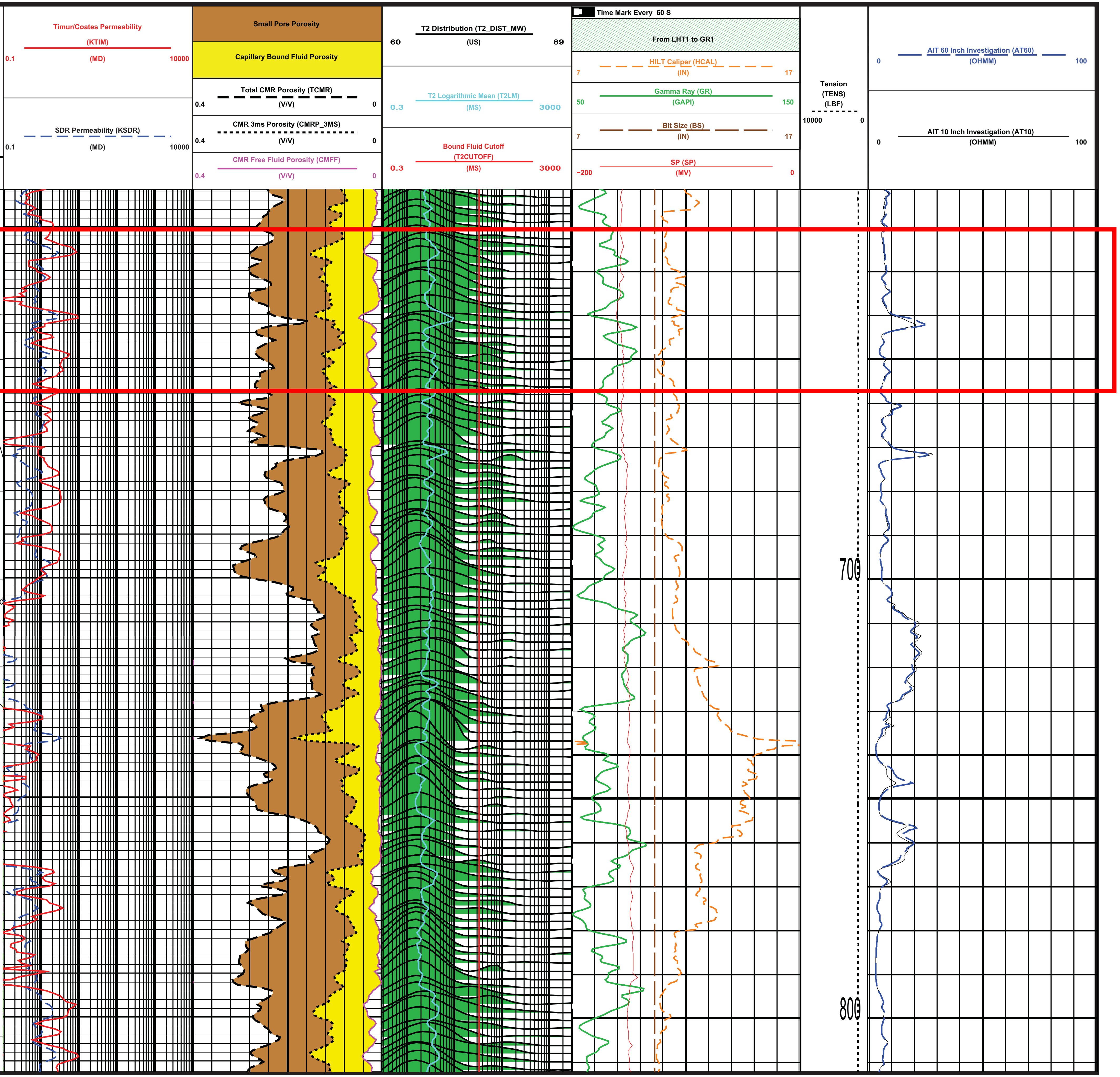
BORING LOG: Esposti Park
Esposti Park Well Test Hole

Start Date: 2/24/2010
End Date: 3/3/2010
Latitude: N 38° 31' 35.4"
Longitude: W 122° 46' 46.5"

Project	Well Installation
Location:	Windsor, CA
E-PUR PN:	E102-001-01, Task 200
Logged by:	B. Gulbranson, J. Buchowski, G. Moore
Surface Conditions:	Grass Covered
Sampler Type:	Grab



USCS	Description
SP/GP	SAND and GRAVEL (SP/GP) - varicolored, moderately sorted, fine to medium, subrounded to subangular sand; some varicolored, subrounded, fine to medium gravel; interbedded gray, soft clay
CL	Silty CLAY (CL) - light gray clay and silt (ash) with interbedded gray, soft clay; some fine sand
SM/ML	Silty SAND/Sandy SILT (SM/ML) - gray to varicolored, fine to coarse, subrounded to subangular sand; abundant gray to varicolored silt (ash); red and yellow, fine to medium gravel; no clay
CL	CLAY (CL) - light tan, soft, occasionally stiff clay; abundant fine sand
GW/SW	GRAVEL to SAND (GW/SW) - dark gray to varicolored, subrounded, medium to large gravel; varicolored, moderately poorly sorted, subrounded to subangular, medium to coarse with some fine sand
GM/SM	Silty GRAVEL (GM) to Silty SAND (SM) - color and texture as above
SW	SAND (SW) - dark green gray, very fine to medium grained sand, rounded to subrounded, poorly sorted; few gravel
CL	Silty CLAY (CL) - dark gray, soft clay; with micaceous silt
SC/CL	Clayey SAND (SC/CL) - gray green, poorly sorted, rounded to subangular, fine to medium sand; alternating light gray clay/silt (ash) and sand with gravel beds; yellow to orange staining abundant
SP	SAND (SP) - gray green, rounded to subrounded, moderately sorted sand; abundant silt (ash)



E-PUR, llc

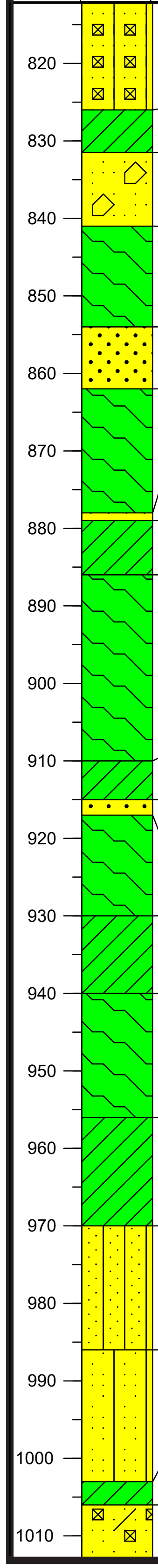
Drilling Company: WDC Exploration and Wells
Driller: Gary Eldred, Greg Gallio, John Chaves
Drilling Equipment: Reverse Circulation
Air (0'-795'), Mud Rotary (795'-867')

BORING LOG: Esposti Park

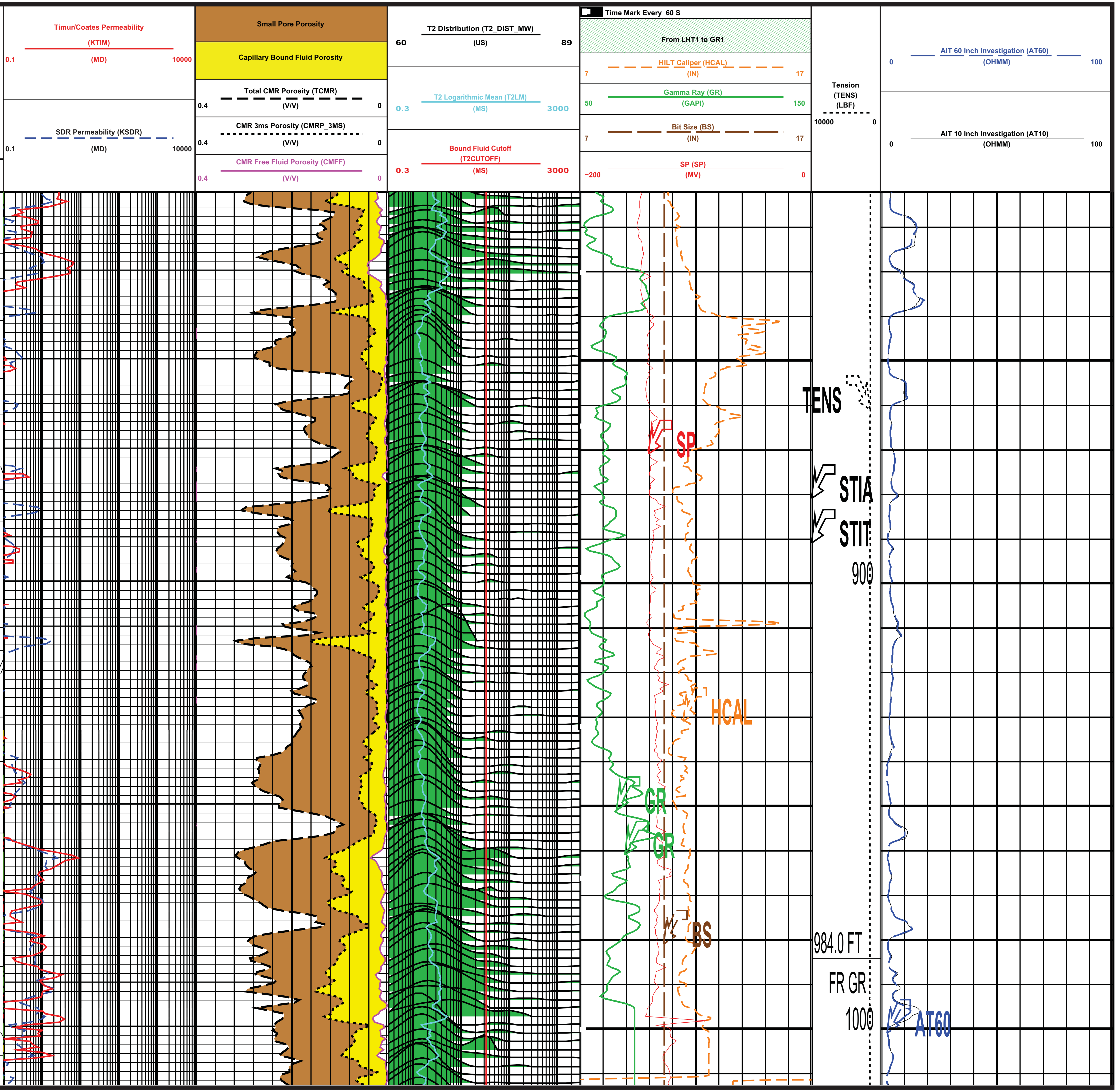
Esposti Park Well Test Hole

Project	Well Installation
Location:	Windsor, CA
E-PUR PN:	E102-001-01, Task 200
Logged by:	B. Gulbranson, J. Buchowski, G. Moore
Surface Conditions:	Grass Covered
Sampler Type:	Grab

Start Date:	2/24/2010
End Date:	3/3/2010
Latitude:	N 38° 31' 35.4"
Longitude:	W 122° 46' 46.5"



USCS	Description
GM	Silty GRAVEL (GM) with Sand - gray green, rounded to subrounded, medium to coarse gravel; predominantly volcanics, intermediate to felsic rhyolite clasts
CL	Sandy CLAY (CL) - light gray clay with sand
GW/SW	Silty GRAVEL (GW) to SAND (SW) - varicolored, fine to medium, subrounded to rounded sand; angular to subrounded, medium to coarse gravel
CH	CLAY (CH) - dark gray to brown, plastic clay
SP	SAND (SP) - gray green to varicolored, moderately sorted, subrounded to angular sand; little gray green to varicolored gravel
CH/CL	CLAY (CH/CL) - dark gray, fat clay grading to a light gray brown, plastic clay with sand
SP	SAND (SP) - sand with gravel and cobbles
CL	CLAY (CL) - light gray, plastic clay with occasional interbedded sand stringers
CH	CLAY (CH) - dark gray to brown, dense plastic clay
CL	Sandy CLAY (CL) - brown clay, with sand
SP	SAND (SP) - light gray, fine sand with silt
CH	CLAY (CH) - gray brown to green gray, highly plastic clay; minor fine sand/silt, obsidian; hard slow drilling
CL	Sandy CLAY (CL) - gray green
CH	CLAY (CH) - green gray, fat clay, some silt, plastic clay with small obsidian
CL	Sandy CLAY (CL) - tan brown clay, sand
SM	Silty SAND (SM) - green gray, fine sand with silt (ash)
SM/SP	SAND (SM/SP) - moderately sorted, rounded sand with silt (ash); minor clay layer; trace coarse sand at 980 feet; flowing sand
CL	Sandy CLAY (CL) - light gray, soft clay, minor fine sand; becoming very dense with depth
SC/GC	Sand CLAY and Clayey Gravel (SC/GC) - gray, rounded to subrounded, fine sand; minor fine gravel; some clay; intercalated, hard slow drilling



E PUR,llc

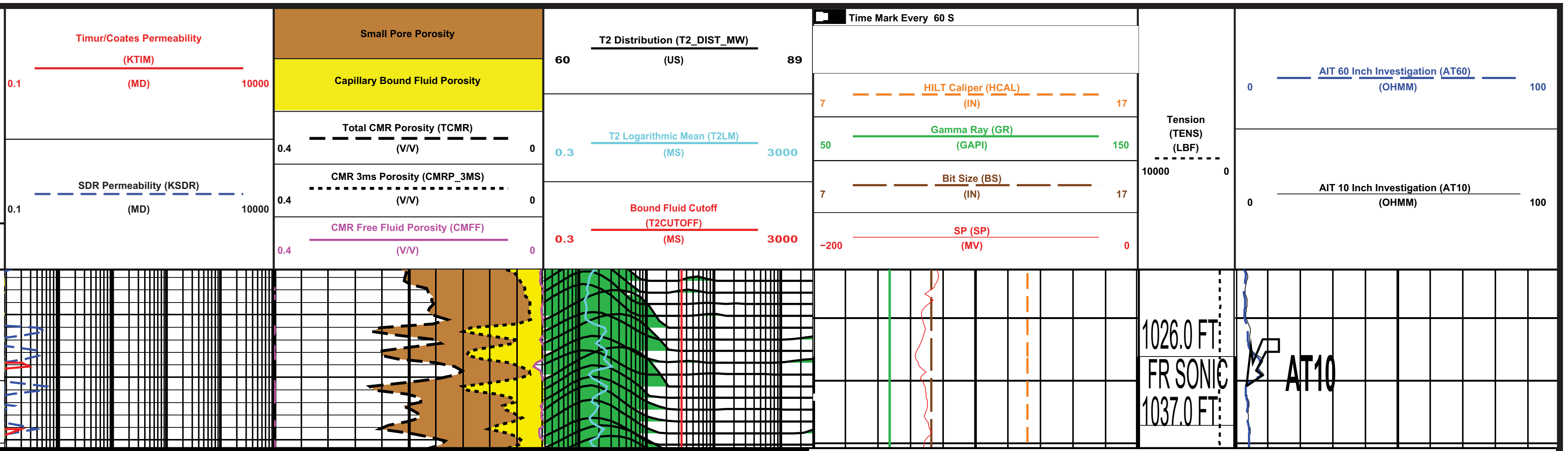
Drilling Company: WDC Exploration and Wells
Driller: Gary Eldred, Greg Gallio, John Chaves
Drilling Equipment: Reverse Circulation
Air (0'-795'), Mud Rotary (795'-867')

BORING LOG: Esposti Park
Esposti Park Well Test Hole

Start Date: 2/24/2010
End Date: 3/3/2010
Latitude: N 38° 31' 35.4"
Longitude: W 122° 46' 46.5"

Project	Well Installation
Location:	Windsor, CA
E-PUR PN:	E102-001-01, Task 200
Logged by:	B. Gulbranson, J. Buchowski, G. Moore
Surface Conditions:	Grass Covered
Sampler Type:	Grab

Depth (feet)	Graphic	USCS	Description
1020			
1030		CL	Sandy CLAY (CL) - soft clay; some sand; intercalated, hard slow drilling; Bottom of Boring
1040			



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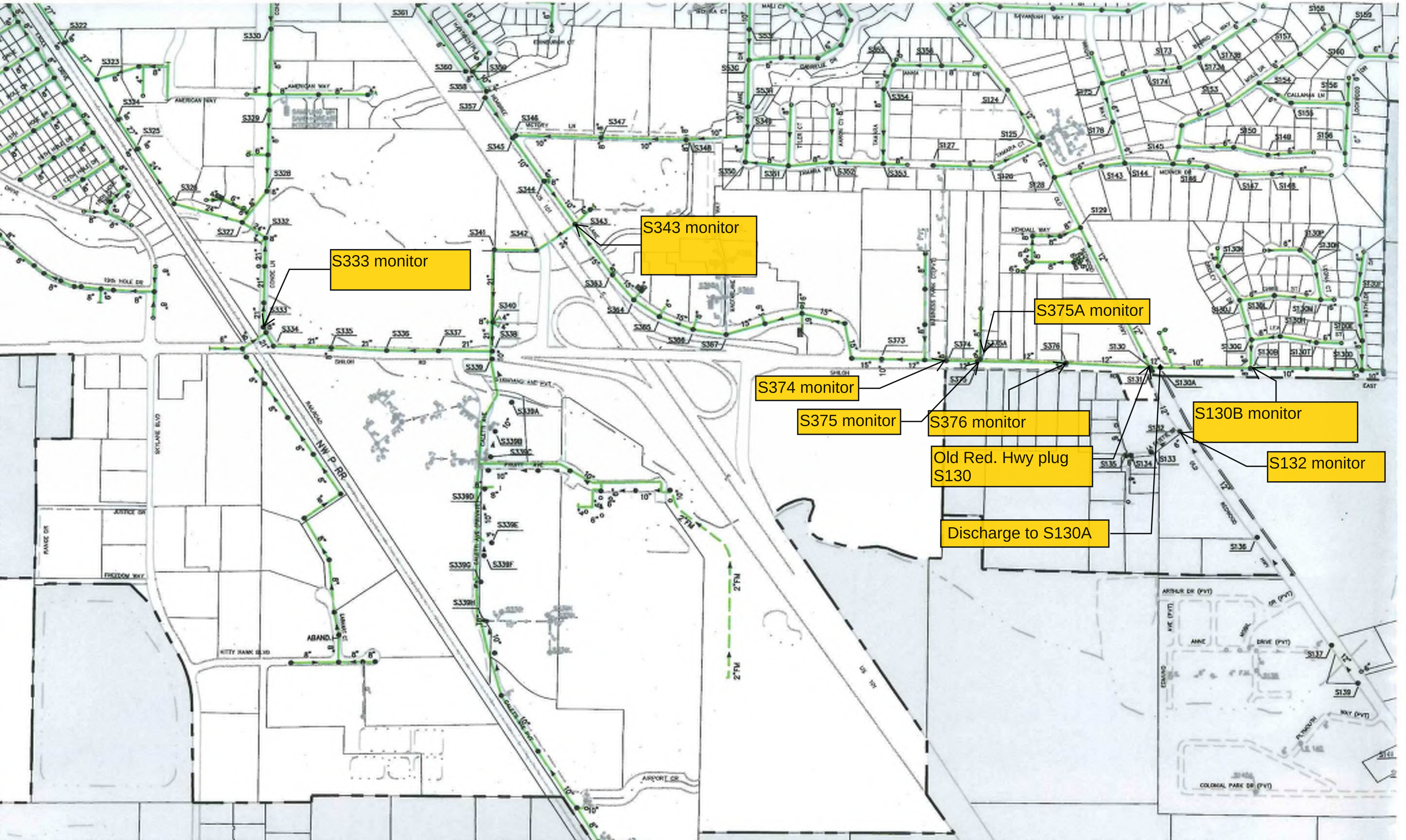
Surface Seal:	Sanitary Seal (Grout)	0 to 60	feet bgs
Annulus Seal:	Grout	0 to 370	feet bgs
Filter Pack:	SRI 1/4 inch Gravel	375 to 670	feet bgs
Monument Type:	Temporary well cap	to	feet bgs

Screened Interval:	380-420, 430-450, 460-470, 480-510, 545-565, 615-655 feet bgs
Casing Diameter:	10.0 inches
Total Boring Depth:	1040.0 feet
Total Well Depth:	670.0 feet

Geophysical Log Notes:
Geophysical logging by Schlumberger (Bakersfiel
CMR - Combinable Magnetic Resonance Tool
SP - Spontaneous Potential

Lithologic Log Notes:
UCS Unified Soil Classification System (Visual-Manual Method)

Appendix C – Sewer Capacity Memo and Flow Test Observation Records


S343 monitor
S333 monitor
S375A monitor
S374 monitor
S375 monitor
S376 monitor
S130B monitor
Old Red. Hwy plug S130
S132 monitor
Discharge to S130A
SHILOH RD
NW P RR
AMERICAN WAY
SKYLANE BLVD
KITTY HAWK BLVD
AIRPORT DR
US 101
2" FM
ABAND.

Town of Windsor, Esposti Well Project

Sewer Manhole S375A

S375A on private drive, 10-ft north of Shiloh Rd, Windsor, CA

S375A on private driveway, looking north off Shiloh Rd, Windsor, Ca

6.5 ft from rim to bottom, 8-inch sewer lateral

S375 on Shiloh Rd, Windsor, Ca.

S130B on Gridley Drive, Windsor, Ca

S130B Looking Inside, 12-ft from rim to bottom, 8-inch sewer

S130B on Gridley Dr Windsor, Ca, Looking North

S130B on Gridley Dr, Looking west on Shiloh Rd, Windsor, Ca

DATE: 5/9/2016

LOCATION: ESPOST PARK, WINDSOR

PROJECT NAME: ESPOSTI REHAB.

EVENT: SEWER DISCHARGE MONITORING & SPECIFIC CAPACITY TEST

5/9 <u>SEWER DISCHARGE MONITORING</u> SITE SAFETY w/ TOWN JOSE, JORDAN

0855- ESW DTW = 40.55 TOC

0910 - TURN ON ESW TO CONFIRM SP. CAP.

* @ 0940 START PUMPING 200 GPM TO S130
* @ 0945 START PUMPING FROM RFR TANKS, BUT FILTERS CLOGGED(?) AND ONLY DOES 100GPM! CLEAN OUT BAGS-FILTERS ✓ GOOD FOR HIGHER FLOW

1105 - START DISCHARGING @ 200 GPM TO S130

DTW @ 1235 = 104.22 HEAD = $\frac{270}{-104}$

LOST COMMUNICATION w/ IN-SITU 700 @ 1235

1255 - DISCHARGING @ 300 GPM FROM FILTER PUMP

1330 - ESW DTW = 106.68, 1340 DTW = 106.69

1345 - ESW PUMP OFF - NO CAPACITY. 400 GPM 0910-1345

1425 - START DISCHARGE @ 400 GPM

1515 - STOP MONITORING & NOW DISCHARGING @ 200 GPM

148.40 - DTW @ 2:41 pm 221.42 head

1600 - STOP SURGE/PURGE - TANKS FULL

1620 - RC/WEEKS OFFSITE

* FINAL NOTES PUMPED ESW @ 400 GPM FOR 4.5 HOURS & DRAWDOWN BEGAN TO FLATTEN OUT @ 65'. TOTAL DRAWDOWN WAS 66.14'

FIELD REPORT

DATE: 5/9/2016	LOCATION: Esposti Well, Old Redwood Hwy at Shiloh Road, Windsor, CA
PROJECT NAME: Town of Windsor, Esposti Well	JOB NO: 11110001.20
EVENT: Sewer Flow Test and Observations	WEATHER/TEMP: Cloudy ° at am 1000 Sunny ° at pm 1440
PRESENT AT SITE: Jourdan (Town of Windsor)	

DATE: ddmm/yr 05 / 09 / 16

Time: use 24 hour time record at 15 min intervals or more freq.	Manhole number/description	Observed flow as a % of full pipe	Other observations
0936	S375	15%	Initail
1000	S375	20%	5% increase w/100gpm
1100	S374	15%	
1105	S375	15%	
1111	S374	15%	
1113	S375	15%	
1121	S374	30%	
1123	S375	30%	
1140	S374	30%	
1147	S375	30%	
1238	S333	25%	
1252	S374	30%	
1305	S374	30%	
1311	S374	30%	
1331	S374	30%	
1341	S374	30%	
1423	S374	30%	
1430	S374	35-40%	400 gpm
1440	S374	40-45%	400 gpm
1453	S374	45%	
1506	S374	30%	

Page 1 of 1

Jose a
Jordan

Jose
Jorda

FIELD REPORT

DATE: 5/9/2016

LOCATION: Esposti Well, Old Redwood Hwy at Shiloh Road, Windsor, CA

PROJECT NAME: Town of Windsor, Esposti Well

JOB NO: 11110001.20

EVENT: Sewer Flow Test and Observations

WEATHER/TEMP: 930 ° at am ° at pm Overcast 60°

PRESENT AT SITE: 9am Weeks (2), Town (3), GHD (1)

DATE: dd/mm/yr 5 / 9 / 16

Time: use 24 hour time record at 15 min intervals or more freq.	Manhole number/description	Observed flow as a % of full pipe	Other observations
0933	S374	~15%	Fairly open flow
0940 - 0942			Side flow coming in ∆5%
0954		~15-20% apparent	increase in flow - faster
1000		~15-20%	Same

Page 1 of 1

FIELD REPORT

DATE: 5/9/2016	LOCATION: Esposti Well, Old Redwood Hwy at Shiloh Road, Windsor, CA
PROJECT NAME: Town of Windsor, Esposti Well	JOB NO: 11110001.20
EVENT: Sewer Flow Test and Observations	WEATHER/TEMP: ° at am ° at pm
PRESENT AT SITE: Weeks GHD	

DATE: dd/mm/yr 5 / 9 / 16

Time: use 24 hour time record at 15 min intervals or more freq.	Manhole number/description	Observed flow as a % of full pipe	Other observations
09:44 AM	S376	15%	15% open flow ~~Gt~~ Grease 10 GPM
09:53 AM	S376	85%	10% increase
1000 AM	" "	Same	at 100 GPM
1100 AM	" "	15%	open flow 200 GPM
1115 11[illegible]5 AM	" "	20%	5% increase
1122 [illegible] AM	" "	Same	
1145 AM	" "	25%	5% incree in flow
1259 AM	" "	25% Same	10% increasein flow
12:49 PM	" "	30%	5% increase in flow 300 GPM
1310 PM	" "	30% same	Same increase in flow
1325 PM	" "	Same	" " "
1339 PM	"	30% Same	0% increase flow 400 GPM
1423 PM	" "	35%	5% increase in flow
1440 PM	" "	35% Same	" " "
11155 [illegible] PM	" "	35% Same	" " "
1510 PM	" "	30%	5% Decrease in flow

Special notes regarding: traffic during test, trucks, buses. Pedestrians, kids in the area, homeless. Is location appropriate for night monitoring. Photograph location and inside of manhole. Consider appropriateness of manhole as a permanent monitoring station with automatic measuring for final system.

on 5/9/16 Light traffic on shiloh Rd at 5376 from 9:30am to 1:40pm heavier traffic after 3:00pm & one or two pedestrians walking bye.

GHD

FIELD REPORT

DATE: 5/16/2016

LOCATION: Esposti Well, Old Redwood Hwy at Shiloh Road, Windsor, CA

PROJECT NAME: Town of Windsor, Esposti Well

JOB NO: 11110001.20

EVENT: Sewer Flow Test and Observations

WEATHER/TEMP: 9 ° at [✓ am] ° at pm Sunny

PRESENT AT SITE: Rich Ramos - 800 GPM

DATE: dd/mm/yr 5 / 16 / 16

Time: use 24 hour time record at 15 min intervals or more freq.	Manhole number/description	Observed flow as a % of full pipe	Other observations
8:46AM	374	50%	GOOD FLOW/CLEAR WATER
8:41 AM	375	50%	GOOD FLOW /CLEAR WATER
8:51 AM	343	50%	27"@1/3 - 10" @ 50% ↳ GOOD FLOW/CLEAR WATER
9:06 AM	327	50%	→ GOOD FLOW/CLEAR WATER

Kent O'Brien 707-478-9559 cell and text

FIELD REPORT

DATE: 5/11/2016	LOCATION: Esposti Well, Old Redwood Hwy at Shiloh Road, Windsor, CA
PROJECT NAME: Town of Windsor, Esposti Well	JOB NO: 11110001.20
EVENT: Sewer Flow Test and Observations	WEATHER/TEMP: ° at am ° at pm
PRESENT AT SITE: WEEKS	JOSE BANUELOS

DATE: dd/mm/yr 5 / 11 / 16

Time: use 24 hour time record at 15 min intervals or more freq.	Manhole number/description	Observed flow as a % of full pipe	Other observations
1313	S376	10%	increase flow. 400 GP
1315	S376	35%	20% increase in flow
1325	S376	Same	Same in flow
1332	S376	35%	Same in flow 400 to 500 GPM
1344	S376	40%	5% increase in flow 60
1359	S376	Same 40%	Same " " GPM
1414	S376	Same 40%	Same " " "
1424	S376	45%	5% increase in flow 70 GPM
~~14~~ "	"	"	AT 700 water starts to
"	"	"	trickling into lateral on
"	"	"	the Southside but it's fi
1439	S376	45% Same	same at 700 GPM in flo
1450	S376	50%	5% increase in flow to 80 GP
1458	S376	55%	5% increase in flow to 8
1506	S376	60%	5% increase flow 900 GPM
1521	S376	Same 60%	Same "
1535	S376	Same 60%	Same " "
1550	S376	Same 60%	Same " " " " 900 GPM
1525	checked S0130B	and flow look good.	
~~1600~~ 1605	S376	Same 60%	Same " " " " 900 GPM
1620	S376	Same 60%	Same " " " " at 900 GPM
1635	S376	Same 60%	Same " "
1653	S376	40%	Drop 20%

Page___of___

5/11/2016

Special notes regarding: traffic during test, trucks, buses. Pedestrians, kids in the area, homeless. Is location appropriate for night monitoring. Photograph location and inside of manhole. Consider appropriateness of manhole as a permanent monitoring station with automatic measuring for final system.

on 5/11/16 A little more people walking than 5/10/16. flow it's nice and Clear & Heavy traffic manhole is on the bike lane

Kent O'Brien 707-478-9559 cell and text

FIELD REPORT

DATE: 5/11/2016	LOCATION: Esposti Well, Old Redwood Hwy at Shiloh Road, Windsor, CA
PROJECT NAME: Town of Windsor, Esposti Well	JOB NO: 11110001.20
EVENT: Sewer Flow Test and Observations	WEATHER/TEMP: ° at am 1:13 ° at pm Sunny
PRESENT AT SITE: Jourdan (Town of Windsor)	

DATE: dd/mm/yr 5 / 11 / 16

Time: use 24 hour time record at 15 min intervals or more freq.	Manhole number/description	Observed flow as a % of full pipe	Other observations
1310	S374 (Shiloh)	10%	Inital inspection
1320	S374	40%	Clear water/400gpm
1328	S374	40%	
1338	S374	40-45%	at 500 gpm
1349	S374	45-50%	at 600 gpm
1356	S374	50%	
1403	S343 (Hembree)	50%	Looks good
1413	S327 (Conde)	25-30%	plenty of capacity
1429	S374	50-55%	at 700 gpm
1440	S374	50-55%	at 700 gpm
1455	S374	50-60%	at 800 gpm
1504	S374	60%	at 900 gpm
1511	S374	60-65%	at 900 gpm
1522	S343 (Hembree)	50%	at 900 gpm
1526	S366	40-50%	at 900 gpm
1536	S374	60-65%	at 900 gpm
1556	S374	60-65%	
1617	S374	60-65%	
1625	S374	60-65%	
1654	S374	40%	End of run

FIELD REPORT

DATE: 8/23/2016

LOCATION: Esposti Well, Old Redwood Hwy at Shiloh Road, Windsor, CA

PROJECT NAME: Town of Windsor, Esposti Well

JOB NO: 11110001.20

EVENT: Sewer Flow Test and Observations

WEATHER/TEMP: ° at am ° at pm

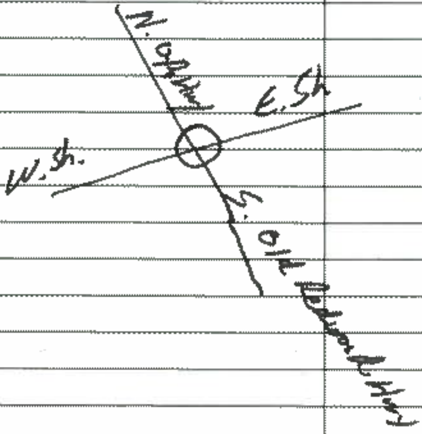
PRESENT AT SITE: Kent O'Brien

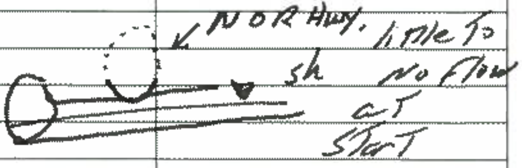
DATE: dd/mm/yy Aug /23/2016

Time: use 24 hour time record at 15 min intervals or more freq.	Manhole number/description	Observed flow as a % of full pipe	Other observations
1115	S130	10% 0 gpm pump	
1122	S130	45% 400 gpm	20% going ORH
1132	S130	50% 410 gpm	

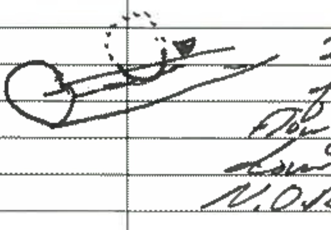
Pump Start: 11:20

by KOB!





Little To no flow at Start



20% of Total flow going down N.O.R. Hwy

Page____ of____

DRAFT Technical Memorandum

Esposti Park Groundwater Disposal Plan

Subject: **Esposti Park Sewer Discharge Analysis**
Prepared For: Kent O'Brien/GHD
Prepared by: Ian Jaffe, RMC
Reviewed by: Leslie Dumas, RMC
Date: April 29, 2016

1 Background

The Town of Windsor's (Town's) Esposti Park Supply Well is currently undergoing redevelopment and testing as part of a program to bring this well on-line as a water supply source for the Town. Groundwater produced from the well will be discharged to the Town's sanitary sewer during the well redevelopment and testing events. Specifically, waters generated during well development and testing will be discharged to the sanitary sewer in Shiloh Road, with a plug installed at the intersection of Shiloh Road and Old Redwood Highway to direct discharged waters and prevent these waters from entering the Old Redwood Highway trunk line as that pipeline is nearing capacity. This analysis was conducted to estimate the expected increase in sewer flow depth and the time to flow concentration at three potential monitoring sites in the Shiloh Road sanitary sewer as a result of the proposed groundwater discharges.

2 Analysis

Initial data for the sewer line in question were collected from a map of the Town's sewer system (as provided by the Town) and from a technical memorandum describing a sewer model for the Town that was utilized for evaluating groundwater discharges to the same sewer line in 2010. The sewer the diameter and length of the pipe segments were obtained from the map, and the expected peak dry weather flow in the sewer line receiving the discharge, as well as the pipe slope, was obtained from the modeling memorandum. These initial data are presented in **Table 1**.

Table 1: Information for Pipeline from Discharge Point (S130) to Potential Monitoring Locations

Manhole	S374	S375	S376
Length (ft)	1294	1106	563
Diameter (in)	12	12	12
Slope (ft/ft)	0.006	0.006	0.006
Manning's "n" (assumed)	0.013	0.013	0.013
PDWF (gpm)	132	132	132

Note: gpm – gallons per minute; ft - feet

Using Manning's equation for open channel flow in a circular channel, an iterative process was used to determine the initial (baseline) flow depth in the pipeline of interest assuming a baseline flow rate of approximately 2 feet per second (fps). Next, the iterative process was repeated for the seven discharge flow scenarios (e.g. anticipated discharge rates to the sewer) to determine the depth of flow and velocity of flow in the sewer at the monitoring locations. Using the distance to the observation points and the calculated velocity, the time to flow observation was estimated. The freeboard (depth of unfilled pipe) was also calculated. It was assumed that the depth of flow at each of the potential observation locations was equal as the pipe diameter and slope is assumed to be uniform from the discharge point to all three observation manholes (as noted in the modeling memo). The results of the iterative process are presented in **Table 2**.

Table 2: Flow Depth and Time to Flow Observations

Flow Added	Total Flow	d/D	Flow	Freeboard	Time to observation point (min)		
gpm	*gpm*	*in/in*	*fps*	*inch*	S374	S375	S376
Baseline (0 gpm added)	132	0.220	2.29	9.36	9.42	8.05	4.09
50	182	0.26	2.52	8.88	8.56	7.32	3.72
100	232	0.295	2.71	8.46	7.96	6.80	3.46
200	332	0.355	2.99	7.74	7.21	6.17	3.14
500	632	0.505	3.54	5.94	6.09	5.21	2.65
600	732	0.555	3.67	5.34	5.88	5.02	2.55
800	932	0.650	3.87	4.20	5.57	4.76	2.42
1,000	1132	0.750	3.99	3.00	5.40	4.62	2.35

Appendix D – Temporary Sewer Discharge Application and Permit

TOWN OF
WINDSOR

WASTEWATER DISCHARGE PERMIT APPLICATION
TEMPORARY DISCHARGE

PART A – APPLICATION / PERMITTEE INFORMATION

A1. **Applicant Business Name** Town of Windsor

A2. **Physical Address of Facility or Location Discharging Wastewater** Esposti Park, Old Redwood Hwy @ Shilo Road

City Windsor State CA Zip 95492

Phone (707) 838-5385 - Elizabeth Cargay

A3. **Mailing Address** 8400 Windsor Road, Bldg. 100

City Windsor State CA Zip 95492

A4. **Chief Executive Officer** Ted Whiton

a. Title Principal/Senior Civil Engineer

b. Mailing Address 2235 Mercury Way Suite 150

City Santa Rosa State CA Zip 95407

A5. **Environmental Consultant** Kent O'Brien

a. Title Senior Hydrogeologist

b. Mailing Address 2235 Mercury Way, Suite 150

City Santa Rosa State CA Zip 95407

c. Phone (707) 523-1010

A6. **Primary Contact Person** David J. Vossler

Title Senior Geologist

Day Phone (707) 523-1010 Night/Emergency Phone (707) 477-1283

TOWN OF
WINDSOR

WASTEWATER DISCHARGE PERMIT APPLICATION
TEMPORARY DISCHARGE

PART B – SITE INFORMATION & TREATMENT

Purpose: *The Site Information Section is primarily used to determine the substances which may enter into the wastewater discharge from the business activity and the intention of how it will be treated.*

B1. Site History

Summarize the business activities and/or manufacturing processes responsible for the wastewater. Provide the name and contact information of the current property owner:

Previously install Town well, Esposti Well, requires additional development and Testing. Discharge will be of extracted groundwater to sanitary sewer via settling tanks and discharge flow controls.

B2. Describe the nature of the site contamination (if any):

Naturally occurring Manganese, and total Arsenic.

B3. Identify the contaminants of concern in the wastewater discharge (eg. Hydrocarbons, BTEX, PAHs, Metals, Suspended Solids, etc.) Include supporting analytical data for the wastewater :

Manganese and Total Arsenic.
Attachment 1 – Memorandum, April 7, 2016 – Summarizes the analytical finding from the Esposti Well.

B4. Describe the proposed treatment system(s) and sampling location(s) and attach a schematic:

Groundwater extracted will be routed through 2 – 20,000 gal settling tanks. If required to further reduce the turbidity, inline bag filter will be used. Discharged via pump and gravity flow to Sanitary sewer at S 930A. Monitoring flow will be at S130A, CT4, CT5.
Attachment 2 – Site Map – Groundwater containment and discharge location map.

PART B – SITE INFORMATION & TREATMENT CONTINUED

B5. Operating Period & Discharge Flow See Attachment 3

Specify the proposed operating period for the activities (i.e. the period during which wastewater is discharged to the sanitary sewer)

Hours/Day: 24 Days/Week: 5 Weeks/Year: 3 Two Discharge Events.

Specify the typical number of hours of discharge to the sanitary sewer during the following periods:
08:00 to 16:00: 8 hours 16:00 to 24:00: 8 hours 0:00 to 08:00: 8 hours.

Expected maximum flow rate of discharge: 100 gpm April 18 – April 22, 2016
500 gpm May 4 – May 12, 2016

Expected average flow rate of discharge: 50 gpm April 18 – April 22, 2016
350 gpm May 4 – May 12, 2016

Maximum volume of treated wastewater to be discharged to the sanitary sewer: 2M gallons

Anticipated start date for project: April 18, 2016

Anticipated end date for project: September 22, 2016

PART C – CERTIFICATION STATEMENT

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is to the best of my knowledge and belief true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

I, the undersigned, and Engineer/Consultant (where applicable), certify that this firm's operation and its resultant wastewater discharge will achieve consistent compliance with the Town of Windsor's Municipal Code and Ordinances, permit requirements (as detailed herein), and applicable Federal and State discharge regulations and requirements. If the wastewater discharge does not meet all the applicable regulations, my firm is responsible for immediately halting the flow causing non-compliance, installing wastewater pretreatment equipment, or performing whatever is necessary to meet the waste discharge requirements. I am aware that there are significant penalties for violation of the regulations, requirements and conditions of this permit, the Town of Windsor's Municipal Code and Ordinances, and the State and Federal Government discharge regulations and requirements, including the possibility of fine and imprisonment.

Signature: ______________________

Title: Senior Geologist

Date: 4-15-2016

This document must be signed by the most responsible person of the organization applying for the discharge permit. This includes the owner, president, corporate officer, or any other representative of the organization in an authorized decision-making capacity. The person signing this document is legally responsible for all information contained herein, and becomes liable for any and all future enforcement actions.

Attachment 1

Memorandum

07 April 2016

To	Frank Caligiuri		
Copy to	James Tamburini, Chuck Ward		
From	Kent O'Brien	Tel	415.296.2043
Subject	Preliminary Design Basis Esposti Well	Job no.	111/10001/

The project is located in the Town of Windsor, CA. The information listed below is a summary of well and groundwater information for the site that is pertinent to the preliminary design for the Esposti Park Well contaminant removal system. Information was obtained from knowledge of the site as well as from the September 2010 Groundwater Well Installation and Testing Project Summary Report prepared by RMC.

This information is provided for developing a laboratory bench test program to be conducted in May of 2016. GHD believes that there could be a benefit to bench testing Greensand Plus with various oxidizers. The removal of arsenic would be completed as a second process. By bench testing oxidizers for manganese removal, we would reduce the number of variables that needed to be evaluated during field Pilot Testing to be performed in August/September of 2016.

System Operation & Parameters

○ Flow Capacity:	800 gpm
○ Annual Well Utilization:	50% of Time
Disinfection	
○ Disinfectant:	Sodium Hypochlorite
○ Discharge Point:	Distribution
Well Pump	
○ Operation Type	Intermittent, full flow
○ Well Pressure	120 psig
Wastewater Handling	
○ Backwash Discharge Available?	Yes
○ Discharge Point	Sewer
○ Zero Discharge Required?	No
Treatment Options	
○ Bypass/Blend OK?	Yes
○ Spare Capacity Required?	No
○ Use of CO_2, HCl, H_2SO_4 or NaOH OK?	Only CO_2
Process Control	
○ System Automation	Yes

SCADA Interface	Yes
Notes	

Summary of Water Quality Assumptions*

pH**	6.67
Temperature**	66 °F
ORP (EMF)**	4 mV
Conductivity**	458 µS/cm
TDS**	300 mg/L
Turbidity**	354 NTU
Cations	
Hardness	120 mg/L $CaCO_3$
Ammonia***	0.3 mg/L NH_3
Calcium	22 mg/L
Magnesium	15 mg/L
Sodium	54 mg/L
Anions	
Alkalinity	230 mg/L $CaCO_3$
Bicarbonate	280 mg/L $CaCO_3$
Carbonate	<1.0 mg/L $CaCO_3$
Chloride	17 mg/L
Fluoride	0.37 mg/L
Nitrate	<2.0 mg/L NO_3
Phosphate	(Unknown)
Silica***	87 mg/L SiO_2
Sulfate	12 mg/L SO_4
Metals	
Antimony	<6.0 µg/L
Total Arsenic	56 µg/L
Copper	<50 µg/L
Iron	<100 µg/L
Lead	<5.0 µg/L
Manganese	750 µg/L
Mercury	<1.0 µg/L
Selenium	<5.0 µg/L
Vanadium	(Uknown)

Notes:

* Water Quality data from Composite 1 of May 2010 sampling event with noted exceptions

** From Borehole at depth of 200 feet bgs

*** From Depth-specific results between 380-420 feet bgs

Attachment 2

Attachment 3

Groundwater Discharge Plan – Esposti Well

Phase of Project	**Event**	**Approx. Date of Sampling**	**Event Notes**
Setup	Video/non-pump spinner	4/18/2016	
Well Redevelopment	Prior to redevelopment	4/18/2016	Assume no sewer sample
	Start of redevelopment	4/19/2016	High turbidity samples
	Mid redevelopment	4/20/2016	High turbidity samples
	End of redevelopment	4/22/2016	Low terbidity samples
	End of redevelopment	4/22/2016	Soil samples of sediment
	Video/non-pump spinner	4/22/2016	
	Notification to Town	4/22/2016	Vell condition summary by emai
Well Packer Testing	Full Well Pumping	5/3/2016	Pump 3 hours with spinner log
	Select well segments	5/4/2016	Install packer lower pump
	Lower pump at 200 gpm	5/4/2016	2 hours
	Lower pump at 350 gpm	5/4/2016	2 hours
	Lower pump at 500 gpm	5/5-6/2016	24 hours
	Move packer	5/9/2016	Install packer upper pump
	pump at 200 gpm	5/9/2016	2 hours
	pump at 350 gpm	5/9/2016	2 hours
	pump at 500 gpm	5/9-10/2016	24 hours
	Remove packer	5/9/2016	Prep for pumping full well
	Pump at 800 gpm	5/11/2016	6+ hours
Pilot Test	Setup	8/23-25/2016	
	Pilot testing	9/6-17/2016	

Non-Residential
One-Time Discharge Permit

Permittee:
Town of Windsor
8400 Windsor Road
Windsor, CA 95492

Discharge Located At:
Esposti Park
Old Redwood Highway @ Shiloh Road
Windsor, CA 95492

PERMIT#: TD-04152016

EFFECTIVE DATE: 04/15/2016

EXPIRATION DATE: 12/31/2016

The above discharger is authorized to discharge non-contaminated, non-sediment laden groundwater and/or well water generated from the project at Esposti Park, Old Redwood Highway at Shiloh Road to the Town of Windsor's sewer collection system. This discharge shall be in accordance with the Town's current Sewer Code and/or Ordinances, and all applicable provisions of federal or state law or regulation, and in accordance with discharge point(s), effluent limitations, monitoring requirements, and other terms and conditions set forth herein.

PART I - SPECIAL CONDITIONS

1. The discharge rate to the sanitary sewer shall be at a discharge rate that will not result in any spillage or surcharging of the sewer system. At no time shall the flow rate of the discharge exceed 800 gpm. Permittee must contact the Town of Windsor's Wastewater Treatment Facility prior to discharging flow rates exceeding 500 gpm.
2. Sediment must be removed prior to any discharge to the sanitary sewer.
3. The Town reserves the right to require water quality sampling and testing at any time. Should any of the sample results indicate that pollutant concentrations are beyond the treatment capabilities of the wastewater treatment plant, the Town reserves the right to revoke this permit and prohibit further discharge.
4. All discharge volumes shall be reported to this office by a Town approved method which may include, metering, storage tank volumes, and/or pumping flow rates to determine the permit discharge fees. **Note: Monthly discharge volumes shall be reported within 15 days of the end of each month, and the total discharge volume shall be reported to this office within 30 days of the completion of this project.**
5. Permittee shall notify this office 48 hours in advance of the commencement of the discharge so that a member of the Industrial Waste Group may be on site at the beginning of the operations to verify the discharge point to the sanitary sewer.
6. The Permittee shall be responsible for all liability imposed by law for personal injury or property damage caused by work done by Permittee under this permit, including work beyond the scope of this permit. If any claim of such liability is made against the Town, its officers or employees, Permittee shall defend, indemnify and hold them, and each of them, harmless from such claim and liability insofar as permitted by law.

CERTIFICATION: I agree to comply with all terms and provisions of this permit and all other regulations set forth within the Town's current Sewer Code and/or Ordinances in the Town of Windsor, or any applicable provisions of federal or state law or regulation.

PLEASE SIGN AND PRINT NAME BELOW

Owner/Manager Title Project Manager Date 4/18/2016

Inspected by: Title Env. Program Manager Date 4/18/16

Approved by: Title Acting PW Dir / Town Eng Date 4/18/16

Appendix E – Street Encroachment Permit

ALLOW 2-3 WEEKS TO PROCESS

TOWN OF WINDSOR

Town of Windsor
Engineering Division
8400 Windsor Road, Bldg. 100
P.O. Box 100
Windsor, CA 95492-0100
Office Hours: Mon – Thurs 7:00am – 6:00pm
(Form A)

ENCROACHMENT PERMIT

PERMIT NO. 2016-16

(For office use only)	*(Date / Initials)*
USA Number:	NA
Performance Bond #:	Town project
Maintenance Bond #:	
Expiration Date:	
Permit Fee:	0
Permit Issue Date:	4-7-16
Permit Expiration Date:	9-28-16
Date Permit Finaled:	

APPLICANT TO COMPLETE THIS PART
(Please Print or Fill out electronically)

☒ **Type of Activity**

☐ Utility: Water, Sewer, Recycled
☐ Sidewalk / Curb / Gutter / Pavement
☐ Driveway: New / Replace / Repair
☐ Equipment: Crane, scaffold
☐ Other: _____
☐ PG&E, ATT, Comcast
☒ Maintenance
☐ Debris Box
☐ Outside Water
☐ Drainage

Check One: Project General Contractor ☒ Project Subcontractor ☐

Permittee: Weeks Drilling
Address: 6100 Hwy 12
Sebastopol CA 95473
Contact: Joshua Moore
E-mail: joshua@weeksdrilling.com

Phone Number: 707-823-3184
Fax Number: 707-823-4258
Cell/Emergency: 707-583-1822
Business Registration #: 005460
Contractor's License #: 177681
Contractor's Class: C61/D21, C57,C36

Attention: General Contractors & Subcontractors – List all subcontractors working for your company on this project on page 2

Project Name: Esposti Well Development
Work Site Address:
Anticipated Start Date of Construction: 4/13/16
Construction End Date (Estimated): 9/22/16

Scope of work: Develope 10" Well to reduce Arsenic contamination. Developed & Pumped water will be Flushed to ball field & Sewer

Excavation in Public Right-of-way? ☒ No | ☐ Yes   If "yes" provide U.S.A. Ticket Number*: ____

Regarding property being served: * *Permit will not be issued without applicant providing USA ticket number.*

Is there an existing water well? ☐ No | ☒ Yes | ☐ N/A   Is there an existing septic system? ☐ No | ☐ Yes | ☒ N/A

PERMITEE TO READ AND SIGN BELOW:

Permittee agrees to accept all responsibility for loss and/or damage to any person or entity and to indemnify, hold harmless, defend and release the Town of Windsor, its agents and employees, from and against any and all liability actions, claims, damages, costs, or expenses which may be asserted by any person or entity including Permittee arising out of or in connection with the willful act or negligence of Permittee performing the work associated with the Encroachment Permit, whether or not there is concurrent negligence on the part of the Town of Windsor, but excluding liability due to the sole active negligence or sole willful misconduct of the Town of Windsor.

The indemnification obligation is not limited in any way by any limitation on the amount or type of damages or compensation payable by or for Permittee under Worker's Compensation, disability or other employee benefit acts or the terms, applicability or limitations of any insurance held or provided by Permittee and shall continue to bind the parties after termination/completion of this permit. Permittee shall comply with all Encroachment Permit requirements and procedures, attached hereto as Exhibit A. including but not limited to the procurement and maintenance of insurance and bonding requirements set forth therein.

THE UNDERSIGNED AGREES THAT THE WORK WILL BE DONE IN ACCORDANCE WITH AND SUBJECT TO THIS PERMIT'S TERMS AND CONDITIONS, THE STATE VEHICLE CODE, STATE STREETS AND HIGHWAYS CODE, AND IS SUBJECT TO INSPECTION AND APPROVAL.

Date: 04/07/2016 **Permittee Signature:**

Print Name: Joshua Moore

(When Encroachment Permit is issued for a special event involving a street closure a copy shall be forwarded to Police and Fire)

SUBCONTRACTORS:

Provide business name, contact name, address, phone number and e-mail.

1. unknown @ this time

2.

3.

4.

5.

6.

7.

8.

9.

10.

11.

12.

1. **Each subcontractor shall obtain an encroachment permit for the portion of the proposed work they are responsible for.**
2. **If the subcontractor is not covered under the Prime Contractors insurance, then the subcontractor must have their own insurance as required by the Town of Windsor and submit the required insurance documents for review and approval.**

To be Completed by Town Staff Only

IF THIS ENCROACHMENT PERMIT IS ASSOCIATED WITH A CAPITAL IMPROVEMENT PROJECT, A LAND DEVELOPMENT PROJECT OR A MAINTENANCE OR REPAIR CONTRACT, THE PUBLIC WORKS PROJECT MANAGER OR PUBLIC WORKS SUPERVISOR RESPONSIBLE FOR THE PROJECT SHALL INITIAL THIS APPLICATION VERIFYING THE PROJECT IS READY TO BE ISSUED AN ENCROACHMENT PERMIT:

_______________ *PROJECT MANAGER SIGNATURE/ INITIALS*

_______________ *Date*

TOWN OF WINDSOR

Town of Windsor
Engineering Division
8400 Windsor Road, Bldg 100
P.O. Box 100
Windsor, CA 95492-0100
(707) 838-5340, Fax (707) 838-5300

Project Ready to Issue an Encroachment Permit

Project Number: 25-1310

Project Manager Name: Elizabeth Cargay

Project Name: Esposti Water Supply Reliability Project

Brief Project Description: Municipal well redevelopment, Pump Test and Treatment Pilot Testing

I, E. Cargay, as the Project Manager for the aforementioned project has verified that the following items have been completed, reviewed and approved by myself or authorized agent and that the project is ready to be issued an Encroachment Permit as required by the Town of Windsor Municipal Code.

The following items have been approved:

The following Items must be approved prior to issuing an Encroachment Permit. Engineering staff to mark Required Items	**The following checked items have been approved by Project Manager** **Project Manager to check off which are approved**	**Comments**
☐	☑ Completed Encr. Permit Application	Attached
☐	☒ USA number (if required)	N/A
☐	☑ Plans	Attached
☐	☑ Cost Estimates	submitted as part of Contract
☐	☑ Contractor/Subcontractor's License	177681
☐	☒ Contractor/Sub Business License	n/a 005460
☐	☑ Insurance Documentation	see attached
☐	☒ Bonds or other type of Security	n/a
☐	☑ Traffic Control Plan	see attached
☐	☒ Tree concerns have been satisfied	n/a
☐	☑ Existing Wells and Septic concerns have been satisfied	n/a

The terms, conditions and restrictions for the Encroachment work are part of the contract documents. No additional terms, conditions and restrictions are required.

Date: 4-7-16

Elizabeth A Cargay
Project Manager's Signature

Mina Ebrahimi
Print Engineering Tech Name processing the Encroachment Permit Application

Elizabeth Cargay
Print Project Manager's Name

TOWN OF
WINDSOR

Town of Windsor
Public Works Department
8400 Windsor Road, Bldg. 100
P.O. Box 100
Windsor, CA 95492-0100
(707) 838-5340, Fax: (707) 838-5300

FORM 'C'

ENCROACHMENT PERMIT TERMS, CONDITIONS & RESTRICTIONS

- OFFICIAL USE ONLY - OFFICIAL USE ONLY - OFFICIAL USE ONLY - OFFICIAL USE ONLY - OFFICIAL USE ONLY - OFFICIAL USE ONLY -

Encroachment Permit #: 2016-16

Location: 6000 Old Redwood Highway - Esposti Park

Scope of Work: Develop 10" well: flush well, pump, test and treatment pilot testing

TERMS, CONDITIONS & RESTRICTIONS:

This Encroachment Permit is to be strictly adhered to and no work other than that specifically mentioned in the Scope of Work above is hereby authorized. If the Town Engineer determines persons performing encroachment work are in non-compliance with the provisions of this permit, the Town Engineer may revoke this permit.

Subject to all the **terms, conditions & restrictions** written hereon or attached hereto, permission is hereby granted for Permittee to:

Specific Project

-

General

1. Follow all of the latest issue of the **Town of Windsor Design and Construction Standards**. Visit the Town's web site for the latest copy of the Design and Construction Standards
2. Follow the approved **Traffic Control Plan,** all traffic control shall comply with the Town of Windsor Construction Traffic Control Procedures on Town Streets Manual.
3. Perform work stated in the Scope of Work and **Return the work site** as required by the Public Works (PW) Inspector.
4. **All work shall be inspected,** failure by the contractor to call for inspection may delay/stop the project.
5. If concrete work is involved, then **all forms for concrete work shall be inspected** prior to pour.
6. The Public Works Inspector to be **notified 24 hours** prior to start of work. Inspector's phone number is 707-838-1230.
7. The Primary Contractor shall **include all Subcontractors** as insureds under the Primary Contractors policies, or the Primary Contractor shall furnish **separate insurance certificates and endorsements for each Subcontractor**. All coverages for subcontractors shall be subject to all of the requirements stated herein.
8. Independent of this Encroachment Permit, if the subcontractors are performing work permitted under this Encroachment Permit the said **Subcontractors shall obtain their own respective Encroachment Permits.**
9. Notify the Public Works Inspector **upon completion of work.**
10. **Water tie-ins** are not permitted on Friday or days preceding a holiday.
11. **Compaction Reports**: The applicant shall retain a licensed Geotechnical Engineer to perform compaction tests. The compaction test results shall be submitted to Town Public Works department prior to final trench paving or restoration.
12. Contractor's may **not turn water valves**. Contact the PW Inspector if there are water valves to be adjusted.
13. All **USA markings** are to be water scrubbed off of concrete sidewalks and drives prior to calling the PW Inspector upon completion of work.

See reverse side for any additional Terms, Conditions or Restrictions

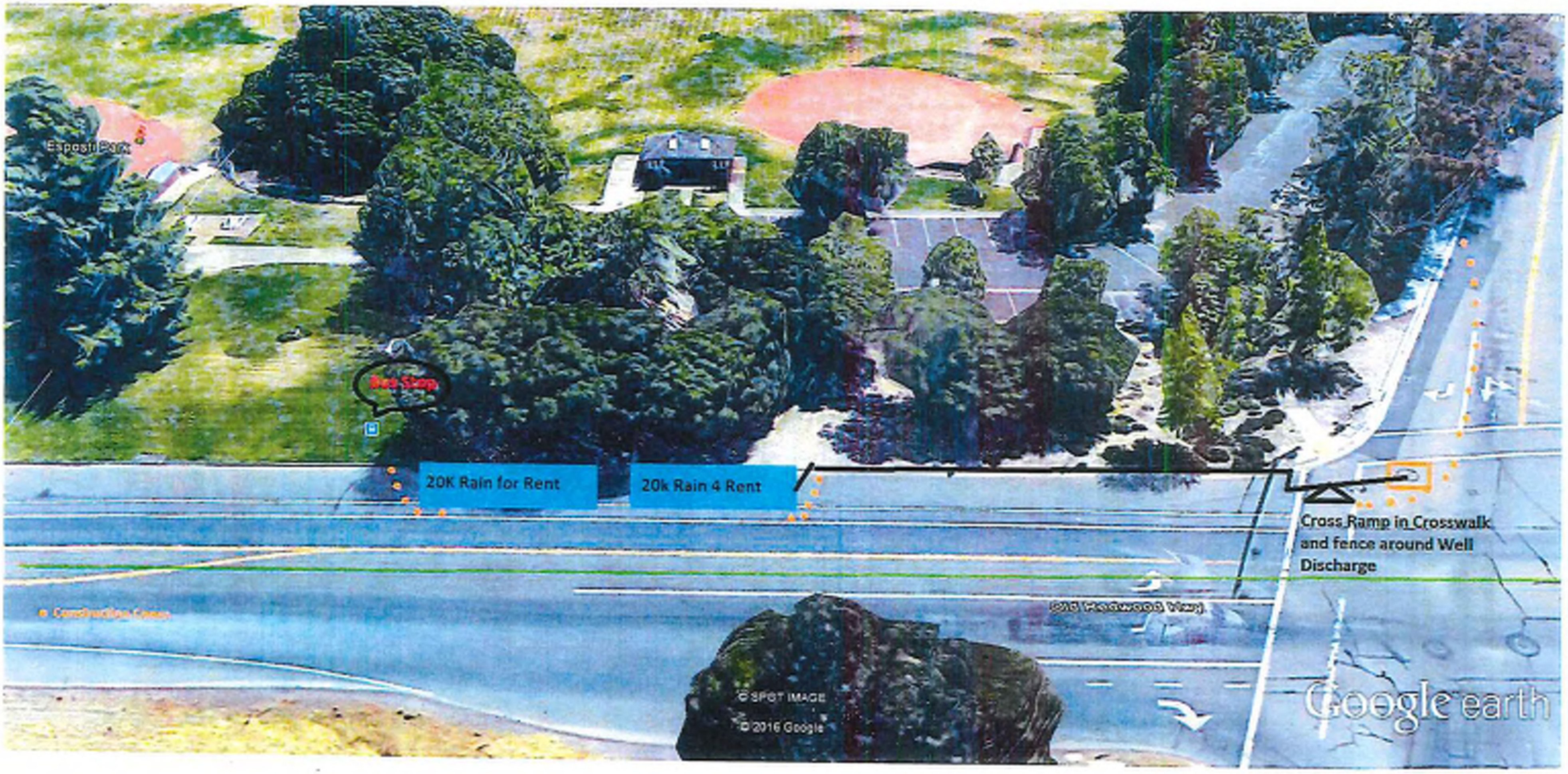
DATE: 4-7-16 **APPROVED:** Mona Ibrahim
Town of Windsor Signature

MONA IBRAHIM, ENG. TECH
Print Name and Title

A COPY OF THIS ENCROACHMENT PERMIT SHALL BE ON THE JOB SITE

Inspections: The Public Works Inspector can be reached at: **707-838-1230**, leave message if phone not answered
Monday through Friday: 7:30 am through 4:30 pm

Field Inspection Hours: Monday through Friday 8:00 am –4:00 pm


Esposti Park
Bus Stop
20K Rain for Rent
20k Rain 4 Rent
Cross Ramp in Crosswalk
and fence around Well
Discharge
Old Redwood Hwy
● Construction Cones
© SPOT IMAGE
© 2016 Google
Google earth

TOWN OF WINDSOR
Town of Windsor
Engineering Division
8400 Windsor Road, Bldg 100
P.O. Box 100
Windsor, CA 95492-0100
(707) 838-5340, Fax (707) 838-5300

EXHIBIT B

ENCROACHMENT PERMIT STANDARD CONDITIONS

Construction within the Town of Windsor Public Right-of-Way: Streets, Properties, and Easements

A. **Definitions:**

1. **Encroachment:** The term 'Encroachment' is used in this permit as defined in §1450, Sub.(b) and §1460 of the Streets & Highways Code and Section 5885(c)(1) of the Public Utilities Code of the State of California, Town of Windsor Code Title XV §4-105-d. This permit is issued in accordance with and subject to the provisions of the Town of Windsor Municipal Code, Title X, Chapter 2 article 1 and 2.
2. **Town Engineer:** The person holding the position of "Town Engineer" for the Town of Windsor. The Town Engineer may assign duly authorized representatives to discharge the responsibilities of the Town Engineer. The duly authorized representatives may include inspectors, maintenance staff, engineers, technicians or otherwise, to be known in this document as Town staff.

B. **Ownership of Lands under Town of Windsor Public Rights-of-Ways:**

1. **Easements:** In some instances, the Town does not own the land in which its right-of-ways traverse, the Town's interest being limited to the easement only. Therefore, this permit covers surface operations at all locations where the Town has no subsurface rights and in such cases does not purport to authorize any excavation, laying of pipe lines, setting of poles, or other operations below the surface of the easement. In such cases, it is the responsibility of the Permittee to obtain the consent of the subsurface owner(s) before undertaking any of the below-surface operations.
2. **In Fee (Simple):** The Town of Windsor owns the underlying land.

C. **General**

1. **Acceptance of Provisions:** It is understood and agreed by the Permittee that the performance of any work under this permit shall constitute an acceptance of these provisions.
2. **Start of Work:** This permit is void unless the proper notification is given 24 hours prior to starting work. Notification shall be by calling the Town of Windsor Public Works Inspector @ 707-838-1230.
3. **Permit Documentation on Site:** The following documents are required to be kept at the work site(s) at all times and must be shown to Town staff upon request.
   a. Encroachment Permit, Encroachment Permit "Terms, Conditions and Restrictions" and the Encroachment Permit Standard Conditions,
   b. Traffic Control Plan,
   c. Project Storm Water Pollution Prevention Plan (SWPPP) & Rain Event Action Plan (REAP), as applicable, and
   d. Town approved project plans.
4. **Superintendence:** The Permittee shall have an authorized representative at the project site at all times, in accordance with the latest adopted State of California Department of Transportation Standard Specifications.
5. **Character of Workers:** Contractors and workers employed by the Permittee shall be subject to "Character of Workers" as required in the latest adopted State of California Department of Transportation Standard Specifications.

6. **Control of Work:** All work performed and all materials furnished under this permit shall be subject to the inspection and approval by the Town Engineer or duly authorized representatives. Such inspection and approval of work and materials shall not relieve the Permittee of any of their obligations to complete the work as specified using materials as specified.

7. **Access to Work Area:** Town Staff shall have access to the work area at all times in order to ascertain that the methods, materials, and workmanship are in accordance with the requirements and intent of this Encroachment Permit.

8. **Standards:** Work shall comply with the latest edition of the Town of Windsor Design and Construction Standards, the latest edition of Standard Specifications of the State of California Department of Transportation and with the Terms, Conditions and Restrictions attached to the Encroachment Permit. Terms, Conditions and Restrictions that are part of the contract package for Capital Improvement Projects or Land Development Projects take precedence.

9. **Inspections:** It will be necessary to obtain approval from Town staff for the work completed at each of the following stages below. Approval must be obtained prior to commencing work on subsequent stages. Town staff may require additional approvals beyond what is listed below. For any work, including excavations, undertaken without proper inspections, Town staff may request the work to be removed, repeated, opened or altered so proper inspections can be performed. The cost of the added work shall be the responsibility of the Permittee.

   Stage 1 Compaction and preparation of embankments, excavations and subgrade.

   Stage 2 Excavation
      a. Construction of forms for all concrete structures, including curbs and gutters.
      b. For storm drains, culverts, and utilities

   Stage 3 Placing
      a. Concrete in structures.
      b. Bedding materials, and bedding material over pipes.
      c. Water pipes, recycled water pipes, sewer lines, storm drains and culvert pipes.

   Stage 4 Backfilling for structures, pipes, and utilities.

   Stage 5 Construction of roadside ditches and other drainage ways.

   Stage 6 Base
      a. Placing and compacting of base material.
      b. If more than one course or type of base or subbase is to be used, approval shall be necessary for each course and/or type.

   Stage 7 Placing of pavement or surfacing.

   Stage 8 Final clean-up.

10. **Rejecting Work:** The Permittee, or authorized agent, shall be in charge of all phases of work. The Permittee will comply with the request to repair, replace or remove defective work that is rejected by Town staff at the Permittee's expense.

11. **Storage of Material:** No materials shall be stored in the street or within eight (8) feet from the edge of the traveled way, unless allowed by Town staff. Materials in the right-of-way may be removed by Town staff at the Permittee's expense.

12. **Maintenance:** The Permittee agrees to exercise reasonable care to maintain the public right-of-way in the area of work. Any damage to public right-of-way; including: street, curb, gutter, sidewalk, landscaping, irrigation, etc caused by work as permitted under the Encroachment Permit shall be repaired, replaced or removed to the satisfaction of the Town Staff at the Permittee's expense.

13. **Damage to Public Right-of-Way due to work performed or failure to perform work under the Encroachment Permit:** The Permittee is liable for all property damage to the Town public right-of-way which may arise out of work performed as permitted under the Encroachment Permit, or which may arise out of failure, on the Permittee's part, to perform their obligations under this Encroachment Permit.

    If the Permittee does not repair, replace or remove damage to the Town's public right-of-way because of work performed or for failure to perform work under the Encroachment Permit, as directed to do so by the Town Inspector and under the specified time period the Town Inspector has requested, then the Town may perform the required repair, replacement or removal of the damaged or incompleted work at the cost incurred by the Town including 100 percent of the administrative and overhead costs associated with such work. This cost shall be paid by the Permittee within 30 days of Permittee's receipt of the invoice for said repair, replacement or removal of damaged or incomplete work to Town property.

14. **Revocation of Encroachment Permit:** This Encroachment Permit may be immediately revoked by Town staff for reasons that are in the best interest of the Town for violation of permit conditions or for the creation of a nuisance. Upon notice given of such revocation, the applicant shall immediately cease all operations and restore Town right-of-way as directed by Town staff. After notification, the Town of Windsor may take full possession of the area. The permittee shall pay the cost incurred by the Town, including 100 percent of administrative and overhead costs, associated in restoration, repair and/or removal of materials to return the public right-of-way to original condition as approved by Town staff. This cost shall be paid by the Permittee within 30 days of Permittee's receipt for the invoice of said work.

15. **Repair of Town Facilities:** Resources must be available on the project site to repair any breaks or damage that may occur to existing Town utility facilities (sewer, water, recycled water and storm drains) during the term of this project.

16. **Clean Up Public Right-of-Way:** Upon completion of the work, debris and material shall be entirely removed and the public right-of-way cleaned and shall be left in as a presentable condition as before work started. The Town Inspector shall approve clean up before accepting the work as complete.

17. **Conflicting Construction:** When construction permitted under this Encroachment Permit falls within the limits of a Town of Windsor construction project, the Town of Windsor construction project has precedence. Work on this encroachment shall be coordinated with the Town of Windsor construction project so as not to create any conflict with the said project or this permit will be revoked.

18. **Disposal of Excavated Materials:** A haul route may be required by Town staff for disposal of excavated materials. If the disposal site is within the Town Boundary then a disposal site agreement shall be approved by Town staff. If the disposal is outside of Town Boundary then only a haul route may be required by Town staff.

D. Traffic Control

1. **Traffic Control:** Permittee shall furnish and install all traffic and warning signs, barricades, etc., in accordance with the latest edition of the "Town of Windsor: Construction Traffic Control Procedures on Town Streets" manual.

2. **Signing:** No work shall commence until traffic control signing has been installed in accordance with the approved traffic control plan.

3. **Sign Encroachment Permits:** Permittee shall obtain any State or County Encroachment Permits, and/or public utility or private property permission for the placement of signs, as applicable.

4. **Detour Plan:** Detour plan(s) shall be submitted to the Town staff for review and approval. No

detours shall be conducted without prior written approval from the Town.

5. **Sign Posting:** All signs shall be post mounted unless Town staff approves otherwise. Attaching signs to existing Town signs, posts, light poles, or traffic signals is not permitted.
6. **Additional Signs:** Town staff may require the Permittee to install additional signs as required for public safety.
7. **Existing Public Signs:** Relocation or removal of existing public signs shall not occur until approval has been obtained from the Town staff.
8. **Special Conditions:** Special Conditions may be imposed at specific locations during peak hour traffic as noted on the Encroachment Permit.

E. **Boring, Excavation, Backfill and Pavement**

1. **Pavement Cuts:** Pavement cuts shall be performed per STD 115 of the Town of Windsor Design and Construction Standards latest edition.
2. **Trenchless technology (boring):** Town staff shall require the use of boring if it is in the best interest of the Town, it is technically, commercially, and economically feasible; and it is not in violation of federal or state regulations or industry safety standards.
    a. Prior to construction, all existing underground public facilities within five feet of the boring shall be physically located (pot holed).
    b. Construction shall be made in such a manner that will minimize interference with vehicular traffic. Unless otherwise approved by Town staff, the location of the boring pits shall be a minimum of three feet from the roadway to prevent undermining of the curb, gutter, or shoulder section and the pit shall be dug to a depth sufficient to maintain a minimum boring depth of 42 inches below the traffic surface. Jetting types of boring equipment are not allowed.
    c. Bore pits or trenches shall be secured adequately to protect the public while left open. All overcutting shall be remedied by pressure grouting the entire length of the installation.
    d. The pits or trenches excavated to facilitate boring shall be backfilled and compacted immediately after work is completed.
    e. The contractor shall have the ability to locate the bore head upon request by Town staff.
3. **Pothole Restoration:** Potholes to be sawcut around the entire failing area, excavated, and base repaired using fresh base. Then proper placement of the asphalt. Base and Asphalt per Town of Windsor design specifications.
4. **Crossing Roadway:** Service and other small diameter pipes shall be jacked or otherwise forced underneath pavement without disturbing the pavement. Pavement or roadway shall not be cut unless specifically permitted by Town staff. Service pipes will not be permitted inside of any culvert pipes used as drainage structures.
5. **Trench Backfill:** Trench backfill and backfill materials shall conform per STD 115 of the Town of Windsor Design and Construction Standards latest edition.
6. **Temporary Patching:** The Contractor shall continually maintain the patch, at the contractor's expense, as directed by Town Staff, until the final pavement is placed. Temporary paving shall be completely removed prior to final paving.
    a. Unless installing permanent paving, temporary paving shall be placed at the end of each work day. Temporary pavement shall be 1½-inch minimum thickness and shall be replaced within ten working days with permanent pavement.
    b. Open trench must be backfilled and capped with at least 2" of cold mix asphalt or metal plated according to Town specifications during non-working hours. Metal plates are required to have

cold mix asphalt ramps at all edges and must be maintained.

   c. Temporary patching of trench is required on lateral cuts in surfaced streets immediately after backfilling. After completion of the refilling and compacting of the backfill material in the excavation as specified and the removal of the obstruction, the permittee shall promptly replace with temporary or permanent patching material or repair any portion of the road surface removed or damaged by the excavation, obstruction or construction operations to the satisfaction of Town staff. Temporary patching material may be left in place for up to 10 working days.

   d. Hot patch is required at high traffic areas, such as intersections, or in harsh weather. Town staff determines such.

7. **Final Paving:** The Contractor shall apply the final paving no later than ten (10) working days after traffic is allowed to pass over the work area. Failure to do so will require the Town Forces to perform the paving work at the cost incurred by the Town including 100 percent of the administrative and overhead costs associated with such work. This paving cost shall be paid by Permittee within thirty (30) days of Permittee's receipt of invoice of such paving costs. Permittee shall restore the roadway to its preconstruction condition unless otherwise directed by Town staff.

F. **Public Safety**

In addition to any other measures taken by the Contractor pursuant to the latest adopted provisions of the Standard Specifications of the State of California Department of Transportation regarding "Public Safety" the Contractor shall install temporary railing (Type K) between any lane carrying public traffic and any excavation, obstacle, or storage area when one of the following conditions exist.

1. **Excavations:** Any excavation with the near edge which is 12 feet or less from the edge of the lane, except:
   a. For excavations covered with steel trench plates or concrete covers in accordance with the latest adopted provisions of the Standard Specifications of the State of California Department of Transportation, to prevent accidental entry by traffic or the public.
   b. For excavations in side slopes, where the slope is less than 4:1.
   c. For excavations protected by an existing barrier or railing.
2. **Temporarily Unprotected Permanent Obstacles:** Whenever the work includes the installation of a fixed obstacle together with a protective system, such as a sign structure together with protective railing, and the Contractor elects to install the obstacle prior to installing the protective system; or whenever the Contractor, for his convenience and with permission of the Town Engineer, removes a portion of an existing protective railing at an obstacle and does not replace such railing complete in place during the same day.
3. **Storage Areas:** Whenever material or equipment is stored within 12 feet of the lane and such storage is not otherwise prohibited by the specifications.

G. **ADA Requirements**

1. **Pedestrian Traffic and the ADA:** Temporary paving in areas subject to pedestrian traffic shall be compliant with the latest ADA regulations and shall be constructed with non-slip surfaces.

   The Americans with Disabilities Act (ADA) is a civil rights law which mandates equal opportunity for individuals with disabilities. The Title II of the ADA prohibits discrimination in access to public facilities, this includes, but not limited to, pedestrian access on sidewalks and streets, including crosswalks, curb ramps, parking and other components of the right of way in the accessible route of travel.

   All work within the public right of way must comply with the requirements of the Americans with Disabilities Act (ADA). If the work in the public right of way affects pedestrian access, the permitee of the Encroachment Permit is required to provide a compliant accessible route of travel including proper signage at the pedestrian access. The temporary accessible route of travel shall be inspected and approved by the Town of Windsor's ADA coordinator prior to work commencing.

H. **Drainage**

1. **Maintenance of Drainage:** Work performed under the Encroachment Permit shall not interfere with the established drainage. The Contractor shall maintain drainage through the work area. Such work shall include but not be limited to keeping all culverts and inlets clean and open. Natural drainage entering the work site shall not be obstructed in any way. The Contractor shall take any and all measures necessary to prevent the flow of silt and debris from leaving the work site. Any silt and debris accumulation in drainage facilities off the work site due to the construction shall be removed immediately.
2. **Storm Water Guidelines:** All construction shall conform to the requirements of the State of California, Construction Activities Storm Water General Permit 2009-0009-DWQ, effective July 1, 2010 and including subsequent amendments thereto, to Town Ordinance 2008-246, 2008-249, 2010-261 and subsequent revisions and if applicable, to the City of Santa Rosa and County of Sonoma Storm Water Low Impact Development Technical Design Manual, dated August 2011 and adopted by the Town of Windsor on December 31, 2014,including any subsequent manual updates.

I. **Tree Protection**

1. **Removal or trimming of trees:** Removal or trimming of protected trees requires Town of Windsor planning approval; refer to the Town of Windsor Code – Title XVII, Zoning, Chapter 27.36 – Tree Preservation and Protection.
2. **Tree Protection in the Work Area:** The contractor shall follow any conditions imposed on the Encroachment Permit regarding Tree Protection in the area of work.

J. **Work Hours**

1. **Work Hours permitted:** Unless approved otherwise, working hours shall be between 7:00 a.m. and 5:00 p.m. Monday through Friday.
2. **Work on Weekends and Holidays:** Unless approved otherwise, no work shall be performed on weekends or holidays.

Appendix F – Video and Spinner Log Reports

WATER WELL VIDEO REPORT

Espoti Supply Well

City of Windsor

West Coast Well Logging Services

P.O.Box 2797 Rancho Cordova, CA. 95741
Phone: 916-224-3810 Fax: 916-858-8174 Web: www.wcwls.com

Client: **Weeks Drilling & Pump, Inc.**
Address: **P.O.Box 176**
City: **Sebastopol, CA 95473**
County: **Sonoma**
Requested By: **Josh**
Copy To:
Reason For Survey: **General Inspection**
Location: **Shilo & Old Redwood Hwy.**
Field: **Windsor**
Other Information:

Survey Date: **April 18, 2016**
Invoice No.: **1287** Run: **One**
P.O.: Van: **WC-1**
Operator: **Mark F. Sharpless**
Type Camera: **CCV Color Flip Camera - Short L.H.**
Latitude: **38.52654°** Longitude: **122.77948°**
Section: **19** TWP: **8N** Range: **8W**

CASING INFORMATION

Stainless Steel Screen
384-423 Ft.
434-453 Ft.
464-473 Ft.
484-513 Ft.
549-569 Ft.
620-656 Ft.

Zero Datum
Top Of Casing

Dia. Reference
Measured

Well Depth
656 Ft.

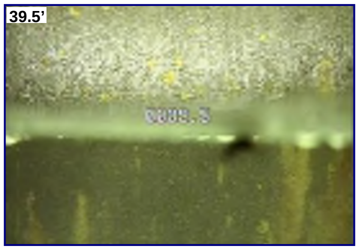
S.W.L
39.5 Ft.

10'' I.D. Casing
0-656 Ft.
Type: Steel

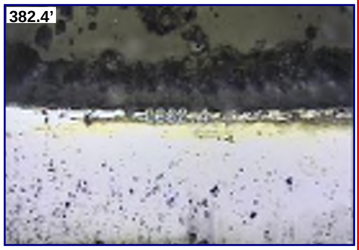
Casing Buildup
Moderate

DEPTHS (SideScan)	VIDEO OBSERVATIONS
0.0 Ft.	Recording Starts - Zeroed on SideScan Lens
39.5 Ft.	Static Water Level (SWL)
160.8 Ft.	Visible cement leakage at casing joint
382-383 Ft.	Dielectric Joint
383.5 Ft.	Perforations, Top Of Screen (384-423)
433.7 Ft.	Perforations, Top Of Screen (434-453)
463.8 Ft.	Perforations, Top Of Screen (464-473)
483.9 Ft.	Perforations, Top Of Screen (484-513)
549.2 Ft.	Perforations, Top Of Screen (549-569)
620.2 Ft.	Perforations, Top Of Screen (620-659)
656.4 Ft.	Downview of soft fill, still in screen

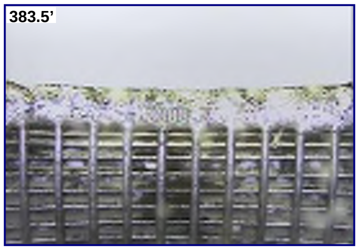
0'


39.5'


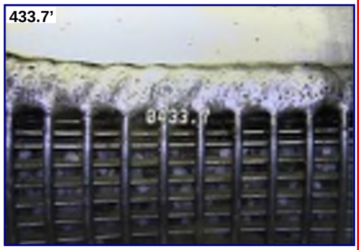
160.8'

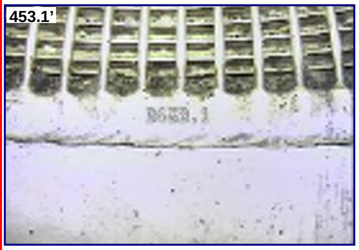

382.4'


383.2'


383.5'


423'


433.7'


453.1'


463.8'


473.2'

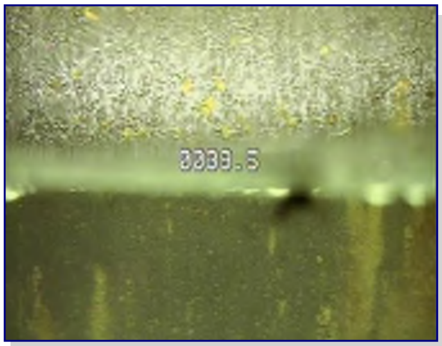

483.9'


Notes:

WELLBORE SNAPSHOT(S)

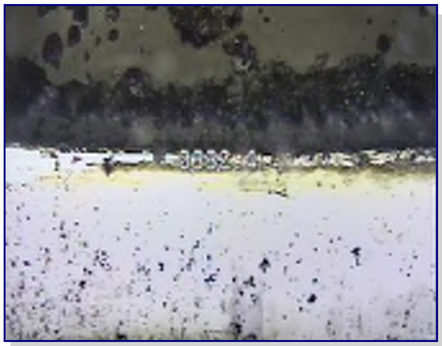
Depth: 0 Feet

Depth: 39.5 Feet



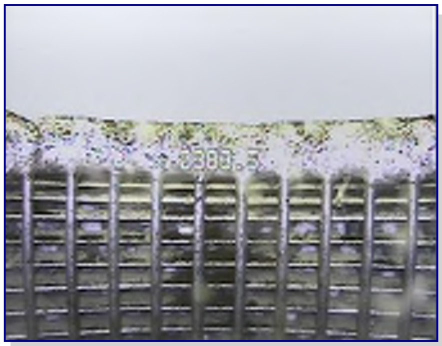
Depth: 160.8 Feet

Depth: 382.4 Feet

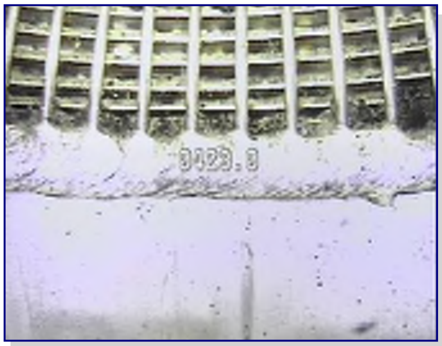


Depth: 383.2 Feet

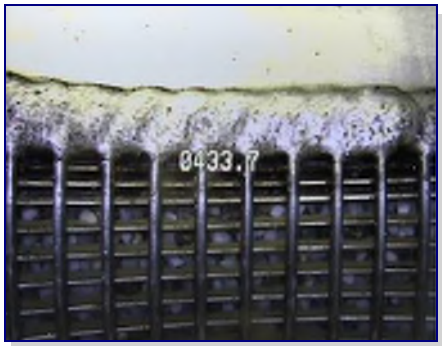
Depth: 383.5 Feet



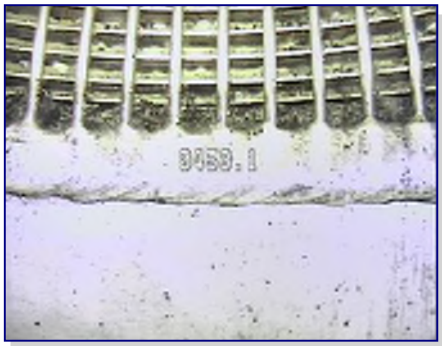
Depth: 423 Feet



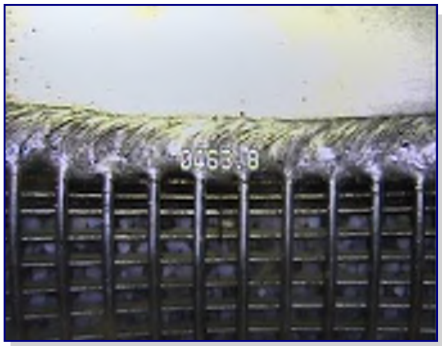
Depth: 433.7 Feet



Depth: 453.1 Feet



Depth: 463.8 Feet



Depth: 473.2 Feet

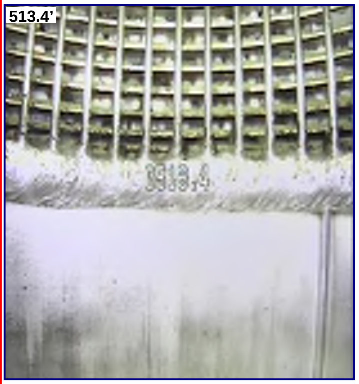
Depth: 483.9 Feet

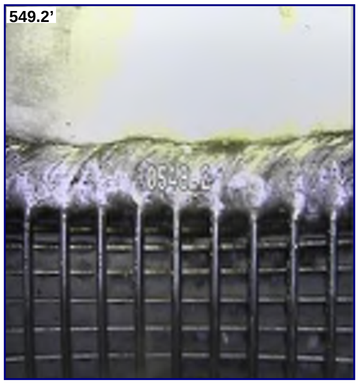
Espoti Supply Well

City of Windsor

P.O.Box 2797 Rancho Cordova, CA. 95741
Phone: 916-224-3810 Fax: 916-858-8174 Web: www.wcwls.com

CASING INFORMATION		DEPTHS (SideScan)	VIDEO OBSERVATIONS
Stainless Steel Screen	**Well Depth**		Additional snapshots
384-423 Ft.	656 Ft.		
434-453 Ft.			
464-473 Ft.	**S.W.L**		
484-513 Ft.	39.5 Ft.		
549-569 Ft.			
620-656 Ft.			
	10'' I.D. Casing		
	0-656 Ft.		
Zero Datum	Type: Steel		
Top Of Casing			
Dia. Reference			
Measured			
Casing Buildup			
Moderate			


513.4'


549.2'


568.6'


620.2'

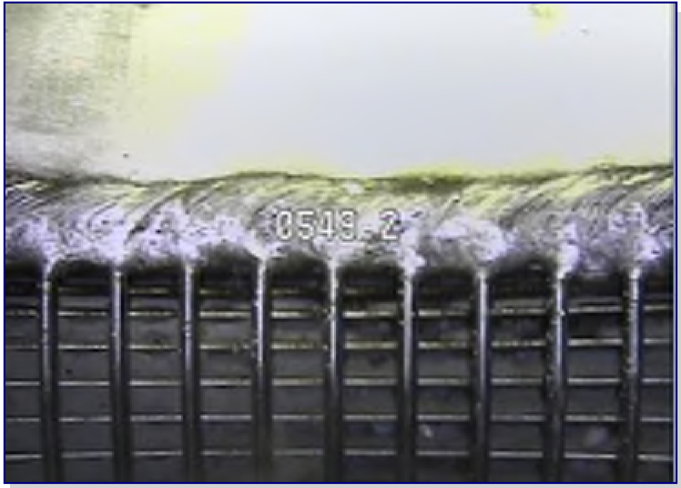

656.4'

Notes:

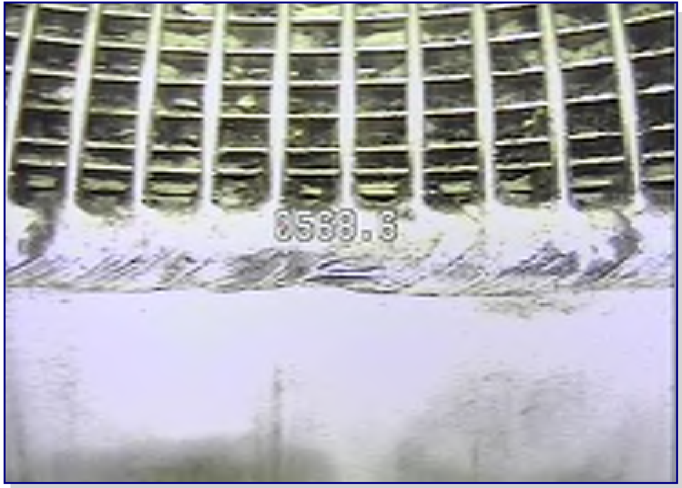
WELLBORE SNAPSHOT(S)

Depth: 513.4 Feet

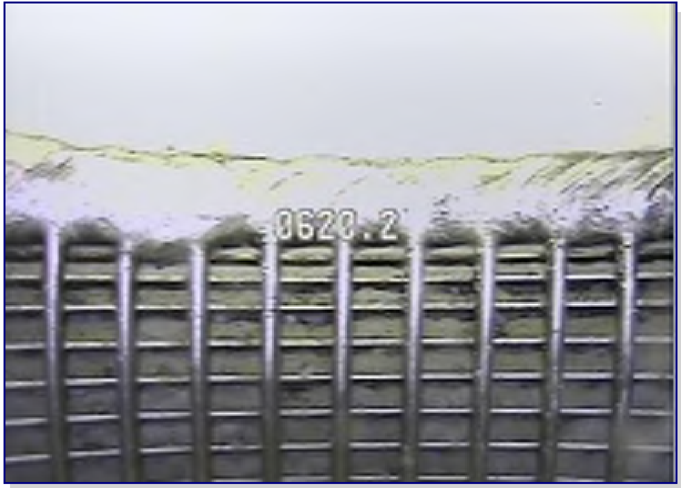
Depth: 549.2 Feet



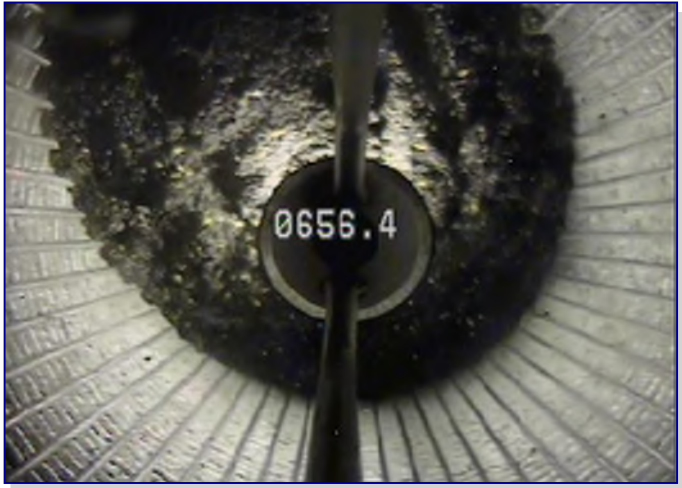
Depth: 568.6 Feet



Depth: 620.2 Feet



Depth: 656.4 Feet



WEST COAST
WELL LOGGING SERVICES
GEOPHYSICAL & VIDEO LOGGING

STATIC SPINNER LOGS

P.O.Box 2797, Rancho Cordova CA 95741 · Phone: 916-858-8148 Fax: 916-858-8174 · Web: www.wcwls.com Email: wcwls@sbcglobal.net

Filing No.

COMPANY **Weeks Drilling & Pump Co., Inc.**

WELL **Espoti Supply Well**

FIELD **Windsor**

STATE **California** COUNTY **Sonoma**

LOCATION:
Shilo Rd. & Old Redwood Hwy.

OTHER SERVICES:
Video

Job No.
1287

SEC: **19** TWP: **8N** RGE: **8W** LAT.: **38.52654** LONG.: **122.77948**

Permanent Datum: **Ground Level** Elev.: **155** Ft. Elevs.: K.B. ____ Ft.

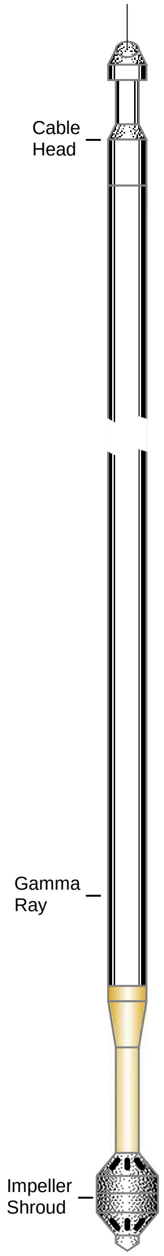
Log Measured From: **Top of Casing** , **0** Ft. Above Perm. Datum D.F. ____ Ft.

Drilling Measured From: **Ground Level** G.L. **155** Ft.

Date	**Apr 18, 2016**			
Type Log	**Spinner**			
Run	**One**			
Depth-Driller	**685** Ft	Ft	Ft	Ft
Depth-Logger	**656** Ft	Ft	Ft	Ft
Top Logged Interval	**0** Ft	Ft	Ft	Ft
Btm Logged Interval	**650** Ft	Ft	Ft	Ft
Type Fluid In Hole	**Water**			
Fluid Level	**39.5** Ft	Ft	Ft	Ft
Max Temp	**n/a** °F	°F	°F	°F
Operating Rig Time	**n/a** °Hr	°Hr	°Hr	°Hr
Van No. / Location	**WC-1** / **RC**			
Recorded By	**Sharpless**			
Witnessed By	**K. O'Brian**			

RUN	BOREHOLE RECORD			CASING RECORD			
NO.	BIT SIZE	FROM	TO	CASING SIZE	CASING TYPE	FROM	TO
1	In	Ft	Ft	**10** In		**0** Ft	**685** Ft
2	In	Ft	Ft	In		Ft	Ft
3	In	Ft	Ft	In		Ft	Ft

STATIC SPINNER LOGS TOOL



SPINNER LOGS:

Spinner logs are used to quantify flow (up or down) in a water well. In a producing water well, the spinner log is usually run downwards at a constant speed. Deflections in the curve are indicative of water entry. Proper calibrations, eliminating the effective of line speed, will quantify the flow rate from zones of interest.

SPINNER SPECIFICATIONS:

Diameter	1.77, 2.76, or 3.94 Inches
Length	5.5 Feet
Weight	16.1 Lbs.
Max. Temp	158° F
Gamma Ray	1.97 inches long x .98 inches diameter Scintillation crystal

MISCELLANEOUS INFORMATION

Type Of Well: Producing

Spinner Info			Screen	
FPM	**Direction**	**Line Style**	**From**	**To**
30	Down	———	384 Ft.	423 Ft.
31	Up	. . . .	434 Ft.	453 Ft.
			464 Ft.	473 Ft.
			484 Ft.	513 Ft.
			549 Ft.	569 Ft.
			620 Ft.	656 Ft.

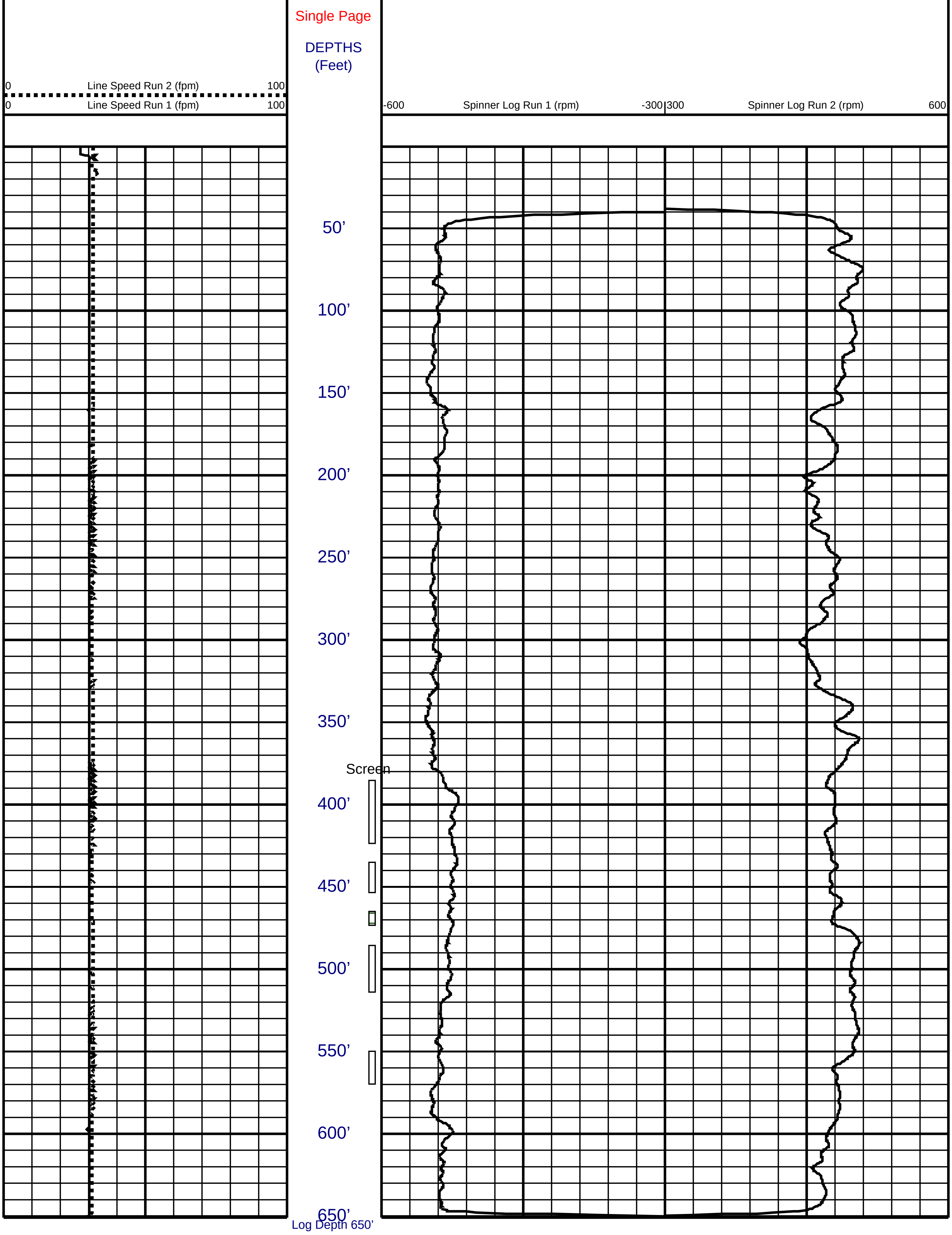
NOTICE

All interpretations are opinions based on inferences from electrical and other measurements and we do not guarantee the accuracy or correctness of any verbal or written interpretation, and we shall not, except in the case of gross or willful negligence on our part, be liable or responsible for any loss, costs, damages or expenses incurred or sustained by anyone resulting from any interpretation made by one of our officers, agents or employees. These interpretations are also subject to our General Terms and Conditions as set out in our current Price Schedule.

REMARKS

Weeks Drilling & Pump Co., Inc.
Espoti Supply Well
Apr 18, 2016

STATIC SPINNER LOGS



GHD

GHD Job 11110001

FIELD REPORT

DATE: 8/23/2016

LOCATION: Esposti Well, Old Redwood Hwy at Shiloh Road, Windsor, CA

PROJECT NAME: Town of Windsor, Esposti Supply Well

JOB NO: 11110001.20

EVENT: spinner Log - sewer check

WEATHER/TEMP: 65 ° at am 10:00
° at pm

PRESENT AT SITE: Weeks, Kent O'Brien

THE FOLLOWING WAS NOTED:

10 Am - Weeks on-site pump installed
suction (pump intake @ 220
Explained to Josh that packer inflation to be
225 psi not 275
samples to be collected 1, 5, 60 & End (4 hours)
11:05: Town arrives for Traffic control, open S130 & S130A
Start pump 11:20 start
11:21 First sample 15:21 4th Last
11:26 second sample
12:21 3rd sample
11:39 - Town closes sewer lids & leaves - checked flow
at S130 where Shiloh Rd & Old Redwood Hwy sewers cross
Flow O.K.
11:55: spinner log truck arrived - West Coast
12:25 (approx) set up spinner
13:20 got spinner data print out

DATE: ~~5/10/2016~~ 8/23/2016

LOCATION: : Esposti Well, Old Redwood Hwy at Shiloh Road, Windsor, CA

PROJECT NAME: Town of Windsor, Esposti Supply Well

EVENT: Zone test - Spinner log

Estimations based on field interp.

370 1625 RPM = 400 gpm = 100%

1 screen 38.5% 154 gpm 38.5%

429 1000 RPM

2 screen 0% 0 gpm 0%

459 1000 RPM

3 screen 0% 0 gpm 0%

477 1000 RPM

4 screen 20% 80 gpm 20%

535 675 RPM

5 screen 41% 164 gpm 41%

575 0 RPM

6 screen 0% 0 gpm 0%

Screen		
1	154 gpm	38.5%
2	0 gpm	0%
3	0 gpm	0%
4	80 gpm	20%
5	164 gpm	41%
6	0 gpm	0%

Start Flow meter 065600 x 100 gallons

End Flow meter 066620 x 100 gallons

96000 gallons pumped

PUMPING WELL

Drawdown Sheet Kent O'Brien 8/23/2016

GHD MANAGEMENT ENGINEERING ENVIRONMENT

Measured Well — Owner: Town of Windsor — Well ID: Esposti Supply Well
Location: Esposti Park — Name/Site:

Pumped Well — Owner: Town of Windsor — Well ID: Esposti Supply Well
Location: — Name/Site:

Test Details — Date pumping commenced: — Time: — Test No.
Date pumping ceased: — Time:

Are Measurements below for the pumped well? yes — Distance from pumped well (ft): NA

Static DTW …………… Feet below measuring point

Measuring Point……………………… Feet above/below ground level

Watch Time	Elapsed Time (min)	Calculated drawdown (ft) (DTW - Static)	Measured DTW (feet) below measuring point	Discharge (gpm) Only if pumped well	Comments or pressure measurements from transducer
11:20			56.50	400	
11:24			103.3	400	
11:34			111.0	400	
11:47			115.75	400	
12:17			120.30	400	
13:13			124.50	400	
14:15			127.40	400	
15:18			129.20	400	
					4 hour specific
					capacity =
					5.5 gpm/ft

GHD | MANAGEMENT ENGINEERING ENVIRONMENT

Parameter Record

Well ID: Esparto ~~Supply~~ well

Job Information

Client: Town of Windsor
Project: ....
Proj. No.: 11110001
Sampler: Kent O'Brien

Sampling Information

Sample Method: direct from pump
WQ Meter Type:
Flow Cell:
Pump Depth: 220 ~~m~~ ft intake ft
WLevel Meter Type: No packer

Well Information

SWL: 56.5 ft
Date: 8/23/2016
Ref.datum: TOC
Well Depth: NM ft
Screen From: ...... ft
Check: ....
Time: 11:20
Stick Up:
Well Diam.: 10 ft
To: .... ft

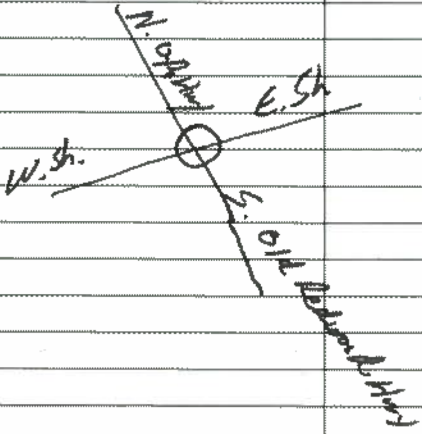
Time (..........)	Temp (°C)	pH (pH units)	Elec.Cond (µS...)	TDS (ppm)	Dis.Oxygen (..........)	Ox-Red Pt. (± mV)	Note	Note	Comment: Colour, turbidity, sediment load, sheen, odour
Stable When:		+/- 0.2 C	+/- 0.05 pH	+/- 3%	+/- 10%	+/- 10 mV			
11:21	25.9	7.29	523.1	359.4		-138			Start at 11:20
11:26	27.7	7.30	499.2	340.1		-92			
11:29	27.7	7.33	500.1	340.6		-71			clear - slight very fine sediment
11:41	27.0	7.36	501.4	342.0		-56			clear - very slight fines
11:49	26.6	7.37	504.6	344.5		-44			
12:06	26.9	7.[illegible]	506.6	345.3		-20			no sand
12:21	26.6	7.35	507.8	347.6		-41			
13:13	27.7 27.7	7.36	505.5	344.4		-30			27.7°C no odor no sand
14:23	26.5	7.38	515.6	352.7		-2			2nd opinion on odor - yes slight sulfer
14:40	26.9	7.41	517.6	355.6		+1			Orp not stable +17 to -23
15:07	26.4	7.33	518.4	354.7		-29			water musty - no change from start
15:21	26.8	7.34	516.3	352.5		-34			End
									400 gpm pumping to
									Sewer for 4 hours
									11:20 to 13:21

FIELD REPORT

DATE: 8/23/2016	LOCATION: Esposti Well, Old Redwood Hwy at Shiloh Road, Windsor, CA
PROJECT NAME: Town of Windsor, Esposti Well	JOB NO: 11110001.20
EVENT: Sewer Flow Test and Observations	WEATHER/TEMP: ° at am ° at pm
PRESENT AT SITE: Kent O'Brien	

DATE: ~~dd/mm/yy~~ Aug /23/2016

Time: use 24 hour time record at 15 min intervals or more freq.	Manhole number/description	Observed flow as a % of full pipe	Other observations
1115	S130	10% 0 gpm	pump
1122	S130	45% 400 gpm	20% going ORH
1132	S130	50% 410 gpm	
Pump Start: 11:20			
by KOB!			



N OR Hwy. little to no flow at start

20% of total flow going down N.O.R. Hwy

Page____ of____

O'Brien, Kent

From: O'Brien, Kent
Sent: Wednesday, August 24, 2016 5:50 AM
To: Elizabeth Cargay (ecargay@townofwindsor.com)
Cc: Dave Vossler (dave.vossler@ghd.com); ryan.crawford@ghd.com
Subject: 8/23/2016 Esposti Supply Well discharge to sewer volume report

Elizabeth – sewer discharge summary is below:

Non-Residential One-Time Discharge Permit
Permit number - TD-04152016
Effective Date - 04/15/2016
Expiration Date- 12/31/2016

Date of discharge – **8/23/2016**
Point of discharge – sewer manhole S130A (Shiloh and Old Redwood Hwy)
Total gallons **discharged – 96,000 gallons**

Kent O'Brien PG, CEG

Senior Associate | Hazen and Sawyer
201 Mission Street, Suite 500, San Francisco, CA 94105
628-242-0050 (direct) 707-478-9559 (cell) 628-242-0042 (main)
41828 (VOIP Extension)
kobrien@hazenandsawyer.com | hazenandsawyer.com

WEST COAST
WELL LOGGING SERVICES
GEOPHYSICAL & VIDEO LOGGING

SPINNER INTERPRETATAION

P.O.Box 2797, Rancho Cordova CA 95741 · Phone: 916-858-8148 Fax: 916-858-8174 · Web: www.wcwls.com Email: wcwls@sbcglobal.net

Filing No.

COMPANY **Weeks Drilling & Pump Co., Inc.**

WELL **Espoti Supply Well**

FIELD **Windsor**

STATE **California** COUNTY **Sonoma**

LOCATION:
Old Redwood Hwy. & Shilo Rd.

OTHER SERVICES:
Stops

Job No.
1425

SEC: 19 TWP: 8N RGE: 8W LAT.: 38.52849 LONG.: 122.77953

Permanent Datum: **Ground Level** Elev.: **150** Ft. Elevs.: K.B. ____ Ft.

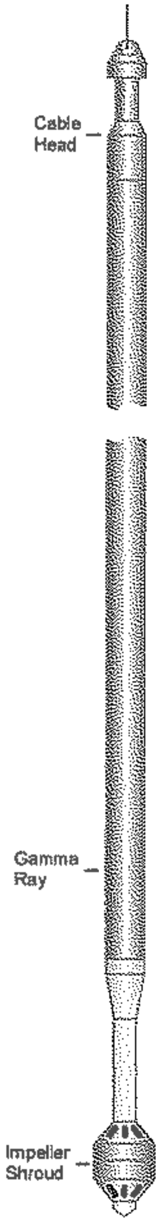
Log Measured From: **Top of Casing** **0** Ft. Above Perm. Datum D.F. ____ Ft.

Drilling Measured From: **Ground Level** G.L. **150** Ft.

Date	Aug 23, 2016			
Type Log	Spinner			
Run	One			
Depth-Driller	575 Ft	Ft	Ft	Ft
Depth-Logger	575 Ft	Ft	Ft	Ft
Top Logged Interval	300 Ft	Ft	Ft	Ft
Btm Logged Interval	575 Ft	Ft	Ft	Ft
Type Fluid In Hole	Water			
Fluid Level	122 pwl Ft	Ft	Ft	Ft
Max Temp	n/a °F	°F	°F	°F
Operating Rig Time	n/a °Hr	°Hr	°Hr	°Hr
Van No. Location	WC-1 RC			
Recorded By	Sharpless			
Witnessed By	J. Moore			

RUN	BOREHOLE RECORD			CASING RECORD			
NO.	BIT SIZE	FROM	TO	CASING SIZE	CASING TYPE	FROM	TO
1	In	Ft	Ft	10 In		0 Ft	656 Ft
2	In	Ft	Ft	In		Ft	Ft
3	In	Ft	Ft	In		Ft	Ft

SPINNER INTERPRETATAION TOOL



SPINNER LOGS:

Spinner logs are used to quantify flow (up or down) in a water well. In a producing water well, the spinner log is usually run downwards at a constant speed. Deflections in the curve are indicative of water entry. Proper calibrations, eliminating the effective of line speed, will quantify the flow rate from zones of interest.

SPINNER SPECIFICATIONS:

Diameter	1.77, 2.76, or 3.94 Inches
Length	5.5 Feet
Weight	16.1 Lbs.
Max. Temp	158° F
Gamma Ray	1.97 inches long x .98 inches diameter Scintillation crystal

NOTICE

REMARKS

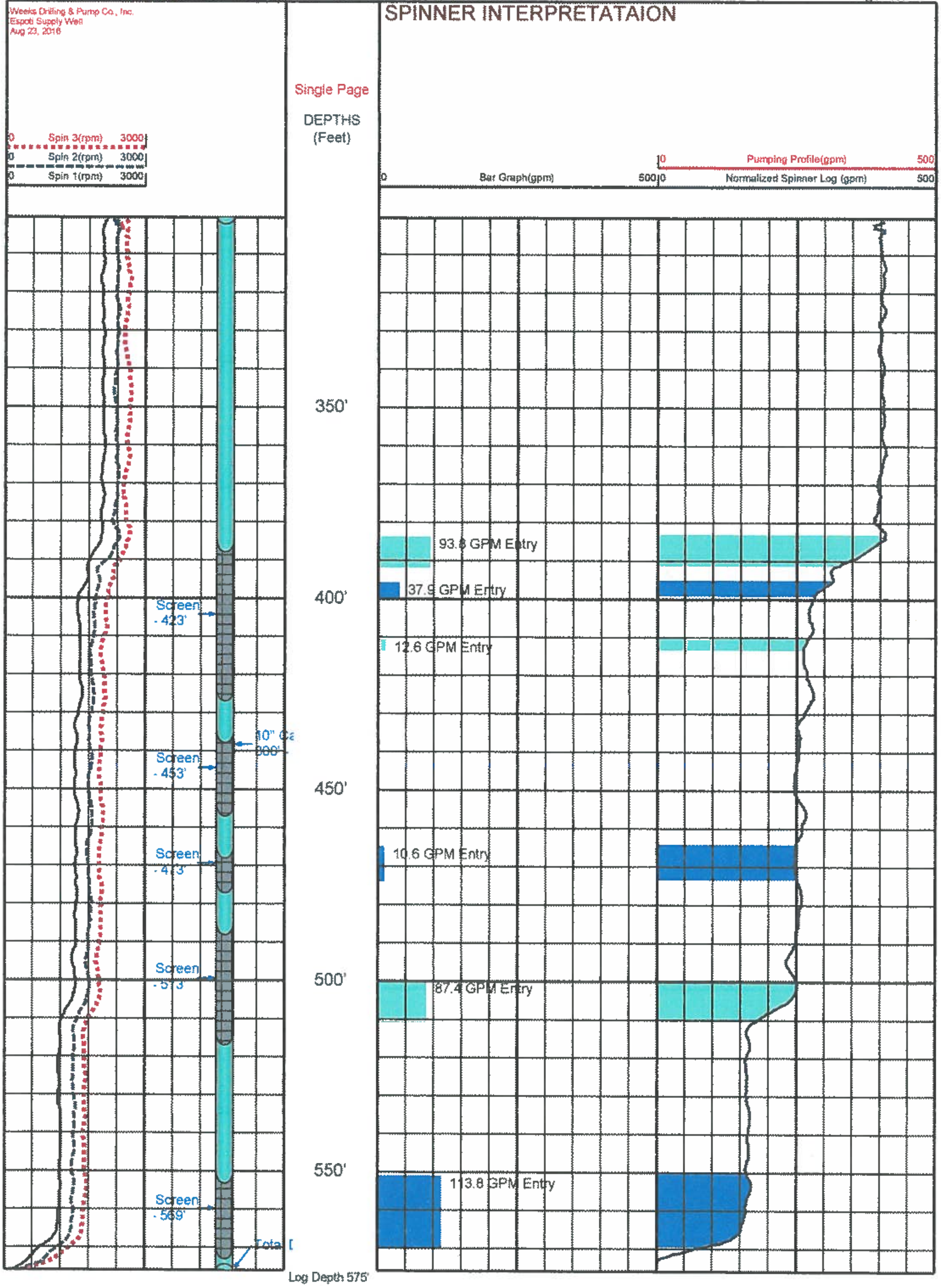
A recreational GPS accurate to +/- 45 feet set for Datum WGS84 was used to calculate Latitude, Longitude, and Elevation values.

Bottom of well blocked by debris

West Coast Well Logging Services - P.O.Box 2797 - CA - 95741   Fax: 916-858-8174   Phone:916-858-8148

SPINNER INTERPRETATAION

Weeks Drilling & Pump Co., Inc.
Espoti Supply Well
Aug 23, 2016



alpha
Alpha Analytical Laboratories Inc.
www.alpha-labs.com
WATERS, SEDIMENTS, SOLIDS

Corporate Laboratory
208 Mason Street, Ukiah, CA 95482
707-468-0401 F) 707-468-5267
clientservices@alpha-labs.com

Bay Area Laboratory
6398 Dougherty Road, #35, Dublin, CA 94568
925-828-6226 F) 925-828-6309

Central Valley Laboratory
9090 Unioin Park Wy., #113, Elk Grove, CA 95624
916-686-5190 F) 916-686-5192

Work Order
Chain of Custody Record

Lab No. ____________ Page ____ of ____

Name: Town of Windsor - Drinking Water

Mailing Address:
9291 Old Redwood Highway Building 400
Windsor, CA 95492

Project Contact (Hardcopy or PDF to):
Elizabeth Cargay
ecargay@townofwindsor.com and to
kobrien@hazenandsawyer.com
Kent O'Brien, Hazen and Sawyer

Project ID: Source Chemical

Phase: Esposti Well

PO#

Bill to: month end billing

Signature below authorizes work under terms stated on reverse side.

Analysis Request

Field Sampler - Print Name & Signature

Sample Identification	Date	Time	40ml VOA	Poly	Amber	Glass		HCL	HNO3	NH4Cl	Other	None	Water	Soil		200.8 As	200.7 Fe	200.7 Mn	TAT
~~Esposti Well~~	~~8/23~~			~~x~~				~~x~~					~~x~~			~~x~~	~~x~~	~~x~~	
ESW-8-23-11:21	8/23	11:24		X				X					X			X	X	X	↑
ESW-8-23-11:26	8/23	11:26		X				X					X			X	X	X	Standard
ESW-8-23-12:21	8/23	12:21		X				X					X			X	X	X	↓
~~ESW-8-23-13:21~~	8/23	~~13:21~~		X				X					X			X	X	X	48 hr.
ESW-8-23-15:21		15:21																	

TAT: 24 hr ○ 48 hr ○ (Lab Approval Required) 1 wk ○ 2 wk (standard) ○
Lab Approval Required For Rush

Relinquished by:	Received by:	Date	Time
Relinquished by:	Received by:	Date	Time
Relinquished by:	Received by:	Date	Time
Relinquished by:	Received by:	Date	Time
Relinquished by:	Received by:	Date	Time

CDPH Write On EDT Report? Yes ○ [✓ No]

State System Number: ____________

CA Geotracker EDF Report Yes ○ [✓ No]

Sampling Company Log Code: ____________

Global ID: EDF to (Email Address)

Travel and Site Time: Mileage: Misc. Supplies:

send results to:
ecargay@townofwindsor.com
~~ken~~ kobrien@hazenandsawyer.com

Appendix G – May 5, 2016 Downhole Video Report

WATER WELL VIDEO REPORT

Espoti Supply Well

City of Windsor

West Coast Well Logging Services
P.O.Box 2797 Rancho Cordova, CA. 95741
Phone: 916-224-3810 Fax: 916-858-8174 Web: www.wcwls.com

Client: **Weeks Drilling & Pump, Inc.**
Address: **P.O.Box 176**
City: **Sebastopol, CA 95473**
County: **Sonoma**
Requested By: **Josh**
Copy To:
Reason For Survey: **Possible damage**
Location: **Espoti Park, Old Redwood Hwy. & Shilo**
Field: **Windsor**
Other Information:

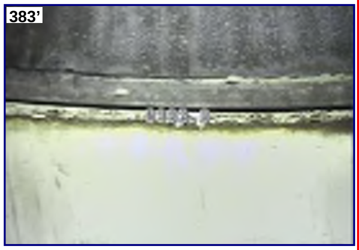
Survey Date: **May 4, 2016**
Invoice No.: **1308** Run: **Two**
P.O.: Van: **WC-1**
Operator: **Mark F. Sharpless**
Type Camera: **CCV Color Flip Camera - Short L.H.**
Latitude: **38.52654°** Longitude: **122.77948°**
Section: **19** TWP: **8N** Range: **8W**

CASING INFORMATION		DEPTHS (SideScan)	VIDEO OBSERVATIONS
Stainless Steel Screen	**Well Depth**	0.0 Ft.	Recording Starts - Zeroed on SideScan Lens
384-424 Ft.	665 Ft.	40.4 Ft.	Static Water Level (SWL)
434-454 Ft.		374.7 Ft.	Small hole in the scale, not the casing
465-474 Ft.	**S.W.L**	382-384 Ft.	Dielectric Joint
485-514 Ft.	40.4 Ft.	383.0 Ft.	Top of Stainless steel
550-569 Ft.		384.2 Ft.	Perforations, Top Of Screen (384-424)
621-654 Ft.		433.6 Ft.	Shipping label on casing wall
		434.4 Ft.	Perforations, Top Of Screen (434-454)
		464.5 Ft.	Perforations, Top Of Screen (465-474)
		484.8 Ft.	Perforations, Top Of Screen (485-514)
		549.9 Ft.	Perforations, Top Of Screen (550-569)
		571.9 Ft.	Top of bailer cable
	10" I.D. Casing	599.4 Ft.	Shipping label on casing wall
	0-665 Ft.	620.9 Ft.	Perforations, Top Of Screen
Zero Datum	Type: Steel	654.1 Ft.	Well plugged screen, camera is stopped on the top of the bailer
Top Of Casing			End of in hole survwy
Dia. Reference			
Measured			
Casing Buildup			
Very Heavy			


0'


40.4'


374.4'


383'


384.2'


423.7'


433.6'


434.4'


453.8'


464.5'


473.9'


484.6'

Notes:

WELLBORE SNAPSHOT(S)

Depth: 0 Feet

Depth: 40.4 Feet

Depth: 374.4 Feet

Depth: 383 Feet

Depth: 384.2 Feet

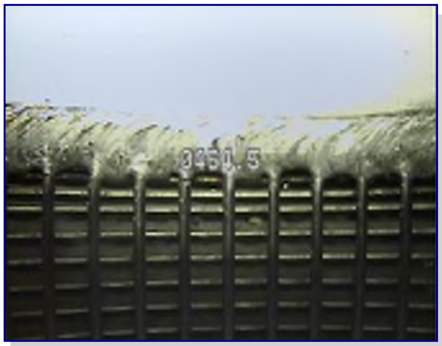
Depth: 423.7 Feet

Depth: 433.6 Feet

Depth: 434.4 Feet

Depth: 453.8 Feet

Depth: 464.5 Feet



Depth: 473.9 Feet

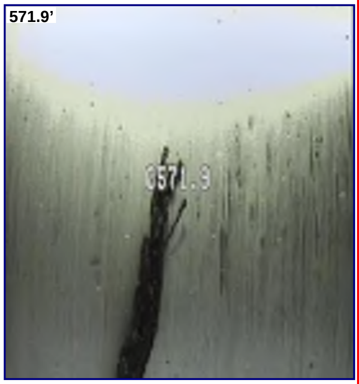
Depth: 484.6 Feet

CASING INFORMATION		DEPTHS (SideScan)	VIDEO OBSERVATIONS
Stainless Steel Screen	**Well Depth**		Additional snapshots
384-424 Ft.	665 Ft.		
434-454 Ft.			
465-474 Ft.	**S.W.L**		
485-514 Ft.	40.4 Ft.		
550-569 Ft.			
621-654 Ft.			
	10'' I.D. Casing		
	0-665 Ft.		
Zero Datum	Type: Steel		
Top Of Casing			
Dia. Reference			
Measured			
Casing Buildup			
Very Heavy			

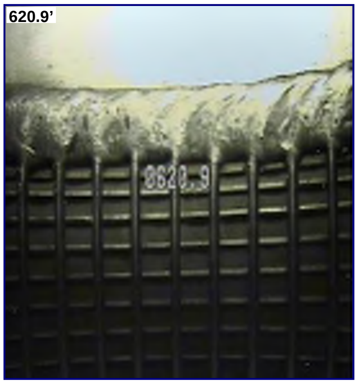

514.1'

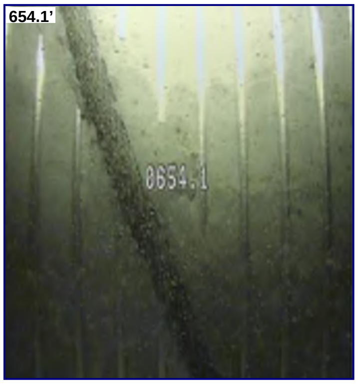

549.9'


569.3'


571.9'


599.4'


620.9'


654.1'

Notes:

WELLBORE SNAPSHOT(S)

Depth: 514.1 Feet

Depth: 549.9 Feet

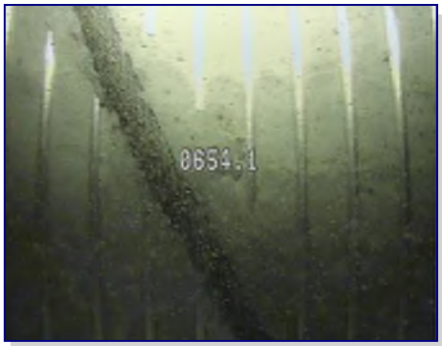
Depth: 569.3 Feet

Depth: 571.9 Feet

Depth: 599.4 Feet

Depth: 620.9 Feet

Depth: 654.1 Feet



FIELD REPORT

DATE: 5/4/2016

LOCATION: Esposti Well, Old Redwood Hwy at Shiloh Road, Windsor, CA

PROJECT NAME: Town of Windsor, Esposti Well

JOB NO: 11110001.20

EVENT: Well Development

WEATHER/TEMP: — ° at am
70 ° at pm BREEZE

PRESENT AT SITE: ~~Dave Vossler,~~ GHD;
RYAN CRAWFORD

THE FOLLOWING WAS NOTED:

1145 RC / WEEKS/ WEST COAST ONSITE. SITE SAFETY MEETING. REVIEW SCOPE & TARGET AREAS (430', 598' & BOTTOM) AND SCREENED ZONES.

1215 SET-UP HIGH DEF. DOWNHOLE CAMERA AND GO DOWN ESW.

145 CONFIRM 430' WAS NOT A HOLE IN CASING, BUT FACTORY LABELS & TAPE. SAME FOR THE 598' INTERVAL.

BOTTOM OF HOLE HAS 77' CABLE & BAILER (WEEKS). COUPLE SMALL (1/4") HOLES @ 373. UPPER SCREENS VERY CLEAN, BOTTOM (640-654') SCREEN DIRTY. TD = 654'. TAKE SPIN VIDEO BACK UP ESW. BURN 3 COPIES OF VIDEO. LOCK-UP SITE.

350 RC/WEEKS/WEST COAST OFFSITE

Appendix H – Site Visit Reports

DAILY FIELD NOTES

Logged by: RC/DV
Sheet 1 of ____

GHD Project Name: ESPOSTI REHAB
Date: 4/21/16

GHD Project Number: ____ Project Location: ____

Rig Type: ____ Pump Type: ____

☐	Well Construction	Well Contractor:	WEEKS
☐	Pumping Test	Pumping Contractor:	" "
☐	Site Reconnaissance		
☐	Video Well		
☐	Other		

NOTES

1005 BLUE BIRD - TDW (TOC EYELID) ~~28.20'~~ 28.82'
1010 SET TRANSD # 19828 @ 38.5'

1020 CHURCH WELL - TD = 75', 4" STEEL LINER TO ORIGINAL 6"
½" ACCESS PORT "VENT"

ESPOSTI IRRIGATION WELL - 3/4" ACCESS PORT, BUT @
~77' PROBE GETS STUCK, NEED TO REAM OUT NEW
7/8" ACCESS PORT ON NORTH SIDE

4/22/10 DV INSTALLED F65 IN ESP. IRR WELL @ 75' BGS
STILL NEED BARO IN

Client
Job Number
Sheet of
Project
Sheets by
Date
Subject ESPOSOTI TRANSDUCER SET-UP
Checked by
Date

- ONE MIN. INTERVALS
- SYNC TO RC UNIT

- ID	TIME/ DATE STARTED	TIME INTERVAL	STATIC WL	TRANSD. DEPTH	TRANSD TYPE/ MODEL
CHURCH	~~9am 4/21~~	1m	?	NONE	F30, ~~21582~~ 20188
BLUEBIRD	9AM 4/21	~~[illegible]~~ 1 min	28.82' (TOC EXIT)	38.50'	F15
ESPOSTI IRR	9AM 4/21 SET IN WELL 9AM 4/22	~~[illegible]~~ 1 MIN	>150' TOC	75' (TOC)	F65
BAROMETER	9am 4/21	1 min	—	SURFACE	F1

GHD

FIELD REPORT

DATE: WEEK OF 25TH APRIL
LOCATION:
PROJECT NAME: EWS REHAB
JOB NO:
EVENT:
WEATHER/TEMP: ° at am ° at pm
PRESENT AT SITE:

THE FOLLOWING WAS NOTED:

4/27 1100 RC ONSITE TO DISCUSS PURGING / BAILING & TRANSDUCER OPTIONS W/ WEEKS & TOWN. NO SAMPLE TODAY OF EWS.

WEST SIDE SEWER @ CONDE IS TOO FAR FOR MONITORING SEWER FLUX FROM PUMP TEST.

JON @ MOBILE HOME SAYS 4/28 BETTER FOR TRANSDUCER INSTALL.

4/28 1010 RC @ MOBILE PARK, MEET W/ JON BOCCI
MOBILE PARK WELL DTW = 22.61' (TOC)
SET TRANSDUCER 20188 (F30) @ 45' TOC

ONSITE TO DISCUSS W/ MATT (WEEKS), COLLECT EWS SAMPLE. WEEK TO GET WADDLES FOR AN INFILTRATION BASIN FOR BAILER SEDIMENT

DATE: 4/28/2016	LOCATION: : Esposti Well, Old Redwood Hwy at Shiloh Road, Windsor, CA
PROJECT NAME: Town of Windsor, Esposti Well	EVENT: Well Development

CONT. - WEEKS TO BRING WADDLES & CONFIRM
RFR TANK DISCHARGE PUMP WILL DO
> 500 GPM TO SEWER. ✓

1230 - RC OFFSITE TO MEET LAB COURIER
FOR SAMPLE.

FIELD REPORT

DATE: 5-2-2016

LOCATION: Esposti Well, Old Redwood Hwy at Shiloh Road, Windsor, CA

PROJECT NAME: Town of Windsor, Esposti Well

JOB NO: 11110001.20

EVENT: Well Development

WEATHER/TEMP: 55° at am 75° at pm BREEZE

PRESENT AT SITE: Dave Vossler, GHD;

THE FOLLOWING WAS NOTED:

1045 - RC ONSITE, START BAILING W/ 8" x 10' SUCTION BAILER. PULLING REALLY GOOD. TOP ~ 2' FINES, NEXT ~ 8' GRAVEL PACK!

1130 EC ONSITE. DISCUSS GRAVEL PACK & UPCOMING PUMP TEST (24-HOUR) EC OFFSITE ~1150

1200 BAILER STUCK, GET WIRE GRIP TOOL TO USE BOTH WINCHES TO TEESE UP BAILER. WIRE TO BAILER BROKE. CALL TEAM & EC.

1245 RC OFFSITE. WEEKS TO MOBILIZE CAMERA MEET BACK OUT @ 1500

1445 RC/WEEKS ONSITE SET-UP CAMERA. 1505 CAMERA DOWN HOLE, SCREENS LOOK SHINY ON WAY DOWN (ALBEIT TURBID). GOT CAMERA TO 648 + 16" TOC ~ 649.25' = TD

1600 RC/WEEKS OFFSITE

FIELD REPORT

DATE: 5/4/2016

LOCATION: Esposti Well, Old Redwood Hwy at Shiloh Road, Windsor, CA

PROJECT NAME: Town of Windsor, Esposti Well

JOB NO: 11110001.20

EVENT: Well Development

WEATHER/TEMP: — ° at am
70 ° at pm BREEZE

PRESENT AT SITE: ~~Dave Vossler,~~ GHD; RYAN CRAWFORD

THE FOLLOWING WAS NOTED:

1145 RC / WEEKS/ WEST COAST ONSITE. SITE SAFETY MEETING. REVIEW SCOPE & TARGET AREAS (430', 598' & BOTTOM) AND SCREENED ZONES.

1215 SET-UP HIGH DEF. DOWNHOLE CAMERA AND GO DOWN ESW.

145 CONFIRM 430' WAS NOT A HOLE IN CASING, BUT FACTORY LABELS & TAPE. SAME FOR THE 598' INTERVAL.

BOTTOM OF HOLE HAS 77' CABLE & BAILER (WEEKS). COUPLE SMALL (1/4") HOLES @ 373. UPPER SCREENS VERY CLEAN, BOTTOM (640-654') SCREEN DIRTY. TD = 654'. TAKE SPIN VIDEO BACK UP ESW. BURN 3 COPIES OF VIDEO, LOCK-UP SITE.

350 RC/WEEKS/WEST COAST OFFSITE

FIELD REPORT

DATE: 5/6/2016	LOCATION: WINDSOR
PROJECT NAME: ESPOSTi WELL REHAB.	JOB NO: 11100001
EVENT: TRANSDUCER INSTALL/CHK	WEATHER/TEMP: 64° at am 64° at pm DRIZZLE & WIND
PRESENT AT SITE: RC / WEEKS	

THE FOLLOWING WAS NOTED:

1145 - RC ONSITE. DISCUSS SITE SAFETY ✓

MEASURE OUT 270' OF DIRECT READ (IN-SITU) CABLE, PROGRAM TROLL 700 AND PLACE IN ESPOSTi SUPPLY WELL.

TRANSDUCER DEPTH (TOC) = 270'

DTW = 42.70, UNIT SAYS 237.30' HEAD

228.30+42.70 = 270' ✓

1245 - ESPOSTi IRRIGATION WELL

DTW = 33.60' (PORT) ✓

UNIT SAYS HEAD = 42.37' SO 33.60'+42.37' = 75.97 DEPTH OF TRANS.

1315 - MOBILE HOME ESTATES WELL

DTW = 19.78 ✓

UNIT SAYS HEAD = 25.22 SO 19.78 + 25.22 = 45' DEPTH OF TRANSDR.

1410 - WEEKS SETTING PUMP & FLOW METER TODAY

RC OFFSITE

WINZLER & KELLY
718 Third Street, Eureka, CA 95501-0504
(707) 443-8326

By ________ Date ________ Client ________ Sheet No. ____ of ____

Subject ESW VIDEO Job No. ________

TARGET DEPTHS

WELD @ 160′ → SLOPPY, MIGHT BE A CRACK OR?
180.

350 - 360′+ HIGHLY ENCRUSTED

510 - 530 SCOUR/TOOL MARKS

430 - 432 HOLE? @ COLLAR

5/6/16 ESW TRANSDUCER PLACEMENT

@ 1230 SET @ 270′ TOC
DTW = 42.70, IN-SITU TROLL 700
DIRECT READ CABLE ✓ TRIAL RUN/DOWNLOAD GOOD
SAYS 237.30′ HEAD

270.0
\- 237.3
42.7 = DTW ✓

ESPOSTI IRRIGATION WELL

SOLINST "LEVEL" (DIRECT READ) = 42.37′

SET @ 75′ TOC, DTW = 34.60 (FROM PORT)

34.60
\+ 42.37
76.97′ = TOTAL DIRECT READ CABLE LENGTH

CONT →

WINZLER & KELLY
718 Third Street, Eureka, CA 95501-0504
(707) 443-8326

By ____ Date ____ Client ____ Sheet No. ____ of ____

Subject ESW Job No. ____

CONT. TRANSDUCER REVIEW

MOBILE HOME ESTATES WELL

5/6/16 1350 REAL TIME "LEVEL" = 25.22

DTW = 20.05, TRANSD. SET @ 45' TOC
-25.2 = 20' ✓

PUMP KICKED ON → FLATLINE @ "LEVEL" = 2.8-2.9

5 MIN PUMP KICKED OFF. BACK TO 25.22 in 2 min. ✓

DATE: 5/9/2016

LOCATION: ESPOST PARK, WINDSOR

PROJECT NAME: ESPOSTI REHAB.

EVENT: SEWER DISCHARGE MONITORING & SPECIFIC CAPACITY TEST

5/9 SEWER DISCHARGE MONITORING SITE SAFETY w/ TOWN
JOSE, JORDAN

0855- ESW DTW = 40.55 TOC

0910 - TURN ON ESW TO CONFIRM SP. CAP.
* @ 0940 START PUMPING 200 GPM TO S130
* @ 0945 START PUMPING FROM RFR TANKS, BUT FILTERS CLOGGED(?) AND ONLY DOES 100GPM!
CLEAN OUT BAGS-FILTERS ✓ GOOD FOR HIGHER FLOW

1105 - START DISCHARGING @ 200 GPM TO S130
DTW @ 1235 = 104.22 HEAD = $\begin{array}{r}270\\-104\end{array}$
LOST COMMUNICATION w/ IN-SITU 700 @ 1235

1255 - DISCHARGING @ 300 GPM FROM FILTER PUMP

1330 - ESW DTW = 106.68, ~~@~~ 1340 DTW = 106.69

1345 - ESW PUMP OFF - NO CAPACITY. 400 GPM 0910-1345

1425 - START DISCHARGE @ 400 GPM

1515 - STOP MONITORING & ~~Ø~~ NOW DISCHARGING @ 200GPM
4/8.40 - DTW @ 241 pm 221.42 head

1600 - STOP SURGE/PURGE - TANKS FULL

1620 - RC/WEEKS OFFSITE

* FINAL NOTES PUMPED ESW @ 400 GPM FOR 4.5 HOURS & DRAWDOWN BEGAN TO FLATTEN OUT @ 65'. TOTAL DRAWDOWN WAS 66.14'

FIELD REPORT

DATE: 5/9/2016

LOCATION: Esposti Well, Old Redwood Hwy at Shiloh Road, Windsor, CA

PROJECT NAME: Town of Windsor, Esposti Well

JOB NO: 11110001.20

EVENT: Sewer Flow Test and Observations

WEATHER/TEMP: Cloudy ° at am 1000
Sunny ° at pm 1440

PRESENT AT SITE: Jourdan (Town of Windsor)

DATE: dd/mm/yr 05 / 09 / 16

Time: use 24 hour time record at 15 min intervals or more freq.	Manhole number/description	Observed flow as a % of full pipe	Other observations
0936	S 375	[illegible] 15%	Initail
1000	S375	20%	5% increase w/100 gp
1100	S374	15%	
1105	S375	15%	
1111	S374	15%	
1113	S375	15%	
1121	S374	30%	
1123	S375	30%	
1140	S374	30%	
1147	S375	30%	
1238	S333	25%	
1252	S374	30%	
1305	S374	30%	
1311	S374	30%	
1331	S374	30%	
1341	S374	30%	
1423	S374	30%	
1430	S374	35-40%	400 gpm
1440	S374	40-45%	400 gpm
1453	S374	45%	
1506	S374	30%	

Page 1 of 1

Jose
Jordan

Jose +
Jordan

FIELD REPORT

DATE: 5/9/2016

LOCATION: Esposti Well, Old Redwood Hwy at Shiloh Road, Windsor, CA

PROJECT NAME: Town of Windsor, Esposti Well

JOB NO: 11110001.20

EVENT: Sewer Flow Test and Observations

WEATHER/TEMP: 930 ° at am ° at pm Overcast 60°

PRESENT AT SITE: 9am Weeks (2), Town (3), GHD (1)

DATE: dd/mm/yr 5 / 9 / 16

Time: use 24 hour time record at 15 min intervals or more freq.	Manhole number/description	Observed flow as a % of full pipe	Other observations
0933	S374	~15%	Fairly open flow
0940 - 0942			Side flow coming in Δ5%
0954		~15-20% apparent	increase in flow - faster
1000		~15-20%	Same

Page 1 of 1

FIELD REPORT

DATE: 5/9/2016	LOCATION: Esposti Well, Old Redwood Hwy at Shiloh Road, Windsor, CA
PROJECT NAME: Town of Windsor, Esposti Well	JOB NO: 11110001.20
EVENT: Sewer Flow Test and Observations	WEATHER/TEMP: ° at am ° at pm
PRESENT AT SITE: Weeks GHD	

DATE: dd/mm/yr 5 / 9 / 16

Time: use 24 hour time record at 15 min intervals or more freq.	Manhole number/description	Observed flow as a % of full pipe	Other observations
09:44 AM	S376	15%	15% open flow ~~Grease~~ 10 GPM
09:53 AM	S376	25%	10% increase
1000 AM	" "	Same	at 100 GPM
1100 AM	" "	15%	open flow 200 GPM
1115 AM	" "	20%	5% increase
1122 AM	" "	Same	
1145 AM	" "	25%	5% incre in flow
1259 AM	" "	25% same	10% increase in flow
12:49 PM	" "	30%	5% increase in flow 300 GPM
1310 PM	" "	30% same	same increase in flow
1325 PM	" "	Same	" " "
1339 PM	"	30% Same	0% increase flow 400 GPM
1423 PM	" "	35%	5% increase in flow
1440 PM	" "	35% Same	" " "
1155 PM	" "	35% same	" " "
1510 PM	" "	30%	5% Decrease in flow

Page 1 of 2

Special notes regarding: traffic during test, trucks, buses. Pedestrians, kids in the area, homeless. Is location appropriate for night monitoring. Photograph location and inside of manhole. Consider appropriateness of manhole as a permanent monitoring station with automatic measuring for final system.

on 5/9/16 Light traffic on shiloh Rd at S376 from 9:30Am to 1:40pm heavier traffic after 3:00pm & one or two pedestrians walking bye.

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925-828-6226 F) 925-828-6309

Central Valley Laboratory
9090 Union Park Wy., #113, Elk Grove, CA 95624
916-686-5190 F) 916-686-5192

Work Order
Chain of Custody Record

Lab No.____________ Page____of____

Name: Town of Windsor - Drinking Water

Project ID: Esposti Potable Well

Mailing Address:
9291 Old Redwood Highway Building 400
Windsor, CA 95492

Phase:

Project Contact (Hardcopy or PDF to):
Elizabeth Cargay
ecargay@townofwindsor.com
Kent O'Brien
kent.obrien@ghd.com

PO#

Bill to: month end billing

Field Sampler - Print Name & Signature

Signature below authorizes work under terms stated on reverse side.

Analysis Request

Sample Identification	Sample Collection Date	Sample Collection Time	Container: 40ml VOA	Container: Poly	Container: Amber	Container: Glass	Preservative: Na2S2O3	Preservative: HNO3	Preservative: NH4Cl	Preservative: Other	Preservative: None	Matrix: Water	Matrix: Soil	200.8 As (Dissolved)	200.7 Fe (Dissolved)	200.7 Mn (Dissolved)	200.8 Cr (Dissolved)	218.6 Cr6 (Dissolved)	200.7 Ca, Mg, K, Na (Dissolved)	Alkalinity	Chloride	Nitrate as N, Nitrite as N	Sulfate	Total Nitrogen (includes TKN, NO2, NO3)	Silica	200.8 Vanadium - total	Phosphate	CAM 17	TPH G, BTEX, D/MO	6010 As STLC	Title 22 Scan (**Below List)	TAT
ESW-5-9-10:50	5/9	1050		X							X	X		X	X	X																Filter-fix
ESW-5-9-15:35	5/9	1535		X							X	X		X	X	X																in Lab

TAT: 24 hr ☒ 48 hr ○ Lab Approval Required; 1 wk ○ 2 wk (standard) ○
Lab Approval Required For Rush

**Title 22 Scan

64432 Primary Inorganics, 64432.1 NO2/NO3, 64449 A&B
Asbestos, Perchlorate, Gross Alpha, 504.1, 507, 508, 515.1,
524.2, 531.1, 548.1, 549.2

Relinquished by:	Received by:	Date	Time
		5/10	1400

CDPH Write On EDT Report? Yes ○ No ☒

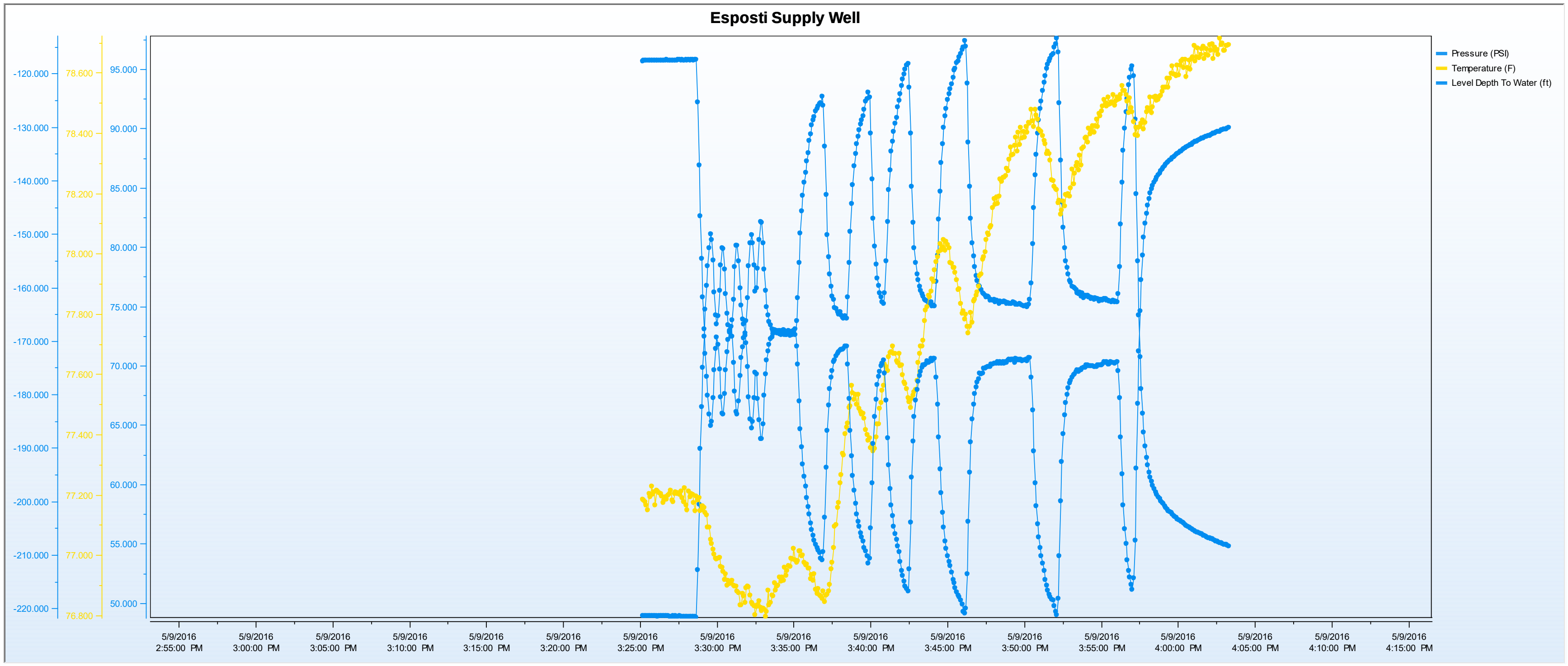
State System Number: ____________

CA Geotracker EDF Report Yes ○ No ☒

Sampling Company Log Code: ____________

Global ID: EDF to (Email Address):

Travel and Site Time: Mileage: Misc. Supplies:


Esposti Supply Well
Pressure (PSI)
Temperature (F)
Level Depth To Water (ft)
-120.000
-130.000
-140.000
-150.000
-160.000
-170.000
-180.000
-190.000
-200.000
-210.000
-220.000
78.600
78.400
78.200
78.000
77.800
77.600
77.400
77.200
77.000
76.800
95.000
90.000
85.000
80.000
75.000
70.000
65.000
60.000
55.000
50.000
5/9/2016 2:55:00 PM
5/9/2016 3:00:00 PM
5/9/2016 3:05:00 PM
5/9/2016 3:10:00 PM
5/9/2016 3:15:00 PM
5/9/2016 3:20:00 PM
5/9/2016 3:25:00 PM
5/9/2016 3:30:00 PM
5/9/2016 3:35:00 PM
5/9/2016 3:40:00 PM
5/9/2016 3:45:00 PM
5/9/2016 3:50:00 PM
5/9/2016 3:55:00 PM
5/9/2016 4:00:00 PM
5/9/2016 4:05:00 PM
5/9/2016 4:10:00 PM
5/9/2016 4:15:00 PM

FIELD REPORT

DATE: 5/10/2016	LOCATION: Esposti Well, Old Redwood Hwy at Shiloh Road, Windsor, CA
PROJECT NAME: Town of Windsor, Esposti Well	JOB NO: 11110001.20
EVENT: Well development by pumping and flow testing	WEATHER/TEMP: ° at am ° at pm
PRESENT AT SITE: Kent O'Brien GHD;	

THE FOLLOWING WAS NOTED:

7:57 - set up generator, text Town with days plan

casing volume DTW = 42, DTB = 655, water column = 613

613 feet in 10" casing = 334 ft^3 = 2,479 gallons

3 casing volumes = 7437 gallons - 7.5 minutes at 1,000 gpm

18.6 minutes at 400 gpm

Tanks all at 1/4; 60,000 gallons capacity

8:09 sewer discharge on at 200 gpm

8:13 (approx) start pumping at 400 gpm - water clear

8:17 - cell phone photo of jar

8:41 - cell phone photo of jar

8:42 - system hard shut off - amperage problem - pump kick off at 1,000 gpm

9:07 restart at 800 gpm

9:09 water test

9:15 water test

9:16 (approx) shut down automatic at 800 gpm and DTW at 164 ft BTOC

9:34 sewer discharge continuing @ 190 gpm 6364 on totalizer

9:48 restart ramp up to 800

9:49 water test immediately at reaching 800 gpm

9:54 DTW 158.5 BTOC - start DTW not measured

Page____ of____

DATE: 5/10/2016

LOCATION: : Esposti Well, Old Redwood Hwy at Shiloh Road, Windsor, CA

PROJECT NAME: Town of Windsor, Esposti Well

EVENT:

10:01 pump auto shutdown at 168 FT BTOC 800 gpm

10:09 water Test - lab sample collection

11:22 Pack up to leave - pump shut down auto - exact time not recorded -

Locked irrigation well enclosure (combo 1111)

Weeks to stay on site and Trouble shoot pump

WELL SAMPLING DATA SHEET

PROJECT NAME: Esposito
PROJECT DATE: 5/11/2016
PROJECT NUMBER: 1111001.2
SAMPLER: Kent O'Brien
WELL DESIGNATION: Esposito Supply well
SAMPLE NUMBER: ____________

CONDITION OF WELL HEAD / VAULT / CAP & LOCK: ____________

A. TOP OF CASING ELEVATION: ____
B. DEPTH TO GROUNDWATER (initial): ____
C. DEPTH OF WELL: ____ MEASURED: ____________
D. HEIGHT OF WATER COLUMN (C-B): ____
E. GROUNDWATER ELEVATION (A-B): ____

CASTING DIAMETER: 2" ________ 3" ________ 4" ________ OTHER 10"

CALCULATED WELL VOLUME: D X V = ____________
Volume (V) of 2" well – 0.163 gal/ft
Volume (V) of 4" well – 0.653 gal/ft

ODOR: ________ SHEEN: ________ FLOATING PRODUCT THICKNESS ________

PUMP TYPE: ________ POLY BAILER: ________ STAINLESS BAILER: ________
ELECTRIC: ________ OTHER: ____________

DECON PROCEDURE: LIQUINOX/ALCONOX ____ TAP ____ BLEACH ____ OTHER ____ WATER SOURCE ____________

4.0 7.0 10
4.2 7.1 10

PUMP DEPTH: 30 ft

METER USED: CALIBRATED?

TIME	Flow GALLONS ~~PURGED~~	NO. OF WELL VOLUMES	pH	TEMP C	CONDUCTIVITY (µMHOS/CM)	ORP (mV)	TURBIDITY (Visual)
08:17	400 To 1,000 surging		6.67	22.7	3214 µS	64	musty/mod/F.san
8:32	400 To 1,400 surge		7.02	23.3	824	-10	musty/mod/F.S
8:41	"	"	7.44	22.9	560.2	-17	L.musty/mod/F.Sa
					100		
9:09	800 gpm		7.51	23.3	558.2/368	-40	L.musty/mod/F.san
9:15	800 gpm		7.55	24.0	553/369	-52	VL.musty/Light/F.San
9:49	800 gpm	measurement drift check:	7.61	22.7	551/369	-59	VL musty/light/F.San
	repeat mea	Same pos[illegible] sure 1 min [illegible]	7.50	22.4	548/367	-58	
9:56	800 gpm	Fill & measure after 1 min	7.53	23.8	549/366	-47	VL musty/light/minor F.sand
10:06	800 gpm	restart-sample	7.63	23.6	552/367	-47	VL musty/VLight/F.sa
10:09	800 gpm	Lab sample	7.63	24.3	550/367	-65	VL musty/VLight/F.sa

RECHARGE RATE (qualitative): ____

SAMPLER TYPE: TEFLON BAILER ____ ACRYLIC BAILER ____ DISPOSABLE BAILER ____

SAMPLES COLLECTED:
PRESERVED VOA'S ____
PRESERVED LITERS ____
500 ml PLASTIC OR GLASS BOTTLE: ____
UNPRESERVED VOA'S ____
UNPRESERVED LITERS ____
OTHER: ____________

FIELD FILTERED: ____ UNFILTERED: ____

COMMENTS: ____________

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916-686-5190 F) 916-686-5192

Work Order
Chain of Custody Record

Lab No.______________ Page____of____

Name: Town of Windsor - Drinking Water

Project ID: Esposti Potable Well

Mailing Address:
9291 Old Redwood Highway Building 400
Windsor, CA 95492

Phase:

Project Contact (Hardcopy or PDF to):
Elizabeth Cargay
ecargay@townofwindsor.com
Kent O'Brien
kent.obrien@ghd.com

PO#

Bill to: month end billing

Field Sampler - Print Name & Signature

Signature below authorizes work under terms stated on reverse side.

Analysis Request

Sample Identification	Sample Collection Date	Sample Collection Time	Container: 40ml VOA	Container: Poly	Container: Amber	Container: Glass		Preservative: Na2S2O3	Preservative: HNO3	Preservative: NH4Cl	Preservative: Other	Preservative: None	Matrix: Water	Matrix: Soil		200.8 As (Dissolved)	200.7 Fe (Dissolved)	200.7 Mn (Dissolved)	200.8 Cr (Dissolved)	218.6 Cr6 (Dissolved)	200.7 Ca, Mg, K, Na (Dissolved)	Alkalinity	Chloride	Nitrate as N, Nitrite as N	Sulfate	Total Nitrogen (includes TKN, NO2, NO3)	Silica	200.8 Vanadium - total	Phosphate	CAM 17	TPH G, BTEX, D/MO	6010 As STLC	Title 22 Scan (**Below List)	TAT
ESW-5-10-10:09	5/10	10:09		X								X	X			X	X	X																Filter and Fix
																																	N/O	Filter then Fix
ESW-5-10-10:09 Total	5/10	10:09		X								X	X			X	X	X																

TAT
☒ 24 hr
○ 48 hr
Lab Approval Required
○ 1 wk
○ 2 wk (standard)
Lab Approval Required For Rush

**Title 22 Scan

64432 Primary Inorganics, 64432.1 NO2/NO3, 64449 A&B
Asbestos, Perchlorate, Gross Alpha, 504.1, 507, 508, 515.1,
524.2, 531.1, 548.1, 549.2

Relinquished by:	Received by:	Date	Time
		5/10	1400

CDPH Write On EDT Report? Yes ○ No ○

State System Number: ______________

CA Geotracker EDF Report Yes ○ No ○

Sampling Company Log Code: ______________

Global ID: ______________ EDF to (Email Address)

Travel and Site Time:

Mileage:

Misc. Supplies:

FIELD REPORT

DATE: 5/~~10~~/2016 5/11/2016	LOCATION: Esposti Well, Old Redwood Hwy at Shiloh Road, Windsor, CA
PROJECT NAME: Town of Windsor, Esposti Well	JOB NO: 11110001.20
EVENT: Well development by pumping and flow testing Flow @800 Sewer Test	WEATHER/TEMP: ° at am ° at pm
PRESENT AT SITE: Kent O'Brien GHD;	

THE FOLLOWING WAS NOTED:

9:00 - meet E. Casey, Tim Smith, Stuart on
site discuss results of last 2 days
800 gpm is target - Today is reset
For direct discharge and test sewer
at higher flow rates

Plan on Aquifer Test Monday
irrigation to be shut off Sat → Thursday
11:18 Pump from 800 gpm
Start pumping 10 Am - some low & High Flow 400-800
800 constant at 10:35 (Approx), sample at 10:44
Jordan - 707 486 1561
Jose - 707 217 8239
Becke Joshua - 1916-532-6654
Start sewer flow test see sheet
16:08 irrigation well Turned on For
Short period of Time - need To
irrigate Field

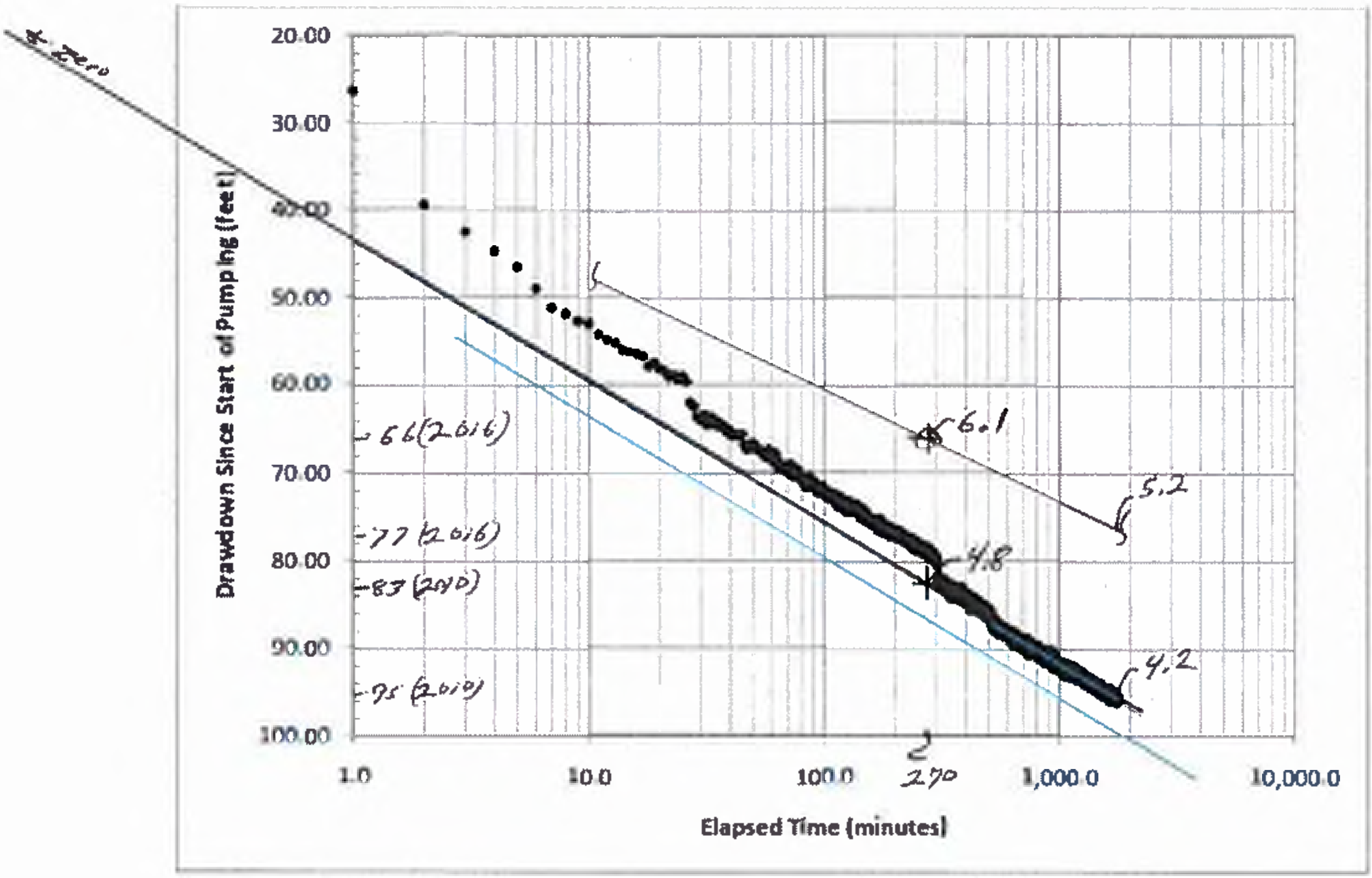
Page____of____

← Zero 0

Drawdown Estimations 5/11/2016

1 0

Figure 4-4: Groundwater Level Data – Esposti Park Replacement Well



@270 minutes (4.5hr) pumping @400 gpm

2010 - 400gpm / 83ft = 4.8 gpm/ft DATA

2016 - 400gpm / 66ft = 6.1 gpm/ft DATA

$\frac{(6.1-4.8)}{4.8} = 27\%$ improvement

@1440 minutes (24hr) pumping at 400gpm

2010 - 400 gpm/95ft = 4.2 gpm/ft DATA

2016 - 400gpm/77ft = 5.2 gpm/ft projected 1.65 ft/sec velocity

@1440minutes (24hr) pumping at 800gpm

2016 77ft x (800/400) = 154 FT Estimate 3.3 FT/sec velocity

@1440 minutes (24hr) pumping at 1,000 gpm

2016 77 (1,000/400) = 193 FT Estimate 4.1 ft/sec velocity

Kent O'Brien 707-478-9559 cell and text

Sheet A

FIELD REPORT

DATE: 5/11/2016	LOCATION: Esposti Well, Old Redwood Hwy at Shiloh Road, Windsor, CA
PROJECT NAME: Town of Windsor, Esposti Well	JOB NO: 11110001.20
EVENT: Sewer Flow Test and Observations	WEATHER/TEMP: ° at am ° at pm
PRESENT AT SITE:	

DATE: dd/mm/yr ___/___/___

Time Time: use 24 ~~hour~~ time record at ~~15~~ min intervals ~~or~~ more freq.	Flow ~~Manhole~~ ~~number~~/description	Observed flow as a % of full pipe	Other observations
			sample 10:44
13:13	900 gpm	DTW Not Measured	
13:32	500 gpm end →	95 Ft BTOC	
13:44	600 gpm end →	116 Ft BTOC	
14:23	700 gpm end →	139.75 BTOC	
14:50	800 gpm end →	162 BTOC	
15:06	900 gpm end →	185 BTOC	
15:20	900 gpm	208.93 BTOC	
15:25	900 gpm	209.9 BTOC	
15:30	900 gpm	210.75 BTOC	
15:35	900 gpm	211.75 BTOC	sample 15:38
15:40	900 gpm	212.30 BTOC	
15:45	900	213.3 BTOC	
15:50	900	213.83 BTOC	
15:55	900	214.91	wellhead flowmeter
16:00	900	215.0	29808500 gallons
16:05	~~900~~ 880	215.41	
16:10	~~900~~ 880	215.92	} change in pumprate
16:15	910	219.30	
16:20	910	220.6	
16:25	910	221.3	
16:30	910	221.75	
16:35	890 (reduction)	222.3	
16:40	890	222.6	
16:45	890 PumpMax	223.0	
16:50	890	223.3	off

WELL SAMPLING DATA SHEET

1 of 2

PROJECT NAME: Esposti well
PROJECT DATE: 5/11/2016
PROJECT NUMBER: 111/0001
SAMPLER: ______
WELL DESIGNATION: Esposti Supply
SAMPLE NUMBER: ______

CONDITION OF WELL HEAD / VAULT / CAP & LOCK: ______

A. TOP OF CASING ELEVATION: ____
B. DEPTH TO GROUNDWATER (initial): ____
C. DEPTH OF WELL: ____ MEASURED: ______
D. HEIGHT OF WATER COLUMN (C-B): ____
E. GROUNDWATER ELEVATION (A-B): ____

CASTING DIAMETER: 2" ______ 3" ______ 4" ______ OTHER ______

CALCULATED WELL VOLUME: D X V = ______

Volume (V) of 2" well – 0.163 gal/ft
Volume (V) of 4" well – 0.653 gal/ft

ODOR: ______ SHEEN: ______ FLOATING PRODUCT THICKNESS ______

PUMP TYPE: ______ POLY BAILER: ______ STAINLESS BAILER: ______
ELECTRIC: ______ OTHER: ______

DECON PROCEDURE: LIQUINOX/ALCONOX ____ TAP ____ BLEACH ____ OTHER ____ WATER SOURCE ______

PUMP DEPTH: ____

METER USED: CALIBRATED?

sample TIME	GALLONS PURGED	NO. OF WELL VOLUMES	pH	TEMP °C	CONDUCTIVITY (µMHOS/CM)/TDS	ORP (mV)	TURBIDITY (Visual)
10:44	pumping at 800 gpm		6.58	23.9	554 µS	25	clear
10:49	"	"	7.32	24.7	549/365 ppm	-5	clear
10:56	"	"	7.50	24.9	550/365	-21	clear slightly yellow
11:10	"		7.50	25.1	549/365	-25	no sand
14:14	600		7.31	27	553/365	-30	
14:18	600		7.41	26.5	604/402	-28	
15:22	900 gpm		7.53	26.2	551/364	-11	cloudy F. sand
15:25	900		7.40	26.6	545/360	-35	slight cloudy minor f. sand
15:38	900	sample	7.42	25.9	544/360	-35	clear
15:51	~~900~~ 880		7.44	25.9	545/361	-28	
16:03	~~900~~ 880		7.46	26.5	545/361	-28	Fine air bubbles clear water Photos

RECHARGE RATE (qualitative): ____

SAMPLER TYPE: TEFLON BAILER ____ ACRYLIC BAILER ____ DISPOSABLE BAILER ____

SAMPLES COLLECTED:
PRESERVED VOA'S ____
PRESERVED LITERS ____
500 ml PLASTIC OR GLASS BOTTLE: ____
UNPRESERVED VOA'S ____
UNPRESERVED LITERS ____
OTHER: ______

FIELD FILTERED: ____ UNFILTERED: ____

COMMENTS: ______

WELL SAMPLING DATA SHEET

2 of 2

PROJECT NAME: Esparti Supply well
PROJECT DATE: 5/11/2016
PROJECT NUMBER: 11110001
SAMPLER: Ken T OBrien
WELL DESIGNATION: Esparti Supply
SAMPLE NUMBER: ____________

CONDITION OF WELL HEAD / VAULT / CAP & LOCK: ____________

A. TOP OF CASING ELEVATION: ____
B. DEPTH TO GROUNDWATER (initial): ____
C. DEPTH OF WELL: ____ MEASURED: ____________
D. HEIGHT OF WATER COLUMN (C-B): ____
E. GROUNDWATER ELEVATION (A-B): ____

CASTING DIAMETER: 2" ________ 3" ________ 4" ________ OTHER ________

CALCULATED WELL VOLUME: D X V = ____________

Volume (V) of 2" well – 0.163 gal/ft
Volume (V) of 4" well – 0.653 gal/ft

ODOR: ________ SHEEN: ________ FLOATING PRODUCT THICKNESS ________

PUMP TYPE: ________ POLY BAILER: ________ STAINLESS BAILER: ________
ELECTRIC: ________ OTHER: ____________

DECON PROCEDURE: LIQUINOX/ALCONOX ____ TAP____ BLEACH____OTHER ____WATER SOURCE ____________

PUMP DEPTH: ____

METER USED: CALIBRATED?

TIME	GALLONS PURGED	NO. OF WELL VOLUMES	pH	TEMP	CONDUCTIVITY (µMHOS/CM)	ORP (mV)	TURBIDITY (Visual)
16:15	910	increase flow	7.52	25.0	542µs/360ppm	-27 mv	
16:23	910		7.46	21.2	544/360	-32	
16:32	910		7.52	25.9	544/360	-39	
16:38	890		7.50	25.8	543/359	-30	
16:45	890		7.40	25.8	542/359	-34	

RECHARGE RATE (qualitative): ____

SAMPLER TYPE: TEFLON BAILER ____ ACRYLIC BAILER ____ DISPOSABLE BAILER ____

SAMPLES COLLECTED:
PRESERVED VOA'S ____
PRESERVED LITERS ____
500 ml PLASTIC OR GLASS BOTTLE: ____
UNPRESERVED VOA'S ____
UNPRESERVED LITERS ____
OTHER: ____________

FIELD FILTERED: ____ UNFILTERED: ____

COMMENTS: ____________

GHD

Kent O'Brien 707-478-9559 cell and text

FIELD REPORT

DATE: 5/11/2016	LOCATION: Esposti Well, Old Redwood Hwy at Shiloh Road, Windsor, CA
PROJECT NAME: Town of Windsor, Esposti Well	JOB NO: 11110001.20
EVENT: Sewer Flow Test and Observations	WEATHER/TEMP: ° at am ° at pm
PRESENT AT SITE: WEEKS	JOSE BANUELOS

DATE: dd/mm/yr 5 / 11 / 16

Time: use 24 hour time record at 15 min intervals or more freq.	Manhole number/description	Observed flow as a % of full pipe	Other observations
1313	S376	10%	increase flow · 400
1315	S376	35%	20% increase in flow GPM
1325	S376	Same	Same in flow
1332	S376	35%	Same in flow 400 to 500
1344	S376	40%	5% increase in flow GPM
1359	S376	Same 40%	Same '' '' 60 GPM
1414	S376	Same 40%	Same '' '' ''
1424	S376	45%	5% increase in flow 70 GPM
~~14~~ ''	''	''	AT 700 water starts to
''	''	''	trickling into lateral on
''	''	''	the Southside but it's fi
1439	S376	45% Same	same at 700 Gpm in flo
1450	S376	50%	5% increase in flow to 80 GP
1458	S376	55%	5% increase in flow to 8[illegible]
1306	S376	60%	5% increase flow 900 GPM
1321	S376	Same 60%	Same ''
1535	S376	Same 60%	Same '' ''
1550	S376	Same 60%	Same '' '' '' 900 GPM
1525	checked S[illegible]130B	and flow	look good.
~~[illegible]~~ 1605	S376	Same 60%	Same '''' 900 GPM
1620	S376	Same 60%	Same '''' at 900 GPM
1635	S376	Same 60%	Same '' ''
1653	S376	40%	Drop 20%

Page____of____

5/11/2016

Special notes regarding: traffic during test, trucks, buses. Pedestrians, kids in the area, homeless. Is location appropriate for night monitoring. Photograph location and inside of manhole. Consider appropriateness of manhole as a permanent monitoring station with automatic measuring for final system.

on 5/11/16 A little more people walking than 5/10/16. flow it's nice and Clear & Heavy traffic manhole is on the bike lane

GHD

Kent O'Brien 707-478-9559 cell and text

FIELD REPORT

DATE: 5/11/2016	LOCATION: Esposti Well, Old Redwood Hwy at Shiloh Road, Windsor, CA
PROJECT NAME: Town of Windsor, Esposti Well	JOB NO: 11110001.20
EVENT: Sewer Flow Test and Observations	WEATHER/TEMP: ° at am 1:13 ° at pm Sunny
PRESENT AT SITE: Jourdan (Town of Windsor)	

DATE: dd/mm/yr 5 / 11 / 16

Time: use 24 hour time record at 15 min intervals or more freq.	Manhole number/description	Observed flow as a % of full pipe	Other observations
1310	S374 (Shiloh)	10%	Inital inspection
1320	S374	40%	Clear water/400gpm
1328	S374	40%	
1338	S374	40-45%	at 500 gpm
1349	S374	45-50%	at 600 gpm
1356	S374	50%	
1403	~~S344~~ S343 (Hembree)	50%	Looks good
1413	S327 (Conde)	25-30%	plenty of capacity
1429	S374	50-55%	at 700 gpm
1440	S374	50-55%	at 700 gpm
1455	S374	50-60%	at 800 gpm
1504	S374	60%	at 900 gpm
1511	S374	60-65%	at 900 gpm
1522	~~S3~~ S343 (Hembree)	50%	at 900 gpm
1526	S366	40-50%	at 900 gpm
1536	S374	60-65%	at 900 gpm
1556	S374	60-65%	
1617	S374	60-65%	
1625	S374	60-65%	
1654	S374	40%	End of run

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Central Valley Laboratory
9090 Union Park Wy., #113, Elk Grove, CA 95624
916-686-5190 F) 916-686-5192

Work Order
Chain of Custody Record

Lab No.________________ Page_____of_____

Name: Town of Windsor - Drinking Water

Project ID: Esposti Potable Well

Mailing Address:
9291 Old Redwood Highway Building 400
Windsor, CA 95492

Phase:

Project Contact (Hardcopy or PDF to):
Elizabeth Cargay
ecargay@townofwindsor.com

PO#

Kent O'Brien
kent.obrien@ghd.com

Bill to: month end billing

Signature below authorizes work under terms stated on reverse side.

Field Sampler - Print Name & Signature

Analysis Request

Sample Identification	Sample Collection		Container				Preservative					Matrix		Analysis Request																		TAT
	Date	Time	40ml VOA	Poly	Amber	Glass	Na2S2O3	HNO3	NH4Cl	Other	None	Water	Soil	200.8 As (Dissolved)	200.7 Fe (Dissolved)	200.7 Mn (Dissolved)	200.8 Cr (Dissolved)	218.6 Cr6 (Dissolved)	200.7 Ca, Mg, K, Na (Dissolved)	Alkalinity	Chloride	Nitrate as N, Nitrite as N	Sulfate	Total Nitrogen (includes TKN, NO2, NO3)	Silica	200.8 Vanadium - total	Phosphate	CAM 17	TPH G, BTEX, D/MO	6010 As STLC	Title 22 Scan (**Below List)	24hr [✓] 48 hr ○ Lab Approval Required 1 wk ○ 2 wk (standard) ○ Lab Approval Required For Rush
ESW-5-11-10:44	5/11	10:44		X							X	X		X	X	X																Filter & fix X

**Title 22 Scan

64432 Primary Inorganics, 64432.1 NO2/NO3, 64449 A&B Asbestos, Perchlorate, Gross Alpha, 504.1, 507, 508, 515.1, 524.2, 531.1, 548.1, 549.2

Relinquished by:	Received by:	Date	Time
	David Poma	5/11/16	11:57

CDPH Write On EDT Report? Yes ○ No ○

State System Number: ________________

CA Geotracker EDF Report Yes ○ No ○

Sampling Company Log Code: ________________

Global ID: EDF to (Email Address):

Travel and Site Time: Mileage: Misc. Supplies:

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Work Order
Chain of Custody Record

Lab No.________ Page____ of____

Name: Town of Windsor - Drinking Water

Mailing Address:
9291 Old Redwood Highway Building 400
Windsor, CA 95492

Project Contact (Hardcopy or PDF to):
Elizabeth Cargay
ecargay@townofwindsor.com
Kent O'Brien
kent.obrien@ghd.com

Project ID: Esposti Potable Well

Phase:

PO#

Bill to: month end billing

Field Sampler - Print Name & Signature

Signature below authorizes work under terms stated on reverse side.

Analysis Request

Sample Identification	Sample Collection Date	Sample Collection Time	Container: 40ml VOA	Container: Poly	Container: Amber	Container: Glass		Preservative: Na2S2O3	Preservative: HNO3	Preservative: NH4Cl	Preservative: Other	Preservative: None	Matrix: Water	Matrix: Soil		200.8 As (Dissolved)	200.7 Fe (Dissolved)	200.7 Mn (Dissolved)	200.8 Cr (Dissolved)	218.6 Cr6 (Dissolved)	200.7 Ca, Mg, K, Na (Dissolved)	Alkalinity	Chloride	Nitrate as N, Nitrite as N	Sulfate	Total Nitrogen (includes TKN, NO2, NO3)	Silica	200.8 Vanadium - total	Phosphate	CAM 17	TPH G, BTEX, D/MO	6010 As STLC	Title 22 Scan (**Below List)	TAT
EWS-5-11-16:42	5/11	16:42		X								X	X			X	X	X																Total or Dissolved (Both)
EWS-5-11-15:38	5/11	15:38		X								X	X			X	X	X																Filtered fix (dissolved)

TAT
24 hr ☒
48 hr ○
Lab Approval Required
1 wk ○
2 wk (standard) ○
Lab Approval Required For Rush

**Title 22 Scan

64432 Primary Inorganics, 64432.1 NO2/NO3, 64449 A&B
Asbestos, Perchlorate, Gross Alpha, 504.1, 507, 508, 515.1,
524.2, 531.1, 548.1, 549.2

Relinquished by:	Received by:	Date	Time
	Dat Gialdini	5/12/16	11:00

CDPH Write On EDT Report? Yes ○ No ○

State System Number: ________

CA Geotracker EDF Report Yes ○ No ○

Sampling Company Log Code: ________

Global ID:

EDF to (Email Address):

Travel and Site Time:

Mileage:

Misc. Supplies:

Client Job Number Sheet of

Project Sheets by Date

Subject ESW Pump Test TD Downloads/Insitu-RC Checked by Date 5/12/16
5/13/16

-1130 RC @ MOBILE HOME ESTATES ✓ GOOD, WELL PUMPING
DOWNLOADED DATA.

-1145 RC OFFSITE

-1150 RC ONSITE @ ESPOSITI PARK
Collect E.I.W. DATA, RESTART TO COLLECT
ONLY 25% MEMORY LEFT, DATA GOOD ✓

-1215 RC @ ESW DTW = 44.09' (TOC)
COLLECT IN-SITU TD DATA... NO. COLLECTOR STOPPED.
RESET, CONFIRM RUNNING. DOWNLOAD WHAT I
GOT TODAY. ✓

-1300 RC/EC ONSITE BLUEBIRD DTW = 28.56' (TOC)
DATA GOOD

-1350 RC/EC OFFSITE

5/13

-0715 RC ONSITE ESW DTW = 42.62 (TOC)
TIE F650 SOCINST TO BOTTOM OF IN-SITU +2'
SET @ 755. DOWNLOAD IN-SITU ESW DATA ✓

-0815 COLLECT BARODATA ✓ RESET DUE TO ONLY
25% MEMORY LEFT. ✓

-0845 LOCK-UP SITE, RC OFFSITE

GHD

FIELD REPORT

DATE: 5/16/2016 + 5/17/2016	LOCATION: Esposti Well, Old Redwood Hwy at Shiloh Road, Windsor, CA
PROJECT NAME: Town of Windsor, Esposti Supply Well	JOB NO: 11110001.20
EVENT: 800 gpm 24 hr Pump Test	WEATHER/TEMP: 55 ° at am 5:30 ° at pm
PRESENT AT SITE: Kent O'Brien, Matt (weeks)	

THE FOLLOWING WAS NOTED:

5:30 Am arrive - weeks onsite setting up (matt)

Driller reported that pump was run for about

0.3 minutes @ lowest RPM 42.35 @ 603

collected samples at 6:06, 6:07 6:12

Ryan arrives 5:55 Am

Josh arrives 7:26 Am depart 7:35 (Josh has the key to the lot

distance between Esposti Supply Living 29.5 Ft.

Elizabeth - 217 - 8365

Rich Ramos - 696 - 5794 pgr - 838 5389

900 - KENT LEFT - CONTINUED NELL TEST & SAMPLING EVERY 30 min

1300 - TOOK WATER SAMPLE FOR GHD

1430 - SPOKE W/ DAVE L. & LINED OUT HAND OFF TONIGHT

1706 - DAVE L. ARRIVED - WENT OVER WELL TEST & SAMPLING

1749 - KENT W/ GHD ARRIVED BACK ON SITE / off site at 6:00 PM

Security on site 6:15

17MAY16 -

0600 - SECURITY LEFT SITE

0630 - DAVE L. LEFT SITE

Page____of____

DATE: 5/10/2016	LOCATION: : Esposti Well, Old Redwood Hwy at Shiloh Road, Windsor, CA
PROJECT NAME: Town of Windsor, Esposti Supply Well	EVENT:

0715 - MIKE G ON SITE

0810 - JOSH SAMSED UP - FUELED GENERATOR

0850 - SAMPLE BOTTLES DROPPED OFF ON SITE

0915 - MIKE G. LEFT FOR A SERVICE CALL

0933 - KENT W/ GHD ON SITE

SET up To collect Samples

PUMPING WELL

Drawdown Sheet

Measured Well	Owner:	Town of Windsor	Well ID:	Esposti Supply Well
	Location:		Name/Site:	
Pumped Well	Owner:	Town of Windsor	Well ID:	Esposti Supply Well
	Location:		Name/Site:	
Test Details	Date pumping commenced:	5/16/2016	Time:	Test No. 1
	Date pumping ceased:		Time:	

Are Measurements below for the pumped well? yes Distance from pumped well (ft): 0

Static DTW …………… Feet below measuring point

Measuring Point……………………… Feet above/below ground level

Watch Time	Elapsed Time (min)	Calculated drawdown (ft) (DTW - Static)	Measured DTW (feet) below measuring point	Discharge (gpm) Only if pumped well	Comments or pressure measurements from transducer
6:03	–		42.35		
6:05	0	0	42.35		
6:15	10	120.54	162.86	800	285 ft head above Tran
6:25	10	131.43	173.78	800	
6:35	10	135.05	177.40	800	
6:45	10	141.79	184.09	800	
6:55	10	144.03	186.38	800	
7:05	10	145.80	188.15	800	
7:15	10	147.32	189.67	800	
7:25	10	148.62	190.97	800	
7:35	10		192.25	800	
7:45	10		193.74	800	
7:55	10		195.10	800	
8:05			196.46	800	
8^{30}			199.–	800	
9^{00}			$201.^{65}$	800	
9^{30}			$203.^{17}$	800	
10^{00}			$204.^{60}$	800	

PUMPING WELL

Watch Time	Elapsed Time (min)	Calculated drawdown (ft) (DTW - Static)	Measured DTW (feet) below measuring point	Discharge (gpm) Only if pumped well	Comments or pressure measurements from transducer
1030			205.38		
1100			206.84		
1130			207.34		
1200			208.35		
1230			209.18		
1300			209.62		
1330			210.18		
1400			210.89		
1430			211.40		
1500			211.86		
1530			212.24		
1600			212.65		
1630			213.18		
1700			214.23		
1730			215.79		
6Pm → 1800			216.38		
7Pm — 1900			218.55		
2000			220.26		
2100			221.90		
2200			223.52		
2300			224.63		
24			225.85		
0100			227.10		
0200			228,18		
0300			228.76		
0400			229.24		
0500			229.72		
0600			230.58		
0700			232.46		
0800			233.08		

PUMPING WELL

Watch Time	Elapsed Time (min)	Calculated drawdown (ft) (DTW - Static)	Measured DTW (feet) below measuring point	Discharge (gpm) Only if pumped well	Comments or pressure measurements from transducer
0900			233.43		
1000			233.97		

GHD MANAGEMENT ENGINEERING ENVIRONMENT

Parameter Record

Well ID: ....

Job Information

Client: Town of Windsor
Project: ....
....
Proj. No.: 11110001
Sampler: ....

Sampling Information

Sample Method: direct from pump
WQ Meter Type: Ultrameter II
Flow Cell:
Pump Depth:..............m
WLevel Meter Type: meter calibratt by Koa 5/13/2016

Well Information

SWL: 42.35 ft
Check: ....
Date: 5/16/2016
Time: 6:05
Ref.datum: TOC
Stick Up:
Well Depth: .... ft
Well Diam.: ft
Screen From:...... ft
To:........... ft

Time (..........)	Temp (°C)	pH (pH units)	Elec.Cond (uS)	TDS (ppm)	Dis:Oxygen ~~(..........)~~	Ox-Red Pt. (± mV)	Note	Note	Comment: Colour, turbidity, sediment load, sheen, odour
Stable When:		~~+/- 0.2 C~~	~~+/- 0.05 pH~~	~~+/- 3%~~	~~+/- 10%~~	~~+/- 10 mV~~			
6:06	17.8	6.70	568	383		-133			Clear
6:14	23.2	7.13	557	371		-69			Clear
6:19	23.3	7.31	558	369		-78			Clear
6:23	23.4	7.34	556	369		-70			Clear - slow Fill on sample Jar No air bubbles
6:39	23.0	7.32	551	366		-55			
6:57	22.1	7.46	549	366		-28			
7:04	23.0	7.42	550	365		-34			
7:15	23.3	7.38	551	365		-39			
7:26	22.8	7.59	545	362		-54			
7:42	21.7	7.58	545	364		-35			
7:54	22.6	7.54	549	364		-41			
839	23.2	7.72	546	365		-28			
900	24.2	7.70	545	360		-37			
930	24.00	7.65	549	363		-13			
1000	25.01	7.62	544	360		-7			
1030	26.04	7.59	540	354		-5			
1100	27.8	7.57	535	351		17			
1130	27.3	7.63	535	351		10			
1200	26.7	7.46	538	352		-13			
1230	26.7	7.42	540	354		-8			
1300	26.9	7.69	540	353		-16			

Time (..........)	Temp (°C)	pH (pH units)	Elec.Cond (..........)	TDS (..........)	Dis.Oxygen (..........)	Ox-Red Pt. (± mV)	Note ORP	Note	Comment: Colour, turbidity, sediment load, sheen, odour
Stable When:		+/- 0.2 C	+/- 0.05 pH	+/- 3%	+/- 10%	+/- 10 mV	after		
1330	27.5	7.63	534	350		28	2min		
1400	26.7	7.49	537	352		-8			
1430	27.3	7.61	540	358		40			
1500	26.8	7.82	543	358		27			
1530	26.5	7.69	540	355		7			
1600	26.4	7.73	541	364		-10			
1630	26.5	7.76	540	353		-20			
1700	26.5	7.54	538	353		14			
1730	25.7	7.50	539	355		3			
L 1800	Kent =	=	=	=	=	-			
19.00	26.1	7.61	537	356		-10	-13		
20 00	26.0	7.51	537	352		-22	-30		
2100	25.3	7.64	535	352		-3	5		
2200	25.5	7.58	537	353		-2	-30		
2300	25.1	7.67	538	353		-26	-19		
2400	25.4	7.54	534	354		-8	-10		
01 00	25.4	7.47	536	353		-23	-27		
0200	25.0	7.62	535	354		-32	-35		
0300	25.3	7.76	531	351		-31	-46		
0400	25.3	7.73	532	355		-19	-31		
0500	25.3	7.71	537	356		-27	-33		
JL 06 00	25.5	7.57	534	353		-22	-30		
07 00	23.0	7.61	534	353		20	20		
0800	24.9	7.63	530	350		-1	8		
0900	25.9	7.79	532	350		-8	-3		

Test Start Date 5/16/16 3 of 3

Time (..........)	Temp (°C)	pH (pH units)	Elec.Cond (..........)	TDS (..........)	Dis.Oxygen (..........)	Ox-Red Pt. (± mV)	Note	Note	**Comment:** Colour, turbidity, sediment load, sheen, odour
Stable When:		*+/- 0.2 C*	*+/- 0.05 pH*	*+/- 3%*	*+/- 10%*	*+/- 10 mV*			
1000	26.2	7.64	534	353	-7				

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Work Order
Chain of Custody Record

Lab No.________ Page 1 of 1

Name: Town of Windsor - Drinking Water	**Project ID:** Source Chemical
Mailing Address: 9291 Old Redwood Highway Building 400 Windsor, CA 95492	**Phase:** Esposti Well
Project Contact (Hardcopy or PDF to): Elizabeth Cargay ecargay@townofwindsor.com	PO# 200336
Kent O'Brien kent.obrien@ghd.com	**Bill to:** month end billing

Signature below authorizes work under terms stated on reverse side.

Analysis Request

Field Sampler - Print Name & Signature

Sample Identification	Sample Collection Date	Sample Collection Time	Container: 40ml VOA	Container: Poly	Container: Amber	Container: Glass	Preservative: HCL	Preservative: HNO3	Preservative: H2SO4	Preservative: Other	Preservative: None	Matrix: Water	Matrix: Soil	~~As III & IV~~ RS As III & As IV	Ammonia	Sulfide	Cr6 DW	Cyanide DW	Radium 228	525.2 DDW Reg 3	547 Glyphosate	1613 Dioxin DW
~~Esposti~~ ESW-5-17-10:00	5/12	10:00		x	x		x	x	x	x	x	x		x	x	x	x	x	x	x	x	x

TAT
○ 24 hr
○ 48hr
Lab Approval Required
○ 1 wk
[✓ 2 wk (standard)]
Lab Approval Required For Rush

Relinquished by:	Received by:	Date 5/17/16	Time 1315
Relinquished by:	Received by:	Date	Time
Relinquished by:	Received by:	Date	Time
Relinquished by:	Received by:	Date	Time
Relinquished by:	Received by:	Date	Time

CDPH Write On EDT Report? [✓ Yes] No
State System Number:
CA Geotracker EDF Report Yes ○ No ○
Sampling Company Log Code:
Global ID: EDF To (Email Address):
Travel and Site Time: Mileage: Misc. Supplies:

alpha
Alpha Analytical Laboratories Inc.
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WATERS, SEDIMENTS, SOLIDS

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clientservices@alpha-labs.com

Bay Area Laboratory
6398 Dougherty Road, #35, Dublin, CA 94568
925-828-6226 F) 925-828-6309

Central Valley Laboratory
9090 Union Park Wy., #113, Elk Grove, CA 95624
916-686-5190 F) 916-686-5192

Work Order
Chain of Custody Record

Lab No.____________ Page 1 of 1

Name: Town of Windsor - Drinking Water

Project ID: Source Chemical

Mailing Address:
9291 Old Redwood Highway Building 400
Windsor, CA 95492

Phase: Esposti Well

Project Contact (Hardcopy or PDF to):
Elizabeth Cargay
ecargay@townofwindsor.com
Kent O'Brien
kent.obrien@ghd.com

PO# 200336

Bill to: month end billing

Signature below authorizes work under terms stated on reverse side.

Analysis Request

TAT See note
24 hr ✓ · 48 hr ○ · Lab Approval Required · 1 wk ○ · 2 wk (standard) ☒
Lab Approval Required For Rush

Field Sampler - Print Name & Signature

Sample Identification	Sample Collection Date	Sample Collection Time	Container: 40ml VOA	Poly	Amber	Glass		Preservative: HCL	HNO3	NH4Cl	Other	None	Matrix: Water	Soil		200.8 As	200.7 Fe	200.7 Mn	200.8 Cr	218.6 Cr6	200.7 Ca, Mg, K, Na	Alkalinity	Chloride	Nitrate as N, Nitrite as N	Sulfate	Total Nitrogen (includes TKN, NO2, NO3)	Silica	200.8 Vanadium - total	Phosphate				Title 22 Scan (**Below List)	TAT
ESW-5-16-13:00	5/16	13:00		X								X	X			X	X	X																↑
ESW-5-16-18:00	5/16	18:00		X								X	X			X	X	X																Preserve in
ESW-5-16-24:00	5/16	24:00		X								X	X			X	X	X																lab ↓
ESW-5-17-04:00	5/17	0400		X								X	X			X	X	X																

TAT standard
24-hr

****Title 22 Scan**

64432 Primary Inorganics, 64432.1 NO2/NO3, 64449 A&B
Asbestos, Perchlorate, Gross Alpha, 504.1, 507, 508, 515.1,
524.2, 531.1, 548.1, 549.2

Relinquished by:	Received by:	Date	Time
		5/17/16	1315

CDPH Write On EDT Report? Yes ☒ No ○
State System Number: ____________
CA Geotracker EDF Report Yes ○ No ○
Sampling Company Log Code: ____________
Global ID: ____________ EDF to (Email Address):
Travel and Site Time: Mileage: Misc. Supplies:

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Work Order
Chain of Custody Record

Lab No.____________ Page 1 of 2

Name: Town of Windsor - Drinking Water

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9291 Old Redwood Highway Building 400
Windsor, CA 95492

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Elizabeth Cargay
ecargay@townofwindsor.com
Kent O'Brien
kent.obrien@ghd.com

Project ID: Source Chemical

Phase: Esposti Well

PO# 200336

Bill to: month end billing

Signature below authorizes work under terms stated on reverse side.

Analysis Request

Field Sampler - Print Name & Signature

Sample Identification	Sample Collection		Container					Preservative					Matrix																					TAT
	Date	Time	40ml VOA	Poly	Amber	Glass		HCL	HNO3	NH4Cl	Other	None	Water	Soil		200.8 As	200.7 Fe	200.7 Mn	200.8 Cr	218.6 Cr6	200.7 Ca, Mg, K, Na	Alkalinity	Chloride	Nitrate as N, Nitrite as N	Sulfate	Total Nitrogen (includes TKN, NO2, NO3)	Silica	200.8 Vanadium - total	Phosphate				Title 22 Scan (**Below List)	24 hr ○ 48 hr ○ Lab Approval Required 1 wk ○ 2 wk (standard) ☒ Lab Approval Required For Rush
ESW-5-17-10:00	5/17	10:00	x	x	x			x	x		x	x	x																				x	See Attached Page - verify all analytes Tested

**Title 22 Scan

64432 Primary Inorganics, 64432.1 NO2/NO3, 64449 A&B Asbestos, Perchlorate, Gross Alpha, 504.1, 507, 508, 515.1, 524.2, 531.1, 548.1, 549.2

Relinquished by:	Received by:	Date	Time
		5/17/16	1315
Relinquished by:	Received by:	Date	Time
Relinquished by:	Received by:	Date	Time
Relinquished by:	Received by:	Date	Time
Relinquished by:	Received by:	Date	Time

CDPH Write On EDT Report? Yes ☒ No ○

State System Number:

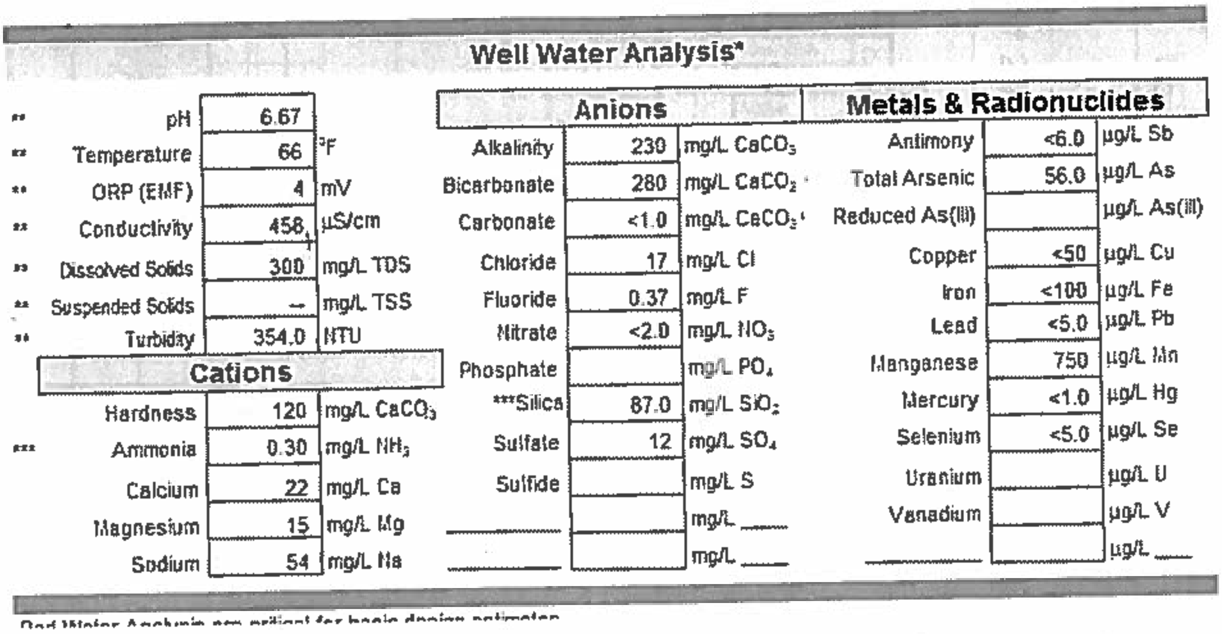
CA Geotracker EDF Report Yes ○ No ○

Sampling Company Log Code:

Global ID: EDF to (Email Address):

Travel and Site Time: Mileage: Misc. Supplies:

Provide analysis for each of the compounds listed below:



Well Water Analysis*

**	pH	6.67	
**	Temperature	66	°F
**	ORP (EMF)	4	mV
**	Conductivity	458	µS/cm
**	Dissolved Solids	300	mg/L TDS
**	Suspended Solids	--	mg/L TSS
**	Turbidity	354.0	NTU

Cations

	Hardness	120	mg/L $CaCO_3$
***	Ammonia	0.30	mg/L NH_3
	Calcium	22	mg/L Ca
	Magnesium	15	mg/L Mg
	Sodium	54	mg/L Na

Anions

Alkalinity	230	mg/L $CaCO_3$
Bicarbonate	280	mg/L $CaCO_2$
Carbonate	<1.0	mg/L $CaCO_3$
Chloride	17	mg/L Cl
Fluoride	0.37	mg/L F
Nitrate	<2.0	mg/L NO_3
Phosphate		mg/L PO_4
***Silica	87.0	mg/L SiO_2
Sulfate	12	mg/L SO_4
Sulfide		mg/L S
______		mg/L ____
______		mg/L ____

Metals & Radionuclides

Antimony	<6.0	µg/L Sb
Total Arsenic	56.0	µg/L As
Reduced As(III)		µg/L As(III)
Copper	<50	µg/L Cu
Iron	<100	µg/L Fe
Lead	<5.0	µg/L Pb
Manganese	750	µg/L Mn
Mercury	<1.0	µg/L Hg
Selenium	<5.0	µg/L Se
Uranium		µg/L U
Vanadium		µg/L V
______		µg/L ____

2 of 2

GHD Job 11110001

FIELD REPORT

DATE: 8/23/2016

LOCATION: Esposti Well, Old Redwood Hwy at Shiloh Road, Windsor, CA

PROJECT NAME: Town of Windsor, Esposti Supply Well

JOB NO: 11110001.20

EVENT: spinner Log - sewer check

WEATHER/TEMP: 65 ° at am 10:00
° at pm

PRESENT AT SITE: Weeks, Kent O'Brien

THE FOLLOWING WAS NOTED:

10 Am - Weeks on-site pump installed
suction (pump intake @ 220
Explained to Josh that packer inflation to be
225 psi not 275
samples to be collected 1, 5, 60 & End (4 hours)
11:05: Town arrives for Traffic control, open S130 & S130A
Start pump 11:20 start
11:21 First sample 15:21 4th Last
11:26 second sample
12:21 3rd sample
11:39 - Town closed sewer lids & leaves - checked flow
at S130 where Shiloh Rd & Old Redwood Hwy sewers cross
Flow O.K.
11:55: spinner log truck arrived - West Coast
12:25 (approx) set up spinner
13:20 got spinner data print out

DATE: ~~5/10/2016~~ 8/23/2016	LOCATION: : Esposti Well, Old Redwood Hwy at Shiloh Road, Windsor, CA
PROJECT NAME: Town of Windsor, Esposti Supply Well	EVENT: Zone test - Spinner log

Estimations based on field interp.

370 1625 RPM = 400 gpm = 100%

1 screen 38.5% 154 gpm 38.5%

429 1000 RPM

2 screen 0% 0 gpm 0%

459 1000 RPM

3 screen 0% 0 gpm 0%

479 1000 RPM

4 screen 20% 80 gpm 20%

535 675 RPM

5 screen 41% 164 gpm 41%

575 0 RPM

6 screen 0% 0 gpm 0%

Screen		
1	154 gpm	38.5%
2	0 gpm	0%
3	0 gpm	0%
4	80 gpm	20%
5	164 gpm	41%
6	0 gpm	0%

Start flow meter 065600 x 100 gallons

End flow meter 066620 x 100 gallons

96000 gallons pumped

PUMPING WELL

Drawdown Sheet

Kent O'Brien

8/23/2016

GHD MANAGEMENT ENGINEERING ENVIRONMENT

Measured Well	Owner: Town of Windsor Location: Esposti Park	Well ID: Esposti Supply Well Name/Site:	
Pumped Well	Owner: Town of Windsor Location:	Well ID: Esposti Supply Well Name/Site:	
Test Details	Date pumping commenced: Date pumping ceased:	Time: Time:	Test No.

Are Measurements below for the pumped well? yes

Distance from pumped well (ft): NA

Static DTW .... Feet below measuring point

Measuring Point.......................... Feet above/below ground level

Watch Time	Elapsed Time (min)	Calculated drawdown (ft) (DTW - Static)	Measured DTW (feet) below measuring point	Discharge (gpm) Only if pumped well	Comments or pressure measurements from transducer
11:20			56.50	400	
11:24			103.3	400	
11:34			111.0	400	
11:47			115.75	400	
12:17			120.30	400	
13:13			124.50	400	
14:15			127.40	400	
15:18			129.20	400	
					4 hour specific
					capacite =
					5.5 gpm/ft

GHD | MANAGEMENT ENGINEERING ENVIRONMENT

Parameter Record

Well ID: Espacio ~~Supply~~ well

Job Information

Client: Town of Windsor
Project: ……………………
Proj. No.: 11110001
Sampler: Kent O'Brien

Sampling Information

Sample Method: direct from pump
WQ Meter Type:
Flow Cell:
Pump Depth: 220 ft intake
WLevel Meter Type: no packer

Well Information

SWL: 56.5 ft
Date: 8/23/2016
Ref.datum: TOC
Well Depth: NM ft
Screen From: …… ft
Check: ……
Time: 11:20
Stick Up:
Well Diam.: 10 ft
To: …… ft

Time (……)	Temp (°C)	pH (pH units)	Elec.Cond (µS…)	TDS (ppm…)	Dis.Oxygen (……)	Ox-Red Pt. (± mV)	Note	Note	Comment: Colour, turbidity, sediment load, sheen, odour
Stable When:		+/- 0.2 C	+/- 0.05 pH	+/- 3%	+/- 10%	+/- 10 mV			
11:21	25.9	7.29	523.1	359.4		-138			Start at 11:20
11:26	27.7	7.30	499.2	340.1		-92			
11:29	27.7	7.33	500.1	340.6		-71			clear - slight very fine sediment
11:41	27.0	7.36	501.4	342.0		-56			clear - very slight fines
11:49	26.6	7.37	504.6	344.5		-44			
12:06	26.9	7.[illegible]	506.6	345.3		-20			no sand
12:21	26.6	7.35	507.8	347.6		-41			
13:13	27.7	7.36	505.5	344.4		-30			27.7°C no odor no sand
14:23	27.7 26.5	7.38	515.6	352.7		-2			2nd opinion on odor - yes slight sulfer
14:40	26.9	7.41	517.6	355.6		+1			Orp not stable +17 to -23
15:07	26.4	7.33	518.4	354.7		-29			water musty - no change from start
15:21	26.8	7.34	516.3	352.5		-34			End
									400 gpm pumping to
									Sewer for 4 hours
									11:20 to 13:21

FIELD REPORT

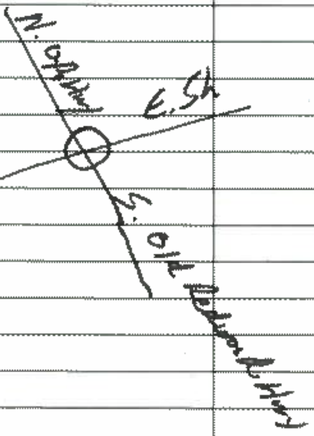
DATE: 8/23/2016	LOCATION: Esposti Well, Old Redwood Hwy at Shiloh Road, Windsor, CA
PROJECT NAME: Town of Windsor, Esposti Well	JOB NO: 11110001.20
EVENT: Sewer Flow Test and Observations	WEATHER/TEMP: ° at am ° at pm
PRESENT AT SITE: Kent O'Brien	

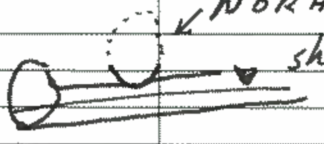
DATE: dd/mm/yy Aug/23/2016

Time: use 24 hour time record at 15 min intervals or more freq.	Manhole number/description	Observed flow as a % of full pipe	Other observations
1115	S130	10% 0 gpm pump	
1122	S130	45% 400 gpm	20% going ORH
1132	S130	50% 410 gpm	

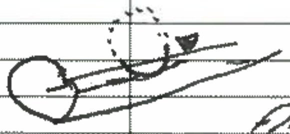
Pump Start: 11:20

by KOB!





little to no flow at start



20% of total flow going down N.O.R. Hwy

O'Brien, Kent

From: O'Brien, Kent
Sent: Wednesday, August 24, 2016 5:50 AM
To: Elizabeth Cargay (ecargay@townofwindsor.com)
Cc: Dave Vossler (dave.vossler@ghd.com); ryan.crawford@ghd.com
Subject: 8/23/2016 Esposti Supply Well discharge to sewer volume report

Elizabeth – sewer discharge summary is below:

Non-Residential One-Time Discharge Permit
Permit number - TD-04152016
Effective Date - 04/15/2016
Expiration Date- 12/31/2016

Date of discharge – **8/23/2016**
Point of discharge – sewer manhole S130A (Shiloh and Old Redwood Hwy)
Total gallons **discharged – 96,000 gallons**

Kent O'Brien PG, CEG

Senior Associate | Hazen and Sawyer
201 Mission Street, Suite 500, San Francisco, CA 94105
628-242-0050 (direct) 707-478-9559 (cell) 628-242-0042 (main)
41828 (VOIP Extension)
kobrien@hazenandsawyer.com | hazenandsawyer.com

WEST COAST
WELL LOGGING SERVICES
GEOPHYSICAL & VIDEO LOGGING

SPINNER INTERPRETATAION

P.O.Box 2797, Rancho Cordova CA 95741 · Phone: 916-858-8148 Fax: 916-858-8174 · Web: www.wcwls.com Email: wcwls@sbcglobal.net

Filing No.

COMPANY **Weeks Drilling & Pump Co., Inc.**

WELL **Espoti Supply Well**

FIELD **Windsor**

STATE **California** COUNTY **Sonoma**

LOCATION:
Old Redwood Hwy. & Shilo Rd.

OTHER SERVICES:
Stops

Job No.
1425

SEC: 19 TWP: 8N RGE: 8W LAT.: 38.52649 LONG.: 122.77953

Permanent Datum: **Ground Level** Elev.: **150** Ft. Elevs.: K.B. ______ Ft.

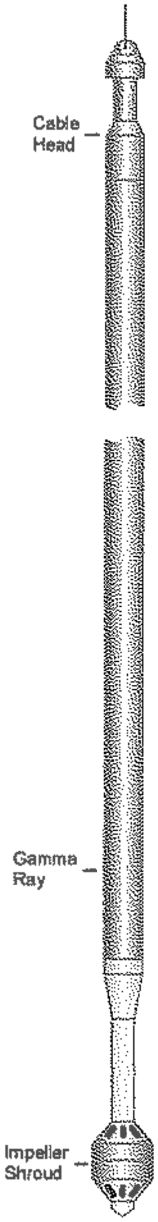
Log Measured From: **Top of Casing** **0** Ft. Above Perm. Datum D.F. ______ Ft.

Drilling Measured From: **Ground Level** G.L. **150** Ft.

Date	Aug 23, 2016			
Type Log	Spinner			
Run	One			
Depth-Driller	575 Ft	Ft	Ft	Ft
Depth-Logger	575 Ft	Ft	Ft	Ft
Top Logged Interval	300 Ft	Ft	Ft	Ft
Btm Logged Interval	575 Ft	Ft	Ft	Ft
Type Fluid In Hole	Water			
Fluid Level	122 pwl Ft	Ft	Ft	Ft
Max Temp	n/a °F	°F	°F	°F
Operating Rig Time	n/a °Hr	°Hr	°Hr	°Hr
Van No. Location	WC-1 RC			
Recorded By	Sharpless			
Witnessed By	J. Moore			

RUN	BOREHOLE RECORD			CASING RECORD			
NO.	BIT SIZE	FROM	TO	CASING SIZE	CASING TYPE	FROM	TO
1	In	Ft	Ft	10 In		0 Ft	656 Ft
2	In	Ft	Ft	In		Ft	Ft
3	In	Ft	Ft	In		Ft	Ft

SPINNER INTERPRETATAION TOOL



SPINNER LOGS:

Spinner logs are used to quantify flow (up or down) in a water well. In a producing water well, the spinner log is usually run downwards at a constant speed. Deflections in the curve are indicative of water entry. Proper calibrations, eliminating the effective of line speed, will quantify the flow rate from zones of interest.

SPINNER SPECIFICATIONS:

Diameter	1.77, 2.76, or 3.94 Inches
Length	5.5 Feet
Weight	16.1 Lbs.
Max. Temp	158° F
Gamma Ray	1.97 inches long x .98 inches diameter Scintillation crystal

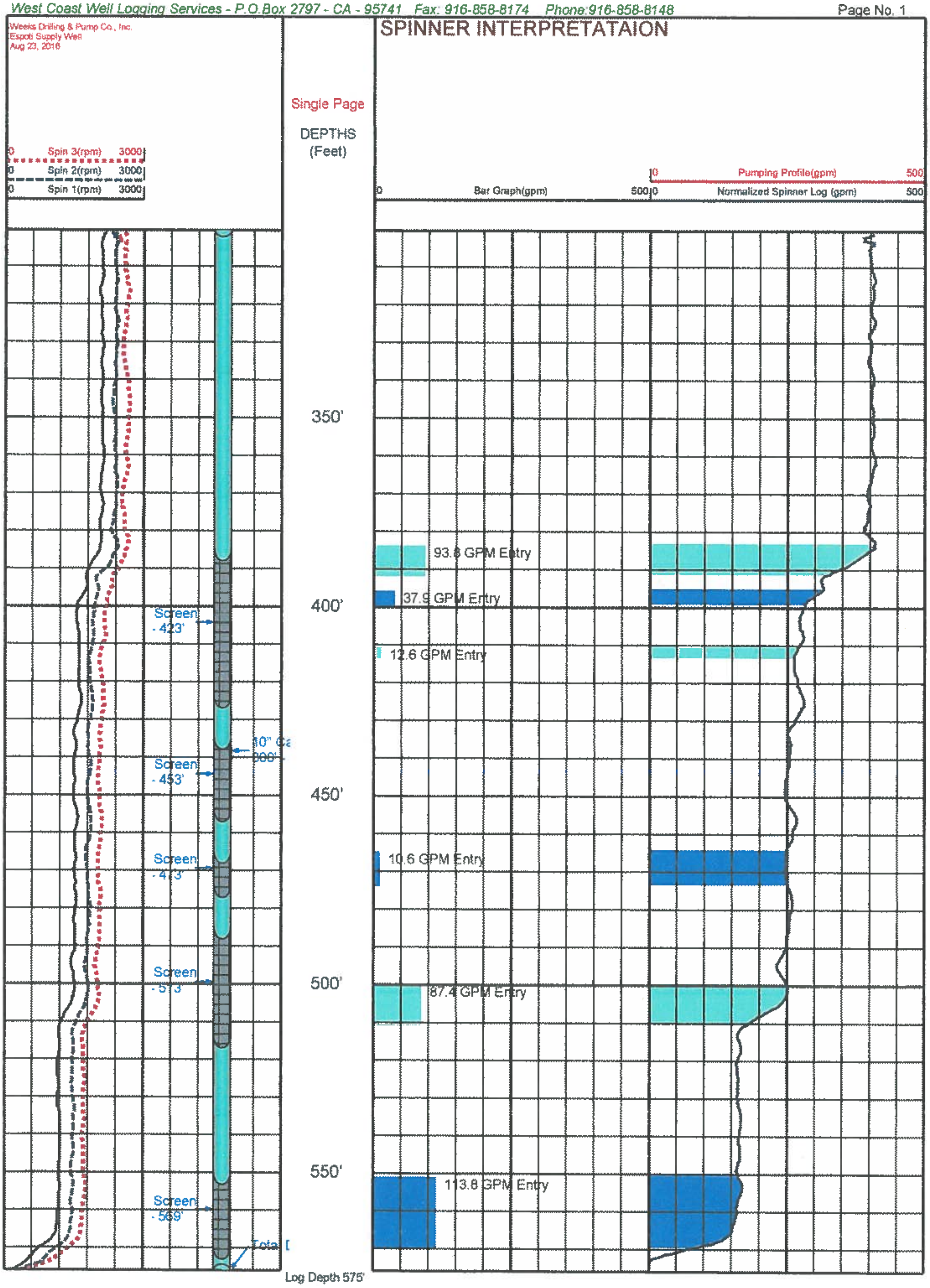
NOTICE

REMARKS

A recreational GPS accurate to +/- 45 feet set for Datum WGS84 was used to calculate Latitude, Longitude, and Elevation values.

Bottom of well blocked by debris

West Coast Well Logging Services - P.O.Box 2797 - CA - 95741 Fax: 916-858-8174 Phone:916-858-8148



SPINNER INTERPRETATAION

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Work Order
Chain of Custody Record

Lab No.__________ Page____of____

send results to:
ecargay@townofwindsor.com
~~ken~~ kobrien@hazenandsawyer.com

Name: Town of Windsor - Drinking Water

Mailing Address: 9291 Old Redwood Highway Building 400
Windsor, CA 95492

Project Contact (Hardcopy or PDF to): Elizabeth Cargay
ecargay@townofwindsor.com and to
kobrien@hazenandsawyer.com
Kent O'Brien, Hazen and Sawyer

Project ID: Source Chemical

Phase: Esposti Well

PO#

Bill to: month end billing

Field Sampler - Print Name & Signature

Signature below authorizes work under terms stated on reverse side.

Analysis Request

Sample Identification	Sample Collection		Container					Preservative					Matrix						TAT
	Date	Time	40ml VOA	Poly	Amber	Glass		HCL	HNO3	NH4Cl	Other	None	Water	Soil		200.8 As	200.7 Fe	200.7 Mn	24 hr ○ 48 hr ○ Lab Approval Required 1 wk ○ 2 wk (standard) ○ Lab Approval Required For Rush
~~Esposti Well~~	~~8/23~~			x					x				x			x	x	x	
ESW-8-23-11:21	8/23	11:24		X					X				X			x	x	X	
ESW-8-23-11:26	8/23	11:26		X					X				X			y	X	X	Standard
ESW-8-23-12:21	8/23	12:21		X					X				X			X	X	X	
~~ESW-8-23-13:21~~	8/23	~~13:21~~		X					X				X			X	X	X	48 hr.
ESW-8-23-15:21		15:21																	

Relinquished by:	Received by:	Date	Time
Relinquished by:	Received by:	Date	Time
Relinquished by:	Received by:	Date	Time
Relinquished by:	Received by:	Date	Time
Relinquished by:	Received by:	Date	Time

CDPH Write On EDT Report? Yes ○ [✓ No]

State System Number:__________

CA Geotracker EDF Report Yes ○ [✓ No]

Sampling Company Log Code:__________

Global ID: EDF to (Email Address)

Travel and Site Time: Mileage: Misc. Supplies:

FIELD REPORT

DATE:	8/24/16	LOCATION:	WINDSOR, ESPOSTI PARK
PROJECT NAME:	ESPOSTI PILOT TEST	JOB NO:	11110007.20
EVENT:	ZONE TESTING (PACKER)	WEATHER/TEMP:	55 ° at am 90 ° at pm
PRESENT AT SITE:	RC / MATT (WEEKS)		

THE FOLLOWING WAS NOTED:

1530 - RC ONSITE, WEEKS ASSEMBLED PACKER. INSPECT / MEASER AND REVIEW PLACEMENT ASSUMPTIONS SUCH THAT THE PACKER SITS EXACTLY AT 428' BTOC. ✓

1645 - RC OFFSITE

8/25/16

0730 - RC ONSITE TO REVIEW PACKER / PUMP / PIPE / DISCHARGE ASSEMBLY. LOOKS GOOD, WEEKS NEEDS 6 MORE PIPES TO PUMP, THEN TRANSDUCER & DTW METER PVC TUBES INSTALL.

930 - RC OFFSITE

1505 - RC ONSITE. 15:15 DTW = 57.3. PREP FOR TEST-RUN (45 MIN) @ 400

DATE: 8/25/16

LOCATION: WINDSOR, ESPOSTI PARK

PROJECT NAME: ESPOSTI PILOT TEST

EVENT: ZONE TEST 1

45 MIN TEST RUN

TIME	DTW	ON/OFF			
1525	57.3	—			
1526	104.3	ON			
1531	119.5				
1536	124.0				
1541	129.8				
1556	132.0		COND.(uS)	pH	TEMP (C°)
1605	133.8	↓	517	7.10	27.1
1610	134.7	OFF	518	7.30	27.1

TOTAL DRAWDOWN = 134.7 - 57.3 = 77.4'

45 MIN @ 400 GPM SPECIFIC CAPACITY = 400 GPM/77

= 5.2 GPM/FT

1615 - DISCHARGE PIPE / SEWER LOOK GOOD, PIN HOLE LEAK @ PIPE NEAR CORNER OF SHILOH & REDWOOD HWY → NO STORMWATER DISCHARGE ✓

1630 - CALL KOB, SCHEDULE TMRW FOR 0700 START TIME

FIELD REPORT

DATE: 8/26/16

LOCATION: Esposti Well, Old Redwood Hwy at Shiloh Road, Windsor, CA

PROJECT NAME: Town of Windsor, Esposti Supply Well

JOB NO: 11110001.20

EVENT: ZONE TEST (1ST)

WEATHER/TEMP: 55 ° at am OVERCAST
75 ° at pm SUNNY/BREEZY

PRESENT AT SITE: RC, MATT (WEEKS)

THE FOLLOWING WAS NOTED:

0630 - RC/MATT ONSITE. SITE SAFETY MEETING ✓
- SET UP PAPERWORK, SAMPLE BOTTLES, AND
CALIBRATE MULTIMETER. ✓

0715 - START 400 GPM "1ST TEST"
SAMPLE @ 0716, 0720, 0815

0945 - RC OFFSITE

1110 - RC ONSITE COLLECT SAMPLE @ 1115,
RC OFFSITE 1120

1430 - RC ONSITE, GET LABELS/SAMPLES PREPARED
CHECK SEWER OK ✓ COLLECT SAMPLES @
1515. TOTAL DRAWDOWN = 153.5 (DTW)
STOP PUMPING @ 1516 - 57.5
SPECIFIC CAPACITY 96'
@ 400 GPM AFTER 4 HOURS
= 400/96 = 4.2 GPM/FOOT

Page 1 of 1

DATE: ~~5/10/2016~~ 8/26/16	LOCATION: : Esposti Well, Old Redwood Hwy at Shiloh Road, Windsor, CA
PROJECT NAME: Town of Windsor, Esposti Supply Well	EVENT: ZONE TEST (1st)

1530 - BEGIN HOSE/EQUIP BREAKDOWN, FINAL SEWER/STORM DRAIN CHECK GOOD ✓

- SITE CLEAN-UP, MATT TO COLLECT RECOVERY DTW WHILE HE WRAPS UP AND CLOSES DOWN SITE.

1615 - RC OFFSITE

PUMPING WELL

Drawdown Sheet

GHD MANAGEMENT ENGINEERING ENVIRONMENT

Measured Well
Owner: WINDSOR
Location: ESPOSTI PARK
Well ID: ESW
Name/Site:

Pumped Well
Owner: Town of Windsor
Location:
Well ID: Esposti Supply Well
Name/Site:

Test Details
Date pumping commenced:
Time:
Date pumping ceased:
Time:
Test No.

Are Measurements below for the pumped well?
Distance from pumped well (ft):

Static DTW 57.55 Feet below measuring point

Measuring Point TOC Feet above/below ground level

Watch Time	Elapsed Time (min)	Calculated drawdown (ft) (DTW - Static)	Measured DTW (feet) below measuring point	Discharge (gpm) Only if pumped well	Comments or pressure measurements from transducer
0715	0	—	57.56	—	PUMP ON
0716	1		105.80	400	
0720	4		123.–	400	
0725	5		127.90	400	
0745	20		136.09	400	
0800	15		138.25	400	
0900	60		143.20	400	
1000	60		146.25	400	
1100	60		149.–	400	1115 SAMPLE
1200	60		150.45	400	
1300	60		151.65	400	
1400	60		152.60	400	
1515	75		153.50	400	
1615	60		73'		PUMP OFF
					RECOVERY

METER S
66846

METER
END
68957

1866 6102375

GHD | MANAGEMENT ENGINEERING ENVIRONMENT

Parameter Record

8/26/16

Well ID: ESW

Job Information

Client: Town of Windsor

Project: ESPOSTI SUPPLY WELL

Proj. No.: 11110001

Sampler: RC/MATT

Sampling Information

Sample Method: direct from pump

WQ Meter Type:

Flow Cell:

Pump Depth: 428' ~~ft~~

WLevel Meter Type:

Well Information

SWL: 57.55 ft

Date: 8/26/16

Ref.datum: TOC

Well Depth: NM ft

Screen From: ...... ft

Check: ....

Time: 0710

Stick Up:

Well Diam.: 10 ~~ft~~ "

To: .... ft

Time (..........)	Temp (°C)	pH (pH units)	Elec.Cond (..........)	TDS (..........)	Dis.Oxygen (..........)	Ox-Red Pt. (± mV)	Note	Note	Comment: Colour, turbidity, sediment load, sheen, odour
Stable When:		+/- 0.2 C	+/- 0.05 pH	+/- 3%	+/- 10%	+/- 10 mV			
0716	24.9	7.52	543	376		-65			PUMP ON @ 715AM @400G/m
0720	26.4	7.30	523	358		-66			
0725	26.4	7.33	520	357		-43			
0730	26.1	7.31	520	356		-57			
0745	26.7	7.30	521	359		-54			
0800	26.6	7.29	524	358		-49			SLIGHT SULFUR ODOR
0830	25.5	7.33	523	359		-41			
0900	26.0	7.34	525	360		-23			SLIGHT SULFUR ODOR
0930	26.8	7.37	525	360		-15			
1000	25.6	7.34	525	359		-17			
1030	25.7	7.32	517	359		-2			
1100	26.2	7.33	525	359		-19			
1130	26.6	7.33	523	359		-28			
1200	26.6	7.34	524	359		-24			
1230	26.4	7.32	525	359		-16			
1300	26.3	7.27	529	362		-5			
1330	26.6	7.31	525	360		-21			
1400	26.6	7.33	523	360		-19			
1430	26.5	7.33	526	360		-23			
1500	26.5	7.35	525	359		-23			
1515	26.5	7.37	525	360		-33			STOP PUMP

Alpha Alpha Analytical Laboratories Inc.
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WATERS, SEDIMENTS, SOLIDS

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208 Mason Street, Ukiah, CA 95482
707-468-0401 F) 707-468-5267
clientservices@alpha-labs.com

Bay Area Laboratory
6398 Dougherty Road, #35, Dublin, CA 94568
925-828-6226 F) 925-828-6309

Central Valley Laboratory
9090 Unioin Park Wy., #113, Elk Grove, CA 95624
916-686-5190 F) 916-686-5192

Work Order
Chain of Custody Record

Lab No.

Page 1 of 1

Name: Town of Windsor - ~~Drinking Water~~ FEASIBILITY STUDY

Mailing Address:
9291 Old Redwood Highway Building 400
Windsor, CA 95492

Project Contact (Hardcopy or PDF to):
Elizabeth Cargay
ecargay@townofwindsor.com
AND
KOBRIEN@HAZENANDSAWYER.COM

Project ID: Source Chemical

Phase: Esposti Well

PO# 200336

Bill to: month end billing

Field Sampler - Print Name & Signature: RYAN CRAWFORD Ryan Crawford

Signature below authorizes work under terms stated on reverse side.

Analysis Request

TAT: 24 hr ○ 48 hr ○ Lab Approval Required; 1 wk ○; [✓ 2 wk (standard)]
Lab Approval Required For Rush

Sample Identification	Sample Collection Date	Sample Collection Time	Container: 40ml VOA	Container: Poly	Container: Amber	Container: Glass	Preservative: HCL	Preservative: HNO3	Preservative: H2SO4	Preservative: Other	Preservative: None	Matrix: Water	Matrix: Soil	200.8 As	200.7 Fe/Mn	200.8 Cr	218.6 Cr6	200.7 Ca, Mg, K, Na	Alkalinity	Chloride	Sulfate	Total Nitrogen (includes TKN, NO2, NO3)	Silica	200.8 Vanadium - total	Phosphate	As3 & As5 - sub Weck
Esposti Well				x				x	x	x	x	x				x	x	x	x	x	x	x	x	x	x	x
ESW-8-26-7:16	8/26/16	716		X										X	X											
ESW-8-26-7:20		720		X										X	X											
ESW-8-26-8:15		815		X										X	X											
ESW-8-26-11:15		1115		X										X	X											
ESW-8-26-15:15		1515		X				X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X

Relinquished by:	Received by:	Date	Time
Ryan Crawford		8/29/16	0630
		8/30/16	1400

CDPH Write On EDT Report? Yes ○ [✓ No]

State System Number:

CA Geotracker EDF Report Yes ○ [✓ No]

Sampling Company Log Code:

Global ID:

EDF to (Email Address):

Travel and Site Time:

Mileage:

Misc. Supplies:

FIELD REPORT

DATE: 9/6/16
LOCATION: ESPOSTI PARK WINDSOR
WEEKS, SEBASTOPOL
PROJECT NAME: ESPOSTI WELL
JOB NO:
EVENT: IRRIGATION WELL SAMPLING/PACKER MEASUREMENTS
WEATHER/TEMP: 70 ° at am
— ° at pm —
PRESENT AT SITE:

THE FOLLOWING WAS NOTED:

- 1000 RC ONSITE at PARK, BEGIN ASSEMBLING SAMPLE PORT COMPONENTS AND PREPARE FIELD ARSENIC TEST (AS A COMP. TO THE ARSENIC ANALYTICAL)

- 1035 BRETT (WINDSOR) ONSITE, OPEN IRRIGATION WELL ENCLOSURE, ISOLATE SAMPLE PORT PLUG WITH VALVES AT PRESSURE TANK AND OUT TO SYSTEM. INSTALL SAMPLE PORT. ✓

- 1045 SAMPLE FOR ANALYTICAL AND RUN A FIELD TEST ARSENIC = 10-13 ug/L

- 1130 RC OFFSITE

- 1300 RC ONSITE @ WEEKS. MEET W/ JOSH AND GO OVER YARD AND MEASURE ALL ZONE TEST PIPING, PUMP ASSEMBLY, PACKER, BRACKET, COUPLERS

- 1415 RC OFFSITE

Client TOWN OF WINDSOR

Project ESPOSTI SUPPLY WELL

Subject PACKER PLACEMENT (EXACT)

Job Number FEASIBILITY STUDY

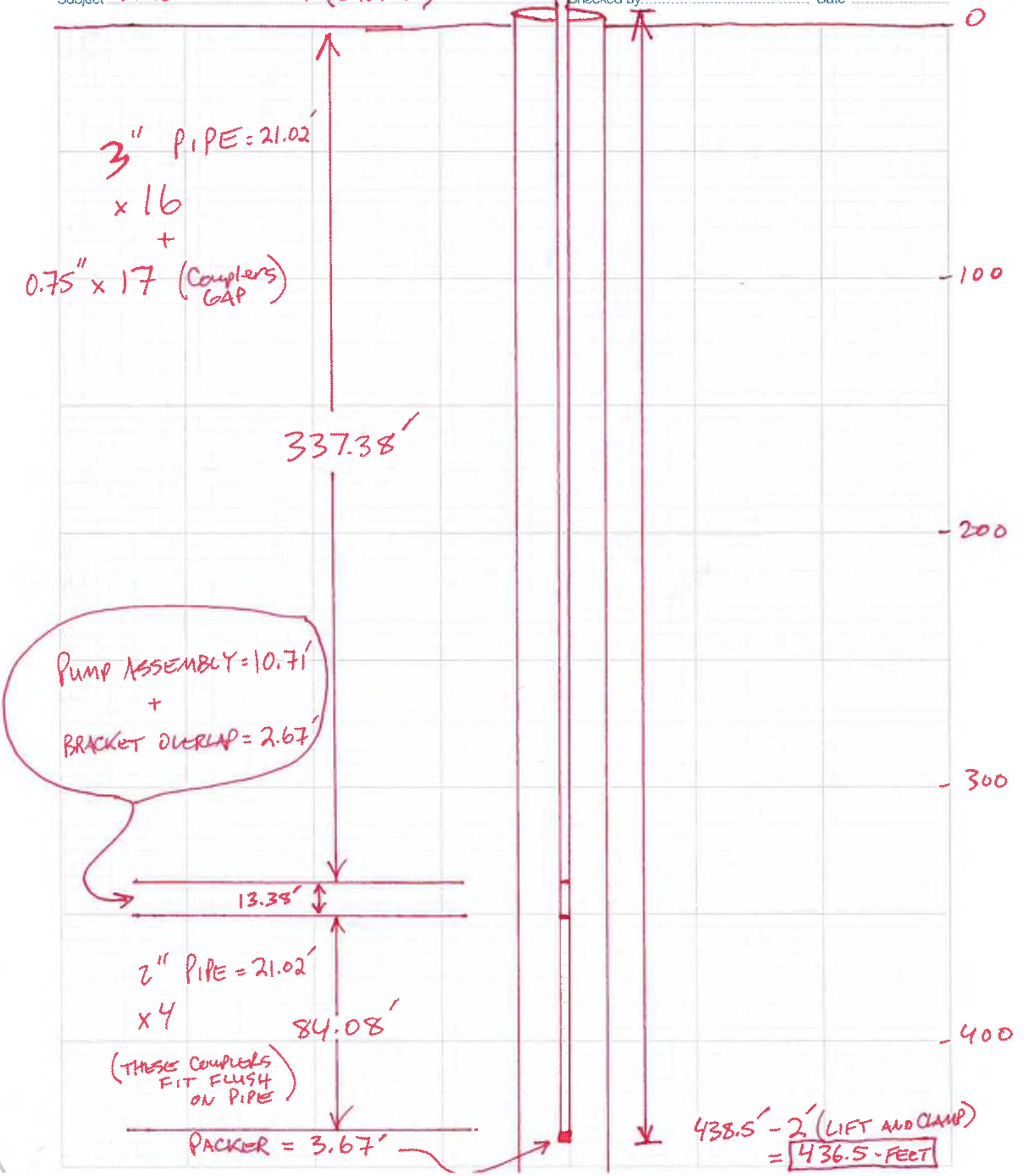
Sheet ____ of ____

Sheets by RC

Date 9/6/16

Checked by ____

Date ____



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Work Order
Chain of Custody Record

Lab No.________ Page 1 of 1

Name: Town of Windsor - ~~Drinking Water~~ FEASIBILITY STUDY

Mailing Address: 9291 Old Redwood Highway Building 400
Windsor, CA 95492

Project Contact (Hardcopy or PDF to): Elizabeth Cargay
ecargay@townofwindsor.com
AND
KOBRIEN@HAZENANDSAWYER.COM

Project ID: #25-1310

Phase: Esposti Well

PO# 200336

Bill to: month end billing

Signature below authorizes work under terms stated on reverse side.

Field Sampler - Print Name & Signature: RYAN CRAWFORD Ryan Crawford

Analysis Request

Sample Identification	Sample Collection		Container					Preservative					Matrix			Analysis Request																		
	Date	Time	40ml VOA	Poly	Amber	Glass		HCL	HNO3	H2SO4	Other	None	Water	Soil		200.8 As	200.7 Fe/Mn		200.8 Cr	218.6 Cr6	200.7 Ca, Mg, K, Na	Alkalinity	Chloride		Sulfate	Total Nitrogen (includes TKN, NO2, NO3)	Silica	200.8 Vanadium - total	Phosphate	As3 & As5 - sub Weck				
Esposti Irrigation Well [illegible]9-6-16	9/6/16	1045		x					x	x	x	x	x			X	X		x	x	x	x	x		x	x	x	x	x	x				

TAT
- 24 hr ○
- 48 hr ○
- Lab Approval Required
- 1 wk ○
- 2 wk (standard) ☒

Lab Approval Required For Rush

BOTTLE KIT ORDER for Esposti Irrigation Well placed 9/1/2016, deliver kit on Friday 9/2/20016 in a cooler to:
Ryan Crawford
2235 Mercury Way, Suite 150,
Santa Rosa, CA 95407

Relinquished by:	Received by:	Date	Time	Global ID:		EDF to (Email Address):
Ryan Crawford		9/6/16	1430	Travel and Site Time:	Mileage:	Misc. Supplies:

DATE: 9/12/16

PROJECT NAME:

LOCATION: ESPOSTI PARK, WINDSOR

EVENT: HI-DEF CAMERA VIDEO ESW

-1255 RC ONSITE – WEEKS/WEST COAST LOGGING ONSITE ALREADY. SCOPE TO "SEE" 400-460' ✓

-1310 SET CAMERA → START DTW = 57.5 (TOC)

383' SCREEN/BLANK JOINT GOOD

400' GOOD SCREENS STILL NOTE: ~10%-30% FINE IN SCREENS

403' SREEN/BLANK WELD GOOD

403-424.1 SCREEN GOOD

424.1 - SCREEN/BLANK WELD GOOD

424.1 - 434.5 BLANK GOOD

00 REVIEW 434.5 BLANK/SREEN GOOD

*438.8 434.5 - 454 SCREEN GOOD. JUST PAST 438 SOME

↑ MATERIALS IN CASING?

DONE ROCK IN SCREEN * 454 - SCREEN/BLANK WELD GOOD

454 - 460+ GOOD

-1440 START TO MAKE CD COPIES, PRINT RPT PICS BEFORE/AFTER ✓

-2 COPIES CD & RPT, RC TO BURN FOR KOB/CITY.

-1335 RC OFFSITE

Page____of____

FIELD REPORT

DATE: 9/19 - 9/21/2016

LOCATION: Esposti Well, Old Redwood Hwy at Shiloh Road, Windsor, CA

PROJECT NAME: Town of Windsor, Esposti Supply Well

JOB NO: 11110001.20

EVENT: PREP. AND ZONE TEST

WEATHER/TEMP: 55-75 ° at am
75-100 ° at pm

PRESENT AT SITE: RC / WEEKS (OTTO & MATT)

THE FOLLOWING WAS NOTED:

- 9/19 10:10 – RC ONSITE, CALL WINDSOR (EC) TO GET INTO ENCLOSURE (EIW) FOR BAROMETRIC TRANSDUCER ETC. EC TO BE ONSITE @ 15:00.

1030 – WEEKS ONSITE, SET-UP, UNLOAD, FENCING L

1100 – START ASSEMBLING PACKER & PUMP ASSEMBLY ALL THE WAY DOWN (SEE SCHEMATIC & PICS)

1455 – STOPPING POINT FOR DOWNHOLE EQUIP INSTALL. CALL KWB REGARDING START-UP ZONE TEST FOR WEDS NOT TUES. ✓ GOOD. WEEKS OFFSITE FOR GENERATOR, NITRO TANK (PACKER) ETC.

1500 – EC ONSITE TO OPEN EIW ENCLOSURE, DROP OFF BAROMETER, DATA DUMP / SYNC TRANSDUCER THATS IN EIW ✓

-1550 RC OFFSITE

Page____ of____

DATE: ~~5/10/2016~~ 9/19 - 9/21

LOCATION: : Esposti Well, Old Redwood Hwy at Shiloh Road, Windsor, CA

PROJECT NAME: Town of Windsor, Esposti Supply Well

EVENT: SEPT. ZONE TEST (R2)

9/20/2016

-1100 - RC / WEEKS ONSITE - FINISH 3" PIPE INSTALL, INSTALL FLEXI PIPE OUT TO SEWER (SHILOH/RED. HWY)

- INSTALL TRANSDUCER IN SOUND TUBE @ 240' ± 1' (TOC)
- ESW STATIC DTW = 58.5' TOC
- RUN PRE-TEST @ 1237 @ 400 GPM

TIME(MIN)		DTW(TOC	FLOW(Q, GPM)
1237	0	58.5	0
1242	5	203	400 → RAPID DROP TO 390 WITH VALVE WIDE OPEN
1247	10	208	375 MAX!
1252	15	206	375 → CALL KOB DISCUSS
1257	20	207.5	375 + CHANGE ZONE TEST TO 300GPM

1345 - RC/ WEEKS OFFSITE

9/21/16

0630 - RC/WEEKS ONSITE, CALIBRATE METER ±0.1 ✓ SET-UP SAMPLE BOTTLE SET

0700 - START TEST, COLLECT 0701, 0705, 0800 SAMPLES & INDICATOR PARAMETERS, MANUAL DTW (WEEKS)

1100 - SAMPLE

1400 - SET-UP FIELD As TEST & FINAL SAMPLES @ 1500✓

FIELD As = 13ppb

1540 - CLEAN-UP, RC/WEEKS OFFSITE

WEEKS WCK-6100
CODE

Client
Job Number
Sheet of
Project
Sheets by RC
Date 9/19
Subject PACKER/TD/PUMP INSTALL SCHEMATIC
Checked by
Date

SPEC'ED FOR 428.5' PACKER SET

*ACTUAL - TOP OF PACKER = 427.10' BELOW TOC

3" GALV PIPE
*15 x 21.02'
+ 10' STICK
+ 1.33' Tee
+ 1.0' COUPLERS
= 327.6'

327.60
+13.33
+86.16
427.09'

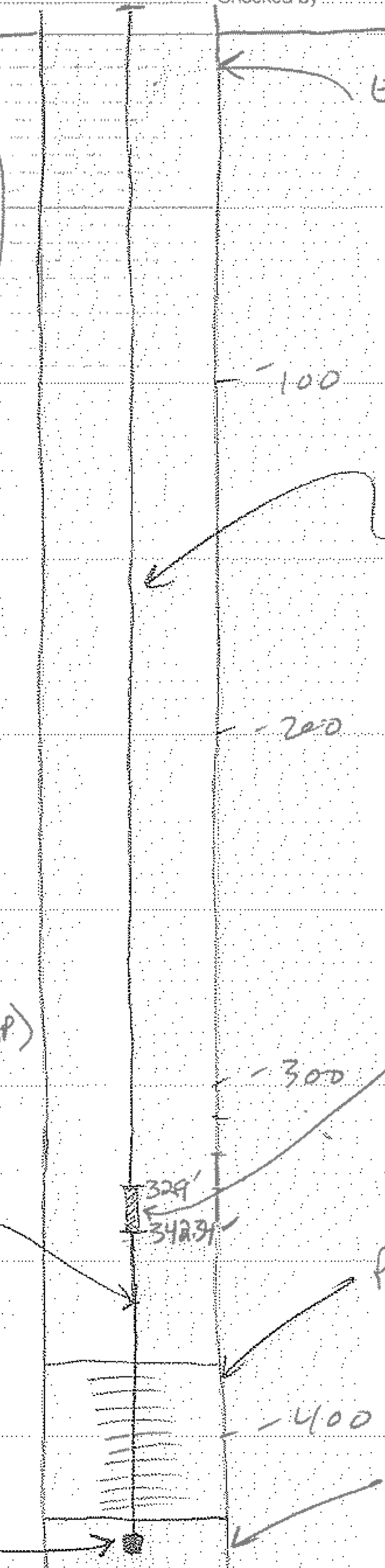
ASSEMBLY
PUMP + BRACKET
94" + 66" = 13.33'

2" PIPE - 21.02' x 4 + 0.25' (COUPLER GAP)
= 84.33'
+ 1.83
= 86.16'

PACKER START
@ 428.5

22" TOP OF PACKER TO BOTTOM OF 2" GALV

22" = 22/12' = 1.83'



9/21/16

Parameter Record

Well ID: GSW

Job Information

Client: Town of Windsor
Project: ....
Proj. No.: 11118001
Sampler: ....

Sampling Information

Sample Method: direct from pump
WQ Meter Type:
Flow Cell: **Pump Depth:**..............m
WLevel Meter Type:

Well Information

SWL: 58.4 ft **Check:** ....
Date: .... **Time:** ....
Ref.datum: .... **Stick Up:**
Well Depth: .... ft **Well Diam.:** ft
Screen From:...... ft **To:**............ ft

Time (..........)	Temp (°C)	pH (pH units)	Elec.Cond (..........)	TDS (..........)	Dis.Oxygen (..........)	Ox-Red Pt. (± mV)	Note	Note	Comment: Colour, turbidity, sediment load, sheen, odour
Stable When:		+/- 0.2 C	+/- 0.05 pH	+/- 3%	+/- 10%	+/- 10 mV			
701	25.1	7.39	515	353	—	-96		300GPM	TURBID (SLIGHTLY)
705	26.0	7.27	513	352	—	-69			CLEAR
710	26.2	7.33	506	347	—	-65			
715	26.7	7.34	509	349	—	-63			
730	23.2	7.30	494	342	—	-33			
745	24.3	7.25	510	351	—	-25	MISSED	745 RC	↓
800	↓	↓	↓	↓		↓			
830	25.2	7.28	526	358		-29			
900	25.7	7.17	525	360		-27			
930	25.2	7.30	526	361		-30			
1000	25.6	7.31	525	360		-35			
1030	25.5	7.33	527	362		-38			
1100	26.–	7.26	528	362		-38			
1130	25.7	7.32	529	362		-35			
1200	26.7	7.31	525	359		-46			
1230	26.7	7.41	527	359		-29			
100	26.2	7.21	530	364		-21			
130	26.3	7.33	533	364		-33			
200	26.2	7.28	533	366		-38			
230	25.9	7.30	531	364		-38			
300	25.8	7.29	533	365		-38			

PUMPING WELL

Drawdown Sheet

Measured Well
Owner: TOWN OF WINDSOR
Location: EPOSTI PARK
Well ID:
Name/Site:

Pumped Well
Owner: Town of Windsor
Location:
Well ID: Esposti Supply Well
Name/Site:

Test Details
Date pumping commenced: 21SEPT16
Time: 0700
Date pumping ceased: 21SEPT16
Time:
Test No.

Are Measurements below for the pumped well?
Distance from pumped well (ft):

Static DTW .... Feet below measuring point

Measuring Point...TOC........... Feet above/below ground level

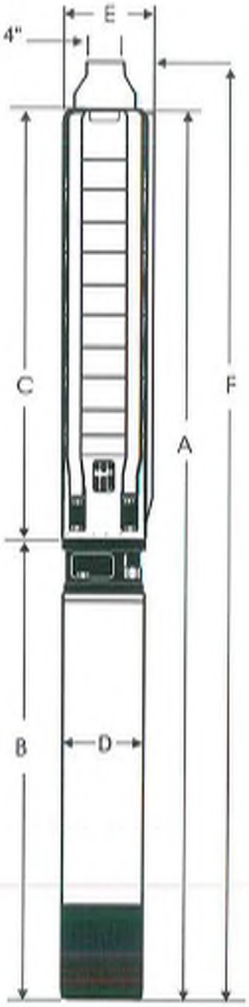
Watch Time	Elapsed Time (min)	Calculated drawdown (ft) (DTW - Static)	Measured DTW (feet) below measuring point	Discharge (gpm) Only if pumped well	Comments or pressure measurements from transducer
0700	0	—	58.40	300	PUMP START - METER 69051
0705	5		152.—	300	
0710	5		158.65	300	
0715	5		162.45	300	
0725	10		165.60	300	
0735	10		167.25	300	
0745	10		169.90	300	
0800	15		171.75	300	
0900	1		177.10	300	
1000	1		177.80	300	
1100	1		178.40	300	
1200	1		180.50	300	
1300	1		178.70	300	
1400	1		179.65	300	
1500	1		180.60	300	
1510				300	PMP STOP-METER-70712
1515	10		91.25	—	RECOVERY
1530	15		73.45	—	"
1600	30		69.20	—	"
1615	15		67.80	—	"

Appendix I – Equipment Technical Information and Photographic Documentation

DIMENSIONS AND WEIGHTS

MODEL NO.	FIG.	HP	MOTOR SIZE	DISCH. SIZE	DIMENSIONS IN INCHES A	B	C	D	E	F	APPROX. SHIP WT.
385S75-1	A	7.5	6"	4" NPT	48.3	24.0	24.3	5.4	7.0	53.1	148
385S100-2BA	A	10	6"	4" NPT	54.8	25.4	29.4	5.4	7.0	59.6	178
385S150-2	A	15	6"	4" NPT	57.4	28.0	29.4	5.4	7.0	62.2	192
385S200-3A	A	20	6"	4" NPT	65.0	30.6	34.4	5.4	7.0	69.8	223
385S250-3	A	25	6"	4" NPT	67.5	33.1	34.4	5.4	7.0	72.3	210
385S250-4B	A	25	6"	4" NPT	72.6	33.1	39.5	5.4	7.0	77.4	210
385S300-4	A	30	6"	4" NPT	75.2	35.7	39.5	5.4	7.0	80.0	243
385S300-5BB	A	30	6"	4" NPT	80.2	35.7	44.5	5.4	7.0	85.0	252
385S400-5*	A	40	6"	4" NPT	85.3	40.8	44.5	5.4	7.0	90.1	276
385S400-6B	A	40	6"	4" NPT	90.4	40.8	49.6	5.4	7.0	95.2	285
385S500-6*	A	50	6"	4" NPT	107.4	57.8	49.6	5.4	7.0	112.2	285
385S500-7A	A	50	6"	4" NPT	113.0	57.8	55.2	5.4	7.0	117.8	450
385S600-7*	A	60	6"	4" NPT	119.0	63.8	55.2	5.4	7.0	123.8	450
385S600-8*	A	60	6"	4" NPT	124.0	63.8	60.2	5.4	7.0	128.8	459
385S750-9	A	75	8"	4" NPT	112.7	47.4	65.3	7.6	7.7	117.5	577
385S750-10	A	75	8"	4" NPT	117.7	47.4	70.3	7.6	7.7	122.5	586
385S1000-11	A	100	8"	4" NPT	130.3	54.91	75.4	7.6	7.7	135.1	672
385S1000-12	A	100	8"	4" NPT	135.3	54.91	80.4	7.6	7.7	140.1	701
385S1000-13	A	100	8"	4" NPT	140.3	54.91	85.4	7.6	7.7	145.1	709
Pipe Adapter	A									4.8	

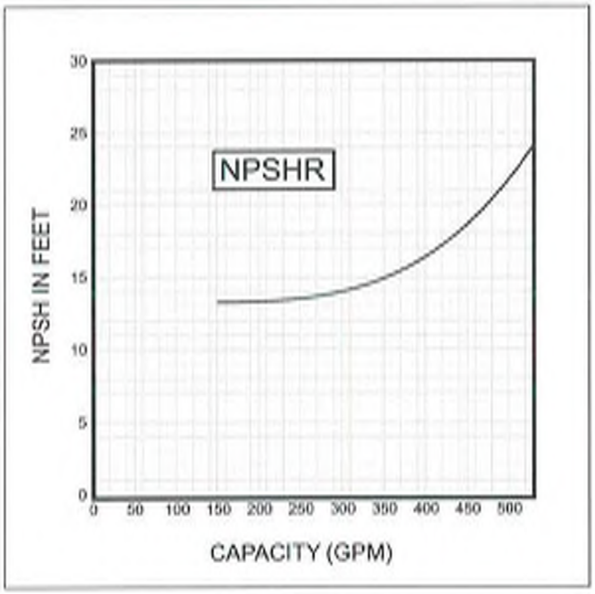
NOTES: All models suitable for use in 8" wells, unless otherwise noted.
Weights include pump end with motor in lbs.
*Alternate motor sizes available.
All models come with a standard 5"-4" Pipe Adapter. Refer to chart for dimensions.



MATERIALS OF CONSTRUCTION

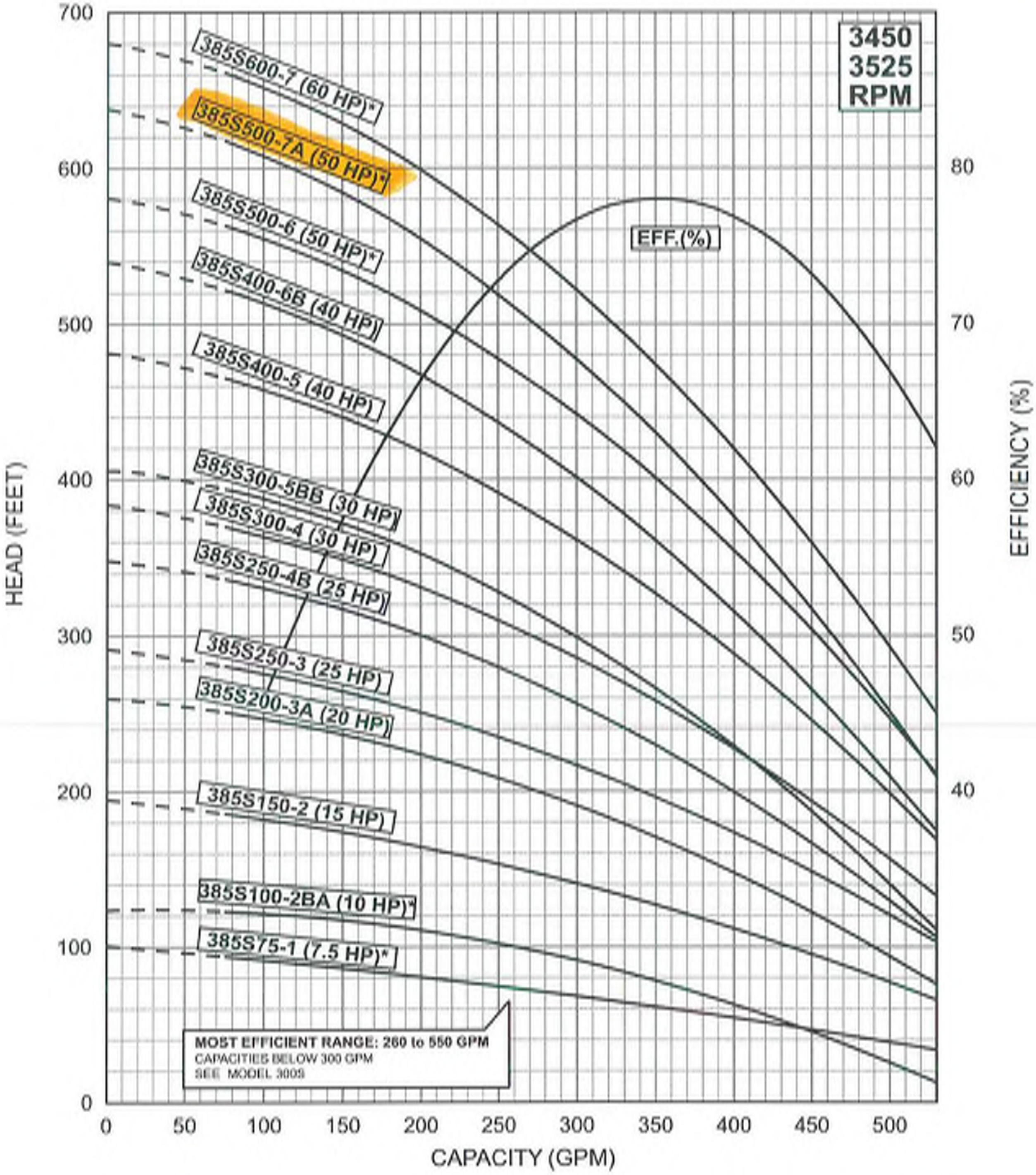
COMPONENT	CYLINDRICAL SHAFT (1-13 Stgs.)
Valve Housing	304 Stainless Steel
Check Valve	304 Stainless Steel
Diffuser Chamber	304 Stainless Steel
Split Cone Nut	304 Stainless Steel
Split Cone	304 Stainless Steel
Impeller	304 Stainless Steel
Suction Interconnector	304 Stainless Steel
Inlet Screen	304 Stainless Steel
Straps	304 Stainless Steel
Cable Guard	304 Stainless Steel
Coupling	316/329 Stainless Steel
Pump Shaft	431 Stainless Steel
Intermediate Bearings	NBR
Impeller Seal Ring	NBR/PPS
Lower Bearing	NBR/316 Stainless Steel
Upthrust Washer	Carbon/Graphite HY22
Upthrust stop ring	304 S.S./Tungsten Carbide
O-Ring	NBR
Valve Seat	304 Stainless Steel
Lower Valve Seat Retainer	316 Stainless Steel
Upper Valve Seat Retainer	304 Stainless Steel
Valve Guide	304 Stainless Steel
Valve Cup Spring	304 Stainless Steel

NOTES: Specifications are subject to change without notice.



PERFORMANCE CURVES 385 GPM MODEL 385S

FLOW RANGE: 75 - 550 GPM **OUTLET SIZE: 4" NPT** **NOMINAL DIA. 8"**



MOST EFFICIENT RANGE: 260 to 550 GPM
CAPACITIES BELOW 300 GPM
SEE MODEL 300S

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE.
6" MOTOR STANDARD, 7.5-60 HP/3450 RPM.
8" MOTOR STANDARD,75-100 HP/3525 RPM.
* Alternate motor sizes available.

Performance conforms to ISO 9906. 1999 (E) Annex A
Minimum submergance is 8 feet.

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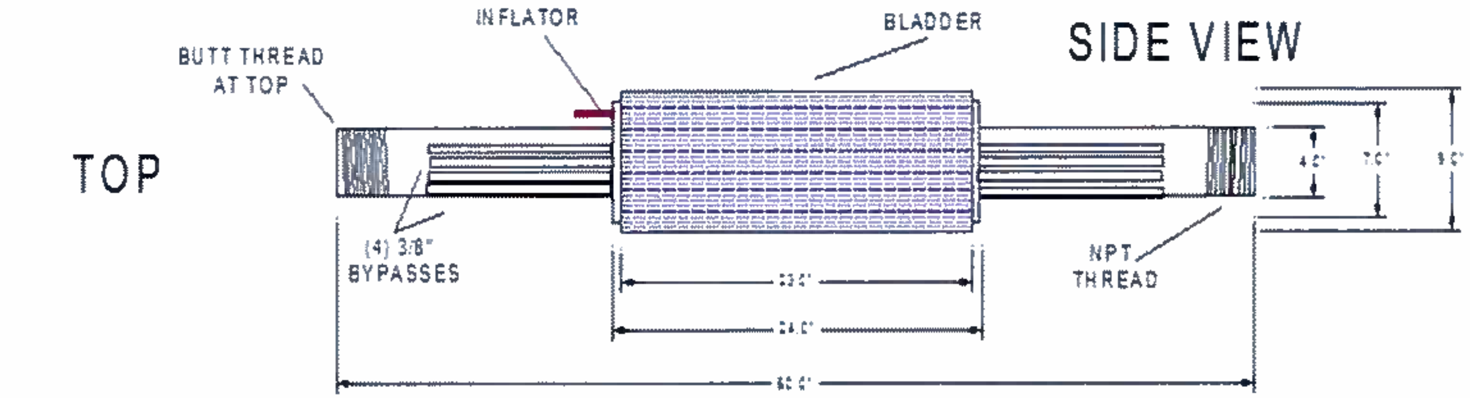
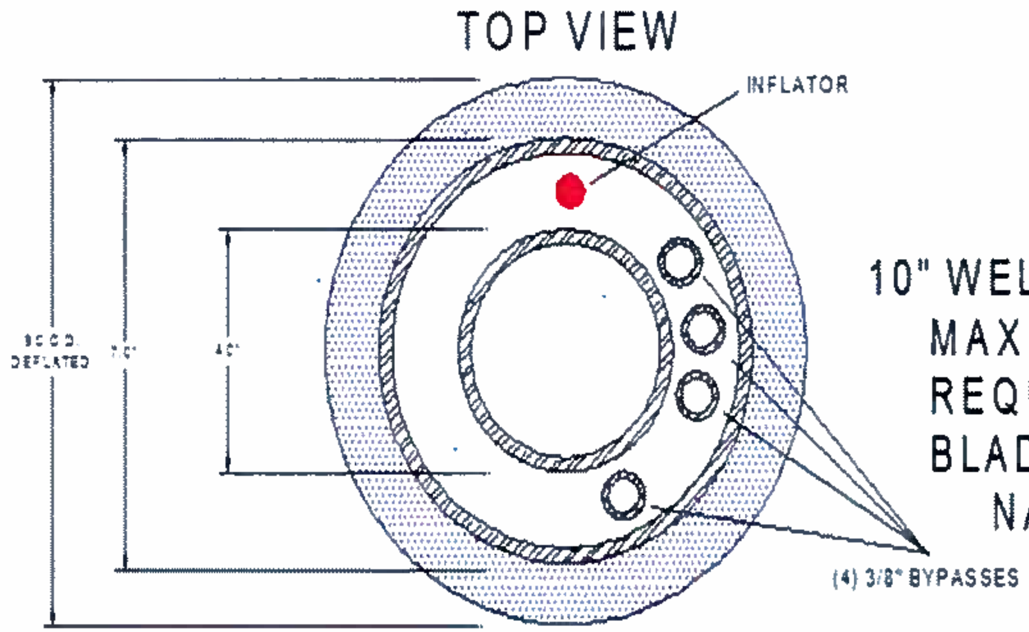
PART NUMBER • 999-99

SIDE VIEW



TOP VIEW



10" WELL PACKER:

MAXIMUM BACK PRESSURE: 200 PSI
REQUIRED INFLATION: 275 PSI
BLADDER: FABRIC REINFORCED NATURAL RUBBER.

r d
P

D 1/4/2016

P		**D r**
	1	**S AA**

Pr d d r r r d

Product No.: 18BG00B3

Multi-stage submersible pump for raw water supply, groundwater lowering and pressure boosting. The pump is suitable for pumping clean, thin, non-agressive liquids without solid particles or fibers.

The pump is made entirely of Stainless steel DIN W.-Nr. EN 1.4301 and suitable for horizontal and vertical installation.
The pump is fitted with a built-in non-return valve.

L d

Pumped liquid:	Water
Maximum liquid temperature:	104 °F
Liquid temp:	68 °F
Density:	62.29 lb/ft³

T

Speed for pump data:	3450 rpm
Rated flow:	1130 US gpm
Rated head:	2772 ft
Curve tolerance:	ISO9906:2012 3B

M r

Pump:	Stainless steel EN 1.4301 AISI ASTM 304
Impeller:	Stainless steel EN 1.4301 AISI 304

I

Pump outlet:	6"NPT
Motor diameter:	8 inch

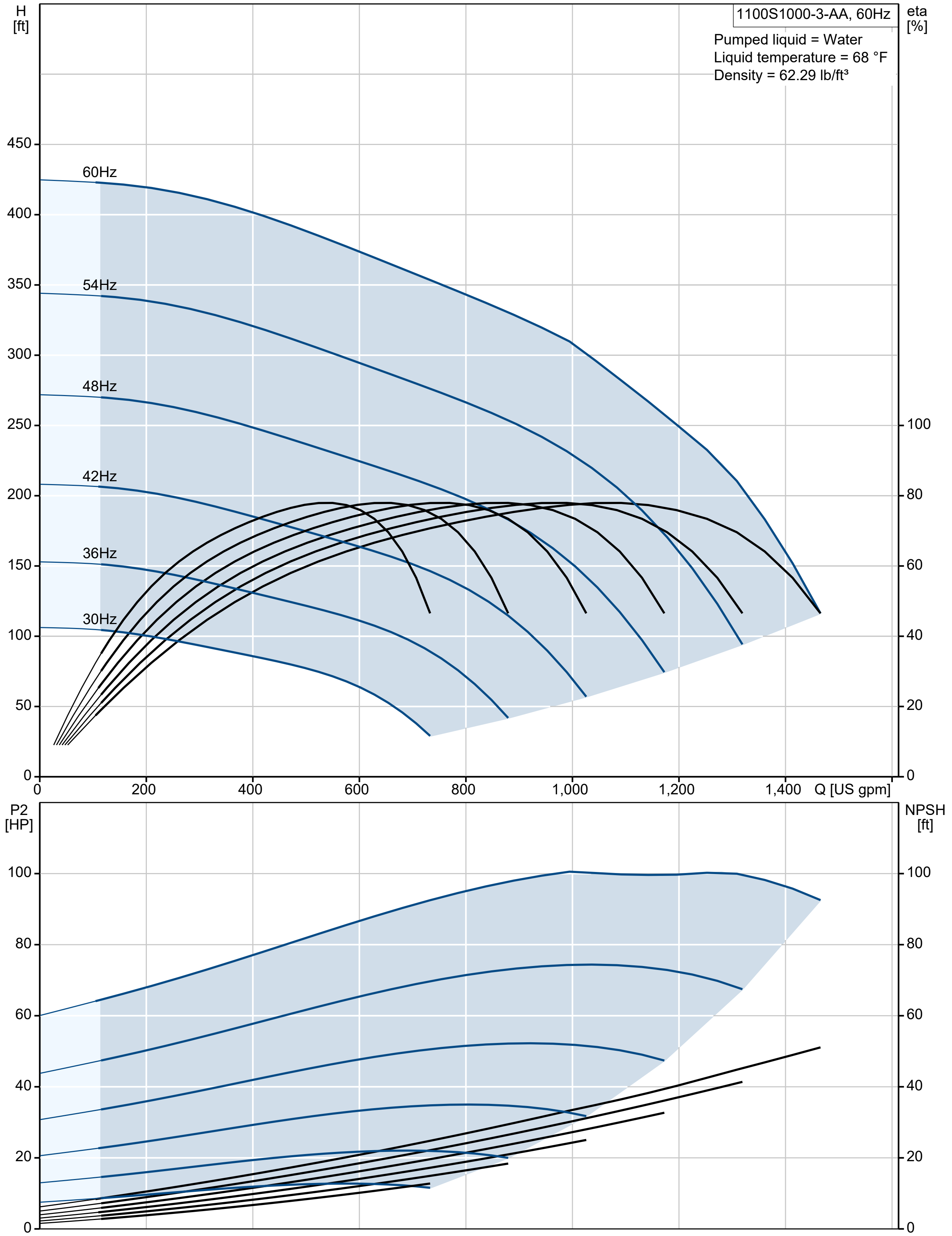
E r d

Rated power - P2:	100 HP
Power (P2) required by pump:	100 HP

r

ErP status:	EuP Standalone/Prod.
Net weight:	138 lb
Gross weight:	198 lb
Shipping volume:	8.58 ft³

S AA


H
[ft]
1100S1000-3-AA, 60Hz
eta
[%]
Pumped liquid = Water
Liquid temperature = 68 °F
Density = 62.29 lb/ft³
450
400
350
300
250
200
150
100
50
0
60Hz
54Hz
48Hz
42Hz
36Hz
30Hz
100
80
60
40
20
0
0
200
400
600
800
1,000
1,200
1,400
Q [US gpm]
P2
[HP]
100
80
60
40
20
0
NPSH
[ft]
100
80
60
40
20
0

Baker tanks staged along Old Redwood Hwy used for settling of silt prior to filtration through bag filters.

Video service at Esposti Supply Well prior to well development.

Baker tanks staged along Old Redwood Hwy.

Bag filters used for sediment removal prior to discharge of water to sanitary sewer.

Configuration of well head during pumping tests.

Head assembly for dual swab development tool.

Dual swap development tool.

Appendix J – Analytical Reports

alpha
Alpha Analytical Laboratories Inc.
e-mail: clientservices@alpha-labs.com
Corporate: 208 Mason St., Ukiah, CA 95482 • Phone: (707) 468-0401 • Fax: (707) 468-5267
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Central Valley: 9090 Union Park Way, Suite 113, Elk Grove, CA 95624 • Phone: (916) 686-5190 • Fax: (916) 686-5192

ELAP Certificates 1551, 2728, and 2922

26 April 2016

Town Of Windsor - Drinking Water
Attn: Elizabeth Cargay
8400 Windsor Rd.
Windsor, CA 95492-0100
RE: Esposti Potable Well
Work Order: 16D1995

Enclosed are the results of analyses for samples received by the laboratory on 04/22/16 16:43. If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Jeanette Poplin

Jeanette L. Poplin For Robbie C. Phillips
Project Manager

Town Of Windsor - Drinking Water
8400 Windsor Rd.
Windsor, CA 95492-0100

Project Manager: Elizabeth Cargay
Project: Esposti Potable Well
Project Number: [none]

Reported:
04/26/16 15:39

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
ESW-4-20-08:23	16D1995-01	Water	04/20/16 08:23	04/22/16 16:43

Town Of Windsor - Drinking Water	Project Manager: Elizabeth Cargay	
8400 Windsor Rd.	Project: Esposti Potable Well	Reported:
Windsor, CA 95492-0100	Project Number: [none]	04/26/16 15:39

	Result	Reporting Limit	Dilution	Batch	Prepared	Analyzed	Method	Note
ESW-4-20-08:23 (16D1995-01)		**Sample Type: Water**			**Sampled: 04/20/16 08:23**			
Metals (Dissolved) by EPA 200 Series Methods								**FILT**
Iron, dissolved	ND mg/L	0.10	1	AD63610	04/25/16 08:01	04/26/16 11:06	EPA 200.7	
Manganese, dissolved	**1.0 mg/L**	**0.020**	1	AD63610	04/25/16 08:01	04/26/16 11:06	EPA 200.7	
Metals (Dissolved) by EPA Method 200.8 ICP/MS								**FILT**
Arsenic, dissolved	**4.4 ug/L**	**0.40**	1	AD63608	04/25/16 07:54	04/26/16 12:34	EPA 200.8	

Metals (Dissolved) by EPA 200 Series Methods - Quality Control

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Batch AD63610 - EPA 200 Series										
Blank (AD63610-BLK1)				Prepared & Analyzed: 04/26/16						
Iron, dissolved	ND	0.10	mg/L							
Manganese, dissolved	ND	0.020	mg/L							
LCS (AD63610-BS1)				Prepared & Analyzed: 04/26/16						
Iron, dissolved	2.21	0.10	mg/L	2.00		111	85-115			
Manganese, dissolved	0.219	0.020	mg/L	0.200		110	85-115			
Duplicate (AD63610-DUP1)	**Source: 16D1995-01**			Prepared & Analyzed: 04/26/16						
Iron, dissolved	ND	0.10	mg/L		ND			6.07	20	
Manganese, dissolved	1.03	0.020	mg/L		0.995			3.48	20	
Matrix Spike (AD63610-MS1)	**Source: 16D1995-01**			Prepared & Analyzed: 04/26/16						
Iron, dissolved	2.28	0.10	mg/L	2.00	ND	111	70-130			
Manganese, dissolved	1.24	0.020	mg/L	0.200	0.995	120	70-130			
Matrix Spike Dup (AD63610-MSD1)	**Source: 16D1995-01**			Prepared & Analyzed: 04/26/16						
Iron, dissolved	2.35	0.10	mg/L	2.00	ND	115	70-130	3.23	20	
Manganese, dissolved	1.28	0.020	mg/L	0.200	0.995	140	70-130	3.11	20	QM-01

Town Of Windsor - Drinking Water
8400 Windsor Rd.
Windsor, CA 95492-0100

Project Manager: Elizabeth Cargay
Project: Esposti Potable Well
Project Number: [none]

Reported:
04/26/16 15:39

Metals (Dissolved) by EPA Method 200.8 ICP/MS - Quality Control

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Batch AD63608 - EPA 200 Series										
Blank (AD63608-BLK1)				Prepared: 04/25/16 Analyzed: 04/26/16						
Arsenic, dissolved	ND	0.40	ug/L							
LCS (AD63608-BS1)				Prepared: 04/25/16 Analyzed: 04/26/16						
Arsenic, dissolved	21.4	0.40	ug/L	20.0		107	85-115			
Duplicate (AD63608-DUP1)	**Source: 16D1995-01**			Prepared: 04/25/16 Analyzed: 04/26/16						
Arsenic, dissolved	4.48	0.40	ug/L		4.36			2.85	20	
Matrix Spike (AD63608-MS1)	**Source: 16D1995-01**			Prepared: 04/25/16 Analyzed: 04/26/16						
Arsenic, dissolved	26.8	0.40	ug/L	20.0	4.36	112	70-130			
Matrix Spike Dup (AD63608-MSD1)	**Source: 16D1995-01**			Prepared: 04/25/16 Analyzed: 04/26/16						
Arsenic, dissolved	26.6	0.40	ug/L	20.0	4.36	111	70-130	0.697	20	

Notes and Definitions

FILT	The sample was filtered in the lab prior to analysis.
QM-01	The spike recovery for this QC sample is outside of established control limits possibly due to a sample matrix interference.
ND	Analyte NOT DETECTED at or above the reporting limit
dry	Sample results reported on a dry weight basis
REC	Recovery
RPD	Relative Percent Difference

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Central Valley Laboratory
9090 Union Park Wy., #113, Elk Grove, CA 95624
916-686-5190 F) 916-686-5192

Work Order
Chain of Custody Record

.4

Lab No. 16D1995 Page____of____

Name: Town of Windsor - Drinking Water

Mailing Address:
9291 Old Redwood Highway Building 400
Windsor, CA 95492

Project Contact (Hardcopy or PDF to):
Elizabeth Cargay
ecargay@townofwindsor.com
Kent O'Brien
kent.obrien@ghd.com

Project ID: Esposti Potable Well

Phase:

PO#

Bill to: month end billing

Signature below authorizes work under terms stated on reverse side.

Analysis Request

Field Sampler - Print Name & Signature

Sample Identification	Sample Collection Date	Sample Collection Time	Container: 40ml VOA	Container: Poly	Container: Amber	Container: Glass	Container:	Preservative: Na2S2O3	Preservative: HNO3	Preservative: NH4Cl	Preservative: Other	Preservative: None	Matrix: Water	Matrix: Soil	Matrix:	200.8 As (Dissolved)	200.7 Fe (Dissolved)	200.7 Mn (Dissolved)	200.8 Cr (Dissolved)	218.6 Cr6 (Dissolved)	200.7 Ca, Mg, K, Na (Dissolved)	Alkalinity	Chloride	Nitrate as N, Nitrite as N	Sulfate	Total Nitrogen (includes TKN, NO2, NO3)	Silica	200.8 Vanadium - total	Phosphate	CAM 17	TPH G, BTEX, D/MO	6010 As STLC	Title 22 Scan (**Below List)	TAT
ESW-4.20-08:23	4/20/16	08:23		X								X	X			X	X	X																Filter & Fix In Lab.

TAT
● 24 hr
○ 48 hr
Lab Approval Required
○ 1 wk
○ 2 wk (standard)
Lab Approval Required For Rush

**Title 22 Scan

64432 Primary Inorganics, 64432.1 NO2/NO3, 64449 A&B Asbestos, Perchlorate, Gross Alpha, 504.1, 507, 508, 515.1, 524.2, 531.1, 548.1, 549.2

Relinquished by:	Received by:	Date	Time
	David Poma	22 4/20/16	11:10
David Poma		4.22.16	1643

CDPH Write On EDT Report? Yes ○ No ●

State System Number:

CA Geotracker EDF Report Yes ○ No ●

Sampling Company Log Code:

Global ID:

EDF to (Email Address):

Travel and Site Time:

Mileage:

Misc. Supplies:

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Bay Area: 6398 Dougherty Rd., Suite 35, Dublin, CA 94568 • Phone: (925) 828-6226 • Fax: (925) 828-6309
Central Valley: 9090 Union Park Way, Suite 113, Elk Grove, CA 95624 • Phone: (916) 686-5190 • Fax: (916) 686-5192

ELAP Certificates 1551, 2728, and 2922

27 April 2016

Town Of Windsor - Drinking Water
Attn: Elizabeth Cargay
8400 Windsor Rd.
Windsor, CA 95492-0100
RE: Esposti Potable Well
Work Order: 16D2256

Enclosed are the results of analyses for samples received by the laboratory on 04/26/16 15:40. If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Jeanette Poplin

Jeanette L. Poplin For Robbie C. Phillips
Project Manager

Town Of Windsor - Drinking Water
8400 Windsor Rd.
Windsor, CA 95492-0100

Project Manager: Elizabeth Cargay
Project: Esposti Potable Well
Project Number: [none]

Reported:
04/27/16 16:12

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
ESW-4-26-11:50	16D2256-01	Water	04/26/16 11:50	04/26/16 15:40

Town Of Windsor - Drinking Water	Project Manager: Elizabeth Cargay	
8400 Windsor Rd.	Project: Esposti Potable Well	Reported:
Windsor, CA 95492-0100	Project Number: [none]	04/27/16 16:12

ESW-4-26-11:50 (16D2256-01) **Sample Type: Water** **Sampled: 04/26/16 11:50**

	Result		Reporting Limit	Dilution	Batch	Prepared	Analyzed	Method	Note
Metals (Dissolved) by EPA 200 Series Methods									**FILT**
Iron, dissolved	ND	mg/L	0.10	1	AD63610	04/27/16 11:20	04/27/16 11:55	EPA 200.7	
Manganese, dissolved	**0.64**	**mg/L**	**0.020**	1	AD63610	04/27/16 11:20	04/27/16 11:55	EPA 200.7	
Metals (Dissolved) by EPA Method 200.8 ICP/MS									**FILT**
Arsenic, dissolved	**3.0**	**ug/L**	**0.40**	1	AD63608	04/27/16 11:20	04/27/16 13:19	EPA 200.8	

Town Of Windsor - Drinking Water
8400 Windsor Rd.
Windsor, CA 95492-0100

Project Manager: Elizabeth Cargay
Project: Esposti Potable Well
Project Number: [none]

Reported:
04/27/16 16:12

Metals (Dissolved) by EPA 200 Series Methods - Quality Control

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Batch AD63610 - EPA 200 Series										
Blank (AD63610-BLK1)				Prepared & Analyzed: 04/26/16						
Iron, dissolved	ND	0.10	mg/L							
Manganese, dissolved	ND	0.020	mg/L							
LCS (AD63610-BS1)				Prepared & Analyzed: 04/26/16						
Iron, dissolved	2.21	0.10	mg/L	2.00		111	85-115			
Manganese, dissolved	0.219	0.020	mg/L	0.200		110	85-115			
Duplicate (AD63610-DUP1)	**Source: 16D1995-01**			Prepared & Analyzed: 04/26/16						
Iron, dissolved	ND	0.10	mg/L		ND			6.07	20	
Manganese, dissolved	1.03	0.020	mg/L		0.995			3.48	20	
Matrix Spike (AD63610-MS1)	**Source: 16D1995-01**			Prepared & Analyzed: 04/26/16						
Iron, dissolved	2.28	0.10	mg/L	2.00	ND	111	70-130			
Manganese, dissolved	1.24	0.020	mg/L	0.200	0.995	120	70-130			
Matrix Spike Dup (AD63610-MSD1)	**Source: 16D1995-01**			Prepared & Analyzed: 04/26/16						
Iron, dissolved	2.35	0.10	mg/L	2.00	ND	115	70-130	3.23	20	
Manganese, dissolved	1.28	0.020	mg/L	0.200	0.995	140	70-130	3.11	20	QM-01

Metals (Dissolved) by EPA Method 200.8 ICP/MS - Quality Control

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Batch AD63608 - EPA 200 Series										
Blank (AD63608-BLK1)				Prepared: 04/25/16 Analyzed: 04/26/16						
Arsenic, dissolved	ND	0.40	ug/L							
LCS (AD63608-BS1)				Prepared: 04/25/16 Analyzed: 04/26/16						
Arsenic, dissolved	21.4	0.40	ug/L	20.0		107	85-115			
Duplicate (AD63608-DUP1)	**Source: 16D1995-01**			Prepared: 04/25/16 Analyzed: 04/26/16						
Arsenic, dissolved	4.48	0.40	ug/L		4.36			2.85	20	
Matrix Spike (AD63608-MS1)	**Source: 16D1995-01**			Prepared: 04/25/16 Analyzed: 04/26/16						
Arsenic, dissolved	26.8	0.40	ug/L	20.0	4.36	112	70-130			
Matrix Spike Dup (AD63608-MSD1)	**Source: 16D1995-01**			Prepared: 04/25/16 Analyzed: 04/26/16						
Arsenic, dissolved	26.6	0.40	ug/L	20.0	4.36	111	70-130	0.697	20	

Notes and Definitions

FILT	The sample was filtered in the lab prior to analysis.
QM-01	The spike recovery for this QC sample is outside of established control limits possibly due to a sample matrix interference.
ND	Analyte NOT DETECTED at or above the reporting limit
dry	Sample results reported on a dry weight basis
REC	Recovery
RPD	Relative Percent Difference

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9090 Unioin Park Wy., #113, Elk Grove, CA 95624
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Work Order
Chain of Custody Record

Lab No. 1602256 Page____of____

0.4

Name: Town of Windsor - Drinking Water

Mailing Address:
9291 Old Redwood Highway Building 400
Windsor, CA 95492

Project Contact (Hardcopy or PDF to):
Elizabeth Cargay
ecargay@townofwindsor.com
Kent O'Brien
kent.obrien@ghd.com

Project ID: Esposti Potable Well

Phase:

PO#

Bill to: month end billing

Signature below authorizes work under terms stated on reverse side.

Analysis Request

TAT
24 hr ●
48 hr ○
Lab Approval Required
1 wk ○
2 wk (standard) ○
Lab Approval Required For Rush

Field Sampler - Print Name & Signature

Sample Identification	Sample Collection Date	Sample Collection Time	Container: 40ml VOA	Poly	Amber	Glass		Preservative: Na2S2O3	HNO3	NH4Cl	Other	None	Matrix: Water	Soil		200.8 As (Dissolved)	200.7 Fe (Dissolved)	200.7 Mn (Dissolved)	200.8 Cr (Dissolved)	218.6 Cr6 (Dissolved)	200.7 Ca, Mg, K, Na (Dissolved)	Alkalinity	Chloride	Nitrate as N, Nitrite as N	Sulfate	Total Nitrogen (includes TKN, NO2, NO3)	Silica	200.8 Vanadium - total	Phosphate	CAM 17	TPH G, BTEX, D/MO	6010 As STLC	Title 22 Scan (**Below List)	
ESW-4-26-11:50	4/26/16	1150		X								X	X			X	X	X																FILTER ?
																																		Fix in LAB

**Title 22 Scan

64432 Primary Inorganics, 64432.1 NO2/NO3, 64449 A&B Asbestos, Perchlorate, Gross Alpha, 504.1, 507, 508, 515.1, 524.2, 531.1, 548.1, 549.2

Relinquished by:	Received by:	Date	Time
		4/26/16	1220
		〃	1540

CDPH Write On EDT Report? Yes ○ [✓ No]

State System Number:

CA Geotracker EDF Report Yes ○ [✓ No]

Sampling Company Log Code:

Global ID: EDF to (Email Address):

Travel and Site Time: Mileage: Misc. Supplies:

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ELAP Certificates 1551, 2728, and 2922

29 April 2016

Town Of Windsor - Drinking Water
Attn: Elizabeth Cargay
8400 Windsor Rd.
Windsor, CA 95492-0100
RE: Esposti Potable Well
Work Order: 16D2432

Enclosed are the results of analyses for samples received by the laboratory on 04/28/16 15:15. If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Robin Edens

Robin C. Edens For Robbie C. Phillips
Project Manager

Town Of Windsor - Drinking Water
8400 Windsor Rd.
Windsor, CA 95492-0100

Project Manager: Elizabeth Cargay
Project: Esposti Potable Well
Project Number: [none]

Reported:
04/29/16 16:24

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
EWS-4-28-11:40	16D2432-01	Water	04/28/16 11:40	04/28/16 15:15

Town Of Windsor - Drinking Water
8400 Windsor Rd.
Windsor, CA 95492-0100

Project Manager: Elizabeth Cargay
Project: Esposti Potable Well
Project Number: [none]

Reported:
04/29/16 16:24

	Result		Reporting Limit	Dilution	Batch	Prepared	Analyzed	Method	Note
EWS-4-28-11:40 (16D2432-01)			**Sample Type: Water**			**Sampled: 04/28/16 11:40**			
Metals (Dissolved) by EPA 200 Series Methods									**FILT**
Iron, dissolved	ND	mg/L	0.10	1	AD63610	04/29/16 08:20	04/29/16 10:49	EPA 200.7	
Manganese, dissolved	**0.93**	**mg/L**	**0.020**	1	AD63610	04/29/16 08:20	04/29/16 10:49	EPA 200.7	
Metals (Dissolved) by EPA Method 200.8 ICP/MS									**FILT**
Arsenic, dissolved	**18**	**ug/L**	**0.40**	1	AD63608	04/29/16 08:20	04/29/16 10:52	EPA 200.8	

Metals (Dissolved) by EPA 200 Series Methods - Quality Control

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Batch AD63610 - EPA 200 Series										
Blank (AD63610-BLK1)				Prepared & Analyzed: 04/26/16						
Iron, dissolved	ND	0.10	mg/L							
Manganese, dissolved	ND	0.020	mg/L							
LCS (AD63610-BS1)				Prepared & Analyzed: 04/26/16						
Iron, dissolved	2.21	0.10	mg/L	2.00		111	85-115			
Manganese, dissolved	0.219	0.020	mg/L	0.200		110	85-115			
Duplicate (AD63610-DUP1)	**Source: 16D1995-01**			Prepared & Analyzed: 04/26/16						
Iron, dissolved	ND	0.10	mg/L		ND			6.07	20	
Manganese, dissolved	1.03	0.020	mg/L		0.995			3.48	20	
Matrix Spike (AD63610-MS1)	**Source: 16D1995-01**			Prepared & Analyzed: 04/26/16						
Iron, dissolved	2.28	0.10	mg/L	2.00	ND	111	70-130			
Manganese, dissolved	1.24	0.020	mg/L	0.200	0.995	120	70-130			
Matrix Spike Dup (AD63610-MSD1)	**Source: 16D1995-01**			Prepared & Analyzed: 04/26/16						
Iron, dissolved	2.35	0.10	mg/L	2.00	ND	115	70-130	3.23	20	
Manganese, dissolved	1.28	0.020	mg/L	0.200	0.995	140	70-130	3.11	20	QM-01

Metals (Dissolved) by EPA Method 200.8 ICP/MS - Quality Control

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Batch AD63608 - EPA 200 Series										
Blank (AD63608-BLK1)				Prepared: 04/25/16 Analyzed: 04/26/16						
Arsenic, dissolved	ND	0.40	ug/L							
LCS (AD63608-BS1)				Prepared: 04/25/16 Analyzed: 04/26/16						
Arsenic, dissolved	21.4	0.40	ug/L	20.0		107	85-115			
Duplicate (AD63608-DUP1)	**Source: 16D1995-01**			Prepared: 04/25/16 Analyzed: 04/26/16						
Arsenic, dissolved	4.48	0.40	ug/L		4.36			2.85	20	
Matrix Spike (AD63608-MS1)	**Source: 16D1995-01**			Prepared: 04/25/16 Analyzed: 04/26/16						
Arsenic, dissolved	26.8	0.40	ug/L	20.0	4.36	112	70-130			
Matrix Spike Dup (AD63608-MSD1)	**Source: 16D1995-01**			Prepared: 04/25/16 Analyzed: 04/26/16						
Arsenic, dissolved	26.6	0.40	ug/L	20.0	4.36	111	70-130	0.697	20	

Town Of Windsor - Drinking Water	Project Manager: Elizabeth Cargay	
8400 Windsor Rd.	Project: Esposti Potable Well	Reported:
Windsor, CA 95492-0100	Project Number: [none]	04/29/16 16:24

Notes and Definitions

FILT	The sample was filtered in the lab prior to analysis.
QM-01	The spike recovery for this QC sample is outside of established control limits possibly due to a sample matrix interference.
ND	Analyte NOT DETECTED at or above the reporting limit
dry	Sample results reported on a dry weight basis
REC	Recovery
RPD	Relative Percent Difference

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WATERS, SEDIMENTS, SOLIDS

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Bay Area Laboratory
6398 Dougherty Road, #35, Dublin, CA 94568
925-828-6226 F) 925-828-6309

Central Valley Laboratory
9090 Unioin Park Wy., #113, Elk Grove, CA 95624
916-686-5190 F) 916-686-5192

Work Order
Chain of Custody Record

6.6

Lab No. 1602432 Page____of____

Name: Town of Windsor - Drinking Water

Project ID: Esposti Potable Well

Mailing Address:
9291 Old Redwood Highway Building 400
Windsor, CA 95492

Phase:

Project Contact (Hardcopy or PDF to):
Elizabeth Cargay
ecargay@townofwindsor.com

PO#

Kent O'Brien
kent.obrien@ghd.com

Bill to: month end billing

Signature below authorizes work under terms stated on reverse side.

Analysis Request

Field Sampler - Print Name & Signature RYAN CRAWFORD Ryan Crawford

Sample Identification	Sample Collection Date	Sample Collection Time	Container: 40ml VOA	Container: Poly	Container: Amber	Container: Glass		Preservative: Na2S2O3	Preservative: HNO3	Preservative: NH4Cl	Preservative: Other	Preservative: None	Matrix: Water	Matrix: Soil		200.8 As (Dissolved)	200.7 Fe (Dissolved)	200.7 Mn (Dissolved)	200.8 Cr (Dissolved)	218.6 Cr6 (Dissolved)	200.7 Ca, Mg, K, Na (Dissolved)	Alkalinity	Chloride	Nitrate as N, Nitrite as N	Sulfate	Total Nitrogen (includes TKN, NO2, NO3)	Silica	200.8 Vanadium - total	Phosphate	CAM 17	TPH G, BTEX, D/MO	6010 As STLC	Title 22 Scan (**Below List)	TAT
EWS-4-28-11:40	4/28/16	1140		X								X	X			X	X	X																FILTER ? FIX in LAB

TAT
24 hr ●
48 hr ○
Lab Approval Required
1 wk ○
2 wk (standard) ○
Lab Approval Required For Rush

**Title 22 Scan

64432 Primary Inorganics, 64432.1 NO2/NO3, 64449 A&B
Asbestos, Perchlorate, Gross Alpha, 504.1, 507, 508, 515.1,
524.2, 531.1, 548.1, 549.2

Relinquished by:	Received by:	Date	Time
Ryan Crawford	Dot Gialdini	4/28/16	1240
Dot Gialdini		〃	1515

CDPH Write On EDT Report? Yes ○ No ●

State System Number:

CA Geotracker EDF Report Yes ○ No ●

Sampling Company Log Code:

Global ID:

EDF to (Email Address):

Travel and Site Time:

Mileage:

Misc. Supplies:

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ELAP Certificates 1551, 2728, and 2922

02 May 2016

Town Of Windsor - Drinking Water
Attn: Elizabeth Cargay
8400 Windsor Rd.
Windsor, CA 95492-0100
RE: Esposti Potable Well
Work Order: 16D2537

Enclosed are the results of analyses for samples received by the laboratory on 04/29/16 14:57. If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Jeanette Poplin

Jeanette L. Poplin For Robbie C. Phillips
Project Manager

Town Of Windsor - Drinking Water
8400 Windsor Rd.
Windsor, CA 95492-0100

Project Manager: Elizabeth Cargay
Project: Esposti Potable Well
Project Number: [none]

Reported:
05/02/16 16:46

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
ESW-4-29-1145	16D2537-01	Water	04/29/16 11:45	04/29/16 14:57

Town Of Windsor - Drinking Water
8400 Windsor Rd.
Windsor, CA 95492-0100

Project Manager: Elizabeth Cargay
Project: Esposti Potable Well
Project Number: [none]

Reported:
05/02/16 16:46

	Result	Reporting Limit	Dilution	Batch	Prepared	Analyzed	Method	Note
ESW-4-29-1145 (16D2537-01)		**Sample Type: Water**			**Sampled: 04/29/16 11:45**			
Metals (Dissolved) by EPA 200 Series Methods								**FILT**
Iron, dissolved	ND mg/L	0.10	1	AD63610	04/29/16 12:20	04/29/16 18:22	EPA 200.7	
Manganese, dissolved	**0.89 mg/L**	**0.020**	1	AD63610	04/29/16 12:20	04/29/16 18:22	EPA 200.7	
Metals (Dissolved) by EPA Method 200.8 ICP/MS								**FILT**
Arsenic, dissolved	**16 ug/L**	**0.40**	1	AD63608	04/29/16 12:20	05/02/16 10:14	EPA 200.8	

Metals (Dissolved) by EPA 200 Series Methods - Quality Control

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Batch AD63610 - EPA 200 Series										
Blank (AD63610-BLK1)				Prepared & Analyzed: 04/26/16						
Iron, dissolved	ND	0.10	mg/L							
Manganese, dissolved	ND	0.020	mg/L							
LCS (AD63610-BS1)				Prepared & Analyzed: 04/26/16						
Iron, dissolved	2.21	0.10	mg/L	2.00		111	85-115			
Manganese, dissolved	0.219	0.020	mg/L	0.200		110	85-115			
Duplicate (AD63610-DUP1)		**Source: 16D1995-01**		Prepared & Analyzed: 04/26/16						
Iron, dissolved	ND	0.10	mg/L		ND			6.07	20	
Manganese, dissolved	1.03	0.020	mg/L		0.995			3.48	20	
Matrix Spike (AD63610-MS1)		**Source: 16D1995-01**		Prepared & Analyzed: 04/26/16						
Iron, dissolved	2.28	0.10	mg/L	2.00	ND	111	70-130			
Manganese, dissolved	1.24	0.020	mg/L	0.200	0.995	120	70-130			
Matrix Spike Dup (AD63610-MSD1)		**Source: 16D1995-01**		Prepared & Analyzed: 04/26/16						
Iron, dissolved	2.35	0.10	mg/L	2.00	ND	115	70-130	3.23	20	
Manganese, dissolved	1.28	0.020	mg/L	0.200	0.995	140	70-130	3.11	20	QM-01

Metals (Dissolved) by EPA Method 200.8 ICP/MS - Quality Control

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Batch AD63608 - EPA 200 Series										
Blank (AD63608-BLK1)				Prepared: 04/25/16 Analyzed: 04/26/16						
Arsenic, dissolved	ND	0.40	ug/L							
LCS (AD63608-BS1)				Prepared: 04/25/16 Analyzed: 04/26/16						
Arsenic, dissolved	21.4	0.40	ug/L	20.0		107	85-115			
Duplicate (AD63608-DUP1)	**Source: 16D1995-01**			Prepared: 04/25/16 Analyzed: 04/26/16						
Arsenic, dissolved	4.48	0.40	ug/L		4.36			2.85	20	
Matrix Spike (AD63608-MS1)	**Source: 16D1995-01**			Prepared: 04/25/16 Analyzed: 04/26/16						
Arsenic, dissolved	26.8	0.40	ug/L	20.0	4.36	112	70-130			
Matrix Spike Dup (AD63608-MSD1)	**Source: 16D1995-01**			Prepared: 04/25/16 Analyzed: 04/26/16						
Arsenic, dissolved	26.6	0.40	ug/L	20.0	4.36	111	70-130	0.697	20	

Notes and Definitions

FILT	The sample was filtered in the lab prior to analysis.
QM-01	The spike recovery for this QC sample is outside of established control limits possibly due to a sample matrix interference.
ND	Analyte NOT DETECTED at or above the reporting limit
dry	Sample results reported on a dry weight basis
REC	Recovery
RPD	Relative Percent Difference

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ELAP Certifications
Ukiah 1551 / Dublin 2728 / Elk Grove 2922

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916-686-5190 F) 916-686-5192

Chain of Custody - Work Order

Reports and Invoices delivered by email in PDF format

Lab No 16D2537 Pg ____ of ____

Signature below authorizes work under terms stated on reverse side.

Report to
Company: TOWN OF WINDSOR - DRINKING WATER
Attn: ELIZABETH CARGAY
Address: 9291 OLD REDWOOD HWY BUILDING 400, WINDSOR CA
Phone/Fax:

Invoice to (if different)
Contact:
Email address:
Address:
Phone/Fax:

Project Information
Project ID: ESPOSTI POTABLE WELL
Project No:
PO Number:

Email Address: ecargay@TOWNOFWINDSOR.com / KENT.OBRIEN@GHD.com

Field Sampler - Printed Name & Signature: RYAN CRAWFORD Ryan Crawford

	Sampling		Container					Preservative					Matrix				Analysis Request				Sample Notes or DDW Source Numbers:
Sample Identification	Date	Time	40ml Vial	Poly	Glass	Sleeve	Other	HCl	HNO3	H2SO4	Other	None	Water	Soil	Other	Total Number of Containers per Sample ID	200.8 As (Diss)	200.7 Fe (Diss)	200.7 Mn (Diss)		
ESGW-4-29-1145	4/29/16	1145		X								X	X				X	X	X		FILTER/FIX IN LAB.

TAT
Standard 10 days ○
RUSH: 5 days ○ 48 hours ○ Other: 1 days ● Lab preapproval required

Temp upon Receipt °C
Ukiah temp: 2.0
Dublin temp:
Elk Grove temp:

Relinquished by	Received by	Date	Time
Ryan Crawford	David Pomar	4.29.16	13 04
David Pomar		4.29.16	1457

DDW Write On EDT Transmission? ○ Yes ● No
State System Number: ____
If "Y" please enter the Source Number(s) in the column above

CA Geotracker EDF Report? ○ Yes ● No
Global ID:
Sampling Company Log Code:
EDF to (Email Address):
Travel and Site Time:
Mileage:
Misc. Supplies:

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ELAP Certificates 1551, 2728, and 2922

11 May 2016

Town Of Windsor - Drinking Water
Attn: Elizabeth Cargay
8400 Windsor Rd.
Windsor, CA 95492-0100
RE: Esposti Potable Well
Work Order: 16E0997

Enclosed are the results of analyses for samples received by the laboratory on 05/10/16 15:50. If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Jeanette Poplin

Jeanette L. Poplin For Robbie C. Phillips
Project Manager

Town Of Windsor - Drinking Water	Project Manager: Elizabeth Cargay	
8400 Windsor Rd.	Project: Esposti Potable Well	Reported:
Windsor, CA 95492-0100	Project Number: [none]	05/11/16 15:40

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
ESW-5-9-10:50	16E0997-01	Water	05/09/16 10:50	05/10/16 15:50
ESW-5-9-15:35	16E0997-02	Water	05/09/16 15:35	05/10/16 15:50

Town Of Windsor - Drinking Water
8400 Windsor Rd.
Windsor, CA 95492-0100

Project Manager: Elizabeth Cargay
Project: Esposti Potable Well
Project Number: [none]

Reported:
05/11/16 15:40

	Result	Reporting Limit	Dilution	Batch	Prepared	Analyzed	Method	Note
ESW-5-9-10:50 (16E0997-01)		**Sample Type: Water**			**Sampled: 05/09/16 10:50**			
Metals (Dissolved) by EPA 200 Series Methods								**FILT**
Iron, dissolved	ND mg/L	0.10	1	AE63518	05/11/16 12:39	05/11/16 13:38	EPA 200.7	
Manganese, dissolved	**0.92 mg/L**	**0.020**	1	AE63518	05/11/16 12:39	05/11/16 13:38	EPA 200.7	
Metals (Dissolved) by EPA Method 200.8 ICP/MS								**FILT**
Arsenic, dissolved	**26 ug/L**	**0.40**	1	AE63517	05/11/16 12:37	05/11/16 14:44	EPA 200.8	
ESW-5-9-15:35 (16E0997-02)		**Sample Type: Water**			**Sampled: 05/09/16 15:35**			
Metals (Dissolved) by EPA 200 Series Methods								**FILT**
Iron, dissolved	ND mg/L	0.10	1	AE63518	05/11/16 12:39	05/11/16 14:08	EPA 200.7	
Manganese, dissolved	**0.94 mg/L**	**0.020**	1	AE63518	05/11/16 12:39	05/11/16 14:08	EPA 200.7	
Metals (Dissolved) by EPA Method 200.8 ICP/MS								**FILT**
Arsenic, dissolved	**16 ug/L**	**0.40**	1	AE63517	05/11/16 12:37	05/11/16 14:59	EPA 200.8	

Metals (Dissolved) by EPA 200 Series Methods - Quality Control

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Batch AE63518 - EPA 200 Series										
Blank (AE63518-BLK1)				Prepared & Analyzed: 05/11/16						
Iron, dissolved	ND	0.10	mg/L							
Manganese, dissolved	ND	0.020	mg/L							
LCS (AE63518-BS1)				Prepared & Analyzed: 05/11/16						
Iron, dissolved	2.16	0.10	mg/L	2.00		108	85-115			
Manganese, dissolved	0.212	0.020	mg/L	0.200		106	85-115			
Duplicate (AE63518-DUP1)	**Source: 16E0997-02**			Prepared & Analyzed: 05/11/16						
Iron, dissolved	ND	0.10	mg/L		ND				20	
Manganese, dissolved	0.928	0.020	mg/L		0.937			0.958	20	
Matrix Spike (AE63518-MS1)	**Source: 16E0997-02**			Prepared & Analyzed: 05/11/16						
Iron, dissolved	2.19	0.10	mg/L	2.00	ND	109	70-130			
Manganese, dissolved	1.08	0.020	mg/L	0.200	0.937	70.1	70-130			
Matrix Spike Dup (AE63518-MSD1)	**Source: 16E0997-02**			Prepared & Analyzed: 05/11/16						
Iron, dissolved	2.31	0.10	mg/L	2.00	ND	116	70-130	5.56	20	
Manganese, dissolved	1.10	0.020	mg/L	0.200	0.937	79.0	70-130	1.64	20	

Metals (Dissolved) by EPA Method 200.8 ICP/MS - Quality Control

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Batch AE63517 - EPA 200 Series										
Blank (AE63517-BLK1)				Prepared & Analyzed: 05/11/16						
Arsenic, dissolved	ND	0.40	ug/L							
LCS (AE63517-BS1)				Prepared & Analyzed: 05/11/16						
Arsenic, dissolved	20.3	0.40	ug/L	20.0		102	85-115			
Duplicate (AE63517-DUP1)		**Source: 16E0997-01**		Prepared & Analyzed: 05/11/16						
Arsenic, dissolved	25.7	0.40	ug/L		25.6			0.443	20	
Matrix Spike (AE63517-MS1)		**Source: 16E0997-01**		Prepared & Analyzed: 05/11/16						
Arsenic, dissolved	48.0	0.40	ug/L	20.0	25.6	112	70-130			
Matrix Spike Dup (AE63517-MSD1)		**Source: 16E0997-01**		Prepared & Analyzed: 05/11/16						
Arsenic, dissolved	48.2	0.40	ug/L	20.0	25.6	113	70-130	0.268	20	

Notes and Definitions

FILT	The sample was filtered in the lab prior to analysis.
ND	Analyte NOT DETECTED at or above the reporting limit
dry	Sample results reported on a dry weight basis
REC	Recovery
RPD	Relative Percent Difference

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916-686-5190 F) 916-686-5192

Work Order
Chain of Custody Record

Lab No. 16E0997 Page____of____

Name: Town of Windsor - Drinking Water

Project ID: Esposti Potable Well

Mailing Address:
9291 Old Redwood Highway Building 400
Windsor, CA 95492

Phase:

Project Contact (Hardcopy or PDF to):
Elizabeth Cargay
ecargay@townofwindsor.com
Kent O'Brien
kent.obrien@ghd.com

PO#

Bill to: month end billing

Signature below authorizes work under terms stated on reverse side.

Analysis Request

TAT
[✓ 24 hr] ○ 48 hr (Lab Approval Required) ○ 1 wk ○ 2 wk (standard)
Lab Approval Required For Rush

1 + 6

Field Sampler - Print Name & Signature

Sample Identification	Sample Collection Date	Sample Collection Time	Container: 40ml VOA	Container: Poly	Container: Amber	Container: Glass	Container	Preservative: Na2S2O3	Preservative: HNO3	Preservative: NH4Cl	Preservative: Other	Preservative: None	Matrix: Water	Matrix: Soil	Matrix	200.8 As (Dissolved)	200.7 Fe (Dissolved)	200.7 Mn (Dissolved)	200.8 Cr (Dissolved)	218.6 Cr6 (Dissolved)	200.7 Ca, Mg, K, Na (Dissolved)	Alkalinity	Chloride	Nitrate as N, Nitrite as N	Sulfate	Total Nitrogen (includes TKN, NO2, NO3)	Silica	200.8 Vanadium - total	Phosphate	CAM 17	TPH G, BTEX, D/MO	6010 As STLC	Title 22 Scan (**Below List)	TAT
ESW-5-9-10:50	5/9	10:50		X								X	X			X	X	X																Filter+fix
ESW-5-9-15:35	5/9	1535		X								X	X			X	X	X																in Lab

**Title 22 Scan

64432 Primary Inorganics, 64432.1 NO2/NO3, 64449 A&B
Asbestos, Perchlorate, Gross Alpha, 504.1, 507, 508, 515.1,
524.2, 531.1, 548.1, 549.2

Relinquished by:	Received by:	Date	Time
		5/10	1400
		"	1550

CDPH Write On EDT Report? ○ Yes [✓ No]

State System Number: ________

CA Geotracker EDF Report ○ Yes [✓ No]

Sampling Company Log Code: ________

Global ID: EDF to (Email Address):

Travel and Site Time: Mileage: Misc. Supplies:

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ELAP Certificates 1551, 2728, and 2922

11 May 2016

Town Of Windsor - Drinking Water
Attn: Elizabeth Cargay
8400 Windsor Rd.
Windsor, CA 95492-0100
RE: Esposti Potable Well
Work Order: 16E0995

Enclosed are the results of analyses for samples received by the laboratory on 05/10/16 15:50. If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Jeanette Poplin

Jeanette L. Poplin For Robbie C. Phillips
Project Manager

Town Of Windsor - Drinking Water
8400 Windsor Rd.
Windsor, CA 95492-0100

Project Manager: Elizabeth Cargay
Project: Esposti Potable Well
Project Number: [none]

Reported:
05/11/16 15:40

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
ESW-5-10-10:09	16E0995-01	Water	05/10/16 10:09	05/10/16 15:50
ESW-5-10-10:09 Total	16E0995-02	Water	05/10/16 10:09	05/10/16 15:50

Town Of Windsor - Drinking Water	Project Manager: Elizabeth Cargay	
8400 Windsor Rd.	Project: Esposti Potable Well	Reported:
Windsor, CA 95492-0100	Project Number: [none]	05/11/16 15:40

	Result		Reporting Limit	Dilution	Batch	Prepared	Analyzed	Method	Note
ESW-5-10-10:09 (16E0995-01)			**Sample Type: Water**			**Sampled: 05/10/16 10:09**			
Metals (Dissolved) by EPA 200 Series Methods									**FILT**
Iron, dissolved	ND	mg/L	0.10	1	AE63518	05/11/16 12:39	05/11/16 14:23	EPA 200.7	
Manganese, dissolved	**0.91**	**mg/L**	**0.020**	1	AE63518	05/11/16 12:39	05/11/16 14:23	EPA 200.7	
Metals (Dissolved) by EPA Method 200.8 ICP/MS									**FILT**
Arsenic, dissolved	**29**	**ug/L**	**0.40**	1	AE63517	05/11/16 12:37	05/11/16 14:51	EPA 200.8	
ESW-5-10-10:09 Total (16E0995-02)			**Sample Type: Water**			**Sampled: 05/10/16 10:09**			
Metals by EPA 200 Series Methods									**P-02**
Iron	**1.1**	**mg/L**	**0.10**	1	AE63520	05/11/16 12:41	05/11/16 14:53	EPA 200.7	
Manganese	**1.0**	**mg/L**	**0.020**	1	AE63520	05/11/16 12:41	05/11/16 14:53	EPA 200.7	
Metals by EPA Method 200.8 ICP/MS									
Arsenic	**33**	**ug/L**	**0.40**	1	AE63290	05/11/16 12:43	05/11/16 15:06	EPA 200.8	

Metals by EPA 200 Series Methods - Quality Control

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Batch AE63520 - EPA 200 Series										
Blank (AE63520-BLK1)				Prepared & Analyzed: 05/11/16						
Iron	ND	0.10	mg/L							
Manganese	ND	0.020	mg/L							
LCS (AE63520-BS1)				Prepared & Analyzed: 05/11/16						
Iron	2.18	0.10	mg/L	2.00		109	85-115			
Manganese	0.213	0.020	mg/L	0.200		107	85-115			
Duplicate (AE63520-DUP1)	**Source: 16E0995-02**			Prepared & Analyzed: 05/11/16						
Iron	1.18	0.10	mg/L		1.06			11.2	20	
Manganese	0.995	0.020	mg/L		1.02			2.29	20	
Matrix Spike (AE63520-MS1)	**Source: 16E0995-02**			Prepared & Analyzed: 05/11/16						
Iron	3.22	0.10	mg/L	2.00	1.06	108	70-130			
Manganese	1.20	0.020	mg/L	0.200	1.02	93.3	70-130			
Matrix Spike Dup (AE63520-MSD1)	**Source: 16E0995-02**			Prepared & Analyzed: 05/11/16						
Iron	3.12	0.10	mg/L	2.00	1.06	103	70-130	3.35	20	
Manganese	1.20	0.020	mg/L	0.200	1.02	89.7	70-130	0.588	20	

Town Of Windsor - Drinking Water
8400 Windsor Rd.
Windsor, CA 95492-0100

Project Manager: Elizabeth Cargay
Project: Esposti Potable Well
Project Number: [none]

Reported:
05/11/16 15:40

Metals by EPA Method 200.8 ICP/MS - Quality Control

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Batch AE63290 - EPA 200 Series										
Blank (AE63290-BLK1)				Prepared: 05/05/16 Analyzed: 05/06/16						
Arsenic	ND	0.40	ug/L							
LCS (AE63290-BS1)				Prepared: 05/05/16 Analyzed: 05/06/16						
Arsenic	21.8	0.40	ug/L	20.0		109	85-115			
Duplicate (AE63290-DUP1)	**Source: 16E0341-07**			Prepared: 05/05/16 Analyzed: 05/06/16						
Arsenic	4.48	2.0	ug/L		4.33			3.52	20	
Matrix Spike (AE63290-MS1)	**Source: 16E0341-07**			Prepared: 05/05/16 Analyzed: 05/06/16						
Arsenic	114	2.0	ug/L	100	4.33	110	70-130			
Matrix Spike Dup (AE63290-MSD1)	**Source: 16E0341-07**			Prepared: 05/05/16 Analyzed: 05/06/16						
Arsenic	114	2.0	ug/L	100	4.33	109	70-130	0.320	20	

Metals (Dissolved) by EPA 200 Series Methods - Quality Control

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Batch AE63518 - EPA 200 Series										
Blank (AE63518-BLK1)				Prepared & Analyzed: 05/11/16						
Iron, dissolved	ND	0.10	mg/L							
Manganese, dissolved	ND	0.020	mg/L							
LCS (AE63518-BS1)				Prepared & Analyzed: 05/11/16						
Iron, dissolved	2.16	0.10	mg/L	2.00		108	85-115			
Manganese, dissolved	0.212	0.020	mg/L	0.200		106	85-115			
Duplicate (AE63518-DUP1)	**Source: 16E0997-02**			Prepared & Analyzed: 05/11/16						
Iron, dissolved	ND	0.10	mg/L		ND				20	
Manganese, dissolved	0.928	0.020	mg/L		0.937			0.958	20	
Matrix Spike (AE63518-MS1)	**Source: 16E0997-02**			Prepared & Analyzed: 05/11/16						
Iron, dissolved	2.19	0.10	mg/L	2.00	ND	109	70-130			
Manganese, dissolved	1.08	0.020	mg/L	0.200	0.937	70.1	70-130			
Matrix Spike Dup (AE63518-MSD1)	**Source: 16E0997-02**			Prepared & Analyzed: 05/11/16						
Iron, dissolved	2.31	0.10	mg/L	2.00	ND	116	70-130	5.56	20	
Manganese, dissolved	1.10	0.020	mg/L	0.200	0.937	79.0	70-130	1.64	20	

Metals (Dissolved) by EPA Method 200.8 ICP/MS - Quality Control

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Batch AE63517 - EPA 200 Series										
Blank (AE63517-BLK1)				Prepared & Analyzed: 05/11/16						
Arsenic, dissolved	ND	0.40	ug/L							
LCS (AE63517-BS1)				Prepared & Analyzed: 05/11/16						
Arsenic, dissolved	20.3	0.40	ug/L	20.0		102	85-115			
Duplicate (AE63517-DUP1)	**Source: 16E0997-01**			Prepared & Analyzed: 05/11/16						
Arsenic, dissolved	25.7	0.40	ug/L		25.6			0.443	20	
Matrix Spike (AE63517-MS1)	**Source: 16E0997-01**			Prepared & Analyzed: 05/11/16						
Arsenic, dissolved	48.0	0.40	ug/L	20.0	25.6	112	70-130			
Matrix Spike Dup (AE63517-MSD1)	**Source: 16E0997-01**			Prepared & Analyzed: 05/11/16						
Arsenic, dissolved	48.2	0.40	ug/L	20.0	25.6	113	70-130	0.268	20	

Notes and Definitions

FILT	The sample was filtered in the lab prior to analysis.
P-02	Sample was received with insufficient preservative. Sample was preserved and allowed to sit 24 hours before further processing.
ND	Analyte NOT DETECTED at or above the reporting limit
dry	Sample results reported on a dry weight basis
REC	Recovery
RPD	Relative Percent Difference

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Work Order Chain of Custody Record

Lab No. 16E0995 Page_____of_____

Name: Town of Windsor - Drinking Water

Project ID: Esposti Potable Well

Mailing Address:
9291 Old Redwood Highway Building 400
Windsor, CA 95492

Phase:

Project Contact (Hardcopy or PDF to):
Elizabeth Cargay
ecargay@townofwindsor.com
Kent O'Brien
kent.obrien@ghd.com

PO#

Bill to: month end billing

Signature below authorizes work under terms stated on reverse side.

Field Sampler - Print Name & Signature

Sample Identification	Sample Collection		Container					Preservative					Matrix			Analysis Request																			TAT
	Date	Time	40ml VOA	Poly	Amber	Glass		Na2S2O3	HNO3	NH4Cl	Other	None	Water	Soil		200.8 As (Dissolved)	200.7 Fe (Dissolved)	200.7 Mn (Dissolved)	200.8 Cr (Dissolved)	218.6 Cr6 (Dissolved)	200.7 Ca, Mg, K, Na (Dissolved)	Alkalinity	Chloride	Nitrate as N, Nitrite as N	Sulfate	Total Nitrogen (includes TKN, NO2, NO3)	Silica	200.8 Vanadium - total	Phosphate	CAM 17	TPH G, BTEX, D/MO	6010 As STLC	Title 22 Scan (**Below List)	24 hr [✓ ○] 48 hr ○ *Lab Approval Required* 1 wk ○ 2 wk (standard) ○ Lab Approval Required For Rush
ESW-5-10-10:09	5/10	10:09		X								X	X			X	X	X																Filter and Fix
																																	N/O	Filter Then Fix
ESW-5-10-10:09 Total	5/10	10:09		X								X	X			X	X	X				total metals per Kent.												

1,6

**Title 22 Scan

64432 Primary Inorganics, 64432.1 NO2/NO3, 64449 A&B Asbestos, Perchlorate, Gross Alpha, 504.1, 507, 508, 515.1, 524.2, 531.1, 548.1, 549.2

Relinquished by:	Received by:	Date	Time
		5/10	1400
		〃	1550

CDPH Write On EDT Report? Yes ○ No ○

State System Number:

CA Geotracker EDF Report Yes ○ No ○

Sampling Company Log Code:

Global ID: EDF to (Email Address):

Travel and Site Time: Mileage: Misc. Supplies:

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ELAP Certificates 1551, 2728, and 2922

12 May 2016

Town Of Windsor - Drinking Water
Attn: Elizabeth Cargay
8400 Windsor Rd.
Windsor, CA 95492-0100
RE: Esposti Potable Well
Work Order: 16E1054

Enclosed are the results of analyses for samples received by the laboratory on 05/11/16 14:20. If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Jeanette Poplin

Jeanette L. Poplin For Robbie C. Phillips
Project Manager

Town Of Windsor - Drinking Water	Project Manager: Elizabeth Cargay	
8400 Windsor Rd.	Project: Esposti Potable Well	Reported:
Windsor, CA 95492-0100	Project Number: [none]	05/12/16 16:12

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
ESW-5-11-10:44	16E1054-01	Water	05/11/16 10:44	05/11/16 14:20

Town Of Windsor - Drinking Water
8400 Windsor Rd.
Windsor, CA 95492-0100

Project Manager: Elizabeth Cargay
Project: Esposti Potable Well
Project Number: [none]

Reported:
05/12/16 16:12

	Result	Reporting Limit	Dilution	Batch	Prepared	Analyzed	Method	Note
ESW-5-11-10:44 (16E1054-01)		**Sample Type: Water**			**Sampled: 05/11/16 10:44**			
Metals (Dissolved) by EPA 200 Series Methods								**FILT**
Iron, dissolved	ND mg/L	0.10	1	AE63518	05/11/16 15:09	05/11/16 17:14	EPA 200.7	
Manganese, dissolved	**1.0 mg/L**	**0.020**	1	AE63518	05/11/16 15:09	05/11/16 17:14	EPA 200.7	
Metals (Dissolved) by EPA Method 200.8 ICP/MS								**FILT**
Arsenic, dissolved	**28 ug/L**	**0.40**	1	AE63517	05/11/16 15:09	05/12/16 09:31	EPA 200.8	

Metals (Dissolved) by EPA 200 Series Methods - Quality Control

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Batch AE63518 - EPA 200 Series										
Blank (AE63518-BLK1)				Prepared & Analyzed: 05/11/16						
Iron, dissolved	ND	0.10	mg/L							
Manganese, dissolved	ND	0.020	mg/L							
LCS (AE63518-BS1)				Prepared & Analyzed: 05/11/16						
Iron, dissolved	2.16	0.10	mg/L	2.00		108	85-115			
Manganese, dissolved	0.212	0.020	mg/L	0.200		106	85-115			
Duplicate (AE63518-DUP1)	**Source: 16E0997-02**			Prepared & Analyzed: 05/11/16						
Iron, dissolved	ND	0.10	mg/L		ND				20	
Manganese, dissolved	0.928	0.020	mg/L		0.937			0.958	20	
Matrix Spike (AE63518-MS1)	**Source: 16E0997-02**			Prepared & Analyzed: 05/11/16						
Iron, dissolved	2.19	0.10	mg/L	2.00	ND	109	70-130			
Manganese, dissolved	1.08	0.020	mg/L	0.200	0.937	70.1	70-130			
Matrix Spike Dup (AE63518-MSD1)	**Source: 16E0997-02**			Prepared & Analyzed: 05/11/16						
Iron, dissolved	2.31	0.10	mg/L	2.00	ND	116	70-130	5.56	20	
Manganese, dissolved	1.10	0.020	mg/L	0.200	0.937	79.0	70-130	1.64	20	

Metals (Dissolved) by EPA Method 200.8 ICP/MS - Quality Control

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Batch AE63517 - EPA 200 Series										
Blank (AE63517-BLK1)				Prepared & Analyzed: 05/11/16						
Arsenic, dissolved	ND	0.40	ug/L							
LCS (AE63517-BS1)				Prepared & Analyzed: 05/11/16						
Arsenic, dissolved	20.3	0.40	ug/L	20.0		102	85-115			
Duplicate (AE63517-DUP1)		**Source: 16E0997-01**		Prepared & Analyzed: 05/11/16						
Arsenic, dissolved	25.7	0.40	ug/L		25.6			0.443	20	
Matrix Spike (AE63517-MS1)		**Source: 16E0997-01**		Prepared & Analyzed: 05/11/16						
Arsenic, dissolved	48.0	0.40	ug/L	20.0	25.6	112	70-130			
Matrix Spike Dup (AE63517-MSD1)		**Source: 16E0997-01**		Prepared & Analyzed: 05/11/16						
Arsenic, dissolved	48.2	0.40	ug/L	20.0	25.6	113	70-130	0.268	20	

Notes and Definitions

FILT	The sample was filtered in the lab prior to analysis.
ND	Analyte NOT DETECTED at or above the reporting limit
dry	Sample results reported on a dry weight basis
REC	Recovery
RPD	Relative Percent Difference

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Work Order Chain of Custody Record

.4

Lab No. 16E1054 Page____of____

Name: Town of Windsor - Drinking Water

Project ID: Esposti Potable Well

Mailing Address:
9291 Old Redwood Highway Building 400
Windsor, CA 95492

Phase:

Project Contact (Hardcopy or PDF to):
Elizabeth Cargay
ecargay@townofwindsor.com
Kent O'Brien
kent.obrien@ghd.com

PO#

Bill to: month end billing

Signature below authorizes work under terms stated on reverse side.

Analysis Request

Field Sampler - Print Name & Signature

Sample Identification	Sample Collection Date	Time	Container: 40ml VOA	Poly	Amber	Glass		Preservative: Na2S2O3	HNO3	NH4Cl	Other	None	Matrix: Water	Soil		200.8 As (Dissolved)	200.7 Fe (Dissolved)	200.7 Mn (Dissolved)	200.8 Cr (Dissolved)	218.6 Cr6 (Dissolved)	200.7 Ca, Mg, K, Na (Dissolved)	Alkalinity	Chloride	Nitrate as N, Nitrite as N	Sulfate	Total Nitrogen (includes TKN, NO2, NO3)	Silica	200.8 Vanadium - total	Phosphate	CAM 17	TPH G, BTEX, D/MO	6010 As STLC	Title 22 Scan (**Below List)	TAT
ESW-5-11-10:44	5/11	10:44		X								X	X			X	X	X																Filter o-fi X

TAT: 24 hr ☑ 48 hr ○ Lab Approval Required; 1 wk ○ 2 wk (standard) ○ — Lab Approval Required For Rush

**Title 22 Scan

64432 Primary Inorganics, 64432.1 NO2/NO3, 64449 A&B
Asbestos, Perchlorate, Gross Alpha, 504.1, 507, 508, 515.1,
524.2, 531.1, 548.1, 549.2

Relinquished by:	Received by:	Date	Time
	David Poma	5/11/16	11:57
David Poma		5-11-16	1420

CDPH Write On EDT Report? Yes ○ No ○
State System Number: ________

CA Geotracker EDF Report Yes ○ No ○
Sampling Company Log Code: ________
Global ID: EDF to (Email Address):

Travel and Site Time: Mileage: Misc. Supplies:

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ELAP Certificates 1551, 2728, and 2922

13 May 2016

Town Of Windsor - Drinking Water
Attn: Elizabeth Cargay
8400 Windsor Rd.
Windsor, CA 95492-0100
RE: Esposti Potable Well
Work Order: 16E1210

Enclosed are the results of analyses for samples received by the laboratory on 05/12/16 14:15. If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Jeanette Poplin

Jeanette L. Poplin For Robbie C. Phillips
Project Manager

Town Of Windsor - Drinking Water
8400 Windsor Rd.
Windsor, CA 95492-0100

Project Manager: Elizabeth Cargay
Project: Esposti Potable Well
Project Number: [none]

Reported:
05/13/16 11:31

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
EWS-5-11-16:42	16E1210-01	Water	05/11/16 16:42	05/12/16 14:15
EWS-5-11-15:38	16E1210-02	Water	05/11/16 15:38	05/12/16 14:15

Town Of Windsor - Drinking Water
8400 Windsor Rd.
Windsor, CA 95492-0100

Project Manager: Elizabeth Cargay
Project: Esposti Potable Well
Project Number: [none]

Reported:
05/13/16 11:31

	Result	Reporting Limit	Dilution	Batch	Prepared	Analyzed	Method	Note
EWS-5-11-16:42 (16E1210-01)		**Sample Type: Water**			**Sampled: 05/11/16 16:42**			
Metals by EPA 200 Series Methods								**P-02**
Iron	**0.29 mg/L**	**0.10**	1	AE63520	05/12/16 15:30	05/12/16 15:54	EPA 200.7	
Manganese	**1.0 mg/L**	**0.020**	1	AE63520	05/12/16 15:30	05/12/16 15:54	EPA 200.7	
Metals by EPA Method 200.8 ICP/MS								**P-02**
Arsenic	**41 ug/L**	**0.40**	1	AE63373	05/12/16 15:30	05/13/16 10:26	EPA 200.8	
Metals (Dissolved) by EPA 200 Series Methods								**FILT**
Iron, dissolved	ND mg/L	0.10	1	AE63518	05/12/16 15:11	05/12/16 15:44	EPA 200.7	
Manganese, dissolved	**0.99 mg/L**	**0.020**	1	AE63518	05/12/16 15:11	05/12/16 15:44	EPA 200.7	
Metals (Dissolved) by EPA Method 200.8 ICP/MS								**FILT**
Arsenic, dissolved	**41 ug/L**	**0.40**	1	AE63517	05/12/16 14:15	05/13/16 10:39	EPA 200.8	
EWS-5-11-15:38 (16E1210-02)		**Sample Type: Water**			**Sampled: 05/11/16 15:38**			
Metals (Dissolved) by EPA 200 Series Methods								**FILT**
Iron, dissolved	ND mg/L	0.10	1	AE63518	05/12/16 15:11	05/12/16 15:49	EPA 200.7	
Manganese, dissolved	**0.97 mg/L**	**0.020**	1	AE63518	05/12/16 15:11	05/12/16 15:49	EPA 200.7	
Metals (Dissolved) by EPA Method 200.8 ICP/MS								**FILT**
Arsenic, dissolved	**38 ug/L**	**0.40**	1	AE63517	05/12/16 14:15	05/13/16 10:46	EPA 200.8	

Metals by EPA 200 Series Methods - Quality Control

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Batch AE63520 - EPA 200 Series										
Blank (AE63520-BLK1)				Prepared & Analyzed: 05/11/16						
Iron	ND	0.10	mg/L							
Manganese	ND	0.020	mg/L							
LCS (AE63520-BS1)				Prepared & Analyzed: 05/11/16						
Iron	2.18	0.10	mg/L	2.00		109	85-115			
Manganese	0.213	0.020	mg/L	0.200		107	85-115			
Duplicate (AE63520-DUP1)	**Source: 16E0995-02**			Prepared & Analyzed: 05/11/16						
Iron	1.18	0.10	mg/L		1.06			11.2	20	
Manganese	0.995	0.020	mg/L		1.02			2.29	20	
Matrix Spike (AE63520-MS1)	**Source: 16E0995-02**			Prepared & Analyzed: 05/11/16						
Iron	3.22	0.10	mg/L	2.00	1.06	108	70-130			
Manganese	1.20	0.020	mg/L	0.200	1.02	93.3	70-130			
Matrix Spike Dup (AE63520-MSD1)	**Source: 16E0995-02**			Prepared & Analyzed: 05/11/16						
Iron	3.12	0.10	mg/L	2.00	1.06	103	70-130	3.35	20	
Manganese	1.20	0.020	mg/L	0.200	1.02	89.7	70-130	0.588	20	

Metals by EPA Method 200.8 ICP/MS - Quality Control

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Batch AE63373 - EPA 200 Series										
Blank (AE63373-BLK1)				Prepared: 05/09/16 Analyzed: 05/13/16						
Arsenic	ND	0.40	ug/L							
LCS (AE63373-BS1)				Prepared: 05/09/16 Analyzed: 05/13/16						
Arsenic	21.5	0.40	ug/L	20.0		107	85-115			
Duplicate (AE63373-DUP1)	**Source: 16E0543-21**			Prepared: 05/09/16 Analyzed: 05/13/16						
Arsenic	ND	2.0	ug/L		ND			10.1	20	
Matrix Spike (AE63373-MS1)	**Source: 16E0543-21**			Prepared: 05/09/16 Analyzed: 05/13/16						
Arsenic	108	2.0	ug/L	100	ND	107	70-130			
Matrix Spike Dup (AE63373-MSD1)	**Source: 16E0543-21**			Prepared: 05/09/16 Analyzed: 05/13/16						
Arsenic	110	2.0	ug/L	100	ND	109	70-130	1.83	20	

Town Of Windsor - Drinking Water	Project Manager: Elizabeth Cargay	
8400 Windsor Rd.	Project: Esposti Potable Well	Reported:
Windsor, CA 95492-0100	Project Number: [none]	05/13/16 11:31

Metals (Dissolved) by EPA 200 Series Methods - Quality Control

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Batch AE63518 - EPA 200 Series										
Blank (AE63518-BLK1)				Prepared & Analyzed: 05/11/16						
Iron, dissolved	ND	0.10	mg/L							
Manganese, dissolved	ND	0.020	mg/L							
LCS (AE63518-BS1)				Prepared & Analyzed: 05/11/16						
Iron, dissolved	2.16	0.10	mg/L	2.00		108	85-115			
Manganese, dissolved	0.212	0.020	mg/L	0.200		106	85-115			
Duplicate (AE63518-DUP1)	**Source: 16E0997-02**			Prepared & Analyzed: 05/11/16						
Iron, dissolved	ND	0.10	mg/L		ND				20	
Manganese, dissolved	0.928	0.020	mg/L		0.937			0.958	20	
Matrix Spike (AE63518-MS1)	**Source: 16E0997-02**			Prepared & Analyzed: 05/11/16						
Iron, dissolved	2.19	0.10	mg/L	2.00	ND	109	70-130			
Manganese, dissolved	1.08	0.020	mg/L	0.200	0.937	70.1	70-130			
Matrix Spike Dup (AE63518-MSD1)	**Source: 16E0997-02**			Prepared & Analyzed: 05/11/16						
Iron, dissolved	2.31	0.10	mg/L	2.00	ND	116	70-130	5.56	20	
Manganese, dissolved	1.10	0.020	mg/L	0.200	0.937	79.0	70-130	1.64	20	

Metals (Dissolved) by EPA Method 200.8 ICP/MS - Quality Control

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Batch AE63517 - EPA 200 Series										
Blank (AE63517-BLK1)				Prepared & Analyzed: 05/11/16						
Arsenic, dissolved	ND	0.40	ug/L							
LCS (AE63517-BS1)				Prepared & Analyzed: 05/11/16						
Arsenic, dissolved	20.3	0.40	ug/L	20.0		102	85-115			
Duplicate (AE63517-DUP1)		**Source: 16E0997-01**		Prepared & Analyzed: 05/11/16						
Arsenic, dissolved	25.7	0.40	ug/L		25.6			0.443	20	
Matrix Spike (AE63517-MS1)		**Source: 16E0997-01**		Prepared & Analyzed: 05/11/16						
Arsenic, dissolved	48.0	0.40	ug/L	20.0	25.6	112	70-130			
Matrix Spike Dup (AE63517-MSD1)		**Source: 16E0997-01**		Prepared & Analyzed: 05/11/16						
Arsenic, dissolved	48.2	0.40	ug/L	20.0	25.6	113	70-130	0.268	20	

Notes and Definitions

FILT	The sample was filtered in the lab prior to analysis.
P-02	Sample was received with insufficient preservative. Sample was preserved and allowed to sit 24 hours before further processing.
ND	Analyte NOT DETECTED at or above the reporting limit
dry	Sample results reported on a dry weight basis
REC	Recovery
RPD	Relative Percent Difference

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Work Order
Chain of Custody Record

~3.0

Lab No. 16E1210 Page_____of_____

Name: Town of Windsor - Drinking Water

Mailing Address:
9291 Old Redwood Highway Building 400
Windsor, CA 95492

Project Contact (Hardcopy or PDF to):
Elizabeth Cargay
ecargay@townofwindsor.com
Kent O'Brien
kent.obrien@ghd.com

Project ID: Esposti Potable Well

Phase:

PO#

Bill to: month end billing

Signature below authorizes work under terms stated on reverse side.

Field Sampler - Print Name & Signature

Analysis Request

Sample Identification	Sample Collection Date	Sample Collection Time	Container: 40ml VOA	Poly	Amber	Glass		Preservative: Na2S2O3	HNO3	NH4Cl	Other	None	Matrix: Water	Soil		200.8 As (Dissolved)	200.7 Fe (Dissolved)	200.7 Mn (Dissolved)	200.8 Cr (Dissolved)	218.6 Cr6 (Dissolved)	200.7 Ca, Mg, K, Na (Dissolved)	Alkalinity	Chloride	Nitrate as N, Nitrite as N	Sulfate	Total Nitrogen (includes TKN, NO2, NO3)	Silica	200.8 Vanadium - total	Phosphate	CAM 17	TPH G, BTEX, D/MO	6010 As STLC	Title 22 Scan (**Below List)	TAT
EWS-5-11-16:42	5/11	16:42		X								X	X			X	X	X																Total & Dissolved (Both)
EWS-5-11-15:38	5/11	15:38		X								X	X			X	X	X																Filtered Fix (dissolved)

TAT:
- 24 hr ☒
- 48 hr ○
- Lab Approval Required
- 1 wk ○
- 2 wk (standard) ○

Lab Approval Required For Rush

**Title 22 Scan

64432 Primary Inorganics, 64432.1 NO2/NO3, 64449 A&B
Asbestos, Perchlorate, Gross Alpha, 504.1, 507, 508, 515.1,
524.2, 531.1, 548.1, 549.2

Relinquished by:	Received by:	Date	Time
	Dot Gialdini	5/12/16	11:00
Dot Gialdini		11	1415

CDPH Write On EDT Report? Yes ○ No ○

State System Number:

CA Geotracker EDF Report Yes ○ No ○

Sampling Company Log Code:

Global ID: EDF to (Email Address):

Travel and Site Time: Mileage: Misc. Supplies:

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Central Valley: 9090 Union Park Way, Suite 113, Elk Grove, CA 95624 • Phone: (916) 686-5190 • Fax: (916) 686-5192

ELAP Certificates 1551, 2728, and 2922

18 May 2016

Town Of Windsor - Drinking Water
Attn: Elizabeth Cargay
8400 Windsor Rd.
Windsor, CA 95492-0100
RE: Esposti Potable Well
Work Order: 16E1515

Enclosed are the results of analyses for samples received by the laboratory on 05/17/16 15:15. If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Jeanette Poplin

Jeanette L. Poplin For Robbie C. Phillips
Project Manager

Town Of Windsor - Drinking Water
8400 Windsor Rd.
Windsor, CA 95492-0100

Project Manager: Elizabeth Cargay
Project: Esposti Potable Well
Project Number: [none]

Reported:
05/18/16 16:44

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
ESW-5-17-04:00	16E1515-01	Water	05/17/16 04:00	05/17/16 15:15

Town Of Windsor - Drinking Water	Project Manager: Elizabeth Cargay	
8400 Windsor Rd.	Project: Esposti Potable Well	Reported:
Windsor, CA 95492-0100	Project Number: [none]	05/18/16 16:44

	Result	Reporting Limit	Dilution	Batch	Prepared	Analyzed	Method	Note
ESW-5-17-04:00 (16E1515-01)		**Sample Type: Water**			**Sampled: 05/17/16 04:00**			
Metals by EPA 200 Series Methods								**P-02**
Iron	ND mg/L	0.10	1	AE63520	05/18/16 07:30	05/18/16 11:15	EPA 200.7	
Manganese	**0.88 mg/L**	**0.020**	1	AE63520	05/18/16 07:30	05/18/16 11:15	EPA 200.7	
Metals by EPA Method 200.8 ICP/MS								**P-02**
Arsenic	**53 ug/L**	**0.40**	1	AE63743	05/18/16 07:46	05/18/16 10:57	EPA 200.8	

Town Of Windsor - Drinking Water	Project Manager: Elizabeth Cargay	
8400 Windsor Rd.	Project: Esposti Potable Well	Reported:
Windsor, CA 95492-0100	Project Number: [none]	05/18/16 16:44

Metals by EPA 200 Series Methods - Quality Control

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Batch AE63520 - EPA 200 Series										
Blank (AE63520-BLK1)				Prepared & Analyzed: 05/11/16						
Iron	ND	0.10	mg/L							
Manganese	ND	0.020	mg/L							
LCS (AE63520-BS1)				Prepared & Analyzed: 05/11/16						
Iron	2.18	0.10	mg/L	2.00		109	85-115			
Manganese	0.213	0.020	mg/L	0.200		107	85-115			
Duplicate (AE63520-DUP1)	**Source: 16E0995-02**			Prepared & Analyzed: 05/11/16						
Iron	1.18	0.10	mg/L		1.06			11.2	20	
Manganese	0.995	0.020	mg/L		1.02			2.29	20	
Matrix Spike (AE63520-MS1)	**Source: 16E0995-02**			Prepared & Analyzed: 05/11/16						
Iron	3.22	0.10	mg/L	2.00	1.06	108	70-130			
Manganese	1.20	0.020	mg/L	0.200	1.02	93.3	70-130			
Matrix Spike Dup (AE63520-MSD1)	**Source: 16E0995-02**			Prepared & Analyzed: 05/11/16						
Iron	3.12	0.10	mg/L	2.00	1.06	103	70-130	3.35	20	
Manganese	1.20	0.020	mg/L	0.200	1.02	89.7	70-130	0.588	20	

Metals by EPA Method 200.8 ICP/MS - Quality Control

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Batch AE63743 - EPA 200 Series										
Blank (AE63743-BLK1)				Prepared & Analyzed: 05/18/16						
Arsenic	ND	0.40	ug/L							
LCS (AE63743-BS1)				Prepared & Analyzed: 05/18/16						
Arsenic	21.6	0.40	ug/L	20.0		108	85-115			
Duplicate (AE63743-DUP1)		**Source: 16E1515-01**		Prepared & Analyzed: 05/18/16						
Arsenic	53.7	0.40	ug/L		52.5			2.17	20	
Matrix Spike (AE63743-MS1)		**Source: 16E1515-01**		Prepared & Analyzed: 05/18/16						
Arsenic	75.8	0.40	ug/L	20.0	52.5	116	70-130			
Matrix Spike Dup (AE63743-MSD1)		**Source: 16E1515-01**		Prepared & Analyzed: 05/18/16						
Arsenic	75.5	0.40	ug/L	20.0	52.5	115	70-130	0.314	20	

Notes and Definitions

P-02	Sample was received with insufficient preservative. Sample was preserved and allowed to sit 24 hours before further processing.
ND	Analyte NOT DETECTED at or above the reporting limit
dry	Sample results reported on a dry weight basis
REC	Recovery
RPD	Relative Percent Difference

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Central Valley Laboratory
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916-686-5190 F) 916-686-5192

Work Order
Chain of Custody Record

Lab No. 16E1515 Page 1 of 1

2.1

Name: Town of Windsor - Drinking Water
Mailing Address: 9291 Old Redwood Highway Building 400
Windsor, CA 95492
Project Contact (Hardcopy or PDF to): Elizabeth Cargay
ecargay@townofwindsor.com
Kent O'Brien
kent.obrien@ghd.com

Project ID: Source Chemical
Phase: Esposti Well
PO# 200336
Bill to: month end billing

Field Sampler - Print Name & Signature

Signature below authorizes work under terms stated on reverse side.

Analysis Request

TAT see note
24 hr [✓] 48 hr ○ Lab Approval Required 1 wk ○ 2 wk (standard) ☒
Lab Approval Required For Rush

Sample Identification	Date	Time	40ml VOA	Poly	Amber	Glass	HCL	HNO3	NH4Cl	Other	None	Water	Soil	200.8 As	200.7 Fe	200.7 Mn	200.8 Cr	218.6 Cr6	200.7 Ca, Mg, K, Na	Alkalinity	Chloride	Nitrate as N, Nitrite as N	Sulfate	Total Nitrogen (includes TKN, NO2, NO3)	Silica	200.8 Vanadium - total	Phosphate	~~Title 22 Scan (**Below List)~~	TAT
ESW-5-16-13:00	5/16	13:00		X							X	X		X	X	X												*	↑
ESW-5-16-18:00	5/16	18:00		X							X	X		X	X	X												*	Preserve in
ESW-5-16-24:00	5/16	24:00		X							X	X		X	X	X												*	lab ↓
ESW-5-17-04:00	5/17	0400		X							X	X		X	X	X													
																												*	msp w/o

TAT standard

24-hr

**Title 22 Scan

64432 Primary Inorganics, 64432.1 NO2/NO3, 64449 A&B
Asbestos, Perchlorate, Gross Alpha, 504.1, 507, 508, 515.1,
524.2, 531.1, 548.1, 549.2

Relinquished by	Received by	Date	Time
		5/17/16	1315
		5/17/16	1515

CDPH Write On EDT Report? Yes ☒ No ○
State System Number:
CA Geotracker EDF Report Yes ○ No ○
~~Sampling Company Log Code:~~
Global ID: EDF to (Email Address):
Travel and Site Time: Mileage: Misc. Supplies:

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ELAP Certificates 1551, 2728, and 2922

01 June 2016

Town Of Windsor - Drinking Water
Attn: Elizabeth Cargay
8400 Windsor Rd.
Windsor, CA 95492-0100
RE: Esposti Potable Well
Work Order: 16E1580

Enclosed are the results of analyses for samples received by the laboratory on 05/17/16 15:15. If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Robin Edens

Robin C. Edens For Robbie C. Phillips
Project Manager

Town Of Windsor - Drinking Water
8400 Windsor Rd.
Windsor, CA 95492-0100

Project Manager: Elizabeth Cargay
Project: Esposti Potable Well
Project Number: [none]

Reported:
06/01/16 10:45

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
ESW-5-16-13:00	16E1580-01	Water	05/16/16 13:00	05/17/16 15:15
ESW-5-16-18:00	16E1580-02	Water	05/16/16 18:00	05/17/16 15:15
ESW-5-16-24:00	16E1580-03	Water	05/17/16 00:00	05/17/16 15:15

Town Of Windsor - Drinking Water
8400 Windsor Rd.
Windsor, CA 95492-0100

Project Manager: Elizabeth Cargay
Project: Esposti Potable Well
Project Number: [none]

Reported:
06/01/16 10:45

	Result		Reporting Limit	Dilution	Batch	Prepared	Analyzed	Method	Note
ESW-5-16-13:00 (16E1580-01)			**Sample Type: Water**			**Sampled: 05/16/16 13:00**			
Metals by EPA 200 Series Methods									
Iron	**0.10**	**mg/L**	**0.10**	1	AE64055	05/25/16 12:54	05/26/16 11:40	EPA 200.7	
Manganese	**0.88**	**mg/L**	**0.020**	1	AE64055	05/25/16 12:54	05/26/16 11:40	EPA 200.7	
Metals by EPA Method 200.8 ICP/MS									
Arsenic	**44**	**ug/L**	**0.50**	1	AE64103	05/26/16 14:54	05/28/16 01:01	EPA 200.8	
ESW-5-16-18:00 (16E1580-02)			**Sample Type: Water**			**Sampled: 05/16/16 18:00**			
Metals by EPA 200 Series Methods									
Iron	ND	mg/L	0.10	1	AE64055	05/25/16 12:54	05/26/16 14:42	EPA 200.7	
Manganese	**0.87**	**mg/L**	**0.020**	1	AE64055	05/25/16 12:54	05/26/16 14:42	EPA 200.7	
Metals by EPA Method 200.8 ICP/MS									
Arsenic	**49**	**ug/L**	**0.50**	1	AE64103	05/26/16 14:54	05/31/16 12:03	EPA 200.8	
ESW-5-16-24:00 (16E1580-03)			**Sample Type: Water**			**Sampled: 05/17/16 00:00**			
Metals by EPA 200 Series Methods									
Iron	**0.11**	**mg/L**	**0.10**	1	AE64055	05/25/16 12:54	05/26/16 14:48	EPA 200.7	
Manganese	**0.85**	**mg/L**	**0.020**	1	AE64055	05/25/16 12:54	05/26/16 14:48	EPA 200.7	
Metals by EPA Method 200.8 ICP/MS									
Arsenic	**52**	**ug/L**	**0.50**	1	AE64103	05/26/16 14:54	05/31/16 12:11	EPA 200.8	

Metals by EPA 200 Series Methods - Quality Control

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Batch AE64055 - Metals Digest										
Blank (AE64055-BLK1)				Prepared: 05/25/16 Analyzed: 05/26/16						
Iron	ND	0.10	mg/L							
Manganese	ND	0.020	mg/L							
LCS (AE64055-BS1)				Prepared: 05/25/16 Analyzed: 05/26/16						
Iron	1.96	0.10	mg/L	2.00		98.0	85-115			
Manganese	0.191	0.020	mg/L	0.200		95.4	85-115			
Duplicate (AE64055-DUP1)	**Source: 16E1580-01**			Prepared: 05/25/16 Analyzed: 05/26/16						
Iron	0.102	0.10	mg/L		ND			2.08	20	
Manganese	0.891	0.020	mg/L		0.882			1.01	20	
Matrix Spike (AE64055-MS1)	**Source: 16E1580-01**			Prepared: 05/25/16 Analyzed: 05/26/16						
Iron	1.97	0.10	mg/L	2.00	ND	93.3	70-130			
Manganese	1.06	0.020	mg/L	0.200	0.882	90.0	70-130			
Matrix Spike (AE64055-MS2)	**Source: 16E1981-02**			Prepared: 05/25/16 Analyzed: 05/26/16						
Iron	2.09	0.10	mg/L	2.00	0.110	99.2	70-130			
Manganese	0.223	0.020	mg/L	0.200	0.0252	99.0	70-130			
Matrix Spike Dup (AE64055-MSD1)	**Source: 16E1580-01**			Prepared: 05/25/16 Analyzed: 05/26/16						
Iron	1.90	0.10	mg/L	2.00	ND	90.0	70-130	3.43	20	
Manganese	1.06	0.020	mg/L	0.200	0.882	86.9	70-130	0.589	20	

Metals by EPA Method 200.8 ICP/MS - Quality Control

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Batch AE64103 - EPA 200.8										
Blank (AE64103-BLK1)				Prepared: 05/26/16 Analyzed: 05/27/16						
Arsenic	ND	0.50	ug/L							
LCS (AE64103-BS1)				Prepared: 05/26/16 Analyzed: 05/27/16						
Arsenic	21.5	0.50	ug/L	20.0		107	85-115			
Duplicate (AE64103-DUP1)	**Source: 16E1994-01**			Prepared: 05/26/16 Analyzed: 05/27/16						
Arsenic	ND	2.0	ug/L		ND				20	R-01

Notes and Definitions

R-01	The Reporting Limit for this analyte has been raised to account for matrix interference.
ND	Analyte NOT DETECTED at or above the reporting limit
dry	Sample results reported on a dry weight basis
REC	Recovery
RPD	Relative Percent Difference

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Work Order
Chain of Custody Record

Lab No. 16E1580

Page 1 of 1

2.1

Name: Town of Windsor - Drinking Water

Mailing Address: 9291 Old Redwood Highway Building 400
Windsor, CA 95492

Project Contact (Hardcopy or PDF to): Elizabeth Cargay
ecargay@townofwindsor.com
Kent O'Brien
kent.obrien@ghd.com

Project ID: Source Chemical

Phase: Esposti Well

PO# 200336

Bill to: month end billing

Field Sampler - Print Name & Signature:

Signature below authorizes work under terms stated on reverse side.

Analysis Request

TAT: see note
24 hr [✓] 48 hr ○
Lab Approval Required
1 wk ○
2 wk (standard) ☒
Lab Approval Required For Rush

Sample Identification	Sample Collection		Container				Preservative					Matrix																	
	Date	Time	40ml VOA	Poly	Amber	Glass	HCL	HNO3	NH4Cl	Other	None	Water	Soil	200.8 As	200.7 Fe	200.7 Mn	200.8 Cr	218.6 Cr6	200.7 Ca, Mg, K, Na	Alkalinity	Chloride	Nitrate as N, Nitrite as N	Sulfate	Total Nitrogen (includes TKN, NO2, NO3)	Silica	200.8 Vanadium - total	Phosphate	~~Title 22 Scan (**Below List)~~ cm	TAT
ESW-5-16-13:00	5/16	13:00		X							X	X		X	X	X													↑
ESW-5-16-18:00	5/16	18:00		X							X	X		X	X	X													Preserve in
ESW-5-16-24:00	5/16	24:00		X							X	X		X	X	X													lab ↓
ESW-5-17-04:00	5/17	0400		X							X	X		X	X	X												*	

TAT standard
24-hr

* on sep w/o cm

**Title 22 Scan

64432 Primary Inorganics, 64432.1 NO2/NO3, 64449 A&B
Asbestos, Perchlorate, Gross Alpha, 504.1, 507, 508, 515.1,
524.2, 531.1, 548.1, 549.2

Relinquished by	Received by	Date	Time
		5/17/16	1315
		5/17/16	1515

CDPH Write On EDT Report? Yes [✓ No]

State System Number:

CA Geotracker EDF Report Yes ○ No ○

Sampling Company Log Code:

Global ID:

EDF to (Email Address):

Travel and Site Time:

Mileage:

Misc. Supplies:

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ELAP Certificates 1551, 2728, and 2922

03 June 2016

Town Of Windsor - Drinking Water
Attn: Elizabeth Cargay
8400 Windsor Rd.
Windsor, CA 95492-0100
RE: Esposti Potable Well
Work Order: 16E1535

Enclosed are the results of analyses for samples received by the laboratory on 05/17/16 15:15. If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Chelsea L Sandelin

Chelsea L. Sandelin For Robbie C. Phillips
Project Manager

Town Of Windsor - Drinking Water
8400 Windsor Rd.
Windsor, CA 95492-0100

Project Manager: Elizabeth Cargay
Project: Esposti Potable Well
Project Number: 4910017 / Esposti Well

Reported:
06/03/16 16:35

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
ESW-5-17-10:00	16E1535-01	Water	05/17/16 10:00	05/17/16 15:15

Town Of Windsor - Drinking Water	Project Manager: Elizabeth Cargay	
8400 Windsor Rd.	Project: Esposti Potable Well	Reported:
Windsor, CA 95492-0100	Project Number: 4910017 / Esposti Well	06/03/16 16:35

	Result	Reporting Limit	Dilution	Batch	Prepared	Analyzed	Method	Note
ESW-5-17-10:00 (16E1535-01)		**Sample Type: Water**			**Sampled: 05/17/16 10:00**			
Metals (Drinking Water) by EPA 200 Series Methods								
Calcium	**22 mg/L**	**1.0**	1	AE64104	05/26/16 15:05	05/27/16 15:08	EPA 200.7	
Iron	ND ug/L	100	1	AE64104	05/26/16 15:05	05/27/16 15:08	EPA 200.7	
Magnesium	**16 mg/L**	**1.0**	1	AE64104	05/26/16 15:05	05/27/16 15:08	EPA 200.7	
Mercury	ND ug/L	1.0	1	AE64068	05/26/16 05:57	05/26/16 12:30	EPA 245.1	
Sodium	**53 mg/L**	**1.0**	1	AE64104	05/26/16 15:05	05/27/16 15:08	EPA 200.7	
Metals by EPA 200 Series Methods								
Chromium, hexavalent	ND ug/L	1.0	1	AE63824	05/19/16 20:55	05/19/16 20:55	EPA 218.6	
Metals by EPA Method 200.8 ICP/MS								
Aluminum	ND ug/L	50	4	AE64054	05/25/16 12:49	05/26/16 11:53	EPA 200.8	
Antimony	ND ug/L	6.0	4	AE64054	05/25/16 12:49	05/26/16 11:53	EPA 200.8	
Arsenic	**57 ug/L**	**2.0**	4	AE64054	05/25/16 12:49	05/26/16 11:53	EPA 200.8	
Barium	**150 ug/L**	**100**	4	AE64054	05/25/16 12:49	05/26/16 11:53	EPA 200.8	
Beryllium	ND ug/L	1.0	4	AE64054	05/25/16 12:49	05/26/16 11:53	EPA 200.8	
Cadmium	ND ug/L	1.0	4	AE64054	05/25/16 12:49	05/26/16 11:53	EPA 200.8	
Chromium	ND ug/L	10	4	AE64054	05/25/16 12:49	05/26/16 11:53	EPA 200.8	
Copper	ND ug/L	50	4	AE64054	05/25/16 12:49	05/26/16 11:53	EPA 200.8	
Lead	ND ug/L	5.0	4	AE64054	05/25/16 12:49	05/26/16 11:53	EPA 200.8	
Manganese	**860 ug/L**	**20**	4	AE64054	05/25/16 12:49	05/26/16 11:53	EPA 200.8	
Nickel	ND ug/L	10	4	AE64054	05/25/16 12:49	05/26/16 11:53	EPA 200.8	
Selenium	ND ug/L	5.0	4	AE64054	05/25/16 12:49	05/26/16 11:53	EPA 200.8	
Silver	ND ug/L	10	4	AE64054	05/25/16 12:49	05/26/16 11:53	EPA 200.8	
Thallium	ND ug/L	1.0	4	AE64054	05/25/16 12:49	05/26/16 11:53	EPA 200.8	
Uranium	ND pCi/l	1.0	4	AE64054	05/25/16 12:49	05/26/16 11:53	EPA 200.8	
Vanadium	ND ug/L	3.0	4	AE64054	05/25/16 12:49	05/26/16 11:53	EPA 200.8	
Zinc	ND ug/L	50	4	AE64054	05/25/16 12:49	05/26/16 11:53	EPA 200.8	

	Result	Reporting Limit	Dilution	Batch	Prepared	Analyzed	Method	Note
ESW-5-17-10:00 (16E1535-01)		**Sample Type: Water**			**Sampled: 05/17/16 10:00**			
Conventional Chemistry Parameters by APHA/EPA Methods								
Aggressive Index	**11.68 NU**	**2.00**	1	AE64104	05/26/16 15:05	05/31/16 13:55	AWWA	
Ammonia as NH3	ND mg/L	0.50	1	AE63917	05/23/16 08:13	05/23/16 17:00	SM4500NH3C	
Bicarbonate	**270 mg/L**	**5.0**	1	AE63838	05/23/16 10:00	05/23/16 12:08	SM2320B	
Carbonate	ND mg/L	5.0	1	AE63838	05/23/16 10:00	05/23/16 12:08	SM2320B	
Color	ND CU	5.0	1	AE63720	05/18/16 09:40	05/18/16 09:40	SM2120B	
Hydroxide	ND mg/L	5.0	1	AE63838	05/23/16 10:00	05/23/16 12:08	SM2320B	
MBAS, calculated as LAS, mw 340	ND mg/L	0.050	1	AE63736	05/19/16 10:00	05/20/16 16:00	SM5540C	
Odor	ND T.O.N.	1.0	1	AE63720	05/18/16 09:15	05/18/16 09:15	EPA 140.1	
Perchlorate	ND ug/L	4.0	1	AE63921	05/23/16 17:34	05/23/16 17:34	EPA 314.0	
pH	**7.60 pH Units**	**1.68**	1	AE63882	05/18/16 17:00	05/18/16 17:00	SM4500-H+ B	T-14
Phosphate, Total	**1.4 mg/L**	**0.20**	2	AE63977	05/24/16 08:00	05/24/16 12:10	SM4500-P E	
Specific Conductance (EC)	**520 umhos/cm**	**20**	1	AE63882	05/18/16 17:00	05/18/16 17:00	SM2510B	
Sulfide	ND mg/L	0.10	1	AE63936	05/23/16 13:30	05/23/16 15:00	SM4500SD	
Total Dissolved Solids	**350 mg/L**	**10**	1	AE63820	05/19/16 09:07	05/23/16 09:22	SM2540C	
Turbidity	**0.26 NTU**	**0.10**	1	AE63882	05/18/16 17:00	05/18/16 17:00	SM2130B	
Silica	**50 mg/L**	**5.0**	5	AE63850	05/19/16 14:00	05/19/16 16:00	SM4500-SiO2 C	
Total Alkalinity as CaCO3	**220 mg/L**	**5.0**	1	AE63838	05/23/16 10:00	05/23/16 12:08	SM2320B	
Hardness, Total	**120 mg/L**	**5**	1	AE64104	05/26/16 15:05	05/27/16 15:08	SM2340B	
Miscellaneous Physical/Conventional Chemistry Parameters								
Cyanide (total)	ND mg/L	0.10	1	AE64032	05/25/16 16:00	05/26/16 10:55	10-204-00-1X	
Anions by EPA Method 300.0								
Chloride	**21 mg/L**	**0.50**	1	AE63804	05/18/16 19:56	05/18/16 19:56	EPA 300.0	
Fluoride	**0.15 mg/L**	**0.10**	1	AE63804	05/18/16 19:56	05/18/16 19:56	EPA 300.0	
Nitrate as N	ND mg/L	0.40	1	AE63804	05/18/16 19:40	05/18/16 19:40	EPA 300.0	
Nitrite as N	ND mg/L	0.40	1	AE63804	05/18/16 19:56	05/18/16 19:56	EPA 300.0	
Sulfate as SO4	**14 mg/L**	**0.50**	1	AE63804	05/18/16 19:56	05/18/16 19:56	EPA 300.0	

	Result	Reporting Limit	Dilution	Batch	Prepared	Analyzed	Method	Note
ESW-5-17-10:00 (16E1535-01)		**Sample Type: Water**			**Sampled: 05/17/16 10:00**			
Volatile Organic Compounds by EPA Method 524.2								
Benzene	ND ug/L	0.50	1	AE64140	05/27/16 12:18	05/27/16 22:06	EPA 524.2	
Carbon tetrachloride	ND ug/L	0.50	1	AE64140	05/27/16 12:18	05/27/16 22:06	EPA 524.2	
Chlorobenzene	ND ug/L	0.50	1	AE64140	05/27/16 12:18	05/27/16 22:06	EPA 524.2	
1,2-Dichlorobenzene	ND ug/L	0.50	1	AE64140	05/27/16 12:18	05/27/16 22:06	EPA 524.2	
1,4-Dichlorobenzene	ND ug/L	0.50	1	AE64140	05/27/16 12:18	05/27/16 22:06	EPA 524.2	
1,1-Dichloroethane	ND ug/L	0.50	1	AE64140	05/27/16 12:18	05/27/16 22:06	EPA 524.2	
1,2-Dichloroethane	ND ug/L	0.50	1	AE64140	05/27/16 12:18	05/27/16 22:06	EPA 524.2	
1,1-Dichloroethene	ND ug/L	0.50	1	AE64140	05/27/16 12:18	05/27/16 22:06	EPA 524.2	
cis-1,2-Dichloroethene	ND ug/L	0.50	1	AE64140	05/27/16 12:18	05/27/16 22:06	EPA 524.2	
trans-1,2-Dichloroethene	ND ug/L	0.50	1	AE64140	05/27/16 12:18	05/27/16 22:06	EPA 524.2	
1,2-Dichloropropane	ND ug/L	0.50	1	AE64140	05/27/16 12:18	05/27/16 22:06	EPA 524.2	
1,3-Dichloropropene (total)	ND ug/L	0.50	1	AE64140	05/27/16 12:18	05/27/16 22:06	EPA 524.2	
Ethylbenzene	ND ug/L	0.50	1	AE64140	05/27/16 12:18	05/27/16 22:06	EPA 524.2	
Methyl tert-butyl ether	ND ug/L	3.0	1	AE64140	05/27/16 12:18	05/27/16 22:06	EPA 524.2	
Methylene chloride	ND ug/L	0.50	1	AE64140	05/27/16 12:18	05/27/16 22:06	EPA 524.2	
Styrene	ND ug/L	0.50	1	AE64140	05/27/16 12:18	05/27/16 22:06	EPA 524.2	
1,1,2,2-Tetrachloroethane	ND ug/L	0.50	1	AE64140	05/27/16 12:18	05/27/16 22:06	EPA 524.2	
Tetrachloroethene	ND ug/L	0.50	1	AE64140	05/27/16 12:18	05/27/16 22:06	EPA 524.2	
Toluene	ND ug/L	0.50	1	AE64140	05/27/16 12:18	05/27/16 22:06	EPA 524.2	
1,2,4-Trichlorobenzene	ND ug/L	0.50	1	AE64140	05/27/16 12:18	05/27/16 22:06	EPA 524.2	
1,1,1-Trichloroethane	ND ug/L	0.50	1	AE64140	05/27/16 12:18	05/27/16 22:06	EPA 524.2	
1,1,2-Trichloroethane	ND ug/L	0.50	1	AE64140	05/27/16 12:18	05/27/16 22:06	EPA 524.2	
Trichloroethene	ND ug/L	0.50	1	AE64140	05/27/16 12:18	05/27/16 22:06	EPA 524.2	
Trichlorofluoromethane	ND ug/L	5.0	1	AE64140	05/27/16 12:18	05/27/16 22:06	EPA 524.2	
Trichlorotrifluoroethane	ND ug/L	10	1	AE64140	05/27/16 12:18	05/27/16 22:06	EPA 524.2	
Vinyl chloride	ND ug/L	0.50	1	AE64140	05/27/16 12:18	05/27/16 22:06	EPA 524.2	
Xylenes (total)	ND ug/L	0.50	1	AE64140	05/27/16 12:18	05/27/16 22:06	EPA 524.2	
Surrogate: Bromofluorobenzene	*94.1 %*	*70-130*		*AE64140*	*05/27/16 12:18*	*05/27/16 22:06*	*EPA 524.2*	
Surrogate: Dibromofluoromethane	*78.0 %*	*70-130*		*AE64140*	*05/27/16 12:18*	*05/27/16 22:06*	*EPA 524.2*	
Surrogate: Toluene-d8	*89.2 %*	*70-130*		*AE64140*	*05/27/16 12:18*	*05/27/16 22:06*	*EPA 524.2*	

	Result	Reporting Limit	Dilution	Batch	Prepared	Analyzed	Method	Note
ESW-5-17-10:00 (16E1535-01)		**Sample Type: Water**			**Sampled: 05/17/16 10:00**			
Nitrogen- and Phosphorus- Pesticides by EPA Method 507								
Alachlor	ND ug/L	1.0	1	AE64018	05/24/16 14:02	05/28/16 07:01	EPA 507	
Atrazine	ND ug/L	0.50	1	AE64018	05/24/16 14:02	05/28/16 07:01	EPA 507	
Molinate	ND ug/L	2.0	1	AE64018	05/24/16 14:02	05/28/16 07:01	EPA 507	
Simazine	ND ug/L	1.0	1	AE64018	05/24/16 14:02	05/28/16 07:01	EPA 507	
Thiobencarb	ND ug/L	1.0	1	AE64018	05/24/16 14:02	05/28/16 07:01	EPA 507	
Surrogate: 1,3-Dimethyl-2-nitrobenzene	*88.1 %*	*70-130*		*AE64018*	*05/24/16 14:02*	*05/28/16 07:01*	*EPA 507*	
Organic Analytes by EPA Method 504.1								
1,2-Dibromo-3-chloropropane	ND ug/L	0.010	1	AE63739	05/18/16 07:30	05/19/16 07:38	EPA 504.1	
1,2-Dibromoethane (EDB)	ND ug/L	0.020	1	AE63739	05/18/16 07:30	05/19/16 07:38	EPA 504.1	
Chlorinated Acids by EPA Method 515.1								
Bentazon	ND ug/L	2.0	1	AE64076	05/26/16 07:26	05/28/16 20:49	EPA 515.1	
2,4-D	ND ug/L	10	1	AE64076	05/26/16 07:26	05/28/16 20:49	EPA 515.1	
Dalapon	ND ug/L	10	1	AE64076	05/26/16 07:26	05/28/16 20:49	EPA 515.1	
Dinoseb	ND ug/L	2.0	1	AE64076	05/26/16 07:26	05/28/16 20:49	EPA 515.1	
Pentachlorophenol	ND ug/L	0.20	1	AE64076	05/26/16 07:26	05/28/16 20:49	EPA 515.1	
Picloram	ND ug/L	1.0	1	AE64076	05/26/16 07:26	05/28/16 20:49	EPA 515.1	
2,4,5-TP (Silvex)	ND ug/L	1.0	1	AE64076	05/26/16 07:26	05/28/16 20:49	EPA 515.1	
Surrogate: DCAA	*99.8 %*	*70-130*		*AE64076*	*05/26/16 07:26*	*05/28/16 20:49*	*EPA 515.1*	
Glyphosate by EPA Method 547								
Glyphosate	ND ug/L	25	1	AE63749	05/18/16 08:59	05/19/16 06:44	EPA 547	

	Result		Reporting Limit	Dilution	Batch	Prepared	Analyzed	Method	Note
ESW-5-17-10:00 (16E1535-01)			**Sample Type: Water**			**Sampled: 05/17/16 10:00**			
Diquat by EPA Method 549.2									
Diquat	ND	ug/L	4.0	1	AE63821	05/19/16 09:12	05/19/16 21:08	EPA 549.2	
Semivolatile Organic Compounds by EPA Method 525.2									
Benzo (a) pyrene	ND	ug/L	0.10	1	AE64017	05/25/16 06:00	06/02/16 22:43	EPA 525.2	
Di(2-ethylhexyl)adipate	ND	ug/L	5.0	1	AE64017	05/25/16 06:00	06/02/16 22:43	EPA 525.2	
Di(2-ethylhexyl)phthalate	ND	ug/L	3.0	1	AE64017	05/25/16 06:00	06/02/16 22:43	EPA 525.2	
Surrogate: 1,3-Dimethyl-2-nitrobenzene	*100 %*		*70-130*		*AE64017*	*05/25/16 06:00*	*06/02/16 22:43*	*EPA 525.2*	
Surrogate: Triphenyl phosphate	*124 %*		*70-130*		*AE64017*	*05/25/16 06:00*	*06/02/16 22:43*	*EPA 525.2*	

Metals (Drinking Water) by EPA 200 Series Methods - Quality Control

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Batch AE64068 - EPA 245.1 Hg Water										
Blank (AE64068-BLK1)				Prepared & Analyzed: 05/26/16						
Mercury	ND	1.0	ug/L							
LCS (AE64068-BS1)				Prepared & Analyzed: 05/26/16						
Mercury	2.41	1.0	ug/L	2.50		96.4	85-115			
Duplicate (AE64068-DUP1)	**Source: 16E1813-01**			Prepared & Analyzed: 05/26/16						
Mercury	ND	1.0	ug/L		ND				20	
Matrix Spike (AE64068-MS1)	**Source: 16E1813-01**			Prepared & Analyzed: 05/26/16						
Mercury	2.53	1.0	ug/L	2.50	ND	101	70-130			
Matrix Spike (AE64068-MS2)	**Source: 16E1535-01**			Prepared & Analyzed: 05/26/16						
Mercury	2.23	1.0	ug/L	2.50	ND	89.2	70-130			
Matrix Spike Dup (AE64068-MSD1)	**Source: 16E1813-01**			Prepared & Analyzed: 05/26/16						
Mercury	2.53	1.0	ug/L	2.50	ND	101	70-130	0.00	20	
Batch AE64104 - Metals Digest										
Blank (AE64104-BLK1)				Prepared: 05/26/16 Analyzed: 05/27/16						
Calcium	ND	1.0	mg/L							
Iron	ND	100	ug/L							
Magnesium	ND	1.0	mg/L							
Sodium	ND	1.0	mg/L							
LCS (AE64104-BS1)				Prepared: 05/26/16 Analyzed: 05/27/16						
Calcium	7.22	1.0	mg/L	8.00		90.2	85-115			
Iron	1880	100	ug/L	2000		93.8	85-115			
Magnesium	7.10	1.0	mg/L	8.00		88.7	85-115			
Sodium	7.52	1.0	mg/L	8.00		94.0	85-115			

Metals (Drinking Water) by EPA 200 Series Methods - Quality Control

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Batch AE64104 - Metals Digest										
Duplicate (AE64104-DUP1)	**Source: 16E1641-01**			Prepared: 05/26/16 Analyzed: 05/27/16						
Calcium	26.6	1.0	mg/L		26.4			0.622	20	
Iron	ND	100	ug/L		ND				20	
Magnesium	19.4	1.0	mg/L		19.3			0.0967	20	
Sodium	19.6	1.0	mg/L		19.5			0.891	20	
Matrix Spike (AE64104-MS1)	**Source: 16E1641-01**			Prepared: 05/26/16 Analyzed: 05/27/16						
Calcium	33.8	1.0	mg/L	8.00	26.4	92.6	70-130			
Iron	1880	100	ug/L	2000	ND	93.8	70-130			
Magnesium	27.1	1.0	mg/L	8.00	19.3	97.2	70-130			
Sodium	26.7	1.0	mg/L	8.00	19.5	90.6	70-130			
Matrix Spike (AE64104-MS2)	**Source: 16E1684-01**			Prepared: 05/26/16 Analyzed: 05/27/16						
Calcium	57.6	1.0	mg/L	8.00	50.0	95.4	70-130			
Iron	1900	100	ug/L	2000	ND	95.1	70-130			
Magnesium	16.9	1.0	mg/L	8.00	9.53	92.6	70-130			
Sodium	34.0	1.0	mg/L	8.00	26.6	93.2	70-130			
Matrix Spike Dup (AE64104-MSD1)	**Source: 16E1641-01**			Prepared: 05/26/16 Analyzed: 05/27/16						
Calcium	34.7	1.0	mg/L	8.00	26.4	104	70-130	2.69	20	
Iron	1880	100	ug/L	2000	ND	94.2	70-130	0.354	20	
Magnesium	26.7	1.0	mg/L	8.00	19.3	91.8	70-130	1.58	20	
Sodium	27.5	1.0	mg/L	8.00	19.5	100	70-130	2.85	20	

Metals by EPA 200 Series Methods - Quality Control

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Batch AE63824 - General Preparation										
Blank (AE63824-BLK1)				Prepared & Analyzed: 05/19/16						
Chromium, hexavalent	ND	1.0	ug/L							
LCS (AE63824-BS1)				Prepared & Analyzed: 05/19/16						
Chromium, hexavalent	9.67	1.0	ug/L	10.0		96.7	90-110			
Duplicate (AE63824-DUP1)	**Source: 16E1268-01**			Prepared & Analyzed: 05/19/16						
Chromium, hexavalent	ND	1.0	ug/L		ND			3.21	20	
Matrix Spike (AE63824-MS1)	**Source: 16E1268-01**			Prepared & Analyzed: 05/19/16						
Chromium, hexavalent	10.2	1.0	ug/L	10.0	ND	97.0	90-110			
Matrix Spike (AE63824-MS2)	**Source: 16E1707-05**			Prepared & Analyzed: 05/20/16						
Chromium, hexavalent	9.56	1.0	ug/L	10.0	ND	95.6	90-110			
Matrix Spike Dup (AE63824-MSD1)	**Source: 16E1268-01**			Prepared & Analyzed: 05/19/16						
Chromium, hexavalent	10.2	1.0	ug/L	10.0	ND	97.4	90-110	0.421	20	

Metals by EPA Method 200.8 ICP/MS - Quality Control

Batch AE64054 - EPA 200.8

Blank (AE64054-BLK1) Prepared: 05/25/16 Analyzed: 05/26/16

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Aluminum	ND	50	ug/L							
Antimony	ND	6.0	ug/L							
Arsenic	ND	2.0	ug/L							
Barium	ND	100	ug/L							
Beryllium	ND	1.0	ug/L							
Cadmium	ND	1.0	ug/L							
Chromium	ND	10	ug/L							
Copper	ND	50	ug/L							
Lead	ND	5.0	ug/L							
Manganese	ND	20	ug/L							
Nickel	ND	10	ug/L							
Selenium	ND	5.0	ug/L							
Silver	ND	10	ug/L							
Thallium	ND	1.0	ug/L							
Uranium	ND	1.0	pCi/l							
Vanadium	ND	3.0	ug/L							
Zinc	ND	50	ug/L							

LCS (AE64054-BS1) Prepared: 05/25/16 Analyzed: 05/26/16

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Aluminum	539	50	ug/L	520		104	85-115			
Antimony	20.9	6.0	ug/L	20.0		104	85-115			
Arsenic	21.7	2.0	ug/L	20.0		109	85-115			
Barium	20.6	100	ug/L	20.0		103	85-115			
Beryllium	22.5	1.0	ug/L	20.0		113	85-115			
Cadmium	21.2	1.0	ug/L	20.0		106	85-115			
Chromium	20.9	10	ug/L	20.0		105	85-115			
Copper	21.3	50	ug/L	20.0		106	85-115			
Lead	21.4	5.0	ug/L	20.0		107	85-115			
Manganese	20.8	20	ug/L	20.0		104	85-115			
Nickel	20.8	10	ug/L	20.0		104	85-115			
Selenium	20.8	5.0	ug/L	20.0		104	85-115			
Silver	20.5	10	ug/L	20.0		103	85-115			
Thallium	21.8	1.0	ug/L	20.0		109	85-115			

Town Of Windsor - Drinking Water
8400 Windsor Rd.
Windsor, CA 95492-0100

Project Manager: Elizabeth Cargay
Project: Esposti Potable Well
Project Number: 4910017 / Esposti Well

Reported:
06/03/16 16:35

Metals by EPA Method 200.8 ICP/MS - Quality Control

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Batch AE64054 - EPA 200.8										
LCS (AE64054-BS1)				Prepared: 05/25/16 Analyzed: 05/26/16						
Uranium	14.0	1.0	pCi/l	13.4		105	85-115			
Vanadium	20.7	3.0	ug/L	20.0		104	85-115			
Zinc	107	50	ug/L	100		107	85-115			
Duplicate (AE64054-DUP1)	**Source: 16E1535-01**			Prepared: 05/25/16 Analyzed: 05/26/16						
Aluminum	ND	50	ug/L		ND			6.19	20	
Antimony	ND	6.0	ug/L		ND			19.8	20	
Arsenic	55.4	2.0	ug/L		56.5			2.03	20	
Barium	150	100	ug/L		151			0.834	20	
Beryllium	ND	1.0	ug/L		ND				20	
Cadmium	ND	1.0	ug/L		ND				20	
Chromium	ND	10	ug/L		ND			43.8	20	
Copper	ND	50	ug/L		ND			91.6	20	
Lead	ND	5.0	ug/L		ND				20	
Manganese	848	20	ug/L		861			1.61	20	
Nickel	ND	10	ug/L		ND			114	20	
Selenium	ND	5.0	ug/L		ND				20	
Silver	ND	10	ug/L		ND				20	
Thallium	ND	1.0	ug/L		ND				20	
Uranium	ND	1.0	pCi/l		ND			2.61	20	
Vanadium	ND	3.0	ug/L		ND				20	
Zinc	ND	50	ug/L		ND			15.7	20	

Conventional Chemistry Parameters by APHA/EPA Methods - Quality Control

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Batch AE63736 - General Preparation										
Blank (AE63736-BLK1)				Prepared: 05/18/16 Analyzed: 05/20/16						
MBAS, calculated as LAS, mw 340	ND	0.050	mg/L							
LCS (AE63736-BS1)				Prepared: 05/18/16 Analyzed: 05/20/16						
MBAS, calculated as LAS, mw 340	0.192	0.050	mg/L	0.200		96.2	80-120			
LCS Dup (AE63736-BSD1)				Prepared: 05/18/16 Analyzed: 05/20/16						
MBAS, calculated as LAS, mw 340	0.197	0.050	mg/L	0.200		98.7	80-120	2.60	20	
Duplicate (AE63736-DUP1)	**Source: 16E1588-02**			Prepared: 05/19/16 Analyzed: 05/20/16						
MBAS, calculated as LAS, mw 340	ND	0.050	mg/L		ND				20	
Matrix Spike (AE63736-MS1)	**Source: 16E1588-02**			Prepared: 05/19/16 Analyzed: 05/20/16						
MBAS, calculated as LAS, mw 340	0.206	0.050	mg/L	0.200	ND	103	80-120			
Matrix Spike (AE63736-MS2)	**Source: 16E1588-02**			Prepared: 05/19/16 Analyzed: 05/20/16						
MBAS, calculated as LAS, mw 340	0.204	0.050	mg/L	0.200	ND	102	80-120			
Batch AE63820 - General Preparation										
Blank (AE63820-BLK1)				Prepared: 05/19/16 Analyzed: 05/23/16						
Total Dissolved Solids	ND	10	mg/L							
Duplicate (AE63820-DUP1)	**Source: 16E1535-01**			Prepared: 05/19/16 Analyzed: 05/23/16						
Total Dissolved Solids	348	10	mg/L		352			1.14	15	
Duplicate (AE63820-DUP2)	**Source: 16E1653-02**			Prepared: 05/19/16 Analyzed: 05/23/16						
Total Dissolved Solids	388	10	mg/L		373			3.85	15	

Conventional Chemistry Parameters by APHA/EPA Methods - Quality Control

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Batch AE63838 - General Preparation										
Duplicate (AE63838-DUP1)	**Source: 16E1725-01**			Prepared & Analyzed: 05/23/16						
Hydroxide	ND	5.0	mg/L		ND				5	
Carbonate	ND	5.0	mg/L		ND				20	
Bicarbonate	190	5.0	mg/L		189			0.643	20	
Total Alkalinity as CaCO3	156	5.0	mg/L		155			0.643	20	
Batch AE63850 - General Preparation										
Blank (AE63850-BLK1)				Prepared & Analyzed: 05/19/16						
Silica	ND	1.0	mg/L							
LCS (AE63850-BS1)				Prepared & Analyzed: 05/19/16						
Silica	9.93	1.0	mg/L	10.0		99.3	85-115			
LCS Dup (AE63850-BSD1)				Prepared & Analyzed: 05/19/16						
Silica	9.89	1.0	mg/L	10.0		98.9	85-115	0.366	20	
Duplicate (AE63850-DUP1)	**Source: 16E1535-01**			Prepared & Analyzed: 05/19/16						
Silica	51.5	5.0	mg/L		50.4			2.14	20	
Matrix Spike (AE63850-MS1)	**Source: 16E1535-01**			Prepared & Analyzed: 05/19/16						
Silica	93.6	5.0	mg/L	50.0	50.4	86.4	80-120			
Matrix Spike Dup (AE63850-MSD1)	**Source: 16E1535-01**			Prepared & Analyzed: 05/19/16						
Silica	94.5	5.0	mg/L	50.0	50.4	88.2	80-120	0.965	20	
Batch AE63882 - General Preparation										
Duplicate (AE63882-DUP1)	**Source: 16E1535-01**			Prepared & Analyzed: 05/18/16						
Specific Conductance (EC)	520	20	umhos/cm		515			0.966	5	
pH	7.61	1.68	pH Units		7.60			0.131	20	T-14
Turbidity	0.260	0.10	NTU		0.260			0.00	15	

Conventional Chemistry Parameters by APHA/EPA Methods - Quality Control

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Batch AE63917 - General Preparation										
Blank (AE63917-BLK1)				Prepared & Analyzed: 05/23/16						
Ammonia as NH3	ND	0.50	mg/L							
LCS (AE63917-BS1)				Prepared & Analyzed: 05/23/16						
Ammonia as NH3	5.85	0.50	mg/L	6.10		96.0	90-110			
LCS Dup (AE63917-BSD1)				Prepared & Analyzed: 05/23/16						
Ammonia as NH3	5.96	0.50	mg/L	6.10		97.7	90-110	1.81	10	
Matrix Spike (AE63917-MS1)	**Source: 16E1775-02**			Prepared & Analyzed: 05/23/16						
Ammonia as NH3	5.96	0.50	mg/L	6.10	ND	97.7	85-115			
Matrix Spike Dup (AE63917-MSD1)	**Source: 16E1775-02**			Prepared & Analyzed: 05/23/16						
Ammonia as NH3	5.75	0.50	mg/L	6.10	ND	94.2	85-115	3.64	20	
Batch AE63921 - General Preparation										
Blank (AE63921-BLK1)				Prepared & Analyzed: 05/23/16						
Perchlorate	ND	4.0	ug/L							
LCS (AE63921-BS1)				Prepared & Analyzed: 05/23/16						
Perchlorate	25.6	4.0	ug/L	25.0		102	85-115			
Duplicate (AE63921-DUP1)	**Source: 16E1095-01**			Prepared & Analyzed: 05/23/16						
Perchlorate	ND	4.0	ug/L		ND				15	
Matrix Spike (AE63921-MS1)	**Source: 16E1095-01**			Prepared & Analyzed: 05/23/16						
Perchlorate	24.9	4.0	ug/L	25.0	ND	99.6	70-130			

Conventional Chemistry Parameters by APHA/EPA Methods - Quality Control

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Batch AE63921 - General Preparation										
Matrix Spike Dup (AE63921-MSD1)	**Source: 16E1095-01**			Prepared & Analyzed: 05/23/16						
Perchlorate	24.2	4.0	ug/L	25.0	ND	96.9	70-130	2.76	15	
Batch AE63936 - General Preparation										
Blank (AE63936-BLK1)				Prepared & Analyzed: 05/23/16						
Sulfide	ND	0.10	mg/L							
LCS (AE63936-BS1)				Prepared & Analyzed: 05/23/16						
Sulfide	0.420	0.10	mg/L	0.400		105	85-115			
Duplicate (AE63936-DUP1)	**Source: 16E1711-05**			Prepared & Analyzed: 05/23/16						
Sulfide	ND	0.10	mg/L		ND				15	
Matrix Spike (AE63936-MS1)	**Source: 16E1711-05**			Prepared & Analyzed: 05/23/16						
Sulfide	0.203	0.10	mg/L	0.400	ND	50.8	80-120			QM-05
Matrix Spike Dup (AE63936-MSD1)	**Source: 16E1711-05**			Prepared & Analyzed: 05/23/16						
Sulfide	0.202	0.10	mg/L	0.400	ND	50.5	80-120	0.494	15	QM-05
Batch AE63977 - General Prep										
Blank (AE63977-BLK1)				Prepared & Analyzed: 05/24/16						
Phosphate, Total	ND	0.10	mg/L							
LCS (AE63977-BS1)				Prepared & Analyzed: 05/24/16						
Phosphate, Total	0.582	0.10	mg/L	0.600		97.0	85-115			

Conventional Chemistry Parameters by APHA/EPA Methods - Quality Control

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Batch AE63977 - General Prep										
Duplicate (AE63977-DUP1)	**Source: 16E1886-01**			Prepared & Analyzed: 05/24/16						
Phosphate, Total	0.118	0.10	mg/L		0.122			3.32	20	
Matrix Spike (AE63977-MS1)	**Source: 16E1886-01**			Prepared & Analyzed: 05/24/16						
Phosphate, Total	0.666	0.10	mg/L	0.600	0.122	90.6	70-130			
Matrix Spike Dup (AE63977-MSD1)	**Source: 16E1886-01**			Prepared & Analyzed: 05/24/16						
Phosphate, Total	0.670	0.10	mg/L	0.600	0.122	91.3	70-130	0.599	20	
Batch AE64104 - Metals Digest										
Blank (AE64104-BLK1)				Prepared: 05/26/16 Analyzed: 05/27/16						
Hardness, Total	ND	5	mg/L							
Duplicate (AE64104-DUP1)	**Source: 16E1641-01**			Prepared: 05/26/16 Analyzed: 05/27/16						
Hardness, Total	146	5	mg/L		146			0.335	20	

Town Of Windsor - Drinking Water	Project Manager: Elizabeth Cargay	
8400 Windsor Rd.	Project: Esposti Potable Well	Reported:
Windsor, CA 95492-0100	Project Number: 4910017 / Esposti Well	06/03/16 16:35

Miscellaneous Physical/Conventional Chemistry Parameters - Quality Control

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Batch AE64032 - General Preparation										
Blank (AE64032-BLK1)				Prepared: 05/25/16 Analyzed: 05/26/16						
Cyanide (total)	ND	0.10	mg/L							
LCS (AE64032-BS1)				Prepared: 05/25/16 Analyzed: 05/26/16						
Cyanide (total)	0.214	0.10	mg/L	0.200		107	85-115			
Duplicate (AE64032-DUP1)	**Source: 16E1234-01**			Prepared: 05/25/16 Analyzed: 05/26/16						
Cyanide (total)	ND	0.10	mg/L		ND				25	
Matrix Spike (AE64032-MS1)	**Source: 16E1234-01**			Prepared: 05/25/16 Analyzed: 05/26/16						
Cyanide (total)	0.209	0.10	mg/L	0.200	ND	105	85-115			
Matrix Spike (AE64032-MS2)	**Source: 16E2085-02**			Prepared: 05/25/16 Analyzed: 05/26/16						
Cyanide (total)	0.173	0.10	mg/L	0.200	ND	84.6	85-115			QM-07
Matrix Spike Dup (AE64032-MSD1)	**Source: 16E1234-01**			Prepared: 05/25/16 Analyzed: 05/26/16						
Cyanide (total)	0.210	0.10	mg/L	0.200	ND	105	85-115	0.534	25	

Anions by EPA Method 300.0 - Quality Control

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Batch AE63804 - General Preparation										
Blank (AE63804-BLK1)				Prepared & Analyzed: 05/18/16						
Nitrite as N	ND	0.40	mg/L							
Nitrate as N	ND	0.40	mg/L							
Chloride	ND	0.50	mg/L							
Fluoride	ND	0.10	mg/L							
Sulfate as SO4	ND	0.50	mg/L							
LCS (AE63804-BS1)				Prepared & Analyzed: 05/18/16						
Fluoride	5.29	0.10	mg/L	5.56		95.2	90-110			
Nitrate as N	5.79	0.40	mg/L	5.56		104	90-110			
Nitrite as N	5.70	0.40	mg/L	5.56		103	90-110			
Sulfate as SO4	23.1	0.50	mg/L	22.2		104	90-110			
Chloride	11.5	0.50	mg/L	11.1		103	90-110			
Duplicate (AE63804-DUP1)	**Source: 16E1525-01**			Prepared & Analyzed: 05/18/16						
Nitrate as N	0.434	0.40	mg/L		0.405			6.94	20	
Fluoride	0.147	0.10	mg/L		0.145			1.37	20	
Sulfate as SO4	0.778	0.50	mg/L		0.769			1.16	20	
Nitrite as N	ND	0.40	mg/L		ND				20	
Chloride	0.664	0.50	mg/L		0.649			2.28	20	
Matrix Spike (AE63804-MS1)	**Source: 16E1525-01**			Prepared & Analyzed: 05/18/16						
Chloride	12.4	0.50	mg/L	11.1	0.649	106	80-120			
Nitrate as N	6.39	0.40	mg/L	5.56	0.405	108	80-120			
Fluoride	5.53	0.10	mg/L	5.56	0.145	97.0	80-120			
Nitrite as N	5.90	0.40	mg/L	5.56	ND	105	80-120			
Sulfate as SO4	24.4	0.50	mg/L	22.2	0.769	106	80-120			
Matrix Spike (AE63804-MS2)	**Source: 16E1518-02**			Prepared & Analyzed: 05/18/16						
Nitrate as N	6.11	0.40	mg/L	5.56	ND	107	80-120			
Nitrite as N	5.89	0.40	mg/L	5.56	ND	105	80-120			
Sulfate as SO4	40.1	0.50	mg/L	22.2	17.9	100	80-120			
Chloride	20.1	0.50	mg/L	11.1	8.98	99.8	80-120			
Fluoride	5.59	0.10	mg/L	5.56	0.113	98.6	80-120			

Anions by EPA Method 300.0 - Quality Control

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Batch AE63804 - General Preparation										
Matrix Spike Dup (AE63804-MSD1)	**Source: 16E1525-01**		Prepared & Analyzed: 05/18/16							
Sulfate as SO4	24.3	0.50	mg/L	22.2	0.769	106	80-120	0.387	20	
Nitrate as N	6.37	0.40	mg/L	5.56	0.405	107	80-120	0.338	20	
Fluoride	5.52	0.10	mg/L	5.56	0.145	96.8	80-120	0.221	20	
Nitrite as N	5.88	0.40	mg/L	5.56	ND	105	80-120	0.283	20	
Chloride	12.4	0.50	mg/L	11.1	0.649	105	80-120	0.197	20	

Volatile Organic Compounds by EPA Method 524.2 - Quality Control

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Batch AE64140 - VOAs in Water GCMS										
Blank (AE64140-BLK1)				Prepared & Analyzed: 05/27/16						
Benzene	ND	0.50	ug/L							
Carbon tetrachloride	ND	0.50	ug/L							
Chlorobenzene	ND	0.50	ug/L							
1,2-Dichlorobenzene	ND	0.50	ug/L							
1,4-Dichlorobenzene	ND	0.50	ug/L							
1,1-Dichloroethane	ND	0.50	ug/L							
1,2-Dichloroethane	ND	0.50	ug/L							
1,1-Dichloroethene	ND	0.50	ug/L							
cis-1,2-Dichloroethene	ND	0.50	ug/L							
trans-1,2-Dichloroethene	ND	0.50	ug/L							
1,2-Dichloropropane	ND	0.50	ug/L							
1,3-Dichloropropene (total)	ND	0.50	ug/L							
Ethylbenzene	ND	0.50	ug/L							
Methyl tert-butyl ether	ND	3.0	ug/L							
Methylene chloride	ND	0.50	ug/L							
Styrene	ND	0.50	ug/L							
1,1,2,2-Tetrachloroethane	ND	0.50	ug/L							
Tetrachloroethene	ND	0.50	ug/L							
Toluene	ND	0.50	ug/L							
1,2,4-Trichlorobenzene	ND	0.50	ug/L							
1,1,1-Trichloroethane	ND	0.50	ug/L							
1,1,2-Trichloroethane	ND	0.50	ug/L							
Trichloroethene	ND	0.50	ug/L							
Trichlorofluoromethane	ND	5.0	ug/L							
Trichlorotrifluoroethane	ND	10	ug/L							
Vinyl chloride	ND	0.50	ug/L							
Xylenes (total)	ND	0.50	ug/L							
Surrogate: Bromofluorobenzene	*23.2*		*ug/L*	*25.0*		*92.8*	*70-130*			
Surrogate: Dibromofluoromethane	*19.7*		*ug/L*	*25.0*		*78.7*	*70-130*			
Surrogate: Toluene-d8	*22.0*		*ug/L*	*25.0*		*88.2*	*70-130*			

Volatile Organic Compounds by EPA Method 524.2 - Quality Control

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Batch AE64140 - VOAs in Water GCMS										
LCS (AE64140-BS1)				Prepared & Analyzed: 05/27/16						
Benzene	5.02	0.50	ug/L	5.00		100	70-130			
Carbon tetrachloride	4.29	0.50	ug/L	5.00		85.8	70-130			
Chlorobenzene	5.18	0.50	ug/L	5.00		104	70-130			
1,2-Dichlorobenzene	4.96	0.50	ug/L	5.00		99.2	70-130			
1,4-Dichlorobenzene	4.82	0.50	ug/L	5.00		96.4	70-130			
1,1-Dichloroethane	5.34	0.50	ug/L	5.00		107	70-130			
1,2-Dichloroethane	5.35	0.50	ug/L	5.00		107	70-130			
1,1-Dichloroethene	4.84	0.50	ug/L	5.00		96.8	70-130			
cis-1,2-Dichloroethene	5.33	0.50	ug/L	5.00		107	70-130			
trans-1,2-Dichloroethene	5.19	0.50	ug/L	5.00		104	70-130			
1,2-Dichloropropane	5.11	0.50	ug/L	5.00		102	70-130			
Ethylbenzene	5.12	0.50	ug/L	5.00		102	70-130			
Methyl tert-butyl ether	5.00	3.0	ug/L	5.00		100	70-130			
Methylene chloride	4.81	0.50	ug/L	5.00		96.2	70-130			
Styrene	5.23	0.50	ug/L	5.00		105	70-130			
1,1,2,2-Tetrachloroethane	5.44	0.50	ug/L	5.00		109	70-130			
Tetrachloroethene	4.93	0.50	ug/L	5.00		98.6	70-130			
Toluene	4.99	0.50	ug/L	5.00		99.8	70-130			
1,2,4-Trichlorobenzene	5.20	0.50	ug/L	5.00		104	70-130			
1,1,1-Trichloroethane	4.64	0.50	ug/L	5.00		92.8	70-130			
1,1,2-Trichloroethane	5.29	0.50	ug/L	5.00		106	70-130			
Trichloroethene	5.05	0.50	ug/L	5.00		101	70-130			
Trichlorofluoromethane	4.81	5.0	ug/L	5.00		96.2	70-130			
Trichlorotrifluoroethane	5.08	10	ug/L	5.00		102	70-130			
Vinyl chloride	5.43	0.50	ug/L	5.00		109	70-130			
Xylenes (total)	15.4	0.50	ug/L	15.0		102	70-130			
Surrogate: Bromofluorobenzene	*24.5*		*ug/L*	*25.0*		*98.1*	*70-130*			
Surrogate: Dibromofluoromethane	*21.6*		*ug/L*	*25.0*		*86.4*	*70-130*			
Surrogate: Toluene-d8	*22.2*		*ug/L*	*25.0*		*88.6*	*70-130*			

Volatile Organic Compounds by EPA Method 524.2 - Quality Control

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Batch AE64140 - VOAs in Water GCMS										
LCS Dup (AE64140-BSD1)				Prepared & Analyzed: 05/27/16						
Benzene	5.24	0.50	ug/L	5.00		105	70-130	4.29	30	
Carbon tetrachloride	4.65	0.50	ug/L	5.00		93.0	70-130	8.05	30	
Chlorobenzene	5.42	0.50	ug/L	5.00		108	70-130	4.53	30	
1,2-Dichlorobenzene	5.36	0.50	ug/L	5.00		107	70-130	7.75	30	
1,4-Dichlorobenzene	5.19	0.50	ug/L	5.00		104	70-130	7.39	30	
1,1-Dichloroethane	5.30	0.50	ug/L	5.00		106	70-130	0.752	30	
1,2-Dichloroethane	5.49	0.50	ug/L	5.00		110	70-130	2.58	30	
1,1-Dichloroethene	4.87	0.50	ug/L	5.00		97.4	70-130	0.618	30	
cis-1,2-Dichloroethene	5.19	0.50	ug/L	5.00		104	70-130	2.66	30	
trans-1,2-Dichloroethene	5.16	0.50	ug/L	5.00		103	70-130	0.580	30	
1,2-Dichloropropane	5.43	0.50	ug/L	5.00		109	70-130	6.07	30	
Ethylbenzene	5.45	0.50	ug/L	5.00		109	70-130	6.24	30	
Methyl tert-butyl ether	5.04	3.0	ug/L	5.00		101	70-130	0.797	30	
Methylene chloride	4.71	0.50	ug/L	5.00		94.2	70-130	2.10	30	
Styrene	5.51	0.50	ug/L	5.00		110	70-130	5.21	30	
1,1,2,2-Tetrachloroethane	5.76	0.50	ug/L	5.00		115	70-130	5.71	30	
Tetrachloroethene	5.39	0.50	ug/L	5.00		108	70-130	8.91	30	
Toluene	5.30	0.50	ug/L	5.00		106	70-130	6.03	30	
1,2,4-Trichlorobenzene	5.30	0.50	ug/L	5.00		106	70-130	1.90	30	
1,1,1-Trichloroethane	4.68	0.50	ug/L	5.00		93.6	70-130	0.858	30	
1,1,2-Trichloroethane	5.61	0.50	ug/L	5.00		112	70-130	5.87	30	
Trichloroethene	5.33	0.50	ug/L	5.00		107	70-130	5.39	30	
Trichlorofluoromethane	5.05	5.0	ug/L	5.00		101	70-130	4.87	30	
Trichlorotrifluoroethane	5.18	10	ug/L	5.00		104	70-130	1.95	30	
Vinyl chloride	6.03	0.50	ug/L	5.00		121	70-130	10.5	30	
Xylenes (total)	16.2	0.50	ug/L	15.0		108	70-130	5.38	30	
Surrogate: Bromofluorobenzene	*23.8*		*ug/L*	*25.0*		*95.2*	*70-130*			
Surrogate: Dibromofluoromethane	*20.3*		*ug/L*	*25.0*		*81.1*	*70-130*			
Surrogate: Toluene-d8	*21.9*		*ug/L*	*25.0*		*87.8*	*70-130*			

Volatile Organic Compounds by EPA Method 524.2 - Quality Control

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Batch AE64140 - VOAs in Water GCMS										
Matrix Spike (AE64140-MS1)		**Source: 16E1420-01**		Prepared & Analyzed: 05/27/16						
Benzene	5.20	0.50	ug/L	5.00	ND	104	70-130			
Carbon tetrachloride	4.50	0.50	ug/L	5.00	ND	90.0	70-130			
Chlorobenzene	5.18	0.50	ug/L	5.00	ND	104	70-130			
1,2-Dichlorobenzene	5.02	0.50	ug/L	5.00	ND	100	70-130			
1,4-Dichlorobenzene	4.79	0.50	ug/L	5.00	ND	95.8	70-130			
1,1-Dichloroethane	5.34	0.50	ug/L	5.00	ND	107	70-130			
1,2-Dichloroethane	5.04	0.50	ug/L	5.00	ND	101	70-130			
1,1-Dichloroethene	4.94	0.50	ug/L	5.00	ND	98.8	70-130			
cis-1,2-Dichloroethene	5.17	0.50	ug/L	5.00	ND	103	70-130			
trans-1,2-Dichloroethene	5.21	0.50	ug/L	5.00	ND	104	70-130			
1,2-Dichloropropane	5.11	0.50	ug/L	5.00	ND	102	70-130			
Ethylbenzene	5.38	0.50	ug/L	5.00	ND	108	70-130			
Methyl tert-butyl ether	4.98	3.0	ug/L	5.00	ND	99.6	70-130			
Methylene chloride	5.03	0.50	ug/L	5.00	ND	101	70-130			
Styrene	5.06	0.50	ug/L	5.00	ND	101	70-130			
1,1,2,2-Tetrachloroethane	5.11	0.50	ug/L	5.00	ND	102	70-130			
Tetrachloroethene	5.38	0.50	ug/L	5.00	ND	108	70-130			
Toluene	5.20	0.50	ug/L	5.00	ND	104	70-130			
1,2,4-Trichlorobenzene	4.70	0.50	ug/L	5.00	ND	94.0	70-130			
1,1,1-Trichloroethane	4.96	0.50	ug/L	5.00	ND	99.2	70-130			
1,1,2-Trichloroethane	4.93	0.50	ug/L	5.00	ND	98.6	70-130			
Trichloroethene	5.32	0.50	ug/L	5.00	ND	106	70-130			
Trichlorofluoromethane	5.22	5.0	ug/L	5.00	ND	104	70-130			
Trichlorotrifluoroethane	5.40	10	ug/L	5.00	ND	108	70-130			
Vinyl chloride	7.57	0.50	ug/L	5.00	ND	151	70-130			QM-05
Xylenes (total)	15.8	0.50	ug/L	15.0	ND	105	70-130			
Surrogate: Bromofluorobenzene	*23.8*		*ug/L*	*25.0*		*95.2*	*70-130*			
Surrogate: Dibromofluoromethane	*20.1*		*ug/L*	*25.0*		*80.3*	*70-130*			
Surrogate: Toluene-d8	*22.3*		*ug/L*	*25.0*		*89.1*	*70-130*			

Nitrogen- and Phosphorus- Pesticides by EPA Method 507 - Quality Control

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Batch AE64018 - SVOAs in Water GC										
Blank (AE64018-BLK1)				Prepared: 05/24/16 Analyzed: 05/27/16						
Alachlor	ND	1.0	ug/L							
Atrazine	ND	0.50	ug/L							
Molinate	ND	2.0	ug/L							
Simazine	ND	1.0	ug/L							
Thiobencarb	ND	1.0	ug/L							
Surrogate: 1,3-Dimethyl-2-nitrobenzene	*1.61*		*ug/L*	*2.00*		*80.3*	*70-130*			
LCS (AE64018-BS1)				Prepared: 05/24/16 Analyzed: 05/28/16						
Alachlor	1.81	1.0	ug/L	2.00		90.5	62-128			
Atrazine	1.85	0.50	ug/L	2.00		92.3	62-122			
Molinate	1.88	2.0	ug/L	2.00		94.2	44-137			
Simazine	1.88	1.0	ug/L	2.00		93.9	70-130			
Thiobencarb	1.80	1.0	ug/L	2.00		90.1	69-129			
Surrogate: 1,3-Dimethyl-2-nitrobenzene	*1.75*		*ug/L*	*2.00*		*87.4*	*70-130*			
LCS Dup (AE64018-BSD1)				Prepared: 05/24/16 Analyzed: 05/28/16						
Alachlor	2.11	1.0	ug/L	2.00		105	62-128	15.3	30	
Atrazine	2.11	0.50	ug/L	2.00		105	62-122	13.2	30	
Molinate	1.90	2.0	ug/L	2.00		95.2	44-137	1.05	30	
Simazine	2.11	1.0	ug/L	2.00		106	70-130	11.9	30	
Thiobencarb	2.03	1.0	ug/L	2.00		101	69-129	11.7	30	
Surrogate: 1,3-Dimethyl-2-nitrobenzene	*1.87*		*ug/L*	*2.00*		*93.6*	*70-130*			
Matrix Spike (AE64018-MS1)	**Source: 16E1425-01**			Prepared: 05/24/16 Analyzed: 05/28/16						
Alachlor	2.16	1.0	ug/L	2.00	ND	108	62-128			
Atrazine	1.91	0.50	ug/L	2.00	ND	95.5	62-122			
Molinate	1.89	2.0	ug/L	2.00	ND	94.3	44-137			
Simazine	1.96	1.0	ug/L	2.00	ND	98.1	70-130			
Thiobencarb	1.89	1.0	ug/L	2.00	ND	94.3	69-129			
Surrogate: 1,3-Dimethyl-2-nitrobenzene	*1.87*		*ug/L*	*2.00*		*93.7*	*70-130*			

Organic Analytes by EPA Method 504.1 - Quality Control

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Batch AE63739 - EPA 504.1										
Blank (AE63739-BLK1)				Prepared & Analyzed: 05/18/16						
1,2-Dibromo-3-chloropropane	ND	0.010	ug/L							
1,2-Dibromoethane (EDB)	ND	0.020	ug/L							
LCS (AE63739-BS1)				Prepared & Analyzed: 05/18/16						
1,2-Dibromo-3-chloropropane	0.220	0.010	ug/L	0.250		88.1	70-130			
1,2-Dibromoethane (EDB)	0.197	0.020	ug/L	0.250		78.9	70-130			
LCS Dup (AE63739-BSD1)				Prepared & Analyzed: 05/18/16						
1,2-Dibromo-3-chloropropane	0.193	0.010	ug/L	0.250		77.2	70-130	13.1	25	
1,2-Dibromoethane (EDB)	0.205	0.020	ug/L	0.250		81.9	70-130	3.66	25	
Matrix Spike (AE63739-MS1)	**Source: 16E1119-01**			Prepared & Analyzed: 05/18/16						
1,2-Dibromo-3-chloropropane	0.190	0.010	ug/L	0.250	ND	75.9	70-130			
1,2-Dibromoethane (EDB)	0.193	0.020	ug/L	0.250	ND	77.4	70-130			

Chlorinated Acids by EPA Method 515.1 - Quality Control

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Batch AE64076 - Herbicides										
Blank (AE64076-BLK1)				Prepared: 05/26/16 Analyzed: 05/28/16						
Bentazon	ND	2.0	ug/L							
2,4-D	ND	10	ug/L							
Dalapon	ND	10	ug/L							
Dinoseb	ND	2.0	ug/L							
Pentachlorophenol	ND	0.20	ug/L							
Picloram	ND	1.0	ug/L							
2,4,5-TP (Silvex)	ND	1.0	ug/L							
Surrogate: DCAA	*12.9*		*ug/L*	*14.2*		*90.6*	*70-130*			
LCS (AE64076-BS1)				Prepared: 05/26/16 Analyzed: 05/28/16						
Bentazon	1.67	2.0	ug/L	1.92		87.0	70-130			
2,4-D	1.52	10	ug/L	1.92		78.9	48-124			
Dalapon	11.5	10	ug/L	12.5		92.1	40-112			
Dinoseb	3.79	2.0	ug/L	6.42		59.1	20-105			
Pentachlorophenol	0.819	0.20	ug/L	0.960		85.3	70-130			
Picloram	0.941	1.0	ug/L	0.960		98.1	70-130			
2,4,5-TP (Silvex)	0.846	1.0	ug/L	0.960		88.1	70-130			
Surrogate: DCAA	*14.1*		*ug/L*	*14.2*		*99.4*	*70-130*			
LCS Dup (AE64076-BSD1)				Prepared: 05/26/16 Analyzed: 05/28/16						
Bentazon	1.79	2.0	ug/L	1.92		93.3	70-130	6.95	50	
2,4-D	1.56	10	ug/L	1.92		81.1	48-124	2.71	50	
Dalapon	11.3	10	ug/L	12.5		90.6	40-112	1.59	50	
Dinoseb	4.64	2.0	ug/L	6.42		72.3	20-105	20.1	50	
Pentachlorophenol	0.831	0.20	ug/L	0.960		86.6	70-130	1.56	50	
Picloram	1.08	1.0	ug/L	0.960		113	70-130	13.9	50	
2,4,5-TP (Silvex)	0.857	1.0	ug/L	0.960		89.3	70-130	1.33	50	
Surrogate: DCAA	*13.5*		*ug/L*	*14.2*		*95.0*	*70-130*			

Chlorinated Acids by EPA Method 515.1 - Quality Control

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Batch AE64076 - Herbicides										
Matrix Spike (AE64076-MS1)	**Source: 16E1438-01**		Prepared: 05/26/16 Analyzed: 05/28/16							
Bentazon	1.59	2.0	ug/L	1.92	ND	82.9	70-130			
2,4-D	1.90	10	ug/L	1.92	ND	98.9	48-124			
Dalapon	11.0	10	ug/L	12.5	ND	87.8	40-112			
Dinoseb	3.32	2.0	ug/L	6.42	ND	51.8	20-105			
Pentachlorophenol	0.385	0.20	ug/L	0.960	ND	40.1	70-130			QM-07
Picloram	0.913	1.0	ug/L	0.960	ND	95.1	70-130			
2,4,5-TP (Silvex)	0.709	1.0	ug/L	0.960	ND	73.9	70-130			
Surrogate: DCAA	*12.1*		*ug/L*	*14.2*		*85.1*	*70-130*			
Matrix Spike Dup (AE64076-MSD1)	**Source: 16E1438-01**		Prepared: 05/26/16 Analyzed: 05/28/16							
Bentazon	1.64	2.0	ug/L	1.92	ND	85.2	70-130	2.75	50	
2,4-D	1.91	10	ug/L	1.92	ND	99.7	48-124	0.758	50	
Dalapon	12.1	10	ug/L	12.5	ND	96.7	40-112	9.66	50	
Dinoseb	4.07	2.0	ug/L	6.42	ND	63.4	20-105	20.2	50	
Pentachlorophenol	0.617	0.20	ug/L	0.960	ND	64.2	70-130	46.2	50	QM-07
Picloram	0.978	1.0	ug/L	0.960	ND	102	70-130	6.84	50	
2,4,5-TP (Silvex)	0.784	1.0	ug/L	0.960	ND	81.6	70-130	9.98	50	
Surrogate: DCAA	*12.6*		*ug/L*	*14.2*		*88.5*	*70-130*			

Glyphosate by EPA Method 547 - Quality Control

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Batch AE63749 - HPLC										
Blank (AE63749-BLK1)				Prepared & Analyzed: 05/18/16						
Glyphosate	ND	25	ug/L							
LCS (AE63749-BS1)				Prepared & Analyzed: 05/18/16						
Glyphosate	105	25	ug/L	120		87.8	70-130			
LCS Dup (AE63749-BSD1)				Prepared & Analyzed: 05/18/16						
Glyphosate	102	25	ug/L	120		84.6	70-130	3.63	30	
Matrix Spike (AE63749-MS1)	**Source: 16E1193-01**			Prepared: 05/18/16 Analyzed: 05/19/16						
Glyphosate	120	25	ug/L	120	ND	100	70-130			
Matrix Spike Dup (AE63749-MSD1)	**Source: 16E1193-01**			Prepared: 05/18/16 Analyzed: 05/19/16						
Glyphosate	138	25	ug/L	120	ND	115	70-130	13.5	30	

Diquat by EPA Method 549.2 - Quality Control

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Batch AE63821 - HPLC										
Blank (AE63821-BLK1)				Prepared & Analyzed: 05/19/16						
Diquat	ND	4.0	ug/L							
LCS (AE63821-BS1)				Prepared & Analyzed: 05/19/16						
Diquat	16.2	4.0	ug/L	20.0		80.9	70-130			
Matrix Spike (AE63821-MS1)	**Source: 16E1456-01**			Prepared & Analyzed: 05/19/16						
Diquat	21.8	4.0	ug/L	20.0	ND	109	70-130			

Semivolatile Organic Compounds by EPA Method 525.2 - Quality Control

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Batch AE64017 - EPA 525.2										
Blank (AE64017-BLK1)				Prepared: 05/25/16 Analyzed: 06/02/16						
Benzo (a) pyrene	ND	0.10	ug/L							
Di(2-ethylhexyl)adipate	ND	5.0	ug/L							
Di(2-ethylhexyl)phthalate	ND	3.0	ug/L							
Surrogate: 1,3-Dimethyl-2-nitrobenzene	*4.82*		*ug/L*	*5.00*		*96.4*	*70-130*			
Surrogate: Triphenyl phosphate	*5.60*		*ug/L*	*5.00*		*112*	*70-130*			
LCS (AE64017-BS1)				Prepared: 05/25/16 Analyzed: 06/02/16						
Benzo (a) pyrene	3.10	0.10	ug/L	3.00		103	70-130			
Di(2-ethylhexyl)adipate	5.76	5.0	ug/L	6.00		96.0	70-130			
Di(2-ethylhexyl)phthalate	5.45	3.0	ug/L	6.00		90.8	70-130			
Surrogate: 1,3-Dimethyl-2-nitrobenzene	*4.89*		*ug/L*	*5.00*		*97.8*	*70-130*			
Surrogate: Triphenyl phosphate	*6.06*		*ug/L*	*5.00*		*121*	*70-130*			
LCS Dup (AE64017-BSD1)				Prepared: 05/25/16 Analyzed: 06/02/16						
Benzo (a) pyrene	3.10	0.10	ug/L	3.00		103	70-130	0.00	20	
Di(2-ethylhexyl)adipate	5.71	5.0	ug/L	6.00		95.2	70-130	0.872	20	
Di(2-ethylhexyl)phthalate	5.59	3.0	ug/L	6.00		93.2	70-130	2.54	20	
Surrogate: 1,3-Dimethyl-2-nitrobenzene	*4.89*		*ug/L*	*5.00*		*97.8*	*70-130*			
Surrogate: Triphenyl phosphate	*6.13*		*ug/L*	*5.00*		*123*	*70-130*			
Matrix Spike (AE64017-MS1)	**Source: 16E1425-01**			Prepared: 05/25/16 Analyzed: 06/03/16						
Benzo (a) pyrene	3.47	0.10	ug/L	3.00	ND	116	70-130			
Di(2-ethylhexyl)adipate	6.51	5.0	ug/L	6.00	ND	108	70-130			
Di(2-ethylhexyl)phthalate	6.02	3.0	ug/L	6.00	ND	100	70-130			
Surrogate: 1,3-Dimethyl-2-nitrobenzene	*4.93*		*ug/L*	*5.00*		*98.6*	*70-130*			
Surrogate: Triphenyl phosphate	*6.47*		*ug/L*	*5.00*		*129*	*70-130*			

Notes and Definitions

QM-05	The spike recovery was outside acceptance limits for the MS and/or MSD due to matrix interference. The LCS and/or LCSD were within acceptance limits showing that the laboratory is in control and the data is acceptable.
QM-07	The spike recovery was outside acceptance limits for the MS and/or MSD. The batch was accepted based on acceptable LCS recovery.
T-14	Residual chlorine, dissolved oxygen, and pH must be analyzed in the field to meet the EPA specified 15 minute hold time.
ND	Analyte NOT DETECTED at or above the reporting limit
dry	Sample results reported on a dry weight basis
REC	Recovery
RPD	Relative Percent Difference

Ceres Analytical Laboratory, Inc.
4919 Windplay Dr., Suite 1
El Dorado Hills, CA 95762

May 23, 2016 Ceres ID: 11002

Alpha Analytical Laboratories, Inc.
208 Mason St.
Ukiah, CA 95482

Enclosed please find the results for the one drinking water sample received on May 19, 2016. This sample was analyzed for 2,3,7,8-TCDD by EPA method 1613B. Routine turn-around time was provided for this work.

This work was authorized under Alpha Analytical Laboratories' project # 16E1535.

The report consists of a Cover Letter, Sample Inventory (Section I), Data Summary (Section II), Sample Tracking (Section VI), and Qualifiers/Abbreviations (Section VII). Raw Data (Section III), Continuing Calibration (Section IV), and Initial Calibration (Section V) are available in a full report (.pdf format) upon request.

If you have any questions regarding this report, please feel free to contact me at (916)932-5011.

Sincerely,

James M. Hedin
Director of Operations/CEO
jhedin@ceres-lab.com

Section I: Sample Inventory

Ceres Sample ID:	Sample ID	Date Received	Collection Date	&Time
11002-001	16E1535-01 ESW-5-17-10:00	5/19/2016	5/17/2016	10:00

Section II: Data Summary

EPA Method 1613B

Quality Assurance Sample **Method Blank**	**QC Batch #:** 1451	**Date Received:** NA **Date Extracted:** 5/20/2016
Project ID: 16E1535	**Matrix:** Drinking Water **Sample Size:** 1.000 L	**ZB-5MS Analysis:** 5/21/2016

Analyte	Conc. (pg/L)	Qualifiers	Labeled Standards	% R	LCL-UCL (a)	Qualifiers
2,3,7,8-TCDD	DL= 2.06		13C-2378-TCDD	84.4	31-137	
			CRS			
			37Cl4-2378-TCDD	92.2	35-197	

DL - Signifies Non-Detect (ND) at sample specific detection limit.
EMPC - Estimated Maximum Possible Concentration due to ion abundance ratio failure.
(a) - Lower control limit - Upper control limit

Analyst: JMH **Reviewed by: BS**

EPA Method 1613B

Quality Assurance Sample **Ongoing Precision and Recovery**	**QC Batch #:** 1451	**Date Received:** NA **Date Extracted:** 5/20/2016
	Matrix: Drinking Water	**ZB-5MS Analysis:** 5/21/2016
Project ID: 16E1535	**Sample Size:** 1.000 L	

Analyte	Conc. (ng/mL)	Limits (a)	Labeled Standards	% Rec.	Limits (a)
2,3,7,8-TCDD	8.32	7.3-14.6	13C-2378-TCDD	89.2	25-141
			CRS		
			37Cl4-2378-TCDD	89.5	37-158

(a) Limits based on method acceptance criteria.

Analyst: JMH **Reviewed by: BS**

CERES Analytical Laboratory, Inc.
4919 Windplay Dr Suite 1, El Dorado Hills, CA 95762

Alpha Analytical Laboratory, Inc.
208 Mason St.
Ukiah, CA 95482

EPA Method 1613B

Client Sample ID: 16E1535-01 ESW-5-17-10:00

Project ID:	16E1535	**Ceres Sample ID:**	11002-001	**Date Received:**	5/19/2016
		QC Batch #:	1451	**Date Extracted:**	5/20/2016
Date Collected:	5/17/2016	**Matrix:**	Drinking Water	**ZB-5MS Analysis:**	5/21/2016
Time Collected:	10:00 AM	**Sample Size:**	1.004 L		

Analyte	Conc. (pg/L)	Qualifiers	Labeled Standards	% R	LCL-UCL (a)	Qualifiers
2,3,7,8-TCDD	DL= 1.88		13C-2378-TCDD	69.4	31-137	
			CRS			
			37Cl4-2378-TCDD	75.8	42-164	

DL - Signifies Non-Detect (ND) at sample specific detection limit.
EMPC - Estimated Maximum Possible Concentration due to ion abundance ratio failure.
(a) - Lower control limit - Upper control limit

Analyst: JMH **Reviewed by: BS**

Section VI: Sample Tracking

SUBCONTRACT ORDER

Alpha Analytical Laboratories, Inc.

16E1535

SENDING LABORATORY:	**RECEIVING LABORATORY:**
Alpha Analytical Laboratories, Inc.	Ceres Labs
208 Mason St.	4919 Windplay Dr.
Ukiah, CA 95482	El Dorado Hills, CA 95762
Phone: (707)468-0401	Phone :(916) 932-5011
Fax: (707)468-5267	Fax: (916) 932-5017
Project Manager: Robbie C. Phillips	**Terms: Net 30**

Analysis	**Due**	**Expires**	**Comments**
16E1535-01 ESW-5-17-10:00 [Water] Sampled 05/17/16 10:00 Pacific			
Dioxin 2378 TCDD DW 1613	06/01/16 12:00	05/17/17 10:00	

Containers Supplied:

1L Amber- Unpres. (AH) 1L Amber- Unpres. (AI)

☐ *Report to State*

System Name: ______________________ **Employed by:** ______________________

User ID: ______________________ **Sampler:** ______________________

System Number: ______________________

W/ QC

	5/18/16	Charles M Schlenker	05-19-16
Released By	Date	Received By	Date
Released By	Date	Received By	Date

Section VII: Qualifiers/Abbreviations

J	Concentration found below the lower quantitation limit but greater than zero.
B	Analyte present in the associated Method Blank.
E	Concentration found exceeds the Calibration range of the HRGC/HRMS.
D	This analyte concentration was calculated from a dilution.
X	The concentration found is the estimated maximum possible concentration due to chlorinated diphenyl ethers present in the sample.
H	Recovery limits exceeded. See cover letter.
*****	Results taken from dilution.
I	Interference. See cover letter.
Conc.	Concentration Found
DL	Calculated Detection Limit
ND	Non-Detect
% Rec.	Percent Recovery

ASBESTOS TEM LABORATORIES, INC.

Modified Drinking Water
Transmission Electron Microscopy
Analytical Report

Laboratory Job # 1288-01013

600 Bancroft Way, Ste. A
Berkeley, CA 94710
(510) 704-8930
FAX (510) 704-8429

ASBESTOS TEM LABORATORIES, INC

Certified by
CA DPH ELAP
Lab No. 1866

Jun 01 2016

Robbie C. Phillips
Alpha Analytical Laboratories, Inc.
208 Mason Street
Ukiah, CA 95482

RE: LABORATORY JOB # 1288-01013
Transmission electron microscopy analytical results for 1 water sample(s).
Job Site:
Job No.: 16E1535

Enclosed please find results for the TEM analysis of one or more water samples. The analytical procedures were performed according to a Modified EPA Method 100.2 which, while similar in analytical technique, does not meet or fulfill the rigorous requirements of the EPA Drinking Water Standard for various reasons (i.e. hold time exceeded 48 hours, unrefrigerated shipping, analytical sensitivity >0.2 MFL due to particulate overloading, etc.).

Prior to analysis, samples are checked for damage, disruption of any chain-of-custody seals, and completeness of accompanying paperwork. If no problems are found, samples are then logged-in, each given a unique laboratory number, and a hard copy containing all pertinent information is generated. This, and all other relevant paper work are kept with each sample throughout the analytical procedures to assure proper analysis.

Preparation of water samples is performed within a HEPA filtered, Class 100 air, laminar flow clean bench environment. Prior to filtration, water sample containers are ultrasonicated, and if necessary, treated with UV light while and ozone gas for three hours to kill and oxidize all organisms and organic materials contained in the water. An aliquot of the water sample is pipetted into a special filtration apparatus where contained particulate is collected onto a mixed cellulose ester (MCE) or polycarbonate (PC) filter. The filters are removed from the apparatus and dried. A portion of each sample filter is sectioned, placed onto a glass microscope slide, and carbon coated. The filters are further sectioned and placed carbon side up onto 200-mesh copper TEM sample grids in a solvent bath until all filter material is dissolved. The TEM grids are removed and placed into labeled grid storage boxes.

TEM analysis is performed on a Philips EM-300 or CM-12 transmission electron microscope operating at 80 or 100 kV. Initially, the grid is scanned at low and medium magnifications to insure proper sample loading, and coherence of the carbon support film. Then TEM grid openings are analyzed at a magnification of ~10,000X. All fibers >10 um in length and exhibiting an aspect ratio >3:1 are analyzed. Scanning continues until either 100 asbestiform fibers >10um in length are counted, 20 grid openings are analyzed, or an analytical sensitivity of 0.2 million fibers per liter (MFL) is achieved. Analyzed fibers are subjected to detailed morphological and selected area diffraction (SAED) analysis. Fibers indicated as asbestos, or potentially asbestos, are further analyzed by energy dispersive X-ray (EDX) analysis as needed. The number of asbestos fibers detected, and other analytical parameters, are then used to calculate the concentration of asbestos in MFL. The results are entered into a standard report format and reviewed by the analyst and the laboratory manager before release to the client.

Sincerely Yours,

Laboratory Manager

--- These results relate only to the samples tested and must not bereproduced, except in full, with the approval of the laboratory. This report must not be used to claim product endorsement by NVLAP or any other agency of the U.S. Government. ---

TRANSMISSION ELECTRON MICROSCOPY
ANALYTICAL REPORT

Contact: Robbie C. Phillips

Address:
Alpha Analytical Laboratories, Inc.
208 Mason Street
Ukiah, CA 95482

Job Site / No. 16E1535

Report No.: 341142
Date: Jun-01-16
Total Samples Analyzed: 1
Sample Collector:

CLIENT SAMPLE # **16E1535-01**

Laboratory Sample # 1288-01013-001

SAMPLE LOCATION/DESCRIPTION

ESQ-5-17

WATER SAMPLE DATA

Date/Time Collected	May-17-16 / 10:00 am		Volume Submitted (ml)	1 liter
Date/Time Lab Received	May-19-16 / 11:22 am		Volume Filtered (ml)	15
Date/Time Filtered	May-19-16 / 10:09 am		Filter & Pore Size	MCE0.22
Date/Time Analyzed	Jun-01-16 / 11:00 am		UV/Ozone Treated:	YES

IDENTIFIED STRUCTURES (>10um)			
ASBESTOS		OTHER	
CHRYS	AMPH	AMBIG	NON-ASB
NSD	NSD	NSD	NSD

CALCULATED ASBESTOS STRUCTURE CONCENTRATION (>10um)		
CHRYS	AMPH	TOTAL
< 0.2 MFL	< 0.2 MFL	< 0.2 MFL

COMMENTS

No Asbestos Detected

Filter Loading: MODERATE

SAED Photo ID Nos.

TEM / ANALYTICAL PARAMETERS

Grid Openings Scanned at 10,000X	8	Analytical Sensitivity	0.2 MFL
Grid Opening Area (mm2)	0.0090	95% UCL	0.69 MFL
Scan Area (mm2)	0.0720	95% LCL	0 MFL

WATER SAMPLE LAB BLANK RESULTS

Lab ID#	TLB-17470	Analytical Sensitivity	0.01 MFL
Grid Openings Scanned at 10,000X	8	Asbestos Structure Concentration	<0.01 MFL
Volume Filtered (ml)	300		

NOTATION KEY

Chrys. - Chrysotile Asbestos
Amph. - Amphibole Asbestos
NSD - No Structures Detected
1 mm = 1 millimeter

1 um = 1 micron = 0.001 mm
MFL = Millions of Fibers per Liter
UCL = Upper Confidence Level
LCL = Lower Confidence Level

Analyzed by Yang Zhang

Crystal Replogle

Reviewed by Crystal Replogle

SUBCONTRACT ORDER

Alpha Analytical Laboratories, Inc.

16E1535

341142

SENDING LABORATORY:

Alpha Analytical Laboratories, Inc.
208 Mason St.
Ukiah, CA 95482
Phone: (707)468-0401
Fax: (707)468-5267
Project Manager: Robbie C. Phillips

RECEIVING LABORATORY:

Asbestos TEM Laboratories, Inc.
630 Bancroft Way
Berkeley, CA 94710
Phone :(510) 704-8930
Fax: (510) 704-8429
Terms: Net 30

Analysis	Due	Expires	Comments
16E1535-01 ESW-5-17-10:00 [Water] Sampled 05/17/16 10:00 Pacific			
Asbestos-DW SUB	06/01/16 12:00	05/19/16 10:00	

Containers Supplied:

1L Amber- Unpres. (N)   1L Amber- Unpres. (O)

☐ *Report to State*

System Name: ____________ Employed by: ____________

User ID: ____________ Sampler: ____________

System Number: ____________

w/QC

Released By: ____ Date: 5/18/16 Received By: Ara ATEM Date: 10am 5/19

Released By: ____ Date: ____ Received By: ____ Date: ____

FGL
ENVIRONMENTAL AGRICULTURAL
Analytical Chemists

June 3, 2016

Alpha Analytical Laboratories, Inc.
208 Mason St.
Ukiah, CA 95482

Lab ID : SP 1605717
Customer : 2-20626

Laboratory Report

Introduction: This report package contains total of 9 pages divided into 3 sections:

Case Narrative	(2 pages)	: An overview of the work performed at FGL.
Sample Results	(2 pages)	: Results for each sample submitted.
Quality Control	(5 pages)	: Supporting Quality Control (QC) results.

Case Narrative

This Case Narrative pertains to the following samples:

Sample Description	Date Sampled	Date Received	FGL Lab ID #	Matrix
ESW-5-17-10:00	05/17/2016	05/19/2016	SP 1605717-001	W

Sampling and Receipt Information: All samples were received in acceptable condition and within temperature requirements, unless noted on the Condition Upon Receipt (CUR) form. All samples arrived at 5 °C. All samples were prepared and analyzed within the method specified hold time. All samples were checked for pH if acid or base preservation is required (except for VOAs). For details of sample receipt information, please see the attached Chain of Custody and Condition Upon Receipt Form.

Quality Control: All samples were prepared and analyzed according to the following tables:

Organic QC

505	05/20/2016:206932 All analysis quality controls are within established criteria, except: The following note applies to Hexachlorocyclopentadiene: 360 CCV above Acceptance Range (AR). Samples which were non detect for this analyte were accepted.
	05/20/2016:207219 All analysis quality controls are within established criteria, except: The following note applies to Tetrachloro-m-xylene: 362 Surrogates are qualified on Control Chart Limits, these are CCV limits. See individual sample reports.
	05/19/2016:205764 All preparation quality controls are within established criteria.
531.1	06/03/2016:207802 All analysis quality controls are within established criteria.
	06/02/2016:206486 All preparation quality controls are within established criteria, except: The following note applies to Aldicarb Sulfone/Sulfoxide, Oxamyl: 435 Sample matrix may be affecting this analyte. Data was accepted based on the LCS or CCV recovery.

Organic QC

548.1	05/27/2016:207526 All analysis quality controls are within established criteria.
	05/19/2016:205874 All preparation quality controls are within established criteria.

Radio QC

900.0	05/30/2016:207789 All analysis quality controls are within established criteria.
	05/26/2016:206157 All preparation quality controls are within established criteria.
Ra - 05	05/29/2016:207557 All analysis quality controls are within established criteria.
	05/26/2016:206021 All preparation quality controls are within established criteria.

Certification:: I certify that this data package is in compliance with ELAP standards, both technically and for completeness, except for any conditions listed above. Release of the data contained in this data package is authorized by the Laboratory Director or his designee, as verified by the following electronic signature.

KD:DMB

Approved By **Kelly A. Dunnahoo, B.S.**

Digitally signed by Kelly A. Dunnahoo, B.S.
Title: Laboratory Director
Date: 2016-06-06

June 3, 2016

Lab ID : SP 1605717-001
Customer ID : 2-20626

Alpha Analytical Laboratories, Inc.
208 Mason St.
Ukiah, CA 95482

Sampled On : May 17, 2016-10:00
Sampled By : Not Available
Received On : May 19, 2016-11:15
Matrix : Water

Description : ESW-5-17-10:00
Project : 16E1535

Sample Result - Organic

Constituent	Result	PQL	Units	Note	Sample Preparation		Sample Analysis	
					Method	Date/ID	Method	Date/ID
EPA 505$^{AGT:1}$								
Tetrachloro-m-xylene‡	126	70-130	%		505	05/19/16:205764	505	05/20/16:207219
Alachlor	ND	0.2	ug/L		505	05/19/16:205764	505	05/20/16:206932
Aldrin	ND	0.075	ug/L		505	05/19/16:205764	505	05/20/16:206932
Chlordane	ND	0.1	ug/L		505	05/19/16:205764	505	05/20/16:206932
Dieldrin	ND	0.01	ug/L		505	05/19/16:205764	505	05/20/16:206932
Endrin	ND	0.01	ug/L		505	05/19/16:205764	505	05/20/16:206932
Heptachlor	ND	0.01	ug/L		505	05/19/16:205764	505	05/20/16:206932
Heptachlor Epoxide	ND	0.01	ug/L		505	05/19/16:205764	505	05/20/16:206932
Hexachlorobenzene	ND	0.01	ug/L		505	05/19/16:205764	505	05/20/16:206932
Hexachlorocyclopentadiene	ND	0.1	ug/L		505	05/19/16:205764	505	05/20/16:206932
Lindane (Gamma BHC)	ND	0.05	ug/L		505	05/19/16:205764	505	05/20/16:206932
Methoxychlor	ND	0.1	ug/L		505	05/19/16:205764	505	05/20/16:206932
Toxaphene	ND	0.5	ug/L		505	05/19/16:205764	505	05/20/16:206932
PCB 1016	ND	0.5	ug/L		505	05/19/16:205764	505	05/20/16:206932
PCB 1221	ND	0.5	ug/L		505	05/19/16:205764	505	05/20/16:206932
PCB 1232	ND	0.5	ug/L		505	05/19/16:205764	505	05/20/16:206932
PCB 1242	ND	0.5	ug/L		505	05/19/16:205764	505	05/20/16:206932
PCB 1248	ND	0.5	ug/L		505	05/19/16:205764	505	05/20/16:206932
PCB 1254	ND	0.5	ug/L		505	05/19/16:205764	505	05/20/16:206932
PCB 1260	ND	0.5	ug/L		505	05/19/16:205764	505	05/20/16:206932
EPA 531.1$^{AGT:1'8}$								
Aldicarb	ND	3	ug/L		531.1	06/02/16:206486	531.1	06/03/16:207802
Aldicarb Sulfone	ND	2	ug/L		531.1	06/02/16:206486	531.1	06/03/16:207802
Aldicarb Sulfoxide	ND	3	ug/L		531.1	06/02/16:206486	531.1	06/03/16:207802
Carbaryl	ND	5	ug/L		531.1	06/02/16:206486	531.1	06/03/16:207802
Carbofuran	ND	5	ug/L		531.1	06/02/16:206486	531.1	06/03/16:207802
3-Hydroxycarbofuran	ND	3	ug/L		531.1	06/02/16:206486	531.1	06/03/16:207802
Methomyl	ND	2	ug/L		531.1	06/02/16:206486	531.1	06/03/16:207802
Oxamyl	ND	5	ug/L		531.1	06/02/16:206486	531.1	06/03/16:207802
EPA 548.1$^{AGT:1}$								
Endothall	ND	40	ug/L		548.1	05/19/16:205874	548.1	05/27/16:207526

ND=Non-Detected. PQL=Practical Quantitation Limit. Containers: (AGT) Amber Glass TFE-Cap, (P) Plastic Preservatives: Monochloracetic Buffer, HNO3 pH < 2 ‡Surrogate. * PQL adjusted for dilution.

June 3, 2016

Alpha Analytical Laboratories, Inc.
208 Mason St.
Ukiah, CA 95482

Lab ID : SP 1605717-001
Customer ID : 2-20626

Sampled On : May 17, 2016-10:00
Sampled By : Not Available
Received On : May 19, 2016-11:15
Matrix : Water

Description : ESW-5-17-10:00
Project : 16E1535

Sample Result - Radio

Constituent	Result ± Error	MDA	Units	MCL/AL	Sample Preparation		Sample Analysis	
					Method	Date/ID	Method	Date/ID
Radio Chemistry$^{P:1'5}$								
Gross Alpha	0.818 ± 1.44	1.91	pCi/L	15/5	900.0	05/26/16-08:00 2P1606157	900.0	05/30/16-07:00 2A1607789
Ra 228	0.049 ± 0.560	0.200	pCi/L	2	Ra - 05	05/26/16-19:30 2P1606021	Ra - 05	05/29/16-11:40 2A1607557

ND=Non-Detected. PQL=Practical Quantitation Limit. Containers: (AGT) Amber Glass TFE-Cap, (P) Plastic Preservatives: Monochloracetic Buffer, HNO3 pH < 2 * PQL adjusted for dilution.

MDA = Minimum Detectable Activity (Calculated at the 95% confidence level) = Data utilized by DHS to determine matrix interference.
MCL / AL = Maximum Contamination Level / Action Level. Alpha's Action Level of 5 pCi/L is based on the Assigned Value (AV).
AV = Assigned Value(Gross Alpha Result + (0.84 x Error)). CCR Section 64442: Drinking Water Compliance Note: Do the following If Gross Alpha's (AV) exceeds 5 pCi/L run Uranium. If Gross Alpha's (AV) minus Uranium exceeds 5 pCi/L run Radium 226.

Drinking Water Compliance:
Gross Alpha (AV) minus Uranium is less than or equal to 15 pCi/L
Uranium is less than or equal to 20 pCi/L
Radium 226 + Radium 228 is less than or equal to 5 pCi/L

Note: Samples are held for 3-6 months prior to disposal.

June 3, 2016		Lab ID	: SP 1605717
Alpha Analytical Laboratories, Inc.		Customer	: 2-20626

Quality Control - Organic

Constituent	Method	Date/ID	Type	Units	Conc.	QC Data	DQO	Note
Organic								
Alachlor	505	05/19/16:205764JOM	Blank	ug/L		ND	<0.2	
			LCS	ug/L	5.802	88.5 %	84-135	
			MS	ug/L	5.596	83.1 %	73-137	
		(SP 1605533-001)	MSD	ug/L	5.729	92.4 %	73-137	
			MSRPD	ug/L	5.729	12.9%	≤30	
	505	05/20/16:206932VRG	CCV	ug/L	100.0	111 %	70-130	
			CCV	ug/L	100.0	89.5 %	70-130	
Aldrin	505	05/19/16:205764JOM	Blank	ug/L		ND	<0.075	
			LCS	ug/L	0.5802	87.5 %	69-134	
			MS	ug/L	0.5596	84.9 %	21-166	
		(SP 1605533-001)	MSD	ug/L	0.5729	90.3 %	21-166	
			MSRPD	ug/L	5.729	8.5%	≤30	
	505	05/20/16:206932VRG	CCV	ug/L	10.00	118 %	70-130	
			CCV	ug/L	10.00	96.5 %	70-130	
Chlordane	505	05/19/16:205764JOM	Blank	ug/L		ND	<0.1	
Dieldrin	505	05/19/16:205764JOM	Blank	ug/L		ND	<0.01	
			LCS	ug/L	0.5802	83.9 %	82-131	
			MS	ug/L	0.5596	82.0 %	66-141	
		(SP 1605533-001)	MSD	ug/L	0.5729	84.4 %	66-141	
			MSRPD	ug/L	5.729	5.2%	≤30	
	505	05/20/16:206932VRG	CCV	ug/L	10.00	113 %	70-130	
			CCV	ug/L	10.00	86.8 %	70-130	
Endrin	505	05/19/16:205764JOM	Blank	ug/L		ND	<0.01	
			LCS	ug/L	0.5802	85.1 %	83-120	
			MS	ug/L	0.5596	84.6 %	58-134	
		(SP 1605533-001)	MSD	ug/L	0.5729	87.4 %	58-134	
			MSRPD	ug/L	5.729	5.6%	≤30	
	505	05/20/16:206932VRG	CCV	ug/L	10.00	117 %	70-130	
			CCV	ug/L	10.00	90.4 %	70-130	
Heptachlor	505	05/19/16:205764JOM	Blank	ug/L		ND	<0.01	
			LCS	ug/L	0.5802	88.2 %	71-131	
			MS	ug/L	0.5596	89.5 %	73-135	
		(SP 1605533-001)	MSD	ug/L	0.5729	93.4 %	73-135	
			MSRPD	ug/L	5.729	6.6%	≤30	
	505	05/20/16:206932VRG	CCV	ug/L	10.00	123 %	70-130	
			CCV	ug/L	10.00	99.5 %	70-130	
Heptachlor Epoxide	505	05/19/16:205764JOM	Blank	ug/L		ND	<0.01	
			LCS	ug/L	0.5802	89.0 %	75-129	
			MS	ug/L	0.5596	85.8 %	65-134	
		(SP 1605533-001)	MSD	ug/L	0.5729	88.0 %	65-134	
			MSRPD	ug/L	5.729	4.9%	≤30	
	505	05/20/16:206932VRG	CCV	ug/L	10.00	118 %	70-130	
			CCV	ug/L	10.00	90.4 %	70-130	
Hexachlorobenzene	505	05/19/16:205764JOM	Blank	ug/L		ND	<0.01	
			LCS	ug/L	0.5802	88.6 %	69-134	
			MS	ug/L	0.5596	85.8 %	71-136	
		(SP 1605533-001)	MSD	ug/L	0.5729	85.9 %	71-136	
			MSRPD	ug/L	5.729	2.5%	≤30	
	505	05/20/16:206932VRG	CCV	ug/L	10.00	116 %	70-130	
			CCV	ug/L	10.00	90.2 %	70-130	
Hexachlorocyclopentadiene	505	05/19/16:205764JOM	Blank	ug/L		ND	<0.1	
			LCS	ug/L	0.5802	94.3 %	48-144	
			MS	ug/L	0.5596	87.1 %	60-152	
		(SP 1605533-001)	MSD	ug/L	0.5729	91.2 %	60-152	
			MSRPD	ug/L	5.729	6.9%	≤30	

Quality Control - Organic

Constituent	Method	Date/ID	Type	Units	Conc.	QC Data	DQO	Note
Organic								
Hexachlorocyclopentadiene	505	05/20/16:206932VRG	CCV	ug/L	10.00	133 %	70-130	360
			CCV	ug/L	10.00	104 %	70-130	
Lindane	505	05/19/16:205764JOM	Blank	ug/L		ND	<0.05	
			LCS	ug/L	0.5802	92.3 %	76-131	
			MS	ug/L	0.5596	90.2 %	72-132	
		(SP 1605533-001)	MSD	ug/L	0.5729	89.2 %	72-132	
			MSRPD	ug/L	5.729	1.2%	≤30	
	505	05/20/16:206932VRG	CCV	ug/L	10.00	124 %	70-130	
			CCV	ug/L	10.00	92.2 %	70-130	
Methoxychlor	505	05/19/16:205764JOM	Blank	ug/L		ND	<0.1	
			LCS	ug/L	2.901	90.0 %	73-137	
			MS	ug/L	2.798	89.1 %	59-145	
		(SP 1605533-001)	MSD	ug/L	2.865	95.7 %	59-145	
			MSRPD	ug/L	5.729	9.5%	≤30	
	505	05/20/16:206932VRG	CCV	ug/L	50.00	125 %	70-130	
			CCV	ug/L	50.00	99.9 %	70-130	
PCB 1016/1242 - 1	505	05/19/16:205764JOM	Blank	ug/L		ND	<0.5	
PCB 1221 - 1	505	05/19/16:205764JOM	Blank	ug/L		ND	<0.5	
PCB 1232 - 1	505	05/19/16:205764JOM	Blank	ug/L		ND	<0.5	
PCB 1242	505	05/19/16:205764JOM	Blank	ug/L		ND	<0.5	
PCB 1248 - 1	505	05/19/16:205764JOM	Blank	ug/L		ND	<0.5	
PCB 1254 - 1	505	05/19/16:205764JOM	Blank	ug/L		ND	<0.5	
PCB 1260 - 1	505	05/19/16:205764JOM	Blank	ug/L		ND	<0.5	
Tetrachloro-m-xylene	505	05/19/16:205764JOM	Blank	ug/L	1.144	119 %	70-130	
			LCS	ug/L	1.162	118 %	70-130	
			MS	ug/L	1.120	106 %	N/A	
		(SP 1605533-001)	MSD	ug/L	1.147	117 %	N/A	
			MSRPD	ug/L	5.729	12.5%	≤30.0	
	505	05/20/16:207219VRG	CCV	ug/L	20.02	146 %	70-130	362
			CCV	ug/L	20.02	111 %	70-130	
Toxaphene	505	05/19/16:205764JOM	Blank	ug/L		ND	<0.5	
3-Hydroxycarbofuran	531.1	06/02/16:206486SG	Blank	ug/L		ND	<3	
			LCS	ug/L	20.00	99.4 %	80-120	
			MS	ug/L	20.00	76.0 %	65-135	
		(VI 1641694-001)	MSD	ug/L	20.00	81.2 %	65-135	
			MSRPD	ug/L	20.00	6.6%	≤16.8	
	531.1	06/03/16:207802SG	CCV	ug/L	10.00	113 %	80-120	
			CCV	ug/L	20.00	89.6 %	80-120	
Aldicarb	531.1	06/02/16:206486SG	Blank	ug/L		ND	<3	
			LCS	ug/L	20.00	94.2 %	80-120	
			MS	ug/L	20.00	92.8 %	65-135	
		(VI 1641694-001)	MSD	ug/L	20.00	97.9 %	65-135	
			MSRPD	ug/L	20.00	5.4%	≤11.2	
	531.1	06/03/16:207802SG	CCV	ug/L	10.00	120 %	80-120	
			CCV	ug/L	20.00	98.8 %	80-120	
Aldicarb Sulfone	531.1	06/03/16:207802SG	CCV	ug/L	10.00	92.2 %	80-120	
			CCV	ug/L	20.00	94.6 %	80-120	
Aldicarb Sulfone/Sulfoxide	531.1	06/02/16:206486SG	Blank	ug/L		ND	<2	
			Blank	ug/L		ND	<3	
			LCS	ug/L	20.00	104 %	80-120	
			LCS	ug/L	20.00	100 %	80-120	
			MS	ug/L	20.00	94.6 %	65-135	
			MS	ug/L	20.00	80.8 %	65-135	
		(VI 1641694-001)	MSD	ug/L	20.00	107 %	65-135	

June 3, 2016 Lab ID : SP 1605717
Alpha Analytical Laboratories, Inc. Customer : 2-20626

Quality Control - Organic

Constituent	Method	Date/ID	Type	Units	Conc.	QC Data	DQO	Note
Organic								
Aldicarb Sulfone/Sulfoxide	531.1	(VI 1641694-001)	MSD	ug/L	20.00	110 %	65-135	
			MSRPD	ug/L	20.00	27.8%	≤7.28	435
			MSRPD	ug/L	20.00	14.6%	≤13.8	435
Aldicarb Sulfoxide	531.1	06/03/16:207802SG	CCV	ug/L	10.00	104 %	80-120	
			CCV	ug/L	20.00	100 %	80-120	
Carbaryl	531.1	06/03/16:207802SG	CCV	ug/L	10.00	109 %	80-120	
			CCV	ug/L	20.00	106 %	80-120	
Carbaryl/Naphthol	531.1	06/02/16:206486SG	Blank	ug/L		ND	<5	
			LCS	ug/L	20.00	99.6 %	80-120	
			MS	ug/L	20.00	99.4 %	65-135	
		(VI 1641694-001)	MSD	ug/L	20.00	106 %	65-135	
			MSRPD	ug/L	20.00	1.4	≤5	
Carbofuran	531.1	06/02/16:206486SG	Blank	ug/L		ND	<5	
			LCS	ug/L	20.00	99.0 %	80-120	
			MS	ug/L	20.00	90.0 %	65-135	
		(VI 1641694-001)	MSD	ug/L	20.00	101 %	65-135	
			MSRPD	ug/L	20.00	2.2	≤5	
	531.1	06/03/16:207802SG	CCV	ug/L	10.00	83.0 %	80-120	
			CCV	ug/L	20.00	109 %	80-120	
Methomyl	531.1	06/02/16:206486SG	Blank	ug/L		ND	<2	
			LCS	ug/L	20.00	104 %	80-120	
			MS	ug/L	20.00	100 %	65-135	
		(VI 1641694-001)	MSD	ug/L	20.00	101 %	65-135	
			MSRPD	ug/L	20.00	0.5%	≤53.1	
	531.1	06/03/16:207802SG	CCV	ug/L	10.00	98.5 %	80-120	
			CCV	ug/L	20.00	107 %	80-120	
Oxamyl	531.1	06/02/16:206486SG	Blank	ug/L		ND	<5	
			LCS	ug/L	20.00	90.6 %	80-120	
			MS	ug/L	20.00	122 %	65-135	
		(VI 1641694-001)	MSD	ug/L	20.00	86.8 %	65-135	
			MSRPD	ug/L	20.00	7.0	≤5	435
	531.1	06/03/16:207802SG	CCV	ug/L	10.00	83.9 %	80-120	
			CCV	ug/L	20.00	86.6 %	80-120	
Endothall	548.1	05/19/16:205874SG	Blank	ug/L		ND	<40	
			LCS	ug/L	83.33	58.8 %	30-96	
			MS	ug/L	83.33	65.6 %	15-87	
		(STK1635948-001)	MSD	ug/L	83.33	51.6 %	15-87	
			MSRPD	ug/L	83.33	12	≤40	
	548.1	05/27/16:207526SG	CCV	ug/L	2500	116 %	70-130	
			CCV	ug/L	1000	115 %	70-130	

Definition

CCV : Continuing Calibration Verification - Analyzed to verify the instrument calibration is within criteria.
Blank : Method Blank - Prepared to verify that the preparation process is not contributing contamination to the samples.
LCS : Laboratory Control Standard/Sample - Prepared to verify that the preparation process is not affecting analyte recovery.
MS : Matrix Spikes - A random sample is spiked with a known amount of analyte. The recoveries are an indication of how that sample matrix affects analyte recovery.
MSD : Matrix Spike Duplicate of MS/MSD pair - A random sample duplicate is spiked with a known amount of analyted. The recoveries are an indication of how that sample matrix affects analyte recovery.
MSRPD : MS/MSD Relative Percent Difference (RPD) - The MS relative percent difference is an indication of precision for the preparation and analysis.
ND : Non-detect - Result was below the DQO listed for the analyte.
DQO : Data Quality Objective - This is the criteria against which the quality control data is compared.

Explanation

360 : CCV above Acceptance Range (AR). Samples which were non detect for this analyte were accepted.

Quality Control - Organic

Explanation	
362	: Surrogates are qualified on Control Chart Limits, these are CCV limits. See individual sample reports.
435	: Sample matrix may be affecting this analyte. Data was accepted based on the LCS or CCV recovery.

Quality Control - Radio

Constituent	Method	Date/ID	Type	Units	Conc.	QC Data	DQO	Note
Radio								
Alpha	900.0	05/30/16:207789caa	CCV	cpm	8661	42.1 %	38 - 47	
			CCB	cpm		0.100	0.18	
Gross Alpha	900.0	05/26/16:206157ELC	Blank	pCi/L		1.12	3	
			LCS	pCi/L	107.4	107 %	75-125	
			MS	pCi/L	107.4	91.2 %	60-140	
		(SP 1605903-001)	MSD	pCi/L	107.4	98.8 %	60-140	
			MSRPD	pCi/L	107.4	7.9%	≤30	
Beta	Ra - 05	05/29/16:207557caa	CCV	cpm	9051	97.8 %	88 - 107	
			CCB	cpm		0.3800	0.49	
Ra 228	Ra - 05	05/26/16:206021emv	RgBlk	pCi/L		-0.05	3	
			LRS	pCi/L	81.13	50.9 %	27-59	
			BS	pCi/L	81.13	108 %	75-125	
			BSD	pCi/L	81.13	111 %	75-125	
			BSRPD	pCi/L	81.13	3.1%	≤25	

Definition

CCV : Continuing Calibration Verification - Analyzed to verify the instrument calibration is within criteria.
CCB : Continuing Calibration Blank - Analyzed to verify the instrument baseline is within criteria.
Blank : Method Blank - Prepared to verify that the preparation process is not contributing contamination to the samples.
RgBlk : Method Reagent Blank - Prepared to correct for any reagent contributions to sample result.
LCS : Laboratory Control Standard/Sample - Prepared to verify that the preparation process is not affecting analyte recovery.
LRS : Laboratory Recovery Standard - Prepared to establish the batch recovery factor used in result calculations.
MS : Matrix Spikes - A random sample is spiked with a known amount of analyte. The recoveries are an indication of how that sample matrix affects analyte recovery.
MSD : Matrix Spike Duplicate of MS/MSD pair - A random sample duplicate is spiked with a known amount of analyted. The recoveries are an indication of how that sample matrix affects analyte recovery.
BS : Blank Spikes - A blank is spiked with a known amount of analyte. It is prepared to verify that the preparation process is not affecting analyte recovery.
BSD : Blank Spike Duplicate of BS/BSD pair - A blank duplicate is spiked with a known amount of analyte. It is prepared to verify that the preparation process is not affecting analyte recovery.
MSRPD : MS/MSD Relative Percent Difference (RPD) - The MS relative percent difference is an indication of precision for the preparation and analysis.
BSRPD : BS/BSD Relative Percent Difference (RPD) - The BS relative percent difference is an indication of precision for the preparation and analysis.
DQO : Data Quality Objective - This is the criteria against which the quality control data is compared.

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925-828-6226 F) 925-828-6309

Central Valley Laboratory
9090 Unioin Park Wy., #113, Elk Grove, CA 95624
916-686-5190 F) 916-686-5192

Work Order
Chain of Custody Record

Lab No. 16E1535 Page 1 of ~~2~~ 3 (AW)

Name: Town of Windsor - Drinking Water	**Project ID:** Source Chemical
Mailing Address: 9291 Old Redwood Highway Building 400 Windsor, CA 95492	**Phase:** Esposti Well
Project Contact (Hardcopy or PDF to): Elizabeth Cargay ecargay@townofwindsor.com	PO# 200336
Kent O'Brien kent.obrien@ghd.com	**Bill to:** month end billing

Signature below authorizes work under terms stated on reverse side.

Analysis Request

Field Sampler - Print Name & Signature

Sample Identification	Sample Collection Date	Sample Collection Time	Container: 40ml VOA	Container: Poly	Container: Amber	Container: Glass	Preservative: HCL	Preservative: HNO3	Preservative: NH4Cl	Preservative: Other	Preservative: None	Matrix: Water	Matrix: Soil	200.8 As	200.7 Fe	200.7 Mn	200.8 Cr	218.6 Cr6	200.7 Ca, Mg, K, Na	Alkalinity	Chloride	Nitrate as N, Nitrite as N	Sulfate	Total Nitrogen (includes TKN, NO2, NO3)	Silica	200.8 Vanadium - total	Phosphate	Title 22 Scan (**Below List)	TAT
ESW-5-17-10:00	5/17	10:00	x	x	x		x	x		x	x	x																x	See Attached Page verify all analytes Tested

TAT: 24 hr ○ 48 hr ○ Lab Approval Required; 1 wk ○ 2 wk (standard) [✓] — Lab Approval Required For Rush

2.4

**Title 22 Scan

64432 Primary Inorganics, 64432.1 NO2/NO3, 64449 A&B Asbestos, Perchlorate, Gross Alpha, 504.1, 507, 508, 515.1, 524.2, 531.1, 548.1, 549.2

Relinquished by:	Received by:	Date	Time
		5/17/16	1315
		"	1515

CDPH Write On EDT Report? [✓ Yes] No ○

State System Number:

CA Geotracker EDF Report Yes ○ No ○

Sampling Company Log Code:

Global ID: EDF to (Email Address):

Travel and Site Time: Mileage: Misc. Supplies:

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Work Order
Chain of Custody Record

Lab No. 16E1535

Page ~~1~~ 2 of ~~1~~ 3 RW

Name: Town of Windsor - Drinking Water

Mailing Address:
9291 Old Redwood Highway Building 400
Windsor, CA 95492

Project Contact (Hardcopy or PDF to):
Elizabeth Cargay
ecargay@townofwindsor.com
Kent O'Brien
kent.obrien@ghd.com

Project ID: Source Chemical

Phase: Esposti Well

PO# 200336

Bill to: month end billing

Signature below authorizes work under terms stated on reverse side.

Analysis Request

Field Sampler - Print Name & Signature

Sample Identification	Sample Collection Date	Sample Collection Time	Container: 40ml VOA	Container: Poly	Container: Amber	Container: Glass	Preservative: HCL	Preservative: HNO3	Preservative: H2SO4	Preservative: Other	Preservative: None	Matrix: Water	Matrix: Soil	~~As III & IV~~ RS As III & As IV	Ammonia	Sulfide	Cr6 DW	Cyanide DW	Radium 228	525.2 DDW Reg 3	547 Glyphosate	1613 Dioxin DW
~~Esposti~~ ESW ESW-5-17-10:00	5/17	10:00		x	x		x	x	x	x	x	x		~~x~~	x	x	x	x	x	x	x	x

TAT
24 hr ○
48 hr ○
Lab Approval Required
1 wk ○
2 wk (standard) ☒
Lab Approval Required For Rush

2.4

Cancel As III & As IV Speciation due to incorrect sample container.
SF

Relinquished by:	Received by:	Date	Time
		5/17/16	1315
		〃	1515

CDPH Write On EDT Report? Yes ☒ No ○
State System Number:

CA Geotracker EDF Report Yes ○ No ○
Sampling Company Log Code:
Global ID:
EDF to (Email Address):

Travel and Site Time:	Mileage:	Misc. Supplies:

16E1535

Provide analysis for each of the compounds listed below:

Well Water Analysis*

**	pH	6.67		**Anions**			**Metals & Radionuclides**		
**	Temperature	66	°F	Alkalinity	230	mg/L $CaCO_3$	Antimony	<6.0	µg/L Sb
**	ORP (EMF)	4	mV	Bicarbonate	280	mg/L $CaCO_3$	Total Arsenic	56.0	µg/L As
**	Conductivity	458	µS/cm	Carbonate	<1.0	mg/L $CaCO_3$	Reduced As(III)		µg/L As(III)
**	Dissolved Solids	300	mg/L TDS	Chloride	17	mg/L Cl	Copper	<50	µg/L Cu
**	Suspended Solids	–	mg/L TSS	Fluoride	0.37	mg/L F	Iron	<100	µg/L Fe
**	Turbidity	354.0	NTU	Nitrate	<2.0	mg/L NO_3	Lead	<5.0	µg/L Pb
	Cations			Phosphate		mg/L PO_4	Manganese	750	µg/L Mn
	Hardness	120	mg/L $CaCO_3$	***Silica	87.0	mg/L SiO_2	Mercury	<1.0	µg/L Hg
***	Ammonia	0.30	mg/L NH_3	Sulfate	12	mg/L SO_4	Selenium	<5.0	µg/L Se
	Calcium	22	mg/L Ca	Sulfide		mg/L S	Uranium		µg/L U
	Magnesium	15	mg/L Mg	______		mg/L ____	Vanadium		µg/L V
	Sodium	54	mg/L Na	______		mg/L ____	______		µg/L ____

Raw Water Analysis are critical for basic design estimates

alpha
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Central Valley: 9090 Union Park Way, Suite 113, Elk Grove, CA 95624 • Phone: (916) 686-5190 • Fax: (916) 686-5192

ELAP Certificates 1551, 2728, and 2922

22 September 2016

Town Of Windsor - Drinking Water
Attn: Elizabeth Cargay
8400 Windsor Rd.
Windsor, CA 95492-0100
RE: Esposti Feasibility Study
Work Order: 16I0423

Enclosed are the results of analyses for samples received by the laboratory on 09/06/16 16:00. If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Jeanette Poplin

Jeanette L. Poplin For Robbie C. Phillips
Project Manager

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
Esposti Irrigation Well	16I0423-01	Water	09/06/16 10:45	09/06/16 16:00

Town Of Windsor - Drinking Water
8400 Windsor Rd.
Windsor, CA 95492-0100

Project Manager: Elizabeth Cargay
Project: Esposti Feasibility Study
Project Number: #25-1310

Reported:
09/22/16 13:21

	Result		Reporting Limit	Dilution	Batch	Prepared	Analyzed	Method	Note
Esposti Irrigation Well (16I0423-01)			**Sample Type: Water**			**Sampled: 09/06/16 10:45**			
Metals (Drinking Water) by EPA 200 Series Methods									
Calcium	**19**	**mg/L**	**1.0**	1	AI63409	09/20/16 08:00	09/20/16 17:49	EPA 200.7	
Iron	ND	ug/L	100	1	AI63409	09/20/16 08:00	09/20/16 17:49	EPA 200.7	
Magnesium	**19**	**mg/L**	**1.0**	1	AI63409	09/20/16 08:00	09/20/16 17:49	EPA 200.7	
Manganese	**1500**	**ug/L**	**20**	1	AI63409	09/20/16 08:00	09/20/16 17:49	EPA 200.7	
Potassium	**7.1**	**mg/L**	**1.0**	1	AI63409	09/20/16 08:00	09/20/16 17:49	EPA 200.7	
Sodium	**31**	**mg/L**	**1.0**	1	AI63409	09/20/16 08:00	09/20/16 17:49	EPA 200.7	
Metals by EPA 200 Series Methods									
Chromium, hexavalent	ND	ug/L	1.0	1	AI63521	09/19/16 15:44	09/19/16 15:44	EPA 218.6	
Metals by EPA Method 200.8 ICP/MS									
Arsenic	**13**	**ug/L**	**2.0**	4	AI63407	09/19/16 06:35	09/20/16 12:21	EPA 200.8	
Chromium	ND	ug/L	10	4	AI63407	09/19/16 06:35	09/20/16 12:21	EPA 200.8	R-01
Vanadium	ND	ug/L	3.0	4	AI63407	09/19/16 06:35	09/20/16 12:21	EPA 200.8	R-01
Conventional Chemistry Parameters by APHA/EPA Methods									
Phosphate, Total	**0.95**	**mg/L**	**0.10**	1	AI63455	09/19/16 07:45	09/19/16 12:57	SM4500-P E	
Silica	**85**	**mg/L**	**5.0**	5	AI63462	09/19/16 08:14	09/19/16 11:30	SM4500-SiO2 C	
Total Alkalinity as CaCO3	**150**	**mg/L**	**5.0**	1	AI63242	09/13/16 08:00	09/13/16 16:13	SM2320B	
Total Kjeldahl Nitrogen	ND	mg/L	1.0	1	AI63268	09/14/16 06:19	09/15/16 09:57	SM4500-Norg B	
Total Nitrogen	ND	mg/L	1.0	1	AI63246	09/12/16 10:47	09/19/16 16:38	SM4500-N	
Anions by EPA Method 300.0									
Chloride	**27**	**mg/L**	**2.5**	5	AI63111	09/08/16 03:04	09/08/16 03:04	EPA 300.0	
Nitrate as N	ND	mg/L	0.20	1	AI63111	09/08/16 03:20	09/08/16 03:20	EPA 300.0	
Nitrite as N	ND	mg/L	0.20	1	AI63111	09/08/16 03:04	09/08/16 03:04	EPA 300.0	
Sulfate as SO4	**9.2**	**mg/L**	**0.50**	1	AI63111	09/08/16 03:20	09/08/16 03:20	EPA 300.0	

Metals (Drinking Water) by EPA 200 Series Methods - Quality Control

Batch AI63409 - Metals Digest

Blank (AI63409-BLK1) Prepared & Analyzed: 09/20/16

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Calcium	ND	1.0	mg/L							
Iron	ND	100	ug/L							
Magnesium	ND	1.0	mg/L							
Manganese	ND	20	ug/L							
Potassium	ND	1.0	mg/L							
Sodium	ND	1.0	mg/L							

LCS (AI63409-BS1) Prepared & Analyzed: 09/20/16

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Calcium	7.31	1.0	mg/L	8.00		91.4	85-115			
Iron	1930	100	ug/L	2000		96.5	85-115			
Magnesium	7.39	1.0	mg/L	8.00		92.4	85-115			
Manganese	192	20	ug/L	200		96.1	85-115			
Potassium	7.74	1.0	mg/L	8.00		96.8	85-115			
Sodium	6.88	1.0	mg/L	8.00		86.0	85-115			

Duplicate (AI63409-DUP1) **Source: 16I0351-01** Prepared & Analyzed: 09/20/16

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Calcium	24.8	1.0	mg/L		24.3			1.77	20	
Iron	ND	100	ug/L		ND			3.83	20	
Magnesium	17.2	1.0	mg/L		17.1			0.696	20	
Manganese	ND	20	ug/L		ND			4.49	20	
Potassium	32.1	1.0	mg/L		31.7			1.28	20	
Sodium	93.5	1.0	mg/L		91.8			1.86	20	

Matrix Spike (AI63409-MS1) **Source: 16I0351-01** Prepared & Analyzed: 09/20/16

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Calcium	32.5	1.0	mg/L	8.00	24.3	103	70-130			
Iron	2020	100	ug/L	2000	ND	97.5	70-130			
Magnesium	24.5	1.0	mg/L	8.00	17.1	92.2	70-130			
Manganese	203	20	ug/L	200	ND	98.6	70-130			
Potassium	38.4	1.0	mg/L	8.00	31.7	83.8	70-130			
Sodium	98.7	1.0	mg/L	8.00	91.8	86.7	70-130			

Metals (Drinking Water) by EPA 200 Series Methods - Quality Control

Batch AI63409 - Metals Digest

Matrix Spike (AI63409-MS2) **Source: 16I0318-01** Prepared & Analyzed: 09/20/16

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Calcium	48.0	1.0	mg/L	8.00	37.1	135	70-130			QM-4X
Iron	32300	100	ug/L	2000	30200	107	70-130			
Magnesium	36.2	1.0	mg/L	8.00	27.1	113	70-130			
Manganese	6030	20	ug/L	200	5760	137	70-130			QM-4X
Potassium	9.63	1.0	mg/L	8.00	1.14	106	70-130			
Sodium	28.2	1.0	mg/L	8.00	18.5	121	70-130			

Matrix Spike Dup (AI63409-MSD1) **Source: 16I0351-01** Prepared & Analyzed: 09/20/16

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Calcium	33.3	1.0	mg/L	8.00	24.3	112	70-130	2.22	20	
Iron	2160	100	ug/L	2000	ND	105	70-130	6.72	20	
Magnesium	24.8	1.0	mg/L	8.00	17.1	96.4	70-130	1.34	20	
Manganese	217	20	ug/L	200	ND	106	70-130	6.75	20	
Potassium	38.7	1.0	mg/L	8.00	31.7	87.7	70-130	0.806	20	
Sodium	102	1.0	mg/L	8.00	91.8	123	70-130	2.89	20	

Town Of Windsor - Drinking Water
8400 Windsor Rd.
Windsor, CA 95492-0100

Project Manager: Elizabeth Cargay
Project: Esposti Feasibility Study
Project Number: #25-1310

Reported:
09/22/16 13:21

Metals by EPA 200 Series Methods - Quality Control

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Batch AI63521 - General Preparation										
Blank (AI63521-BLK1)				Prepared & Analyzed: 09/19/16						
Chromium, hexavalent	ND	1.0	ug/L							
LCS (AI63521-BS1)				Prepared & Analyzed: 09/19/16						
Chromium, hexavalent	9.93	1.0	ug/L	10.0		99.3	90-110			
Duplicate (AI63521-DUP1)	**Source: 16I0423-01**			Prepared & Analyzed: 09/19/16						
Chromium, hexavalent	ND	1.0	ug/L		ND				20	
Matrix Spike (AI63521-MS1)	**Source: 16I0423-01**			Prepared & Analyzed: 09/19/16						
Chromium, hexavalent	9.72	1.0	ug/L	10.0	ND	97.2	90-110			
Matrix Spike (AI63521-MS2)	**Source: 16I1463-01**			Prepared & Analyzed: 09/19/16						
Chromium, hexavalent	9.83	1.0	ug/L	10.0	ND	98.3	90-110			
Matrix Spike Dup (AI63521-MSD1)	**Source: 16I0423-01**			Prepared & Analyzed: 09/19/16						
Chromium, hexavalent	9.60	1.0	ug/L	10.0	ND	96.0	90-110	1.15	20	

Metals by EPA Method 200.8 ICP/MS - Quality Control

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Batch AI63407 - EPA 200.8										
Blank (AI63407-BLK1)				Prepared: 09/19/16 Analyzed: 09/20/16						
Arsenic	ND	2.0	ug/L							
Chromium	ND	10	ug/L							
Vanadium	ND	3.0	ug/L							
LCS (AI63407-BS1)				Prepared: 09/19/16 Analyzed: 09/20/16						
Arsenic	21.9	2.0	ug/L	20.0		110	85-115			
Chromium	20.9	10	ug/L	20.0		104	85-115			
Vanadium	21.0	3.0	ug/L	20.0		105	85-115			
Duplicate (AI63407-DUP1)	**Source: 16I0351-01**			Prepared: 09/19/16 Analyzed: 09/20/16						
Arsenic	6.08	2.0	ug/L		6.63			8.57	20	
Chromium	ND	10	ug/L		ND				20	
Vanadium	ND	30	ug/L		ND				20	

Conventional Chemistry Parameters by APHA/EPA Methods - Quality Control

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Batch AI63242 - General Preparation										
Duplicate (AI63242-DUP1)	**Source: 16I0603-01**			Prepared & Analyzed: 09/13/16						
Total Alkalinity as CaCO3	11.0	5.0	mg/L		11.0			0.00	20	
Batch AI63268 - General Prep										
LCS (AI63268-BS1)				Prepared: 09/13/16 Analyzed: 09/14/16						
Total Kjeldahl Nitrogen	2.95	1.0	mg/L	2.98		99.0	80-120			
LCS Dup (AI63268-BSD1)				Prepared: 09/13/16 Analyzed: 09/14/16						
Total Kjeldahl Nitrogen	2.95	1.0	mg/L	2.98		99.0	80-120	0.00	20	
Matrix Spike (AI63268-MS1)	**Source: 16I0737-03**			Prepared: 09/13/16 Analyzed: 09/14/16						
Total Kjeldahl Nitrogen	3.13	1.0	mg/L	2.98	ND	105	75-125			
Matrix Spike Dup (AI63268-MSD1)	**Source: 16I0737-03**			Prepared: 09/13/16 Analyzed: 09/14/16						
Total Kjeldahl Nitrogen	3.13	1.0	mg/L	2.98	ND	105	75-125	0.00	20	
Batch AI63455 - General Prep										
Blank (AI63455-BLK1)				Prepared & Analyzed: 09/19/16						
Phosphate, Total	ND	0.10	mg/L							
LCS (AI63455-BS1)				Prepared & Analyzed: 09/19/16						
Phosphate, Total	0.590	0.10	mg/L	0.600		98.4	85-115			
Duplicate (AI63455-DUP1)	**Source: 16I1150-01**			Prepared & Analyzed: 09/19/16						
Phosphate, Total	ND	0.10	mg/L		ND			6.35	20	

Conventional Chemistry Parameters by APHA/EPA Methods - Quality Control

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Batch AI63455 - General Prep										
Matrix Spike (AI63455-MS1)	**Source: 16I1150-01**			Prepared & Analyzed: 09/19/16						
Phosphate, Total	0.607	0.10	mg/L	0.600	ND	90.7	70-130			
Matrix Spike Dup (AI63455-MSD1)	**Source: 16I1150-01**			Prepared & Analyzed: 09/19/16						
Phosphate, Total	0.607	0.10	mg/L	0.600	ND	90.7	70-130	0.00	20	
Batch AI63462 - General Preparation										
Blank (AI63462-BLK1)				Prepared & Analyzed: 09/19/16						
Silica	ND	1.0	mg/L							
LCS (AI63462-BS1)				Prepared & Analyzed: 09/19/16						
Silica	9.57	1.0	mg/L	10.0		95.7	85-115			
LCS Dup (AI63462-BSD1)				Prepared & Analyzed: 09/19/16						
Silica	9.61	1.0	mg/L	10.0		96.1	85-115	0.411	20	
Duplicate (AI63462-DUP1)	**Source: 16I0685-01**			Prepared & Analyzed: 09/19/16						
Silica	34.3	5.0	mg/L		35.8			4.50	20	
Matrix Spike (AI63462-MS1)	**Source: 16I0685-01**			Prepared & Analyzed: 09/19/16						
Silica	56.1	5.0	mg/L	25.0	35.8	81.3	80-120			
Matrix Spike Dup (AI63462-MSD1)	**Source: 16I0685-01**			Prepared & Analyzed: 09/19/16						
Silica	56.5	5.0	mg/L	25.0	35.8	82.8	80-120	0.700	20	

Town Of Windsor - Drinking Water	Project Manager: Elizabeth Cargay	
8400 Windsor Rd.	Project: Esposti Feasibility Study	Reported:
Windsor, CA 95492-0100	Project Number: #25-1310	09/22/16 13:21

Anions by EPA Method 300.0 - Quality Control

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Batch AI63111 - General Preparation										
Blank (AI63111-BLK1)				Prepared & Analyzed: 09/07/16						
Nitrate as N	ND	0.20	mg/L							
Sulfate as SO4	ND	0.50	mg/L							
Nitrite as N	ND	0.20	mg/L							
Chloride	ND	0.50	mg/L							
LCS (AI63111-BS1)				Prepared & Analyzed: 09/07/16						
Sulfate as SO4	23.4	0.50	mg/L	22.2		105	90-110			
Nitrite as N	5.85	0.20	mg/L	5.56		105	90-110			
Nitrate as N	5.86	0.20	mg/L	5.56		105	90-110			
Chloride	11.6	0.50	mg/L	11.1		104	90-110			
Duplicate (AI63111-DUP1)	**Source: 16I0425-04**			Prepared & Analyzed: 09/08/16						
Nitrate as N	ND	0.20	mg/L		ND				20	
Nitrite as N	ND	0.20	mg/L		ND				20	
Chloride	ND	0.50	mg/L		ND				20	
Sulfate as SO4	ND	0.50	mg/L		ND				20	
Matrix Spike (AI63111-MS1)	**Source: 16I0425-04**			Prepared & Analyzed: 09/08/16						
Nitrite as N	5.58	0.20	mg/L	5.56	ND	100	80-120			
Chloride	11.4	0.50	mg/L	11.1	ND	102	80-120			
Nitrate as N	5.76	0.20	mg/L	5.56	ND	104	80-120			
Sulfate as SO4	22.8	0.50	mg/L	22.2	ND	103	80-120			
Matrix Spike (AI63111-MS2)	**Source: 16I0362-03**			Prepared & Analyzed: 09/08/16						
Chloride	15.9	2.5	mg/L	11.1	5.03	98.2	80-120			
Nitrate as N	5.32	1.0	mg/L	5.56	ND	95.7	80-120			
Nitrite as N	5.29	1.0	mg/L	5.56	ND	95.2	80-120			
Sulfate as SO4	32.0	2.5	mg/L	22.2	11.1	93.9	80-120			

Anions by EPA Method 300.0 - Quality Control

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Batch AI63111 - General Preparation										
Matrix Spike Dup (AI63111-MSD1)		**Source: 16I0425-04**		Prepared & Analyzed: 09/08/16						
Chloride	11.6	0.50	mg/L	11.1	ND	104	80-120	1.65	20	
Nitrate as N	5.85	0.20	mg/L	5.56	ND	105	80-120	1.65	20	
Nitrite as N	5.59	0.20	mg/L	5.56	ND	101	80-120	0.139	20	
Sulfate as SO4	23.1	0.50	mg/L	22.2	ND	104	80-120	1.48	20	

Notes and Definitions

QM-4X	The spike recovery was outside of QC acceptance limits for the MS and/or MSD due to analyte concentration at 4 times or greater the spike concentration. The QC batch was accepted based on LCS and/or LCSD recoveries within the acceptance limits.
R-01	The Reporting Limit for this analyte has been raised to account for matrix interference.
ND	Analyte NOT DETECTED at or above the reporting limit
dry	Sample results reported on a dry weight basis
REC	Recovery
RPD	Relative Percent Difference

WECK LABORATORIES, INC.

Certificate of Analysis

FINAL REPORT

Work Orders:	6I09025	**Report Date:**	9/13/2016
		Received Date:	9/9/2016
Project:	16I0423	**Turnaround Time:**	Normal
		Phones:	(925) 828-6226
		Fax:	(925) 828-6309
		P.O. #:	
Attn:	Robbie Phillips		

Client: Alpha Analytical Laboratories - Ukiah
208 Mason St
Ukiah, CA 95482

Dear Robbie Phillips,

Enclosed are the results of analyses for samples received 9/09/16 with the Chain-of-Custody document. The samples were received in good condition, at 3.3 °C and on ice. All analyses met the method criteria except as noted in the case narrative or in the report with data qualifiers.

Sample Results

Sample: 16I0423-01, Alias: Esposti Irrigation Well
6I09025-01 (Water)
Sampled: 09/06/16 10:45 by Client

Method: IC-ICP/MS **Batch ID:** W6I0467 **Instr:** Inst **Prepared:** 09/11/16 08:36 **Analyst:** apa

Analyte	Result	MRL	Units	Dil	Analyzed	Qualifier
Arsenic III	**0.52**	0.40	ug/l	1	09/11/16 16:57	
Arsenic V	**13**	4.0	ug/l	10	09/11/16 16:57	

Quality Control Results

Metals by EPA 200 Series Methods

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W6I0467 - Direct Injection										
Blank (W6I0467-BLK1)				**Prepared & Analyzed: 09/11/16**						
Arsenic III	ND	0.40	ug/l							
Arsenic V	ND	0.40	ug/l							
LCS (W6I0467-BS1)				**Prepared & Analyzed: 09/11/16**						
Arsenic III	9.56	0.40	ug/l	10.0		96	85-115			
Arsenic V	8.92	0.40	ug/l	10.0		89	85-115			
Matrix Spike (W6I0467-MS1)	**Source: 6H26026-01**			**Prepared & Analyzed: 09/11/16**						
Arsenic III	118	4.0	ug/l	100	ND	118	70-130			
Arsenic V	119	4.0	ug/l	100	5.42	114	70-130			
Matrix Spike (W6I0467-MS2)	**Source: 6I08004-01**			**Prepared & Analyzed: 09/11/16**						
Arsenic III	112	4.0	ug/l	100	0.260	112	70-130			
Arsenic V	139	4.0	ug/l	100	28.7	110	70-130			
Matrix Spike Dup (W6I0467-MSD1)	**Source: 6H26026-01**			**Prepared & Analyzed: 09/11/16**						
Arsenic III	109	4.0	ug/l	100	ND	109	70-130	8	30	
Arsenic V	114	4.0	ug/l	100	5.42	108	70-130	4	30	
Matrix Spike Dup (W6I0467-MSD2)	**Source: 6I08004-01**			**Prepared & Analyzed: 09/11/16**						
Arsenic III	110	4.0	ug/l	100	0.260	110	70-130	2	30	
Arsenic V	140	4.0	ug/l	100	28.7	112	70-130	1	30	

Notes and Definitions

Item	Definition
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.

Not Certified Analyses Summary

Analyte	CAS #	Not Accredited By
IC-ICP/MS in Water		
Arsenic III	22541-54-4	NELAP
Arsenic V	17428-41-0	NELAP

Reviewed by:

Kim Tu

Kim G. Tu
Project Manager

DoD-ELAP #L15-366 ELAP-CA #1132 EPA-UCMR #CA00211 HW-DOH # ISO 17025 #L15-365 NELAP-OR #4047 NJ-DEP #CA015 NV-DEP #NAC 445A SCAQMD #93LA1006

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.

Alpha Analytical Laboratories Inc.
www.alpha-labs.com
WATERS, SEDIMENTS, SOLIDS

Corporate Laboratory
208 Mason Street, Ukiah, CA 95482
707-468-0401 F) 707-468-5267
clientservices@alpha-labs.com

Bay Area Laboratory
6398 Dougherty Road, #35, Dublin, CA 94568
925-828-6228 F) 925-828-6309

Central Valley Laboratory
9090 Unioin Park Wy., #113, Elk Grove, CA 95624
916-686-5190 F) 916-686-5192

Work Order
Chain of Custody Record

Lab No. 16I0423 Page 1 of 1

Name: Town of Windsor - ~~Drinking Water~~ FEASIBILITY STUDY

Mailing Address:
9291 Old Redwood Highway Building 400
Windsor, CA 95492

Project Contact (Hardcopy or PDF to):
Elizabeth Cargay
ecargay@townofwindsor.com
AND
KOBRIEN@HAZENANDSAWYER.COM

Project ID: #25-1310

Phase: Esposti Well

PO# 200336

Bill to: month end billing

Field Sampler - Print Name & Signature: RYAN CRAWFORD Ryan Crawford

Signature below authorizes work under terms stated on reverse side.

Analysis Request

Sample Identification	Date	Time	40ml VOA	Poly	Amber	Glass		HCL	HNO3	H2SO4	Other	None	Water	Soil		200.8 As	200.7 Fe/Mn		200.8 Cr	218.6 Cr6	200.7 Ca, Mg, K, Na	Alkalinity	Chloride		Sulfate	Total Nitrogen (includes TKN, NO2, NO3)	Silica	200.8 Vanadium - total	Phosphate	As3 & As5 - sub Weck				TAT
Esposti Irrigation Well 9-6-16	9/6/16	1045		x					x	x	x	x	x			X	X		x	x	x	x	x		x	x	x	x	x	x				

Container: 40ml VOA, Poly, Amber, Glass — Preservative: HCL, HNO3, H2SO4, Other, None — Matrix: Water, Soil

TAT: ○ 24 hr ○ 48 hr (Lab Approval Required) ○ 1 wk [✓ 2 wk (standard)] — Lab Approval Required For Rush!

2.2

BOTTLE KIT ORDER for Esposti Irrigation Well placed 9/1/2016, deliver kit on Friday 9/2/20016 in a cooler to:
Ryan Crawford
2235 Mercury Way, Suite 150,
Santa Rosa, CA 95407

Global ID: EDF to (Email Address):

Relinquished by:	Received by:	Date	Time	Travel and Site Time:	Mileage:	Misc. Supplies:
Ryan Crawford	[illegible]	9/6/16	1430			
[illegible]	[illegible]		1600			

Alpha Analytical Laboratories Inc.
e-mail: clientservices@alpha-labs.com
Corporate: 208 Mason St., Ukiah, CA 95482 • Phone: (707) 468-0401 • Fax: (707) 468-5267
Bay Area: 6398 Dougherty Rd., Suite 35, Dublin, CA 94568 • Phone: (925) 828-6226 • Fax: (925) 828-6309
Central Valley: 9090 Union Park Way, Suite 113, Elk Grove, CA 95624 • Phone: (916) 686-5190 • Fax: (916) 686-5192

ELAP Certificates 1551, 2728, and 2922

30 September 2016

Town Of Windsor - Drinking Water
Attn: Elizabeth Cargay
8400 Windsor Rd.
Windsor, CA 95492-0100
RE: Esposti Feasibility Study - Weeks
Work Order: 16I2059

Enclosed are the results of analyses for samples received by the laboratory on 09/22/16 16:06. If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Sheri Speaks

Sheri L. Speaks For Robbie C. Phillips
Project Manager

Town Of Windsor - Drinking Water	Project Manager: Elizabeth Cargay	
8400 Windsor Rd.	Project: Esposti Feasibility Study - Weeks	Reported:
Windsor, CA 95492-0100	Project Number: 25-1310	09/30/16 14:14

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
ESW-9-21-7:01	16I2059-01	Water	09/21/16 07:01	09/22/16 16:06
ESW-9-21-7:05	16I2059-02	Water	09/21/16 07:05	09/22/16 16:06
ESW-9-21-8:00	16I2059-03	Water	09/21/16 08:00	09/22/16 16:06
ESW-9-21-11:00	16I2059-04	Water	09/21/16 11:00	09/22/16 16:06
ESW-9-21-15:00	16I2059-05	Water	09/21/16 15:00	09/22/16 16:06

	Result	Reporting Limit	Dilution	Batch	Prepared	Analyzed	Method	Note
ESW-9-21-7:01 (16I2059-01)		**Sample Type: Water**			**Sampled: 09/21/16 07:01**			
Metals (Drinking Water) by EPA 200 Series Methods								
Iron	**1700** ug/L	**100**	1	AI63684	09/28/16 13:45	09/28/16 14:45	EPA 200.7	
Manganese	**860** ug/L	**20**	1	AI63684	09/28/16 13:45	09/28/16 14:45	EPA 200.7	
Metals by EPA Method 200.8 ICP/MS								
Arsenic	**58** ug/L	**1.6**	1	AI63725	09/28/16 15:30	09/29/16 08:22	EPA 200.8	
ESW-9-21-7:05 (16I2059-02)		**Sample Type: Water**			**Sampled: 09/21/16 07:05**			
Metals (Drinking Water) by EPA 200 Series Methods								
Iron	**3400** ug/L	**100**	1	AI63684	09/28/16 13:45	09/28/16 14:50	EPA 200.7	
Manganese	**1100** ug/L	**20**	1	AI63684	09/28/16 13:45	09/28/16 14:50	EPA 200.7	
Metals by EPA Method 200.8 ICP/MS								
Arsenic	**52** ug/L	**1.6**	1	AI63725	09/28/16 15:30	09/29/16 08:34	EPA 200.8	
ESW-9-21-8:00 (16I2059-03)		**Sample Type: Water**			**Sampled: 09/21/16 08:00**			
Metals (Drinking Water) by EPA 200 Series Methods								
Iron	**260** ug/L	**100**	1	AI63684	09/28/16 13:45	09/28/16 14:54	EPA 200.7	
Manganese	**860** ug/L	**20**	1	AI63684	09/28/16 13:45	09/28/16 14:54	EPA 200.7	
Metals by EPA Method 200.8 ICP/MS								
Arsenic	**43** ug/L	**1.6**	1	AI63725	09/28/16 15:30	09/29/16 08:47	EPA 200.8	
ESW-9-21-11:00 (16I2059-04)		**Sample Type: Water**			**Sampled: 09/21/16 11:00**			
Metals (Drinking Water) by EPA 200 Series Methods								
Iron	**190** ug/L	**100**	1	AI63684	09/28/16 13:45	09/28/16 14:58	EPA 200.7	
Manganese	**910** ug/L	**20**	1	AI63684	09/28/16 13:45	09/28/16 14:58	EPA 200.7	

	Result	Reporting Limit	Dilution	Batch	Prepared	Analyzed	Method	Note
ESW-9-21-11:00 (16I2059-04)		**Sample Type: Water**			**Sampled: 09/21/16 11:00**			
Metals by EPA Method 200.8 ICP/MS								
Arsenic	**38 ug/L**	**1.6**	1	AI63725	09/28/16 15:30	09/29/16 09:00	EPA 200.8	
ESW-9-21-15:00 (16I2059-05)		**Sample Type: Water**			**Sampled: 09/21/16 15:00**			
Metals (Drinking Water) by EPA 200 Series Methods								
Calcium	**23 mg/L**	**1.0**	1	AI63684	09/28/16 13:45	09/28/16 15:03	EPA 200.7	
Iron	**140 ug/L**	**100**	1	AI63684	09/28/16 13:45	09/28/16 15:03	EPA 200.7	
Magnesium	**18 mg/L**	**1.0**	1	AI63684	09/28/16 13:45	09/28/16 15:03	EPA 200.7	
Manganese	**910 ug/L**	**20**	1	AI63684	09/28/16 13:45	09/28/16 15:03	EPA 200.7	
Potassium	**14 mg/L**	**1.0**	1	AI63684	09/28/16 13:45	09/28/16 15:03	EPA 200.7	
Sodium	**52 mg/L**	**1.0**	1	AI63684	09/28/16 13:45	09/28/16 15:03	EPA 200.7	
Metals by EPA 200 Series Methods								
Chromium, hexavalent	ND ug/L	1.0	1	AI63833	09/28/16 11:53	09/28/16 15:40	EPA 218.6	
Metals by EPA Method 200.8 ICP/MS								
Arsenic	**35 ug/L**	**1.6**	1	AI63725	09/28/16 15:30	09/29/16 09:13	EPA 200.8	
Chromium	ND ug/L	8.0	1	AI63725	09/28/16 15:30	09/29/16 15:40	EPA 200.8	
Conventional Chemistry Parameters by APHA/EPA Methods								
Phosphate, Total	**1.2 mg/L**	**0.10**	1	AI63857	09/29/16 08:00	09/29/16 10:34	SM4500-P E	
Silica	**86 mg/L**	**5.0**	5	AI63840	09/28/16 14:00	09/28/16 16:10	SM4500-SiO2 C	
Total Alkalinity as CaCO3	**220 mg/L**	**5.0**	1	AI63828	09/28/16 10:34	09/28/16 12:20	SM2320B	
Total Kjeldahl Nitrogen	ND mg/L	1.0	1	AI63778	09/28/16 06:15	09/28/16 09:54	SM4500-Norg B	
Total Nitrogen	ND mg/L	1.0	1	AI63774	09/26/16 16:38	09/29/16 08:41	SM4500-N	

Town Of Windsor - Drinking Water
8400 Windsor Rd.
Windsor, CA 95492-0100

Project Manager: Elizabeth Cargay
Project: Esposti Feasibility Study - Weeks
Project Number: 25-1310

Reported:
09/30/16 14:14

ESW-9-21-15:00 (16I2059-05) **Sample Type: Water** **Sampled: 09/21/16 15:00**

Anions by EPA Method 300.0

	Result	Reporting Limit	Dilution	Batch	Prepared	Analyzed	Method	Note
Chloride	**22 mg/L**	**0.50**	1	AI63687	09/23/16 16:34	09/23/16 16:34	EPA 300.0	
Nitrate as N	ND mg/L	0.20	1	AI63687	09/23/16 16:50	09/23/16 16:50	EPA 300.0	
Nitrite as N	ND mg/L	0.20	1	AI63687	09/23/16 16:50	09/23/16 16:50	EPA 300.0	
Sulfate as SO4	**14 mg/L**	**0.50**	1	AI63687	09/23/16 16:50	09/23/16 16:50	EPA 300.0	

Metals (Drinking Water) by EPA 200 Series Methods - Quality Control

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Batch AI63684 - EPA 200 Series										
Blank (AI63684-BLK1)				Prepared & Analyzed: 09/23/16						
Calcium	ND	1.0	mg/L							
Iron	ND	100	ug/L							
Magnesium	ND	1.0	mg/L							
Manganese	ND	20	ug/L							
Potassium	ND	1.0	mg/L							
Sodium	ND	1.0	mg/L							
LCS (AI63684-BS1)				Prepared & Analyzed: 09/23/16						
Calcium	7.30	1.0	mg/L	6.80		107	85-115			
Iron	1810	100	ug/L	1700		107	85-115			
Magnesium	7.18	1.0	mg/L	6.80		106	85-115			
Manganese	193	20	ug/L	200		96.5	85-115			
Potassium	7.67	1.0	mg/L	7.60		101	85-115			
Sodium	7.36	1.0	mg/L	6.80		108	85-115			
Duplicate (AI63684-DUP1)		**Source: 16I1992-02**		Prepared & Analyzed: 09/23/16						
Calcium	35.3	1.0	mg/L		32.1			9.29	20	
Iron	ND	100	ug/L		ND				20	
Magnesium	11.4	1.0	mg/L		11.0			3.26	20	
Manganese	ND	20	ug/L		ND				20	
Potassium	3.59	1.0	mg/L		3.41			5.15	20	
Sodium	23.8	1.0	mg/L		21.8			8.77	20	
Matrix Spike (AI63684-MS1)		**Source: 16I1992-02**		Prepared & Analyzed: 09/23/16						
Calcium	42.9	1.0	mg/L	6.80	32.1	158	70-130			QM-4X
Iron	1830	100	ug/L	1700	ND	108	70-130			
Magnesium	18.5	1.0	mg/L	6.80	11.0	110	70-130			
Manganese	203	20	ug/L	200	ND	102	70-130			
Potassium	10.7	1.0	mg/L	7.60	3.41	96.1	70-130			
Sodium	30.9	1.0	mg/L	6.80	21.8	133	70-130			QM-01

Metals (Drinking Water) by EPA 200 Series Methods - Quality Control

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Batch AI63684 - EPA 200 Series										
Matrix Spike (AI63684-MS2)	**Source: 16I2059-01**			Prepared & Analyzed: 09/28/16						
Calcium	28.4	1.0	mg/L	6.80	21.9	96.1	70-130			
Iron	3360	100	ug/L	1700	1700	98.1	70-130			
Magnesium	23.2	1.0	mg/L	6.80	15.9	107	70-130			
Manganese	1030	20	ug/L	200	856	88.1	70-130			
Potassium	24.3	1.0	mg/L	7.60	17.6	88.4	70-130			
Sodium	60.2	1.0	mg/L	6.80	56.0	61.9	70-130			QM-4X
Matrix Spike Dup (AI63684-MSD1)	**Source: 16I1992-02**			Prepared & Analyzed: 09/23/16						
Calcium	42.3	1.0	mg/L	6.80	32.1	149	70-130	1.40	20	QM-4X
Iron	1770	100	ug/L	1700	ND	104	70-130	3.42	20	
Magnesium	19.2	1.0	mg/L	6.80	11.0	121	70-130	3.81	20	
Manganese	197	20	ug/L	200	ND	98.5	70-130	3.22	20	
Potassium	10.4	1.0	mg/L	7.60	3.41	91.6	70-130	3.30	20	
Sodium	30.6	1.0	mg/L	6.80	21.8	129	70-130	0.810	20	

Metals by EPA 200 Series Methods - Quality Control

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Batch AI63833 - General Preparation										
Blank (AI63833-BLK1)				Prepared & Analyzed: 09/28/16						
Chromium, hexavalent	ND	1.0	ug/L							
LCS (AI63833-BS1)				Prepared & Analyzed: 09/28/16						
Chromium, hexavalent	9.44	1.0	ug/L	10.0		94.4	90-110			
Duplicate (AI63833-DUP1)		**Source: 16I2059-05**		Prepared & Analyzed: 09/28/16						
Chromium, hexavalent	ND	1.0	ug/L		ND				20	
Matrix Spike (AI63833-MS1)		**Source: 16I2059-05**		Prepared & Analyzed: 09/28/16						
Chromium, hexavalent	9.54	1.0	ug/L	10.0	ND	95.4	90-110			
Matrix Spike (AI63833-MS2)		**Source: 16I2319-01**		Prepared & Analyzed: 09/28/16						
Chromium, hexavalent	14.2	1.0	ug/L	10.0	4.56	96.1	90-110			
Matrix Spike Dup (AI63833-MSD1)		**Source: 16I2059-05**		Prepared & Analyzed: 09/28/16						
Chromium, hexavalent	9.32	1.0	ug/L	10.0	ND	93.2	90-110	2.36	20	

Metals by EPA Method 200.8 ICP/MS - Quality Control

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Batch AI63725 - EPA 200 Series										
Blank (AI63725-BLK1)				Prepared & Analyzed: 09/26/16						
Arsenic	ND	1.6	ug/L							
Chromium	ND	8.0	ug/L							
LCS (AI63725-BS1)				Prepared & Analyzed: 09/26/16						
Arsenic	20.8	1.6	ug/L	20.0		104	85-115			
Chromium	21.1	8.0	ug/L	20.0		105	85-115			
Duplicate (AI63725-DUP1)	Source: 16I2160-01			Prepared & Analyzed: 09/26/16						
Arsenic	2.01	1.6	ug/L		2.05			2.09	20	
Chromium	ND	8.0	ug/L		ND				20	
Matrix Spike (AI63725-MS1)	Source: 16I2160-01			Prepared & Analyzed: 09/26/16						
Arsenic	107	1.6	ug/L	100	2.05	105	70-130			
Chromium	101	8.0	ug/L	100	ND	101	70-130			
Matrix Spike (AI63725-MS2)	Source: 16I2162-01			Prepared & Analyzed: 09/26/16						
Arsenic	106	1.6	ug/L	100	2.03	104	70-130			
Matrix Spike Dup (AI63725-MSD1)	Source: 16I2160-01			Prepared & Analyzed: 09/26/16						
Arsenic	106	1.6	ug/L	100	2.05	104	70-130	1.08	20	
Chromium	104	8.0	ug/L	100	ND	104	70-130	2.65	20	

Conventional Chemistry Parameters by APHA/EPA Methods - Quality Control

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Batch AI63778 - General Prep										
LCS (AI63778-BS1)				Prepared: 09/27/16 Analyzed: 09/28/16						
Total Kjeldahl Nitrogen	3.04	1.0	mg/L	2.98		102	80-120			
LCS Dup (AI63778-BSD1)				Prepared: 09/27/16 Analyzed: 09/28/16						
Total Kjeldahl Nitrogen	3.04	1.0	mg/L	2.98		102	80-120	0.00	20	
Matrix Spike (AI63778-MS1)	**Source: 16I2096-02**			Prepared: 09/27/16 Analyzed: 09/28/16						
Total Kjeldahl Nitrogen	3.13	1.0	mg/L	2.98	ND	105	75-125			
Matrix Spike Dup (AI63778-MSD1)	**Source: 16I2096-02**			Prepared: 09/27/16 Analyzed: 09/28/16						
Total Kjeldahl Nitrogen	3.13	1.0	mg/L	2.98	ND	105	75-125	0.00	20	
Batch AI63828 - General Preparation										
Duplicate (AI63828-DUP1)	**Source: 16I2104-01**			Prepared & Analyzed: 09/28/16						
Total Alkalinity as CaCO3	190	5.0	mg/L		190			0.00	20	
Batch AI63840 - General Preparation										
Blank (AI63840-BLK1)				Prepared & Analyzed: 09/28/16						
Silica	ND	1.0	mg/L							
LCS (AI63840-BS1)				Prepared & Analyzed: 09/28/16						
Silica	10.0	1.0	mg/L	10.0		100	85-115			
LCS Dup (AI63840-BSD1)				Prepared & Analyzed: 09/28/16						
Silica	9.98	1.0	mg/L	10.0		99.8	85-115	0.355	20	

Conventional Chemistry Parameters by APHA/EPA Methods - Quality Control

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Batch AI63857 - General Prep										
Blank (AI63857-BLK1)				Prepared & Analyzed: 09/29/16						
Phosphate, Total	ND	0.10	mg/L							
LCS (AI63857-BS1)				Prepared & Analyzed: 09/29/16						
Phosphate, Total	0.604	0.10	mg/L	0.600		101	85-115			
Duplicate (AI63857-DUP1)	**Source: 16I2098-01**			Prepared & Analyzed: 09/29/16						
Phosphate, Total	ND	0.10	mg/L		ND				20	
Matrix Spike (AI63857-MS1)	**Source: 16I2098-01**			Prepared & Analyzed: 09/29/16						
Phosphate, Total	0.600	0.10	mg/L	0.600	ND	100	70-130			
Matrix Spike Dup (AI63857-MSD1)	**Source: 16I2098-01**			Prepared & Analyzed: 09/29/16						
Phosphate, Total	0.604	0.10	mg/L	0.600	ND	101	70-130	0.672	20	

Anions by EPA Method 300.0 - Quality Control

Batch AI63687 - General Preparation

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Blank (AI63687-BLK1)				Prepared & Analyzed: 09/23/16						
Nitrate as N	ND	0.20	mg/L							
Sulfate as SO4	ND	0.50	mg/L							
Nitrite as N	ND	0.20	mg/L							
Chloride	ND	0.50	mg/L							
LCS (AI63687-BS1)				Prepared & Analyzed: 09/23/16						
Chloride	11.4	0.50	mg/L	11.1		102	90-110			
Nitrate as N	5.91	0.20	mg/L	5.56		106	90-110			
Sulfate as SO4	22.6	0.50	mg/L	22.2		102	90-110			
Nitrite as N	5.23	0.20	mg/L	5.56		94.1	90-110			
Duplicate (AI63687-DUP1)		**Source: 16I2096-01**		Prepared & Analyzed: 09/23/16						
Chloride	5.34	0.50	mg/L		5.30			0.677	20	
Nitrite as N	ND	0.20	mg/L		ND				20	
Nitrate as N	ND	0.20	mg/L		ND				20	
Sulfate as SO4	11.3	0.50	mg/L		11.1			1.45	20	
Matrix Spike (AI63687-MS1)		**Source: 16I2096-01**		Prepared & Analyzed: 09/23/16						
Sulfate as SO4	34.1	0.50	mg/L	22.2	11.1	103	80-120			
Chloride	16.6	0.50	mg/L	11.1	5.30	102	80-120			
Nitrite as N	5.74	0.20	mg/L	5.56	ND	103	80-120			
Nitrate as N	6.02	0.20	mg/L	5.56	ND	108	80-120			
Matrix Spike (AI63687-MS2)		**Source: 16I2098-01**		Prepared & Analyzed: 09/24/16						
Sulfate as SO4	34.2	0.50	mg/L	22.2	10.8	105	80-120			
Chloride	16.7	0.50	mg/L	11.1	5.17	104	80-120			
Nitrate as N	6.19	0.20	mg/L	5.56	ND	111	80-120			
Nitrite as N	5.90	0.20	mg/L	5.56	ND	106	80-120			

Anions by EPA Method 300.0 - Quality Control

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Batch AI63687 - General Preparation										
Matrix Spike Dup (AI63687-MSD1)	**Source: 16I2096-01**		Prepared & Analyzed: 09/24/16							
Nitrate as N	6.01	0.20	mg/L	5.56	ND	108	80-120	0.188	20	
Chloride	16.6	0.50	mg/L	11.1	5.30	102	80-120	0.107	20	
Nitrite as N	5.74	0.20	mg/L	5.56	ND	103	80-120	0.155	20	
Sulfate as SO4	34.1	0.50	mg/L	22.2	11.1	103	80-120	0.0554	20	

Notes and Definitions

QM-01	The spike recovery for this QC sample is outside of established control limits possibly due to a sample matrix interference.
QM-4X	The spike recovery was outside of QC acceptance limits for the MS and/or MSD due to analyte concentration at 4 times or greater the spike concentration. The QC batch was accepted based on LCS and/or LCSD recoveries within the acceptance limits.
ND	Analyte NOT DETECTED at or above the reporting limit
dry	Sample results reported on a dry weight basis
REC	Recovery
RPD	Relative Percent Difference

WECK LABORATORIES, INC.

Certificate of Analysis

FINAL REPORT

Work Orders: 6I27070

Project: 16I2059

Attn: Robbie Phillips

Client: Alpha Analytical Laboratories - Ukiah
208 Mason St
Ukiah, CA 95482

Report Date: 10/10/2016

Received Date: 9/27/2016

Turnaround Time: Normal

Phones: (925) 828-6226

Fax: (925) 828-6309

P.O. #:

Dear Robbie Phillips,

Enclosed are the results of analyses for samples received 9/27/16 with the Chain-of-Custody document. The samples were received in good condition, at 18.1 °C and on ice. All analyses met the method criteria except as noted in the case narrative or in the report with data qualifiers.

Sample Results

Sample: 16I2059-05, Alias: ESW-921-15:00 — Sampled: 09/22/16 15:00 by Client

6I27070-01 (Water)

Method: IC-ICP/MS **Batch ID:** W6J0393 **Instr:** Inst **Prepared:** 10/09/16 09:07 **Analyst:** apa

Analyte	Result	MDL	MRL	Units	Dil	Analyzed	Qualifier
Arsenic III	**20**	0.14	4.0	ug/l	10	10/10/16 15:29	
Arsenic V	**17**	0.14	4.0	ug/l	10	10/10/16 15:29	

Quality Control Results

Metals by EPA 200 Series Methods

Analyte	Result	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W6J0393 - Direct Injection										
Blank (W6J0393-BLK1)				**Prepared: 10/09/16 Analyzed: 10/10/16**						
Arsenic III	ND	0.014	ug/l							
Arsenic V	0.177	0.014	ug/l							J
LCS (W6J0393-BS1)				**Prepared: 10/09/16 Analyzed: 10/10/16**						
Arsenic III	9.89	0.014	ug/l	8.94		111	85-115			
Arsenic V	9.29	0.014	ug/l	9.13		102	85-115			
Matrix Spike (W6J0393-MS1)	**Source: 6I15020-01**			**Prepared: 10/09/16 Analyzed: 10/10/16**						
Arsenic III	9.79	0.014	ug/l	8.94	0.276	106	70-130			
Arsenic V	10.2	0.014	ug/l	9.13	0.536	105	70-130			
Matrix Spike Dup (W6J0393-MSD1)	**Source: 6I15020-01**			**Prepared: 10/09/16 Analyzed: 10/10/16**						
Arsenic III	9.86	0.014	ug/l	8.94	0.276	107	70-130	0.7	30	
Arsenic V	10.2	0.014	ug/l	9.13	0.536	105	70-130	0.03	30	

Notes and Definitions

Item	Definition
J	Estimated conc. detected <MRL and >MDL.
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.

Not Certified Analyses Summary

Analyte	CAS #	Not Accredited By
IC-ICP/MS in Water		
Arsenic III	22541-54-4	NELAP
Arsenic V	17428-41-0	NELAP

Reviewed by:

Kim Tu

Kim G. Tu
Project Manager

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 • SCAQMD #93LA1006

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.

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925-828-6226 F) 925-828-6309

Central Valley Laboratory
9090 Union Park Wy #113, Elk Grove CA 95624
916-686-5190 F) 916-686-5192

Work Order
Chain of Custody Record

2.C

Lab No 16I2059 Page 1 of 1

Name: Town of Windsor - Drinking Water
Mailing Address: 9291 Old Redwood Highway Building 400
Windsor, CA 95492
Project Contact (Hardcopy or PDF to): Elizabeth Cargay
ecargay@townofwindsor.com
Kent O'Brien
kobrien@hazenandsawyer.com

Project ID: Esposti Well
Phase: Project ID: 25-1310
PO# 200336
Bill to: 9GE NOTE: WEEKS ? TOWN OF WINDSOR

Field Sampler - Print Name & Signature: RYAN CRAWFORD Ryan Crawford

Signature below authorizes work under terms stated on reverse side

Sample Identification	Sample Collection Date	Sample Collection Time	Container: 40ml VOA	Container: Poly	Container: Amber	Container: Glass	Container:	Preservative: HCL	Preservative: HNO3	Preservative: H3PO4	Preservative: Other	Preservative: None	Matrix: Water	Matrix: Soil	Matrix:
ESW - -			x	x						x		x	x		
ESW-9-21-7:01	9/21/16	7:01		X					X				X		
ESW-9-21-7:05	↓	7:05		X					X				X		
ESW-9-21-8:00		8:00		X					X				X		
ESW-9-21-11:00		11:00		X					X				X		
ESW-9-21-15:00		15:00	X	X					X	X			X		

Analysis Request

Sample Identification	TSS	TOC	Gross Alpha	Tannins	200.8 Ag	200.7 Fe/Mn/Ca/Mg/K/Na	ALKALINITY	CHLORIDE	NITRATE/NITRITE as N	SULFATE	TOTAL NITROGEN (TKN, NO2, NO3)	SILICA	PHOSPHATE	As3+ and As5+	200.8 Cr	200.6 Cr6+		
ESW - -	x	x	x	x														
ESW-9-21-7:01					X	X												
ESW-9-21-7:05					X	X												
ESW-9-21-8:00					X	X												
ESW-9-21-11:00					X	X												
ESW-9-21-15:00	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		

GHD SUPPLIED BOTTLES

TSS, TOC, GA Tannins only w/o

TAT
24 hr ○
48 hr ☒
Lab Approval Required
1 wk ○
2 wk (standard) ☒
Lab Approval Required For Rush

TSS/TOC/GROSS ALPHA/TANNINS BILL TO TOWN OF WINDSOR, REMAINING ANALYTES BILL TO WEEKS

Relinquished by:	Received by:	Date	Time
Ryan Crawford	David Poma	9/22/16	0815
David Poma		9.22.16	1606

CDPH Write On EDT Report? Yes ○ No ☒
State System Number:
CA Geotracker EDF Report Yes ○ No ☒
Sampling Company Log Code:
Global ID:
EDF to (Email Address):
Travel and Site Time
Mileage
Misc. Supplies

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Central Valley Laboratory
9090 Union Park Wy., #113, Elk Grove, CA 95624
916-686-5190 F) 916-686-5192

questions call Kent O'Brien at
707-478-9559

Work Order
Chain of Custody Record

Lab No. 16I 2059 Page 1 of 1

Revised COC per Robbie 9/28/16

Name: Town of Windsor - Drinking Water

Mailing Address: 9291 Old Redwood Highway Building 400
Windsor, CA 95492

Project Contact (Hardcopy or PDF to):
Elizabeth Cargay
ecargay@townofwindsor.com
Kent O'Brien
kobrien@hazenandsawyer.com

Project ID: Esposti Well

Phase: Project ID: 25-1310

PO# 200336

Bill to: SEE NOTE: WEEKS ? TOWN OF WINDSOR

Field Sampler - Print Name & Signature: RYAN CRAWFORD Ryan Crawford

Signature below authorizes work under terms stated on reverse side.

Analysis Request

Sample Identification	Date	Time	40ml VOA	Poly	Amber	Glass	HCL	HNO3	H3PO4	Other	None	Water	Soil	TSS	TOC	Gross Alpha	Tannins	200.8 As	200.7 Fe/Mn/Ca/Mg/K/Na	ALKALINITY	CHLORIDE	NITRATE / NITRITE as N	SULFATE	TOTAL NITROGEN (TKN, NO2, NO3)	SILICA	PHOSPHATE	As^{3+} and As^{5+}	200.8 Cr	200.6 Cr^{6+}
ESW			x	x					x		x	x		x	x	x	x												
ESW-9-21-7:01	9/21/16	7:01		X				X				X						X	X										
ESW-9-21-7:05	↓	7:05		X				X				X						X	X										
ESW-9-21-8:00		8:00		X				X				X						X	X										
ESW-9-21-11:00		11:00		X				X				X						X	X										
ESW-9-21-15:00	↓	15:00	X	X				X	X			X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Mn/Fe only, no Ca/Mg/K or Na, for these four samples

48-hour TAT for As/Mn/Fe Only

GHD SUPPLIED BOTTLES

TSS/TOC/GROSS ALPHA/TANNINS BILL TO TOWN OF WINDSOR, REMAINING ANALYTES BILL TO WEEKS

TAT: 24 hr ○ 48 hr ☒ (Lab Approval Required For Rush) 1 wk ○ 2 wk (standard) ☒

Relinquished by: Ryan Crawford	Received by:	Date 9/22/16	Time 0815
Relinquished by:	Received by:	Date	Time
Relinquished by:	Received by:	Date	Time
Relinquished by:	Received by:	Date	Time
Relinquished by:	Received by:	Date	Time

CDPH Write On EDT Report? Yes ○ No ☒

State System Number:

CA Geotracker EDF Report Yes ○ No ☒

Sampling Company Log Code

Global ID: EDF to (Email Address)

Travel and Site Time: Mileage: Misc. Supplies:

alpha
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Bay Area: 6398 Dougherty Rd., Suite 35, Dublin, CA 94568 • Phone: (925) 828-6226 • Fax: (925) 828-6309
Central Valley: 9090 Union Park Way, Suite 113, Elk Grove, CA 95624 • Phone: (916) 686-5190 • Fax: (916) 686-5192

ELAP Certificates 1551, 2728, and 2922

07 October 2016

Town Of Windsor - Drinking Water
Attn: Elizabeth Cargay
8400 Windsor Rd.
Windsor, CA 95492-0100
RE: Esposti Feasibility Study
Work Order: 16I2103

Enclosed are the results of analyses for samples received by the laboratory on 09/22/16 16:06. If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Jeanette Poplin

Jeanette L. Poplin For Robbie C. Phillips
Project Manager

Town Of Windsor - Drinking Water	Project Manager: Elizabeth Cargay	
8400 Windsor Rd.	Project: Esposti Feasibility Study	Reported:
Windsor, CA 95492-0100	Project Number: 25-1310	10/07/16 08:13

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
ESW-9-21-15:00	16I2103-01	Water	09/21/16 15:00	09/22/16 16:06

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Town Of Windsor - Drinking Water
8400 Windsor Rd.
Windsor, CA 95492-0100

Project Manager: Elizabeth Cargay
Project: Esposti Feasibility Study
Project Number: 25-1310

Reported:
10/07/16 08:13

	Result		Reporting Limit	Dilution	Batch	Prepared	Analyzed	Method	Note
ESW-9-21-15:00 (16I2103-01)			**Sample Type: Water**			**Sampled: 09/21/16 15:00**			
Conventional Chemistry Parameters by APHA/EPA Methods									
Tannins & Lignins	ND	mg/L	0.50	1	AJ63130	10/03/16 09:00	10/03/16 11:45	SM5550B	
Total Suspended Solids	**3.5**	**mg/L**	**1.0**	1	AI63813	09/27/16 13:30	09/29/16 10:59	SM2540D	
Total Organic Carbon	ND	mg/L	0.300	1	AI63861	09/29/16 06:58	09/29/16 14:37	SM5310C	

Conventional Chemistry Parameters by APHA/EPA Methods - Quality Control

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Batch AI63813 - General Preparation										
Blank (AI63813-BLK1)				Prepared: 09/27/16 Analyzed: 09/29/16						
Total Suspended Solids	ND	1.0	mg/L							
Duplicate (AI63813-DUP1)	**Source: 16I2071-01**			Prepared: 09/27/16 Analyzed: 09/29/16						
Total Suspended Solids	157	1.0	mg/L		154			1.98	30	
Duplicate (AI63813-DUP2)	**Source: 16I2148-01**			Prepared: 09/27/16 Analyzed: 09/29/16						
Total Suspended Solids	243	1.0	mg/L		247			1.74	30	
Batch AI63861 - General Prep										
Blank (AI63861-BLK1)				Prepared & Analyzed: 09/29/16						
Total Organic Carbon	ND	0.300	mg/L							
LCS (AI63861-BS1)				Prepared & Analyzed: 09/29/16						
Total Organic Carbon	10.4	0.300	mg/L	10.0		104	85-115			
LCS Dup (AI63861-BSD1)				Prepared & Analyzed: 09/29/16						
Total Organic Carbon	10.6	0.300	mg/L	10.0		106	85-115	1.96	20	
Duplicate (AI63861-DUP1)	**Source: 16I2213-02**			Prepared & Analyzed: 09/29/16						
Total Organic Carbon	0.916	0.300	mg/L		0.866			5.60	20	
Matrix Spike (AI63861-MS1)	**Source: 16I2213-02**			Prepared & Analyzed: 09/29/16						
Total Organic Carbon	21.5	0.600	mg/L	20.0	0.866	103	70-130			
Matrix Spike Dup (AI63861-MSD1)	**Source: 16I2213-02**			Prepared & Analyzed: 09/29/16						
Total Organic Carbon	21.7	0.600	mg/L	20.0	0.866	104	70-130	1.09	20	

Conventional Chemistry Parameters by APHA/EPA Methods - Quality Control

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Batch AJ63130 - General Preparation										
Blank (AJ63130-BLK1)				Prepared & Analyzed: 10/03/16						
Tannins & Lignins	ND	0.50	mg/L							
LCS (AJ63130-BS1)				Prepared & Analyzed: 10/03/16						
Tannins & Lignins	4.20	0.50	mg/L	4.00		105	80-120			
LCS Dup (AJ63130-BSD1)				Prepared & Analyzed: 10/03/16						
Tannins & Lignins	4.27	0.50	mg/L	4.00		107	80-120	1.70	20	
Duplicate (AJ63130-DUP1)	**Source: 16I2103-01**			Prepared & Analyzed: 10/03/16						
Tannins & Lignins	ND	0.50	mg/L		ND				200	
Matrix Spike (AJ63130-MS1)	**Source: 16I2103-01**			Prepared & Analyzed: 10/03/16						
Tannins & Lignins	3.60	0.50	mg/L	4.00	ND	90.0	80-120			
Matrix Spike Dup (AJ63130-MSD1)	**Source: 16I2103-01**			Prepared & Analyzed: 10/03/16						
Tannins & Lignins	3.57	0.50	mg/L	4.00	ND	89.1	80-120	1.01	20	

Notes and Definitions

P-04	This analysis was run from a plastic container because a glass container was not provided.
ND	Analyte NOT DETECTED at or above the reporting limit
dry	Sample results reported on a dry weight basis
REC	Recovery
RPD	Relative Percent Difference

October 12, 2016

Alpha Analytical Laboratories, Inc.
208 Mason St.
Ukiah, CA 95482

Lab ID : SP 1611469
Customer : 2-20626

Laboratory Report

Introduction: This report package contains total of 3 pages divided into 3 sections:

Case Narrative	(1 pages)	: An overview of the work performed at FGL.
Sample Results	(1 page)	: Results for each sample submitted.
Quality Control	(1 page)	: Supporting Quality Control (QC) results.

Case Narrative

This Case Narrative pertains to the following samples:

Sample Description	Date Sampled	Date Received	FGL Lab ID #	Matrix
16I2103-01 ESW-9-21-15:00	09/21/2016	09/27/2016	SP 1611469-001	W

Sampling and Receipt Information: All samples were received in acceptable condition and within temperature requirements, unless noted on the Condition Upon Receipt (CUR) form. All samples arrived at 6 °C. All samples were prepared and analyzed within the method specified hold time. All samples were checked for pH if acid or base preservation is required (except for VOAs). For details of sample receipt information, please see the attached Chain of Custody and Condition Upon Receipt Form.

Quality Control: All samples were prepared and analyzed according to the following tables:

Radio QC

900.0	10/06/2016:214631 All analysis quality controls are within established criteria.
	10/04/2016:211974 All preparation quality controls are within established criteria, except: The following note applies to Gross Alpha: 435 Sample matrix may be affecting this analyte. Data was accepted based on the LCS or CCV recovery.

Certification:: I certify that this data package is in compliance with ELAP standards, both technically and for completeness, except for any conditions listed above. Release of the data contained in this data package is authorized by the Laboratory Director or his designee, as verified by the following electronic signature.

KD:DMB

Approved By **Kelly A. Dunnahoo, B.S.** Digitally signed by Kelly A. Dunnahoo, B.S.
Title: Laboratory Director
Date: 2016-10-12

October 12, 2016

Alpha Analytical Laboratories, Inc.
208 Mason St.
Ukiah, CA 95482

Lab ID : SP 1611469-001
Customer ID : 2-20626

Sampled On : September 21, 2016-15:00
Sampled By : Not Available
Received On : September 27, 2016-11:40
Matrix : Water

Description : 16I2103-01 ESW-9-21-15:00
Project : 16I2103

Sample Result - Radio

Constituent	Result ± Error	MDA	Units	MCL/AL	Sample Preparation		Sample Analysis	
					Method	Date/ID	Method	Date/ID
Radio Chemistry$^{P:1}$								
Gross Alpha	0.844 ± 1.40	1.75	pCi/L	15/5	900.0	10/04/16-14:55 2P1611974	900.0	10/06/16-14:00 2A1614631

ND=Non-Detected. PQL=Practical Quantitation Limit. Containers: (P) Plastic Preservatives: N/A * PQL adjusted for dilution.

MDA = Minimum Detectable Activity (Calculated at the 95% confidence level) = Data utilized by DHS to determine matrix interference.
MCL / AL = Maximum Contamination Level / Action Level. Alpha's Action Level of 5 pCi/L is based on the Assigned Value (AV).
AV = Assigned Value(Gross Alpha Result + (0.84 x Error)). CCR Section 64442: Drinking Water Compliance Note: Do the following
If Gross Alpha's (AV) exceeds 5 pCi/L run Uranium. If Gross Alpha's (AV) minus Uranium exceeds 5 pCi/L run Radium 226.

Drinking Water Compliance:
Gross Alpha (AV) minus Uranium is less than or equal to 15 pCi/L
Uranium is less than or equal to 20 pCi/L
Radium 226 + Radium 228 is less than or equal to 5 pCi/L

Note: Samples are held for 3-6 months prior to disposal.

October 12, 2016
Alpha Analytical Laboratories, Inc.

Lab ID : SP 1611469
Customer : 2-20626

Quality Control - Radio

Constituent	Method	Date/ID	Type	Units	Conc.	QC Data	DQO	Note
Radio								
Alpha	900.0	10/06/16:214631caa	CCV	cpm	8567	42.4 %	39 - 48	
			CCB	cpm		0.100	0.14	
Gross Alpha	900.0	10/04/16:211974ELC	Blank	pCi/L		0.93	3	
			LCS	pCi/L	107.4	95.6 %	75-125	
			MS	pCi/L	107.4	148 %	60-140	435
		(SP 1611307-001)	MSD	pCi/L	107.4	132 %	60-140	
			MSRPD	pCi/L	107.4	11.6%	≤30	

Definition

CCV : Continuing Calibration Verification - Analyzed to verify the instrument calibration is within criteria.
CCB : Continuing Calibration Blank - Analyzed to verify the instrument baseline is within criteria.
Blank : Method Blank - Prepared to verify that the preparation process is not contributing contamination to the samples.
LCS : Laboratory Control Standard/Sample - Prepared to verify that the preparation process is not affecting analyte recovery.
MS : Matrix Spikes - A random sample is spiked with a known amount of analyte. The recoveries are an indication of how that sample matrix affects analyte recovery.
MSD : Matrix Spike Duplicate of MS/MSD pair - A random sample duplicate is spiked with a known amount of analyted. The recoveries are an indication of how that sample matrix affects analyte recovery.
MSRPD : MS/MSD Relative Percent Difference (RPD) - The MS relative percent difference is an indication of precision for the preparation and analysis.
DQO : Data Quality Objective - This is the criteria against which the quality control data is compared.

Explanation

435 : Sample matrix may be affecting this analyte. Data was accepted based on the LCS or CCV recovery.

Alpha Alpha Analytical Laboratories Inc.
www.alpha-labs.com
WATERS, SEDIMENTS, SOLIDS

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Central Valley Laboratory
9090 Union Park Wy #113, Elk Grove, CA 95624
916-686-5190 F) 916-686-5192

Work Order
Chain of Custody Record

2.C

Lab No 16I2103 Page 1 of 1

Name: Town of Windsor - Drinking Water

Mailing Address:
9291 Old Redwood Highway Building 400
Windsor, CA 95492

Project Contact (Hardcopy or PDF to):
Elizabeth Cargay
ecargay@townofwindsor.com
Kent O'Brien
kobrien@hazenandsawyer.com

Project ID: Esposti Well

Phase: Project ID: 25-1310

PO# 200336

Bill to: SEE NOTE: WEEKS & TOWN OF WINDSOR

Field Sampler - Print Name & Signature: RYAN CRAWFORD Ryan Crawford

Signature below authorizes work under terms stated on reverse side.

Analysis Request

Sample Identification	Date	Time	40ml VOA	Poly	Amber	Glass	HCL	HNO3	H3PO4	Other	None	Water	Soil	TSS	TOC	Gross Alpha	Tannins	200.8 As	200.7 Fe/Mn/Ca/Mg/K/Na	ALKALINITY	CHLORIDE	NITRATE / NITRITE as N	SULFATE	TOTAL NITROGEN (TKN, NO2, NO3)	SILICA	PHOSPHATE	As3+ AND As5+	200.8 Cr	200.6 Cr6+
			x	x					x		x	x		x	x	x	x												
ESW - -																													
ESW-9-21-7:01	9/21/16	7:01		X				X				X						X	X										
ESW-9-21-7:05	↓	7:05		X				X				X						X	X										
ESW-9-21-8:00	↓	8:00		X				X				X						X	X										
ESW-9-21-11:00	↓	11:00		X				X				X						X	X										
ESW-9-21-15:00	↓	15:00	X	X				X	X			X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

GHD SUPPLIED BOTTLES

TSS / TOC / GROSS ALPHA / TANNINS BILL TO TOWN OF WINDSOR, REMAINING ANALYTES BILL TO WEEKS

weeks billing analyses on sep w/o ©

TAT
24 hr ○
48 hr ☒
Lab Approval Required
1 wk ○
2 wk (standard) ☒
Lab Approval Required For Rush

Relinquished by	Received by	Date	Time
Ryan Crawford	David Pomo	9/22/16	0815
David Pomo		9.22.16	1606

CDPH Write On EDT Report? Yes ○ No ☒

State System Number:

CA Geotracker EDF Report Yes ○ No ☒

Sampling Company Log Code:

Global ID: EDF to (Email Address):

Travel and Site Time	Mileage	Misc. Supplies

alpha
Alpha Analytical Laboratories Inc.
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Central Valley: 9090 Union Park Way, Suite 113, Elk Grove, CA 95624 • Phone: (916) 686-5190 • Fax: (916) 686-5192

ELAP Certificates 1551, 2728, and 2922

22 September 2016

Town Of Windsor - Drinking Water
Attn: Elizabeth Cargay
8400 Windsor Rd.
Windsor, CA 95492-0100
RE: Esposti Feasibility Study
Work Order: 16I0423

Enclosed are the results of analyses for samples received by the laboratory on 09/06/16 16:00. If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Jeanette Poplin

Jeanette L. Poplin For Robbie C. Phillips
Project Manager

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
Esposti Irrigation Well	16I0423-01	Water	09/06/16 10:45	09/06/16 16:00

Town Of Windsor - Drinking Water	Project Manager: Elizabeth Cargay	
8400 Windsor Rd.	Project: Esposti Feasibility Study	Reported:
Windsor, CA 95492-0100	Project Number: #25-1310	09/22/16 13:21

	Result	Reporting Limit	Dilution	Batch	Prepared	Analyzed	Method	Note
Esposti Irrigation Well (16I0423-01)		**Sample Type: Water**			**Sampled: 09/06/16 10:45**			
Metals (Drinking Water) by EPA 200 Series Methods								
Calcium	**19 mg/L**	**1.0**	1	AI63409	09/20/16 08:00	09/20/16 17:49	EPA 200.7	
Iron	ND ug/L	100	1	AI63409	09/20/16 08:00	09/20/16 17:49	EPA 200.7	
Magnesium	**19 mg/L**	**1.0**	1	AI63409	09/20/16 08:00	09/20/16 17:49	EPA 200.7	
Manganese	**1500 ug/L**	**20**	1	AI63409	09/20/16 08:00	09/20/16 17:49	EPA 200.7	
Potassium	**7.1 mg/L**	**1.0**	1	AI63409	09/20/16 08:00	09/20/16 17:49	EPA 200.7	
Sodium	**31 mg/L**	**1.0**	1	AI63409	09/20/16 08:00	09/20/16 17:49	EPA 200.7	
Metals by EPA 200 Series Methods								
Chromium, hexavalent	ND ug/L	1.0	1	AI63521	09/19/16 15:44	09/19/16 15:44	EPA 218.6	
Metals by EPA Method 200.8 ICP/MS								
Arsenic	**13 ug/L**	**2.0**	4	AI63407	09/19/16 06:35	09/20/16 12:21	EPA 200.8	
Chromium	ND ug/L	10	4	AI63407	09/19/16 06:35	09/20/16 12:21	EPA 200.8	R-01
Vanadium	ND ug/L	3.0	4	AI63407	09/19/16 06:35	09/20/16 12:21	EPA 200.8	R-01
Conventional Chemistry Parameters by APHA/EPA Methods								
Phosphate, Total	**0.95 mg/L**	**0.10**	1	AI63455	09/19/16 07:45	09/19/16 12:57	SM4500-P E	
Silica	**85 mg/L**	**5.0**	5	AI63462	09/19/16 08:14	09/19/16 11:30	SM4500-SiO2 C	
Total Alkalinity as CaCO3	**150 mg/L**	**5.0**	1	AI63242	09/13/16 08:00	09/13/16 16:13	SM2320B	
Total Kjeldahl Nitrogen	ND mg/L	1.0	1	AI63268	09/14/16 06:19	09/15/16 09:57	SM4500-Norg B	
Total Nitrogen	ND mg/L	1.0	1	AI63246	09/12/16 10:47	09/19/16 16:38	SM4500-N	
Anions by EPA Method 300.0								
Chloride	**27 mg/L**	**2.5**	5	AI63111	09/08/16 03:04	09/08/16 03:04	EPA 300.0	
Nitrate as N	ND mg/L	0.20	1	AI63111	09/08/16 03:20	09/08/16 03:20	EPA 300.0	
Nitrite as N	ND mg/L	0.20	1	AI63111	09/08/16 03:04	09/08/16 03:04	EPA 300.0	
Sulfate as SO4	**9.2 mg/L**	**0.50**	1	AI63111	09/08/16 03:20	09/08/16 03:20	EPA 300.0	

Town Of Windsor - Drinking Water	Project Manager: Elizabeth Cargay	
8400 Windsor Rd.	Project: Esposti Feasibility Study	Reported:
Windsor, CA 95492-0100	Project Number: #25-1310	09/22/16 13:21

Metals (Drinking Water) by EPA 200 Series Methods - Quality Control

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Batch AI63409 - Metals Digest										
Blank (AI63409-BLK1)				Prepared & Analyzed: 09/20/16						
Calcium	ND	1.0	mg/L							
Iron	ND	100	ug/L							
Magnesium	ND	1.0	mg/L							
Manganese	ND	20	ug/L							
Potassium	ND	1.0	mg/L							
Sodium	ND	1.0	mg/L							
LCS (AI63409-BS1)				Prepared & Analyzed: 09/20/16						
Calcium	7.31	1.0	mg/L	8.00		91.4	85-115			
Iron	1930	100	ug/L	2000		96.5	85-115			
Magnesium	7.39	1.0	mg/L	8.00		92.4	85-115			
Manganese	192	20	ug/L	200		96.1	85-115			
Potassium	7.74	1.0	mg/L	8.00		96.8	85-115			
Sodium	6.88	1.0	mg/L	8.00		86.0	85-115			
Duplicate (AI63409-DUP1)	**Source: 16I0351-01**			Prepared & Analyzed: 09/20/16						
Calcium	24.8	1.0	mg/L		24.3			1.77	20	
Iron	ND	100	ug/L		ND			3.83	20	
Magnesium	17.2	1.0	mg/L		17.1			0.696	20	
Manganese	ND	20	ug/L		ND			4.49	20	
Potassium	32.1	1.0	mg/L		31.7			1.28	20	
Sodium	93.5	1.0	mg/L		91.8			1.86	20	
Matrix Spike (AI63409-MS1)	**Source: 16I0351-01**			Prepared & Analyzed: 09/20/16						
Calcium	32.5	1.0	mg/L	8.00	24.3	103	70-130			
Iron	2020	100	ug/L	2000	ND	97.5	70-130			
Magnesium	24.5	1.0	mg/L	8.00	17.1	92.2	70-130			
Manganese	203	20	ug/L	200	ND	98.6	70-130			
Potassium	38.4	1.0	mg/L	8.00	31.7	83.8	70-130			
Sodium	98.7	1.0	mg/L	8.00	91.8	86.7	70-130			

Metals (Drinking Water) by EPA 200 Series Methods - Quality Control

Batch AI63409 - Metals Digest

Matrix Spike (AI63409-MS2) **Source: 16I0318-01** Prepared & Analyzed: 09/20/16

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Calcium	48.0	1.0	mg/L	8.00	37.1	135	70-130			QM-4X
Iron	32300	100	ug/L	2000	30200	107	70-130			
Magnesium	36.2	1.0	mg/L	8.00	27.1	113	70-130			
Manganese	6030	20	ug/L	200	5760	137	70-130			QM-4X
Potassium	9.63	1.0	mg/L	8.00	1.14	106	70-130			
Sodium	28.2	1.0	mg/L	8.00	18.5	121	70-130			

Matrix Spike Dup (AI63409-MSD1) **Source: 16I0351-01** Prepared & Analyzed: 09/20/16

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Calcium	33.3	1.0	mg/L	8.00	24.3	112	70-130	2.22	20	
Iron	2160	100	ug/L	2000	ND	105	70-130	6.72	20	
Magnesium	24.8	1.0	mg/L	8.00	17.1	96.4	70-130	1.34	20	
Manganese	217	20	ug/L	200	ND	106	70-130	6.75	20	
Potassium	38.7	1.0	mg/L	8.00	31.7	87.7	70-130	0.806	20	
Sodium	102	1.0	mg/L	8.00	91.8	123	70-130	2.89	20	

Town Of Windsor - Drinking Water	Project Manager: Elizabeth Cargay	
8400 Windsor Rd.	Project: Esposti Feasibility Study	Reported:
Windsor, CA 95492-0100	Project Number: #25-1310	09/22/16 13:21

Metals by EPA 200 Series Methods - Quality Control

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Batch AI63521 - General Preparation										
Blank (AI63521-BLK1)				Prepared & Analyzed: 09/19/16						
Chromium, hexavalent	ND	1.0	ug/L							
LCS (AI63521-BS1)				Prepared & Analyzed: 09/19/16						
Chromium, hexavalent	9.93	1.0	ug/L	10.0		99.3	90-110			
Duplicate (AI63521-DUP1)	**Source: 16I0423-01**			Prepared & Analyzed: 09/19/16						
Chromium, hexavalent	ND	1.0	ug/L		ND				20	
Matrix Spike (AI63521-MS1)	**Source: 16I0423-01**			Prepared & Analyzed: 09/19/16						
Chromium, hexavalent	9.72	1.0	ug/L	10.0	ND	97.2	90-110			
Matrix Spike (AI63521-MS2)	**Source: 16I1463-01**			Prepared & Analyzed: 09/19/16						
Chromium, hexavalent	9.83	1.0	ug/L	10.0	ND	98.3	90-110			
Matrix Spike Dup (AI63521-MSD1)	**Source: 16I0423-01**			Prepared & Analyzed: 09/19/16						
Chromium, hexavalent	9.60	1.0	ug/L	10.0	ND	96.0	90-110	1.15	20	

Metals by EPA Method 200.8 ICP/MS - Quality Control

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Batch AI63407 - EPA 200.8										
Blank (AI63407-BLK1)				Prepared: 09/19/16 Analyzed: 09/20/16						
Arsenic	ND	2.0	ug/L							
Chromium	ND	10	ug/L							
Vanadium	ND	3.0	ug/L							
LCS (AI63407-BS1)				Prepared: 09/19/16 Analyzed: 09/20/16						
Arsenic	21.9	2.0	ug/L	20.0		110	85-115			
Chromium	20.9	10	ug/L	20.0		104	85-115			
Vanadium	21.0	3.0	ug/L	20.0		105	85-115			
Duplicate (AI63407-DUP1)	**Source: 16I0351-01**			Prepared: 09/19/16 Analyzed: 09/20/16						
Arsenic	6.08	2.0	ug/L		6.63			8.57	20	
Chromium	ND	10	ug/L		ND				20	
Vanadium	ND	30	ug/L		ND				20	

Town Of Windsor - Drinking Water
8400 Windsor Rd.
Windsor, CA 95492-0100

Project Manager: Elizabeth Cargay
Project: Esposti Feasibility Study
Project Number: #25-1310

Reported:
09/22/16 13:21

Conventional Chemistry Parameters by APHA/EPA Methods - Quality Control

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Batch AI63242 - General Preparation										
Duplicate (AI63242-DUP1)	**Source: 16I0603-01**			Prepared & Analyzed: 09/13/16						
Total Alkalinity as CaCO3	11.0	5.0	mg/L		11.0			0.00	20	
Batch AI63268 - General Prep										
LCS (AI63268-BS1)				Prepared: 09/13/16 Analyzed: 09/14/16						
Total Kjeldahl Nitrogen	2.95	1.0	mg/L	2.98		99.0	80-120			
LCS Dup (AI63268-BSD1)				Prepared: 09/13/16 Analyzed: 09/14/16						
Total Kjeldahl Nitrogen	2.95	1.0	mg/L	2.98		99.0	80-120	0.00	20	
Matrix Spike (AI63268-MS1)	**Source: 16I0737-03**			Prepared: 09/13/16 Analyzed: 09/14/16						
Total Kjeldahl Nitrogen	3.13	1.0	mg/L	2.98	ND	105	75-125			
Matrix Spike Dup (AI63268-MSD1)	**Source: 16I0737-03**			Prepared: 09/13/16 Analyzed: 09/14/16						
Total Kjeldahl Nitrogen	3.13	1.0	mg/L	2.98	ND	105	75-125	0.00	20	
Batch AI63455 - General Prep										
Blank (AI63455-BLK1)				Prepared & Analyzed: 09/19/16						
Phosphate, Total	ND	0.10	mg/L							
LCS (AI63455-BS1)				Prepared & Analyzed: 09/19/16						
Phosphate, Total	0.590	0.10	mg/L	0.600		98.4	85-115			
Duplicate (AI63455-DUP1)	**Source: 16I1150-01**			Prepared & Analyzed: 09/19/16						
Phosphate, Total	ND	0.10	mg/L		ND			6.35	20	

Conventional Chemistry Parameters by APHA/EPA Methods - Quality Control

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Batch AI63455 - General Prep										
Matrix Spike (AI63455-MS1)	**Source: 16I1150-01**			Prepared & Analyzed: 09/19/16						
Phosphate, Total	0.607	0.10	mg/L	0.600	ND	90.7	70-130			
Matrix Spike Dup (AI63455-MSD1)	**Source: 16I1150-01**			Prepared & Analyzed: 09/19/16						
Phosphate, Total	0.607	0.10	mg/L	0.600	ND	90.7	70-130	0.00	20	
Batch AI63462 - General Preparation										
Blank (AI63462-BLK1)				Prepared & Analyzed: 09/19/16						
Silica	ND	1.0	mg/L							
LCS (AI63462-BS1)				Prepared & Analyzed: 09/19/16						
Silica	9.57	1.0	mg/L	10.0		95.7	85-115			
LCS Dup (AI63462-BSD1)				Prepared & Analyzed: 09/19/16						
Silica	9.61	1.0	mg/L	10.0		96.1	85-115	0.411	20	
Duplicate (AI63462-DUP1)	**Source: 16I0685-01**			Prepared & Analyzed: 09/19/16						
Silica	34.3	5.0	mg/L		35.8			4.50	20	
Matrix Spike (AI63462-MS1)	**Source: 16I0685-01**			Prepared & Analyzed: 09/19/16						
Silica	56.1	5.0	mg/L	25.0	35.8	81.3	80-120			
Matrix Spike Dup (AI63462-MSD1)	**Source: 16I0685-01**			Prepared & Analyzed: 09/19/16						
Silica	56.5	5.0	mg/L	25.0	35.8	82.8	80-120	0.700	20	

Anions by EPA Method 300.0 - Quality Control

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Batch AI63111 - General Preparation										
Blank (AI63111-BLK1)				Prepared & Analyzed: 09/07/16						
Nitrate as N	ND	0.20	mg/L							
Sulfate as SO4	ND	0.50	mg/L							
Nitrite as N	ND	0.20	mg/L							
Chloride	ND	0.50	mg/L							
LCS (AI63111-BS1)				Prepared & Analyzed: 09/07/16						
Sulfate as SO4	23.4	0.50	mg/L	22.2		105	90-110			
Nitrite as N	5.85	0.20	mg/L	5.56		105	90-110			
Nitrate as N	5.86	0.20	mg/L	5.56		105	90-110			
Chloride	11.6	0.50	mg/L	11.1		104	90-110			
Duplicate (AI63111-DUP1)	**Source: 16I0425-04**			Prepared & Analyzed: 09/08/16						
Nitrate as N	ND	0.20	mg/L		ND				20	
Nitrite as N	ND	0.20	mg/L		ND				20	
Chloride	ND	0.50	mg/L		ND				20	
Sulfate as SO4	ND	0.50	mg/L		ND				20	
Matrix Spike (AI63111-MS1)	**Source: 16I0425-04**			Prepared & Analyzed: 09/08/16						
Nitrite as N	5.58	0.20	mg/L	5.56	ND	100	80-120			
Chloride	11.4	0.50	mg/L	11.1	ND	102	80-120			
Nitrate as N	5.76	0.20	mg/L	5.56	ND	104	80-120			
Sulfate as SO4	22.8	0.50	mg/L	22.2	ND	103	80-120			
Matrix Spike (AI63111-MS2)	**Source: 16I0362-03**			Prepared & Analyzed: 09/08/16						
Chloride	15.9	2.5	mg/L	11.1	5.03	98.2	80-120			
Nitrate as N	5.32	1.0	mg/L	5.56	ND	95.7	80-120			
Nitrite as N	5.29	1.0	mg/L	5.56	ND	95.2	80-120			
Sulfate as SO4	32.0	2.5	mg/L	22.2	11.1	93.9	80-120			

Town Of Windsor - Drinking Water
8400 Windsor Rd.
Windsor, CA 95492-0100

Project Manager: Elizabeth Cargay
Project: Esposti Feasibility Study
Project Number: #25-1310

Reported:
09/22/16 13:21

Anions by EPA Method 300.0 - Quality Control

Analyte(s)	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Flag
Batch AI63111 - General Preparation										
Matrix Spike Dup (AI63111-MSD1)	**Source: 16I0425-04**			Prepared & Analyzed: 09/08/16						
Chloride	11.6	0.50	mg/L	11.1	ND	104	80-120	1.65	20	
Nitrate as N	5.85	0.20	mg/L	5.56	ND	105	80-120	1.65	20	
Nitrite as N	5.59	0.20	mg/L	5.56	ND	101	80-120	0.139	20	
Sulfate as SO4	23.1	0.50	mg/L	22.2	ND	104	80-120	1.48	20	

Notes and Definitions

QM-4X	The spike recovery was outside of QC acceptance limits for the MS and/or MSD due to analyte concentration at 4 times or greater the spike concentration. The QC batch was accepted based on LCS and/or LCSD recoveries within the acceptance limits.
R-01	The Reporting Limit for this analyte has been raised to account for matrix interference.
ND	Analyte NOT DETECTED at or above the reporting limit
dry	Sample results reported on a dry weight basis
REC	Recovery
RPD	Relative Percent Difference

WECK LABORATORIES, INC.

Certificate of Analysis

FINAL REPORT

Work Orders: 6I09025

Project: 16I0423

Attn: Robbie Phillips

Client: Alpha Analytical Laboratories - Ukiah
208 Mason St
Ukiah, CA 95482

Report Date: 9/13/2016
Received Date: 9/9/2016
Turnaround Time: Normal
Phones: (925) 828-6226
Fax: (925) 828-6309
P.O. #:

Dear Robbie Phillips,

Enclosed are the results of analyses for samples received 9/09/16 with the Chain-of-Custody document. The samples were received in good condition, at 3.3 °C and on ice. All analyses met the method criteria except as noted in the case narrative or in the report with data qualifiers.

Sample Results

Sample: 16I0423-01, Alias: Esposti Irrigation Well
6I09025-01 (Water)
Sampled: 09/06/16 10:45 by Client

Method: IC-ICP/MS **Batch ID:** W6I0467 **Instr:** Inst **Prepared:** 09/11/16 08:36 **Analyst:** apa

Analyte	Result	MRL	Units	Dil	Analyzed	Qualifier
Arsenic III	**0.52**	0.40	ug/l	1	09/11/16 16:57	
Arsenic V	**13**	4.0	ug/l	10	09/11/16 16:57	

Quality Control Results

Metals by EPA 200 Series Methods

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W6I0467 - Direct Injection										
Blank (W6I0467-BLK1)				**Prepared & Analyzed: 09/11/16**						
Arsenic III	ND	0.40	ug/l							
Arsenic V	ND	0.40	ug/l							
LCS (W6I0467-BS1)				**Prepared & Analyzed: 09/11/16**						
Arsenic III	9.56	0.40	ug/l	10.0		96	85-115			
Arsenic V	8.92	0.40	ug/l	10.0		89	85-115			
Matrix Spike (W6I0467-MS1)	**Source: 6H26026-01**			**Prepared & Analyzed: 09/11/16**						
Arsenic III	118	4.0	ug/l	100	ND	118	70-130			
Arsenic V	119	4.0	ug/l	100	5.42	114	70-130			
Matrix Spike (W6I0467-MS2)	**Source: 6I08004-01**			**Prepared & Analyzed: 09/11/16**						
Arsenic III	112	4.0	ug/l	100	0.260	112	70-130			
Arsenic V	139	4.0	ug/l	100	28.7	110	70-130			
Matrix Spike Dup (W6I0467-MSD1)	**Source: 6H26026-01**			**Prepared & Analyzed: 09/11/16**						
Arsenic III	109	4.0	ug/l	100	ND	109	70-130	8	30	
Arsenic V	114	4.0	ug/l	100	5.42	108	70-130	4	30	
Matrix Spike Dup (W6I0467-MSD2)	**Source: 6I08004-01**			**Prepared & Analyzed: 09/11/16**						
Arsenic III	110	4.0	ug/l	100	0.260	110	70-130	2	30	
Arsenic V	140	4.0	ug/l	100	28.7	112	70-130	1	30	

Notes and Definitions

Item	Definition
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.

Not Certified Analyses Summary

Analyte	CAS #	Not Accredited By
IC-ICP/MS in Water		
Arsenic III	22541-54-4	NELAP
Arsenic V	17428-41-0	NELAP

Reviewed by:

Kim Tu

Kim G. Tu
Project Manager

DoD-ELAP #L15-366 ELAP-CA #1132 EPA-UCMR #CA00211 HW-DOH # ISO 17025 #L15-365 NELAP-OR #4047 NJ-DEP #CA015 NV-DEP #NAC 445A SCAQMD #93LA1006

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.

Alpha
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925-828-6228 F) 925-828-6309

Central Valley Laboratory
9090 Union Park Wy., #113, Elk Grove, CA 95624
916-686-5190 F) 916-686-5192

Work Order
Chain of Custody Record

Lab No. 16I0423 Page 1 of 1

Name:
Town of Windsor - ~~Drinking Water~~ FEASIBILITY STUDY

Mailing Address:
9291 Old Redwood Highway Building 400
Windsor, CA 95492

Project Contact (Hardcopy or PDF to):
Elizabeth Cargay
ecargay@townofwindsor.com
AND
KOBRIEN@HAZENANDSAWYER.COM

Project ID: #25-1310

Phase: Esposti Well

PO# 200336

Bill to: month end billing

Signature below authorizes work under terms stated on reverse side.

Field Sampler - Print Name & Signature: RYAN CRAWFORD Ryan Crawford

Sample Identification	Sample Collection Date	Sample Collection Time	Container: 40ml VOA	Container: Poly	Container: Amber	Container: Glass	Container:	Preservative: HCL	Preservative: HNO3	Preservative: H2SO4	Preservative: Other	Preservative: None	Matrix: Water	Matrix: Soil	Matrix:
Esposti Irrigation Well [illegible]9-6-16	9/6/16	1045		x					x	x	x	x	x		

Analysis Request

Sample Identification	200.8 As	200.7 Fe/Mn		200.8 Cr	218.6 Cr6	200.7 Ca, Mg, K, Na	Alkalinity	Chloride		Sulfate	Total Nitrogen (includes TKN, NO2, NO3)	Silica	200.8 Vanadium - total	Phosphate	As3 & As5 - sub Weck			
Esposti Irrigation Well [illegible]9-6-16	X	X		x	x	x	x	x		x	x	x	x	x	x			

TAT
24 hr ○
48 hr ○
Lab Approval Required
1 wk ○
2 wk (standard) ☒
Lab Approval Required For Rush

2.2

BOTTLE KIT ORDER for Esposti Irrigation Well placed 9/1/2016, deliver kit on Friday 9/2/20016 in a cooler to:
Ryan Crawford
2235 Mercury Way, Suite 150,
Santa Rosa, CA 95407

Global ID:
EDF to (Email Address):

Relinquished by:	Received by:	Date	Time	Travel and Site Time:	Mileage:	Misc. Supplies:
		9/6/16	1430			
			1600			

Appendix K – Comprehensive Analytical Table A

Table A - Comprehesive Analytical Results

Constituent	Analytical Method	Entire Well Pumping at 800 gpm for 28 Hours May 17, 2016 (mg/L[1])	Upper Zone Pumping at 300 gpm for 8 Hours September 21, 2016 (mg/L[1])	Irrigation Well September 6, 2016 (mg/L[1])	State MCL Drinking Water Standard Units in mg/L (Unless Otherwise Noted)
Aluminum	EPA 200.8	<0.050	NA	NA	1.0
Antimony	EPA 200.8	<0.006	NA	NA	0.006
Arsenic	EPA 200.8	**0.057**	**0.035**	**0.013**	0.010
Barium	EPA 200.8	0.150	NA	NA	1.0
Beryllium	EPA 200.8	<0.001	NA	NA	0.004
Boron	EPA 200.7	NA	NA	NA	1 (NL)
Cadmium	EPA 200.8	<0.001	NA	NA	0.005
Calcium	EPA 200.7	22	23	19	
Chromium (Total)	EPA 200.8	<0.010	<0.008	<0.010	0.05
Chromium (Hexavalent)	EPA 200	<0.001	<0.001	<0.001	0.01
Copper	EPA 200.8	<0.050	NA	NA	1.0 (SMCL)
Iron	EPA 200.7	<0.100	0.140	<0.10	0.3 (SMCL)
Lead	EPA 200.7	<0.005	NA	NA	0.015
Magnesium	EPA 200.7	16	18	19	
Manganese	EPA 200.8	**0.860**	**0.910**	**1.5**	0.05 (SMCL)
Mercury	EPA 245.1	<0.001	NA	NA	0.002
Nickel	EPA 200.8	<0.010	NA	NA	0.1
Potassium	EPA 200.7	NA	14	7.1	
Selenium	EPA 200.8	<0.005	NA	NA	0.05
Silver	EPA 200.8	<0.010	NA	NA	0.1 (SMCL)
Sodium	EPA 200.7	53	52	31	
Thallium	EPA 200.8	<0.001	NA	NA	0.002
Gross Alpha	EPA 900.0	0.818 ± 1.44 pCi/L	0.844 ± 1.40 pCi/L	NA	15 pCi/L
Ra 228	Ra - 05	0.049 ± 0.560 pCi/L	NA	NA	2 pCi/L
Uranium	EPA 200.8	<1.0 pCi/L	NA	NA	20 pCi/L
Vanadium	EPA 200.8	<0.003	NA	<0.003	0.05 (NL)
Zinc	EPA 200.8	<0.050	NA	NA	5.0 (SMCL)
Aggressive Index	AWWA	11.68 NU	NA	NA	
Ammonia as NH$_3$	SM4500/H3N	<0.50	NA	NA	
Bicarbonate	SM2320B	270	NA	NA	
Carbonate	SM2320B	<5.0	NA	NA	
Color	SM2120B	<5.0 CU	NA	NA	15 Units (SMCL)
Cyanide (Total)	10-204-001X	<0.10	NA	NA	0.2
Hydroxide	SM2320B	<5.0	NA	NA	
MBAS, calculated as LAS, mw 340	SM5540C	<0.050	NA	NA	0.5 (SMCL)
Odor	EPA 140.1	<1.0 T.O.N.	NA	NA	
Perchlorate	EPA 314.0	<0.004	NA	NA	0.006
pH	SM4500-H+B	7.60 pH Units	NA	NA	
Phosphate (Total)	SM4500-PE	1.4	1.2	0.95	
Specific Conductance (EC)	SM2510B	520 uS/cm	NA	NA	900 uS/cm (SMCL)
Sulfide	SM4500SD	<0.10	NA	NA	

Constituent	**Analytical Method**	**Entire Well Pumping at 800 gpm for 28 Hours May 17, 2016 (mg/L[1])**	**Upper Zone Pumping at 300 gpm for 8 Hours September 21, 2016 (mg/L[1])**	**Irrigation Well September 6, 2016 (mg/L[1])**	**State MCL Drinking Water Standard Units in mg/L (Unless Otherwise Noted)**
Silica	SM4500-SiO2 C	50	86	85	
Total Dissolved Solids	SM2540C	350	NA	NA	500 (SMCL)
Turbidity	SM2130B	0.26 NTU	NA	NA	5 NTU (SMCL)
Total Alkalinity as $CaCO_3$	SM2320B	220	220	150	
Hardness, Total	SM2340B	120	NA	NA	
Chloride	EPA 300.0	21	22	27	250 (SMCL)
Fluoride	EPA 300.0	**0.15**	NA	NA	
Nitrate as N	EPA 300.0	<0.40	<0.20	<0.20	10
Nitrite as N	EPA 300.0	<0.40	<0.20	<0.20	1.0
Total Nitrogen	SM4500-N	NA	<1.0	<1.0	
Total Kjeldahl Nitrogen	SM4500-NorgB	NA	<1.0	<1.0	
Sulfate as SO_4	EPA 300.0	14	14	9.2	250 (SMCL)
Volatile Organic Compounds	EPA 524.2	<0.0005 to <0.010	NA	NA	
Chlorinated Pesticides and PCBs	EPA 508	NA	NA	NA	
Nitrogen- and Phosphorus- Pesticides	EPA 507	<0.0005 to <0.002	NA	NA	
1,2-Dibromo-3-chloropropane	EPA 504.1	<1E-05	NA	NA	
1,2-Dibromoethane (EDB)	EPA 504.1	<2E-05	NA	NA	
Chlorinated Acids	EPA 515.1	<0.0002 to <0.010	NA	NA	
Semivolatile Organic Compounds	EPA 525.2	<0.0001 to <0.005	NA	NA	
Carbofuran	EPA 531.1	NA	NA	NA	0.018
Oxamyl	EPA 531.1	NA	NA	NA	0.05
Glphosate	EPA 547	<0.025	NA	NA	0.7
Endothall	EPA 548.1	NA	NA	NA	0.1
Diquat	EPA 549.2	<0.004	NA	NA	0.02
Tannins & Lignins	SM5550B	NA	<0.50	NA	
Total Suspended Solids	SM2540D	NA	3.5	NA	
Total Organic Carbon	SM5310C	NA	<0.300	NA	

Notes:
1 = Some analytical results are reported in units of μg/L these have been converted to mg/L for ease of comparison with water quality standards
NA = Not analyzed
MCL = Maximum Contaminant Level
SMCL = Secondary Maximum Contaminant Level
NL = Notification Level

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APPENDIX D

Acorn Environmental
Water and Wastewater Feasibility Study
Geotechnical Data Memorandum

CE&G
Pragmatic Expertise™

CAL ENGINEERING & GEOLOGY
785 Ygnacio Valley Rd. | Walnut Creek | CA 94596
6455 Almaden Expwy., Suite 100| San José | CA 95120
23785 Cabot Blvd., Suite 321 | Hayward | CA 94545
www.caleng.com

GEOTECHNICAL DATA MEMORANDUM

To: Curtis Lam, Principal
HydroScience Engineers
741 Allston Way
Berkeley, California 94710

From: Christian Rodil, E.I.T. & Kevin Loeb P.G., C.E.G.
Cal Engineering & Geology, Inc.
6455 Almaden Expwy., Suite 100
San Jose, California 95120

Date: 26 July 2022

KEVIN P. LOEB
No. 2763

RE: Geotechnical Data Memorandum
Windsor Wastewater Treatment System Project
Windsor, California
CE&G Document 220270.001

INTRODUCTION

Cal Engineering & Geology, Inc. (CE&G) has provided geotechnical engineering services to HydroScience Engineers for the Windsor Wastewater Treatment System Project located in Windsor, California. This geotechnical memorandum has been prepared to provide a summary of subsurface soil and groundwater conditions, as well as percolation rate data for the project site soils to be considered during the design and construction of the planned improvements.

SCOPE OF SERVICES

The purpose of CE&G's geotechnical engineering services was to explore and evaluate the percolation potential of shallow subsurface soils in the planned percolation pond areas, around the project site as well as provide information on subsurface soils for use by the project designer.

The scope of work completed for this study and memorandum included:

- Completion of an office study to identify and evaluate relevant geologic and geotechnical information available for the site, including published geologic maps, and unpublished geotechnical information in our files regarding the site and vicinity.

- Geologic reconnaissance to observe current site conditions and to mark for Underground Service Alert (USA) utility clearance.

- Excavation of four test pits to visually classify subsurface soils and perform percolation testing.

- Laboratory testing to determine key engineering index properties of selected earth materials.

- Engineering analyses to evaluate percolation rates of on-site shallow soils.

- Preparation of this geotechnical data memorandum.

SITE DESCRIPTION

The project site is located at 222 E Shiloh Rd. in Windsor, California as shown in Figure 1, and is bounded by Old Redwood Highway on the west; East Shiloh Road on the north; a neighboring vineyard to the east; and Santa Rosa Mineral Gem Society to the south. The project site is divided by the northeast-southwest trending Pruitt Creek, which flows southwest. Most of the project site is comprised of vineyards with various access roads and a single dwelling unit and associated improvements as well as a storage structure near the eastern border. Elevations throughout the project site range from approximately 134 to 160 feet above sea level with elevations decreasing from northeast to southwest.

A topographic survey of the project site was prepared by HMH, Inc. and provided to us by HydroScience Engineers. The topographic survey as well as other site features are shown in the attached Site Plan (Figure 2).

SITE GEOLOGY

The general vicinity of the project site has been mapped several times, with geologic mapping having different emphases (e.g., Knudsen and others, 2000; Graymer and others, 2006; and Witter and others, 2006). Knudsen and others (2000) mapped Quaternary geologic materials in detail for much of the San Francisco Bay Area. Much of Knudsen and others' mapping was incorporated or refined by Witter and others (2006). For the purposes of the project, the Quaternary geologic mapping of Knudsen and others (2000), refined by Witter and others (2006) is the most detailed and pertinent. The central and southwestern portions of the site are mapped as being underlain by Holocene to Latest Pleistocene aged basin deposits, which generally consist of poorly drained, clay-rich soils (Witter and others, 2006). The northern and eastern limits of the project site are mapped as being underlain by Holocene-aged alluvial fan deposits, which generally consist of varying amounts of sand, gravel, silt, and clay, and are moderately- to poorly-sorted and bedded (Witter and others, 2006). Historical stream channel deposits are mapped along the on-site Pruitt Creek area and are described as "loose, unconsolidated, poorly- to well-sorted sand, gravel, and cobbles, with minor silt and clay" (Witter and others, 2006).

NRCS SOIL SURVEY

The U.S. Department of Agriculture Natural Resources Conservation Service (NRCS) Soil Survey was reviewed for the project area. The soil survey identifies general shallow soil materials that may be encountered within the upper few feet. The project site is shown on the NRCS soil map as being underlain by the following shallow soil materials:

- Huichica loam (HtA/HuB): Generally, extends to depths about 57 inches below grade. This unit is imperfectly drained, has a slow runoff class, and has very low to moderately low saturated hydraulic conductivity (Ksat) of 0.00 to 0.06 in/hr.

- Yolo silt loam (YsA): Generally, extends to depths about 65 inches below grade. This unit is well-drained, has a slow to medium runoff class, and has moderately high to high saturated hydraulic conductivity (Ksat) of 0.60 to 2.00 in/hr.

- Riverwash (RnA): Generally, consists of barren, coarse-textured, alluvial areas that are exposed along streams with low water levels and are subject to shifting during normal high-water levels. This unit is excessively drained and has high to very high saturated hydraulic conductivity (Ksat) of 5.95 to 19.98 in/hr.

The attached Figure 4 shows the NRCS soil survey map for the project site. Further soil descriptions are included in Attachment C.

REGIONAL GROUNDWATER

Groundwater level data from the Sustainable Groundwater Management Act (SGMA) database, by the Department of Water Resources (DWR), was reviewed for a site located approximately 0.5 miles south of the project area. According to the database, depth to groundwater ranges from about 9 ft below ground surface (bgs) after wet seasons to about 37 ft bgs after dryer seasons, between 2018 and early 2022.

FIELD EXPLORATION

SITE RECONNAISSANCE

CE&G performed field reconnaissance of the site on April 4, 2022, in advance of performing the test pits and percolation testing. Site reconnaissance consisted of photographic documentation of the project site and identifying and marking the test pit locations for utility clearance by Underground Service Alert (USA). The test pit locations were also cleared by a private utility locator.

SUBSURFACE EXPLORATIONS

Scope of Explorations

Our field explorations included excavating four test pits in the vicinity of the planned percolation ponds and/or leach fields. The test pits were excavated by Houck's Grading on April 11, 2022, using a mini excavator equipped with 12-inch and 24-inch-wide buckets. The test pits were excavated to a depth of 5 feet bgs. An additional 12-inch by 12-inch hole was hand-excavated at the bottom of each test pit to approximately 6 feet bgs for percolation testing, which is further described in the Percolation Testing Section of this memorandum. Test pit locations were selected by HydroScience Engineers and are shown in Figure 2.

Logging and Sampling

The materials encountered in the test pits were logged in the field by a CE&G engineer. The soil was visually classified in the field, office, and laboratory according to the Unified Soil Classification System (USCS) in general accordance with ASTM D2487 and D2488.

Soil samples obtained from the test pits were packaged and sealed in the field to reduce the potential for moisture loss. The samples were taken to CE&G's local laboratory for further analysis and storage.

LABORATORY TESTING

Laboratory testing was performed to obtain information regarding the physical and index properties of selected samples recovered from the test pits. Tests performed included grain size distribution and Atterberg limits. Tests were completed in general conformance with applicable ASTM standards. The results of the laboratory tests are summarized on the test pit logs in Attachment B and are included in Attachment C.

SOIL CONDITIONS ENCOUNTERED

Alluvial deposits were encountered in each test pit to the maximum depth explored of 6 feet. The encountered alluvium within the upper four feet of test pits P-1, P-2, and P-3 primarily consists of lean clays with varying amounts of sand, silt, and gravel and occasional silty sand layers. Shallow soils encountered in test pit P-4 are more granular and consist of moist to wet silty sand, clayey gravel, and clayey sand from 0 to 5 feet below the ground surface. Sandy lean clay and lean clay with sand was encountered in each of the four test pits from approximately 5 to 6 feet below ground surface.

For a more detailed description of the encountered soils, the test pit logs, and laboratory test results are included in Attachments B and C.

GROUNDWATER CONDITIONS ENCOUNTERED

Perched groundwater was encountered at approximately 2 feet bgs in test pit P-4. Groundwater was not encountered in test pits P-1, P-2, or P-3.

PERCOLATION TESTING

Percolation testing was performed by CE&G on April 12 and 13, 2022, at three locations on the project site, selected by HydroScience Engineers. The three percolation tests were designated as P-1, P-2 and P-3, and their approximate locations are shown in Figure 2. Soil samples were collected from each percolation testing zones (depth of 5 to 6 feet) for laboratory analysis.

The previously discussed test pits were utilized to perform the percolation tests in general conformance with Regional Water Quality Control Board Basin Plan percolation testing guidelines for OTWS sites. Percolation testing was only performed in 3 of the 4 test pits due to perched groundwater seeping into and filling the bottom 6 inches of test pit P-4.

Preparation for the percolation tests consisted of excavating a 12-inch diameter by 12-inch deep hole into the bottom of each test pit and continuously presoaking the test holes for 12 hours. Starting 24-hours after beginning the initial presoak, the test holes were again presoaked for one additional hour by continuously adding water to maintain a constant head of 12 inches within the test hole. Once the presoaking was completed, the testing began with 12 inches of water above the bottom of the hole. Water level drops were then measured and recorded at varying time intervals for the observed rate of percolation. Upon completion of the percolation testing, the test pits were backfilled with the stockpiled soil and compacted using the excavator bucket.

Data plots showing the recorded cumulative water level drops versus time are shown on Charts 1, 2, and 3 for tests P-1, P-2, and P-3, respectively. The average slopes of the recorded values were used to calculate the percolation rates for each percolation test. The calculated percolation rates are listed in Table 1.

Chart 2 – Percolation Testing Measurements for P-1

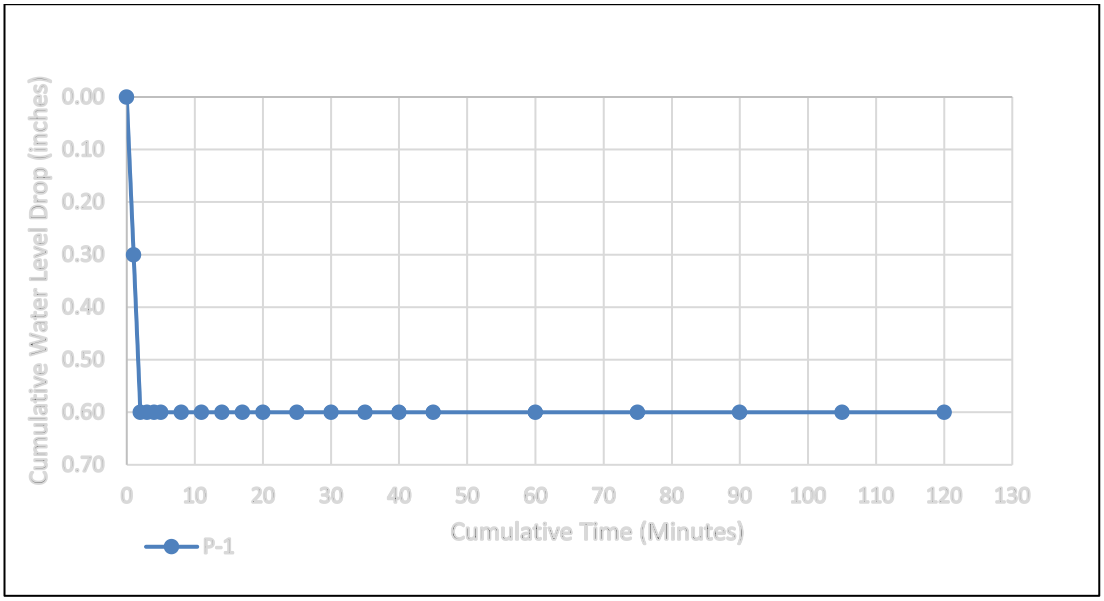


Chart 2 – Percolation Testing Measurements for P-2

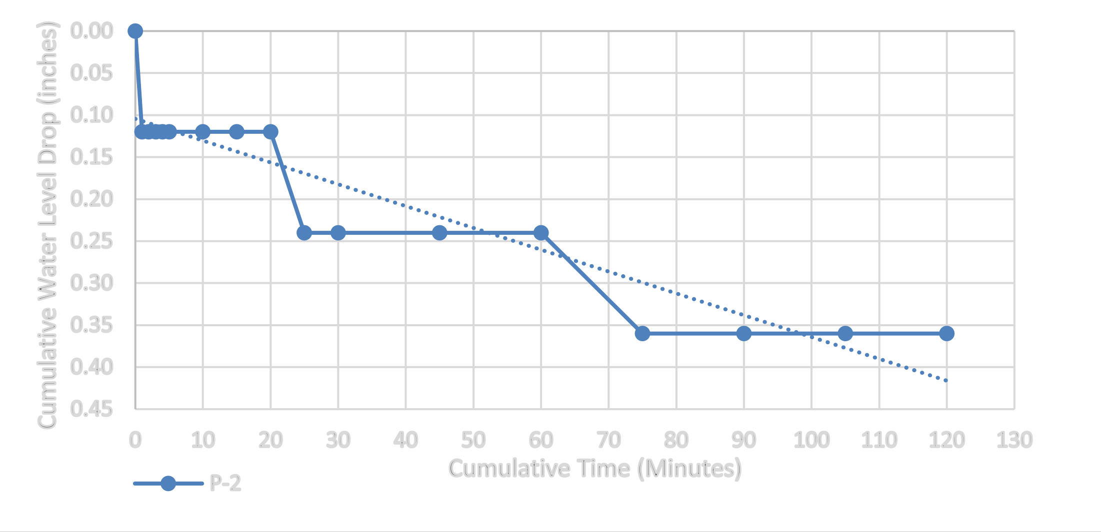


Chart 3 – Percolation Testing Measurements for P-3

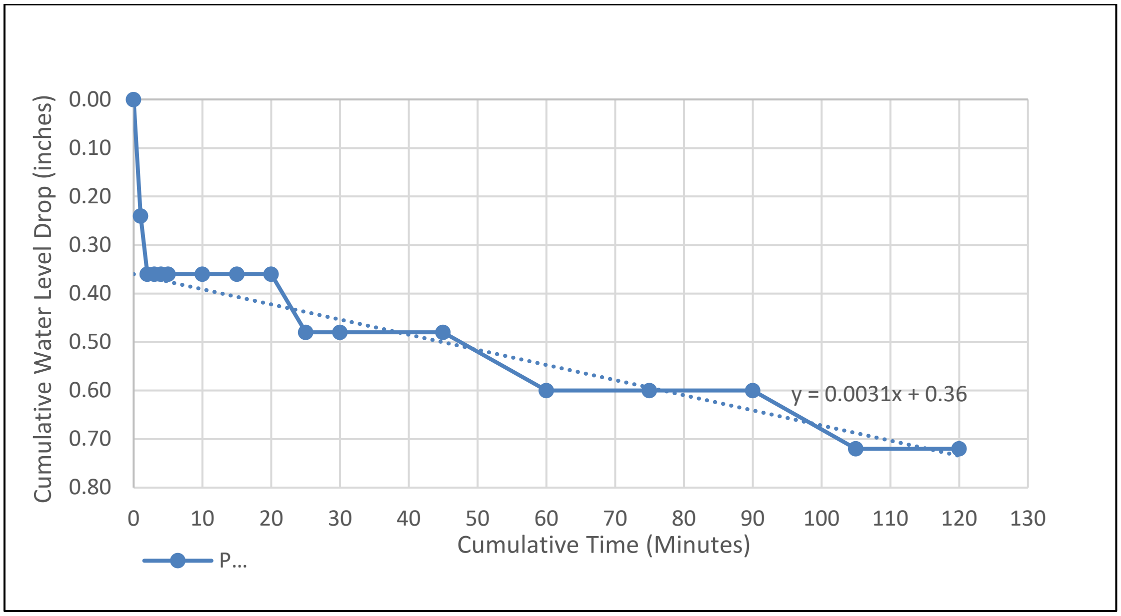


Table 1 – Percolation Rate Data

Infiltration Test ID	Soil Type	Average Percolation Rate (in/hr)	Average Percolation Rate (in/min)
P-1	Sandy Lean Clay	0.0	0.000
P-2	Sandy Lean Clay	0.2	0.003
P-3	Sandy Lean Clay	0.2	0.003
NRCS*	--	0.00 to 0.06	--

*NRCS saturated hydraulic conductivity (Ksat) values for shallow soils within the site vicinity.

CONCLUSIONS

CE&G has performed data research and field explorations to characterize the subsurface soil and groundwater conditions, including percolation rates of shallow soils for the Windsor Wastewater Treatment System Project. A summary of infiltration rates is presented in Table 1.

In our judgment, percolation rates ranging from 0.00 to 0.2 in/hr are recommended for the sandy lean clay soils encountered from approximately 5 to 6 feet below the ground surface. Percolation testing of P-4 was unsuccessful due to the presence of perched groundwater.

LIMITATIONS

The information presented in this memorandum is based upon information provided to us regarding the project, subsurface conditions encountered at the exploration locations, our reconnaissance, and professional judgment.

The information provided in this report and on the test pit logs should be provided to the engineer for design of the proposed improvements.

We have employed accepted geologic and geotechnical engineering procedures, and our professional opinions and conclusions are made in accordance with generally accepted geotechnical engineering principles and practices. This standard is in lieu of all warranties, either expressed or implied.

The locations of the exploratory test pits were determined by using a handheld GPS, and tape and compass methods from established site features and are considered to be approximate. Site conditions described in the text of this report are those existing at the time of our last field exploration and reconnaissance in April 2022 and are not necessarily representative of the site conditions at other times or locations.

Unanticipated soil conditions are frequently encountered during construction and cannot be fully determined by a limited number of subsurface exploration locations. Additional expenditures may be required during the construction phases of the project as conditions vary. If it is found during construction that subsurface conditions differ from those described on the exploratory logs, then the findings presented in this report shall be considered invalid, unless the changes are reviewed and the findings modified and approved in writing by Cal Engineering & Geology, Inc.

The evaluation or identification of the potential presence of hazardous materials at the site was not requested and is beyond the scope of this project. If you have any questions regarding this report, or if we may be of further service, please contact us.

REFERENCES

Graymer, R.W., and 5 others, 2006, Geologic Map of the San Francisco Bay Region. U.S. Geological Survey, Scientific Investigations Map 2918.

Department of Water Resources (DWR), 2015, Sustainable Groundwater Management Act (SGMA) https://sgma.water.ca.gov/webgis

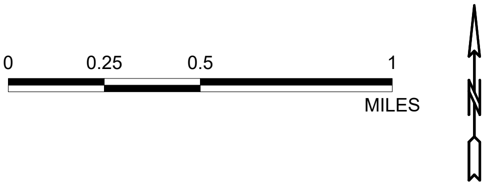
Knudsen, K.L., and 7 others, 2000, Preliminary Maps of Quaternary Deposits and Liquefaction Susceptibility, Nine-County San Francisco Bay Region, California; a Digital Database: U.S. Geological Survey Open-File Report 00-444, 1:24,000.

U.S. Department of Agriculture, 2019, Natural Resources Conservation Service Soil Survey, accessed April 2022. https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx

Witter, R. C., Knudsen, K. L., Sowers, J. M., Wentworth, C. M., Koehler, R. D., Randolph, C. E., and Gans, K. D., 2006, Maps of Quaternary deposits and liquefaction susceptibility in the central San Francisco Bay region, California (No. 2006-1037). Geological Survey (US).

BASEMAP REFERENCE

1. STREET CENTERLINES FROM CALTRANS CALIFORNIA ROAD SYSTEM, DOWNLOADED ON 18 FEB 2020.
2. ORTHOIMAGERY FROM ESRI (MAXAR), 2019.



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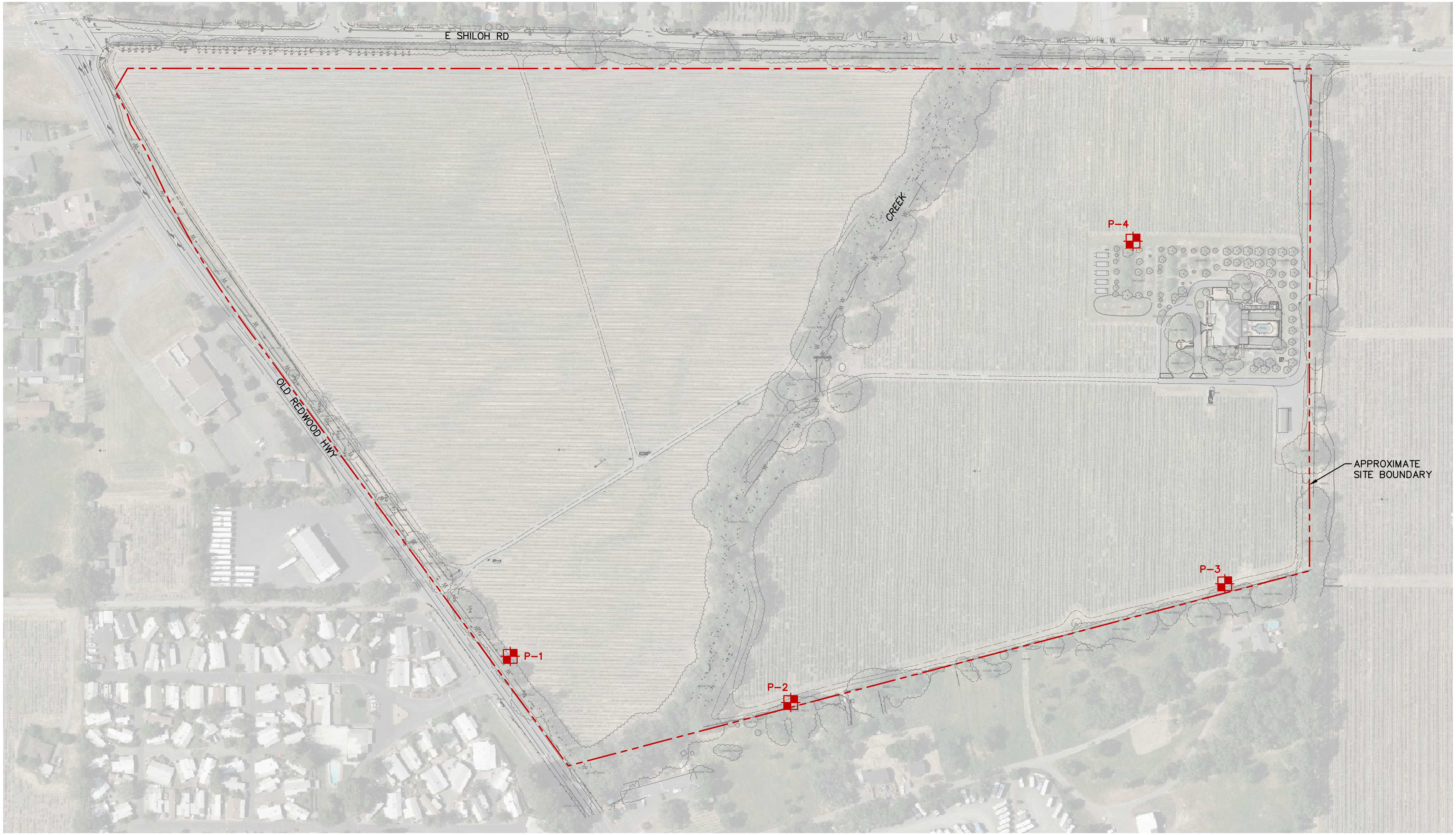
WINDSOR WASTEWATER TREATMENT SYSTEM PROJECT
222 EAST SHILOH ROAD
WINDSOR, CALIFORNIA

SITE LOCATION MAP

220270	JULY 2022	FIGURE 1



REFERENCES

1. TOPOGRAPHIC BASEMAP FROM HYDROSCIENCE; CAD FILES RECEIVED ON 4/4/2022.
2. ORTHOIMAGERY FROM AUTODESK MAP IMAGE; MAXAR, MICROSOFT CORPORATION, 2022.

SUBSURFACE EXPLORATION

P-4 ⊞ TEST PIT LOCATION BY CE&G, PERFORMED ON 4/11/2022

100 0 100 200
SCALE FEET

N

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SITE PLAN

220270	JULY 2022	FIGURE 2

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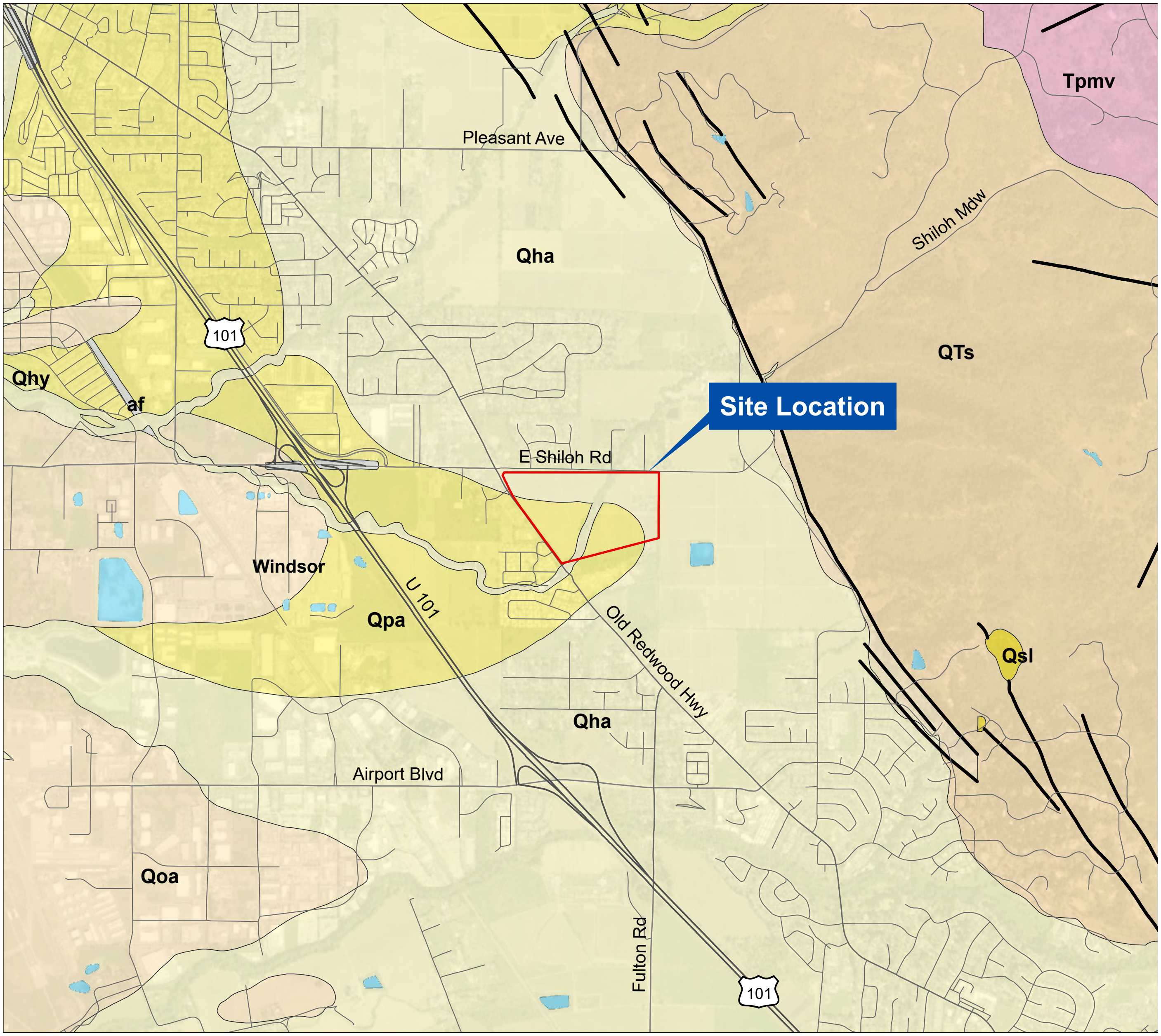

BASEMAP REFERENCE

1. REGIONAL GEOLOGY FROM GRAYMER, 2006.

MAP UNIT DESCRIPTION

af	Artificial Fill
Qhy	Alluvium (late Holocene)
Qha	Alluvium (Holocene)
Qsl	Hillslope deposits (Quaternary)
Qpa	Alluvium (Pleistocene)
Qoa	Alluvium (early Pleistocene)
QTs	Sediments (early Pleistocene and (or) Pliocene)
Tpmv	Volcanic rocks (Pliocene and early Miocene)

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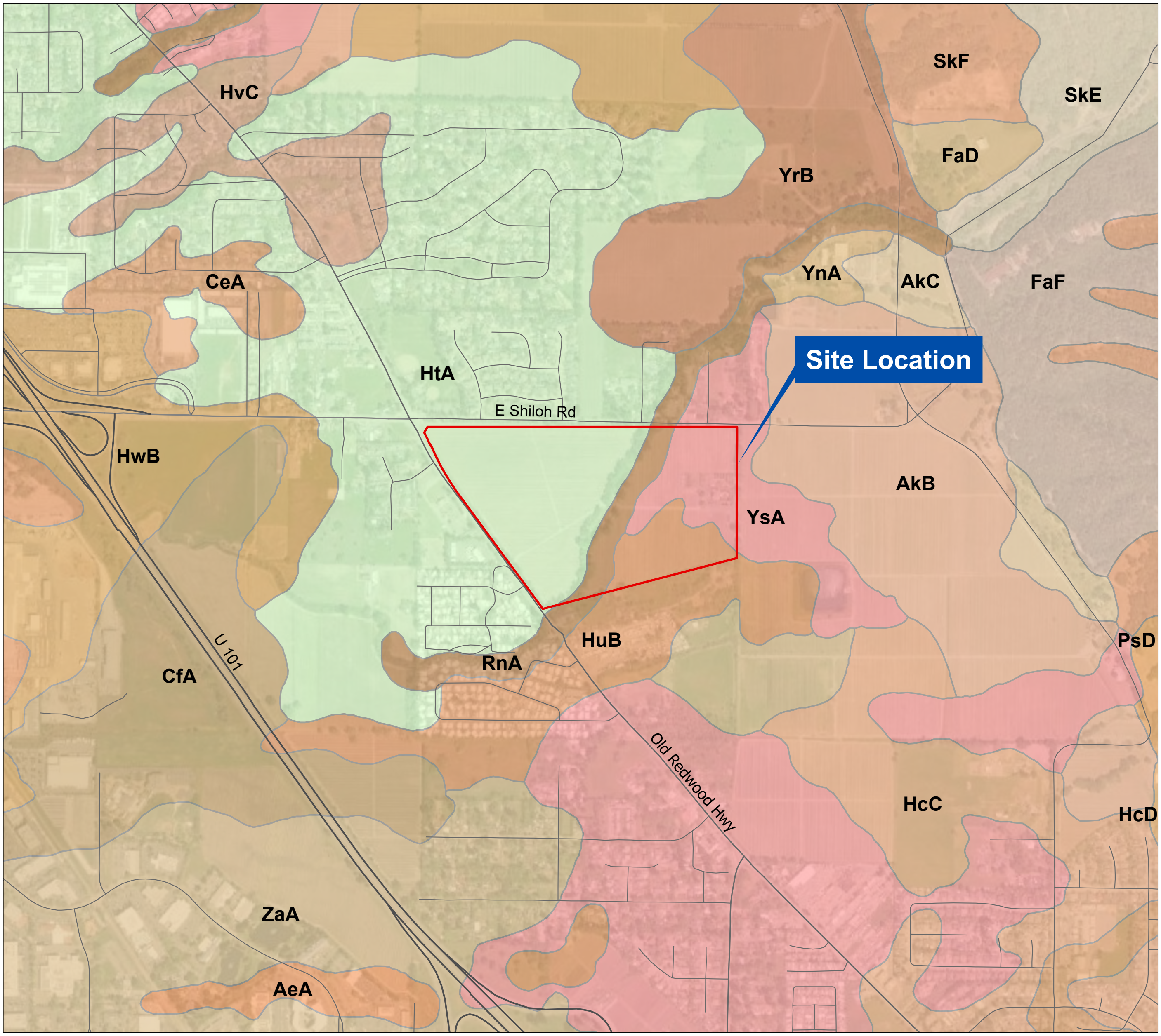
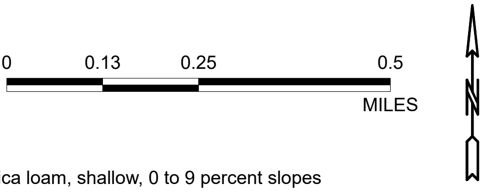
REGIONAL GEOLOGY MAP

220270	JULY 2022	FIGURE 3



BASEMAP REFERENCE

1. SOIL DATA FROM NATURAL RESOURCES CONSERVATION SERVICE,
US DEPARTMENT OF AGRICULTURE; WEB SOIL SURVEY, ACCESSED ONLINE ON 6/29/2020.



MAP UNIT DESCRIPTION

AeA	Alluvial land, clayey
AkB	Arbuckle gravelly loam, 0 to 5 percent slopes
AkC	Arbuckle gravelly loam, 5 to 9 percent slopes
CeA	Clear Lake clay, sandy substratum, drained, 0 to 2 percent slopes, MLRA 14
CfA	Clear Lake clay, ponded, 0 to 2 percent slopes
FaD	Felta very gravelly loam, 5 to 15 percent slopes
FaF	Felta very gravelly loam, 30 to 50 percent slopes
HcC	Haire clay loam, 0 to 9 percent slopes
HcD	Haire clay loam, 9 to 15 percent slopes
HtA	Huichica loam, 0 to 2 percent slopes
HuB	Huichica loam, ponded, 0 to 5 percent slopes
HvC	Huichica loam, shallow, 0 to 9 percent slopes
HwB	Huichica loam, shallow, ponded, 0 to 5 percent slopes
PsD	Positas gravelly loam, 9 to 15 percent slopes
RnA	Riverwash
SkE	Spreckels loam, 15 to 30 percent slopes
SkF	Spreckels loam, 30 to 50 percent slopes
YnA	Yolo loam, 0 to 10 percent slopes, moist, MLRA 14
YrB	Yolo gravelly loam, 0 to 8 percent slopes, MLRA 14
YsA	Yolo silt loam, 0 to 5 percent slopes, MLRA 14
ZaA	Zamora silty clay loam, moist, 0 to 2 percent slopes, MLRA 14

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NRCS SOIL MAP

220270	JULY 2022	FIGURE 4

Attachment A. NRCS Soil Descriptions

Map Unit Description

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

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

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

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

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

Soils that have profiles that are almost alike make up a *soil series*. All the soils of a series have major horizons that are similar in composition, thickness, and arrangement. Soils of a given series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

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

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

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

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

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

Additional information about the map units described in this report is available in other soil reports, which give properties of the soils and the limitations, capabilities, and potentials for many uses. Also, the narratives that accompany the soil reports define some of the properties included in the map unit descriptions.

Sonoma County, California

HtA—Huichica loam, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: hffk
Elevation: 100 to 300 feet
Mean annual precipitation: 30 inches
Mean annual air temperature: 61 degrees F
Frost-free period: 260 days

Farmland classification: Farmland of statewide importance

Map Unit Composition

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

Description of Huichica

Setting

Landform: Terraces
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from igneous, metamorphic and sedimentary rock

Typical profile

H1 - 0 to 14 inches: loam
H2 - 14 to 23 inches: sandy clay loam
H3 - 23 to 30 inches: clay
H4 - 30 to 57 inches: cemented

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches; 20 to 40 inches to duripan
Drainage class: Moderately well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 3.5 inches)

Interpretive groups

Land capability classification (irrigated): 3s
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: C
Ecological site: R014XG912CA - Loamy Terrace
Hydric soil rating: No

Minor Components

Unnamed

Percent of map unit: 5 percent
Landform: Basin floors
Hydric soil rating: Yes

Wright

Percent of map unit: 3 percent

Hydric soil rating: No

Haire

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

Clear lake

Percent of map unit: 2 percent
Landform: Depressions
Hydric soil rating: Yes

Zamora

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

Data Source Information

Soil Survey Area: Sonoma County, California
Survey Area Data: Version 15, Sep 10, 2021

Sonoma County, California

HuB—Huichica loam, ponded, 0 to 5 percent slopes

Map Unit Setting

National map unit symbol: hffn
Elevation: 100 to 300 feet
Mean annual precipitation: 30 inches
Mean annual air temperature: 61 degrees F
Frost-free period: 260 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

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

Description of Huichica

Setting

Landform: Terraces
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from igneous, metamorphic and sedimentary rock

Typical profile

H1 - 0 to 14 inches: loam
H2 - 14 to 23 inches: sandy clay loam
H3 - 23 to 38 inches: clay
H4 - 38 to 57 inches: cemented

Properties and qualities

Slope: 0 to 5 percent
Depth to restrictive feature: More than 80 inches; 20 to 40 inches to duripan
Drainage class: Moderately well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Available water supply, 0 to 60 inches: Low (about 3.5 inches)

Interpretive groups

Land capability classification (irrigated): 3w
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: D

Ecological site: R014XG912CA - Loamy Terrace
Hydric soil rating: Yes

Minor Components

Clear lake
Percent of map unit: 5 percent
Landform: Depressions
Hydric soil rating: Yes

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

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

Data Source Information

Soil Survey Area: Sonoma County, California
Survey Area Data: Version 15, Sep 10, 2021

Sonoma County, California

RnA—Riverwash

Map Unit Setting

National map unit symbol: hfj7
Elevation: 700 to 2,900 feet
Mean annual precipitation: 8 to 15 inches
Mean annual air temperature: 46 to 52 degrees F
Frost-free period: 110 to 180 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Riverwash

Setting

Landform: Flood plains
Parent material: Sandy and gravelly alluvium

Typical profile

H1 - 0 to 6 inches: very gravelly sand
H2 - 6 to 60 inches: stratified very gravelly coarse sand to very gravelly sand

Properties and qualities

Slope: 0 to 2 percent
Drainage class: Excessively drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: FrequentNone
Available water supply, 0 to 60 inches: Very low (about 1.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydric soil rating: Yes

Minor Components

Unnamed

Percent of map unit: 15 percent

Hydric soil rating: No

Data Source Information

Soil Survey Area: Sonoma County, California
Survey Area Data: Version 15, Sep 10, 2021

Sonoma County, California

YsA—Yolo silt loam, 0 to 5 percent slopes, MLRA 14

Map Unit Setting

National map unit symbol: 2w8b0
Elevation: 30 to 790 feet
Mean annual precipitation: 31 to 54 inches
Mean annual air temperature: 56 to 60 degrees F
Frost-free period: 240 to 260 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

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

Description of Yolo

Setting

Landform: Alluvial fans
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from volcanic and sedimentary rock

Typical profile

Ap - 0 to 8 inches: silt loam
C - 8 to 60 inches: loam

Properties and qualities

Slope: 0 to 5 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Rare
Frequency of ponding: None
Calcium carbonate, maximum content: 1 percent
Maximum salinity: Nonsaline (0.3 to 0.5 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 11.0 inches)

Interpretive groups

Land capability classification (irrigated): 1
Land capability classification (nonirrigated): 3c
Hydrologic Soil Group: B
Ecological site: R014XG918CA - Loamy Fan

Hydric soil rating: No

Minor Components

Pleasanton

Percent of map unit: 5 percent

Cortina

Percent of map unit: 5 percent

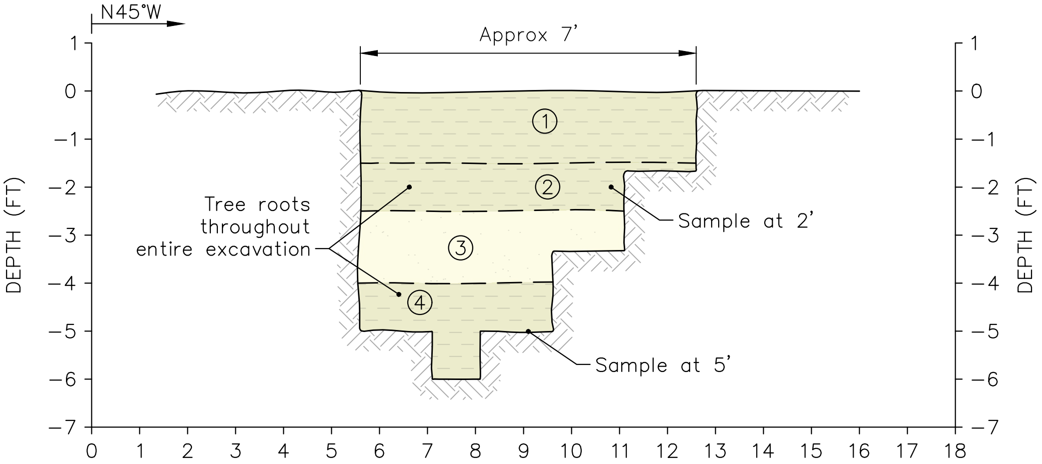
Pajaro

Percent of map unit: 5 percent

Data Source Information

Soil Survey Area: Sonoma County, California
Survey Area Data: Version 15, Sep 10, 2021

Attachment B. Test Pit Logs



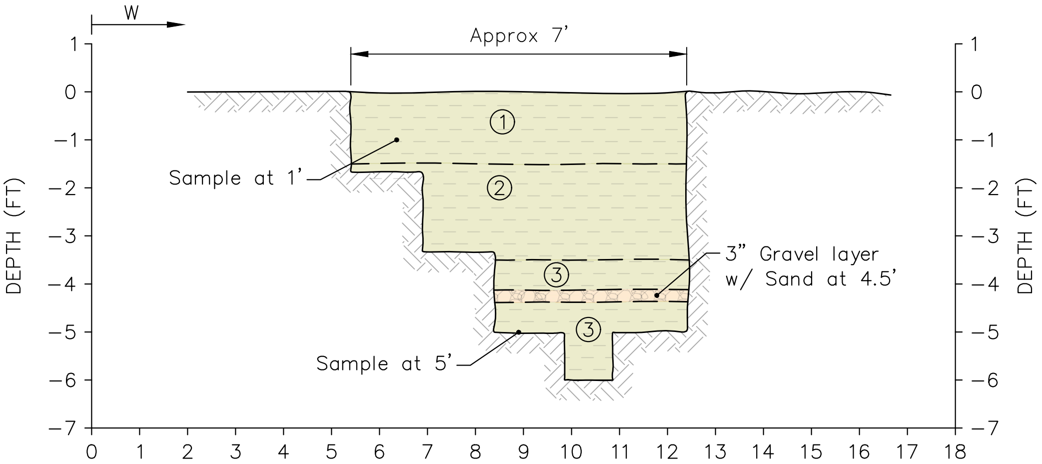
TEST PIT P–1

① SANDY LEAN CLAY (CL); LIGHT GRAYISH BROWN, DRY, LOW PLASTICITY, FINE TO MEDIUM SAND

② SANDY LEAN CLAY W/ GRAVEL (CL); DARK GRAYISH BROWN, MOIST, LOW PLASTICITY, FINE TO COARSE SAND, FINE GRAVEL

③ SILTY SAND W/ GRAVEL (SM); DRY TO MOIST, FINE TO COARSE SAND, SUB–ROUNDED GRAVEL UP TO 2.0", FEW CLAY

④ SANDY LEAN CLAY (CL); YELLOWISH BROWN, MOIST, LOW PLASTICITY, FINE TO MEDIUM SAND, FEW GRAVEL



TEST PIT P–2

① SANDY LEAN CLAY (CL); LIGHT GRAYISH BROWN, DRY, LOW PLASTICITY, FINE TO MEDIUM SAND, SILTY

② LEAN CLAY W/ SAND (CL); GREYISH BROWN, MOIST, MEDIUM PLASTICITY, SOME FINE SAND

③ SANDY LEAN CLAY (CL); LIGHT YELLOWISH BROWN, MOIST, LOW PLASTICITY, FINE TO MEDIUM SAND

NOTES

1. TEST PITS LOGGED BY C. RODIL ON 4/11/2022.

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TEST PIT LOGS FOR P-1 AND P-2

220270	JULY 2022	APPENDIX B (1 OF 2)

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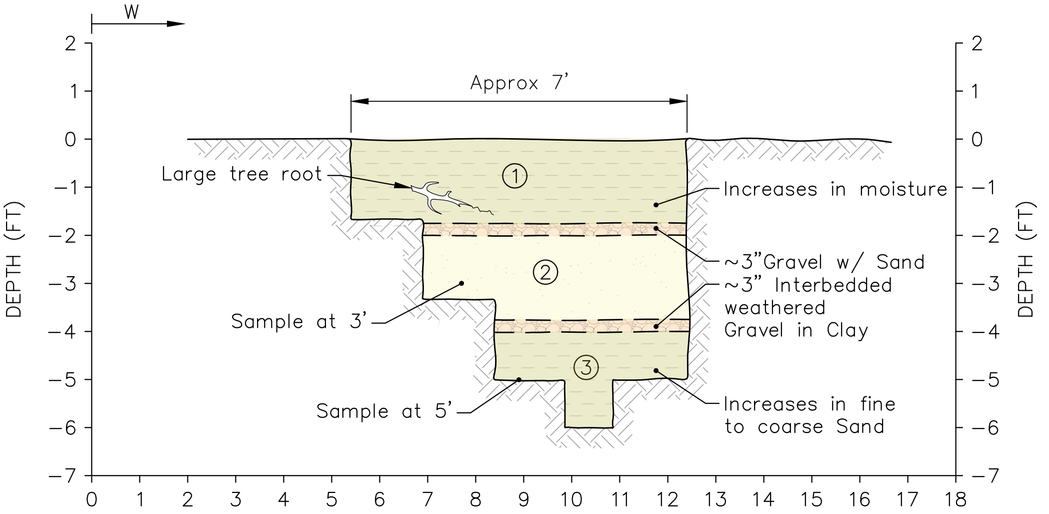
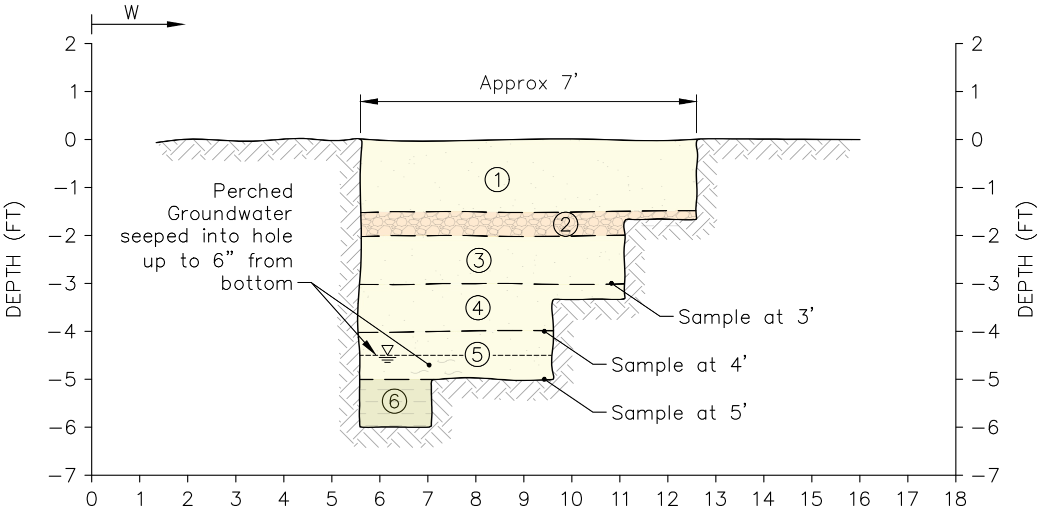


TEST PIT P−3

① LEAN CLAY (CL); LIGHT GRAYISH BROWN, DRY, LOW TO MEDIUM PLASTICITY, FEW FINE TO COARSE SAND, SILTY?

② SILTY SAND (SM); LIGHT GRAY, DRY TO MOIST, FINE TO COARSE SAND, FEW FINE GRAVEL

③ SANDY LEAN CLAY (CL); VERY DARK BROWN, MOIST, MEDIUM PLASTICITY, FINE TO COARSE SAND



TEST PIT P−4

① SILTY SAND (SM); LIGHT BROWNISH GRAY, DRY, FINE TO MEDIUM SAND, CLAYEY?

② CLAYEY GRAVEL (GC); FINE TO COARSE GRAVEL

③ CLAYEY SAND (SC); YELLOWISH BROWN, MOIST, FINE TO MEDIUM SAND, TRACE GRAVEL

④ SILTY SAND (SM); GRAYISH BROWN, FINE TO COARSE SAND, FEW FINE GRAVEL, FEW SILT

⑤ SILTY SAND (SM); DARK BROWN TO VERY DARK BROWN, WET, MEDIUM SAND

⑥ BOTTOM OBSERVED AS LEAN CLAY W/ SOME SAND

NOTES

1. TEST PITS LOGGED BY C. RODIL ON 4/11/2022.

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WINDSOR WASTEWATER TREATMENT PLANT PROJECT
222 EAST SHILOH ROAD
WINDSOR, CALIFORNIA

TEST PIT LOGS FOR P-3 AND P-4

220270	JULY 2022	APPENDIX B (2 OF 2)

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Attachment C. Laboratory Testing

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SUMMARY OF LABORATORY RESULTS

CLIENT HydroScience Engineers

PROJECT NAME Windsor Wastewater Treatment System Project

PROJECT NUMBER 220270

PROJECT LOCATION Windsor, CA

Borehole	Depth	Date Tested	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Screen Size (mm)	%<#200 Sieve	Class-ification	Water Content (%)	Dry Density (pcf)	Satur-ation (%)	Void Ratio
P-1	2.0	4/29/2022				19	52					
P-1	5.0	4/29/2022	37	23	14	0.106	56	CL				
P-2	1.0	4/29/2022				0.106	60					
P-2	3.0	4/29/2022										
P-2	5.0	4/29/2022	35	23	12	0.106	53	CL				
P-3	3.0	4/29/2022				0.106	39					
P-3	5.0	4/29/2022	42	22	20	0.106	63	CL				
P-4	3.0	4/29/2022				9.5	42					
P-4	4.0	4/29/2022				19	15					
P-4	5.0	4/29/2022				0.106	27					

ATTERBERG LIMITS RESULTS

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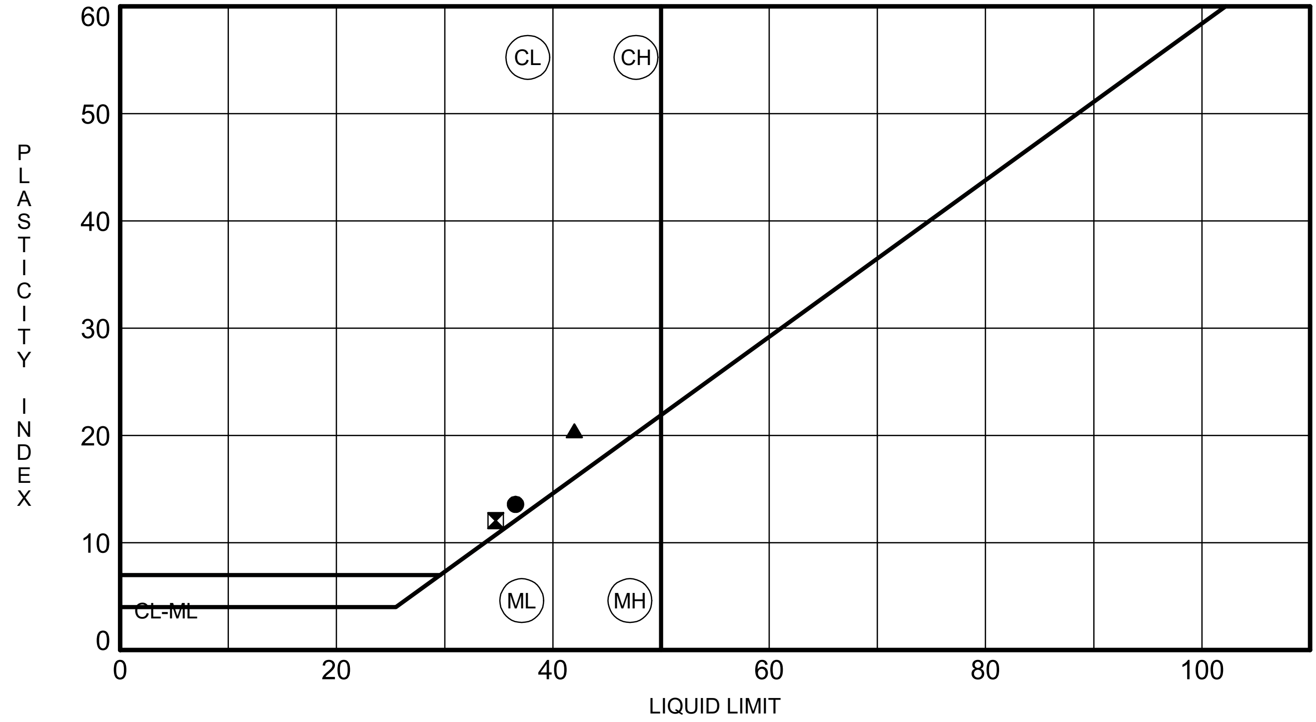
CLIENT HydroScience Engineers
PROJECT NAME Windsor Wastewater Treatment System Project
PROJECT NUMBER 220270
PROJECT LOCATION Windsor, CA



	BOREHOLE	DEPTH	LL	PL	PI	Fines	Classification	Date Tested
●	**P-1**	**5.0**	**37**	**23**	**14**	**56**	**SANDY LEAN CLAY(CL)**	**4/29/2022**
☒	**P-2**	**5.0**	**35**	**23**	**12**	**53**	**SANDY LEAN CLAY(CL)**	**4/29/2022**
▲	**P-3**	**5.0**	**42**	**22**	**20**	**63**	**SANDY LEAN CLAY(CL)**	**4/29/2022**

GRAIN SIZE DISTRIBUTION

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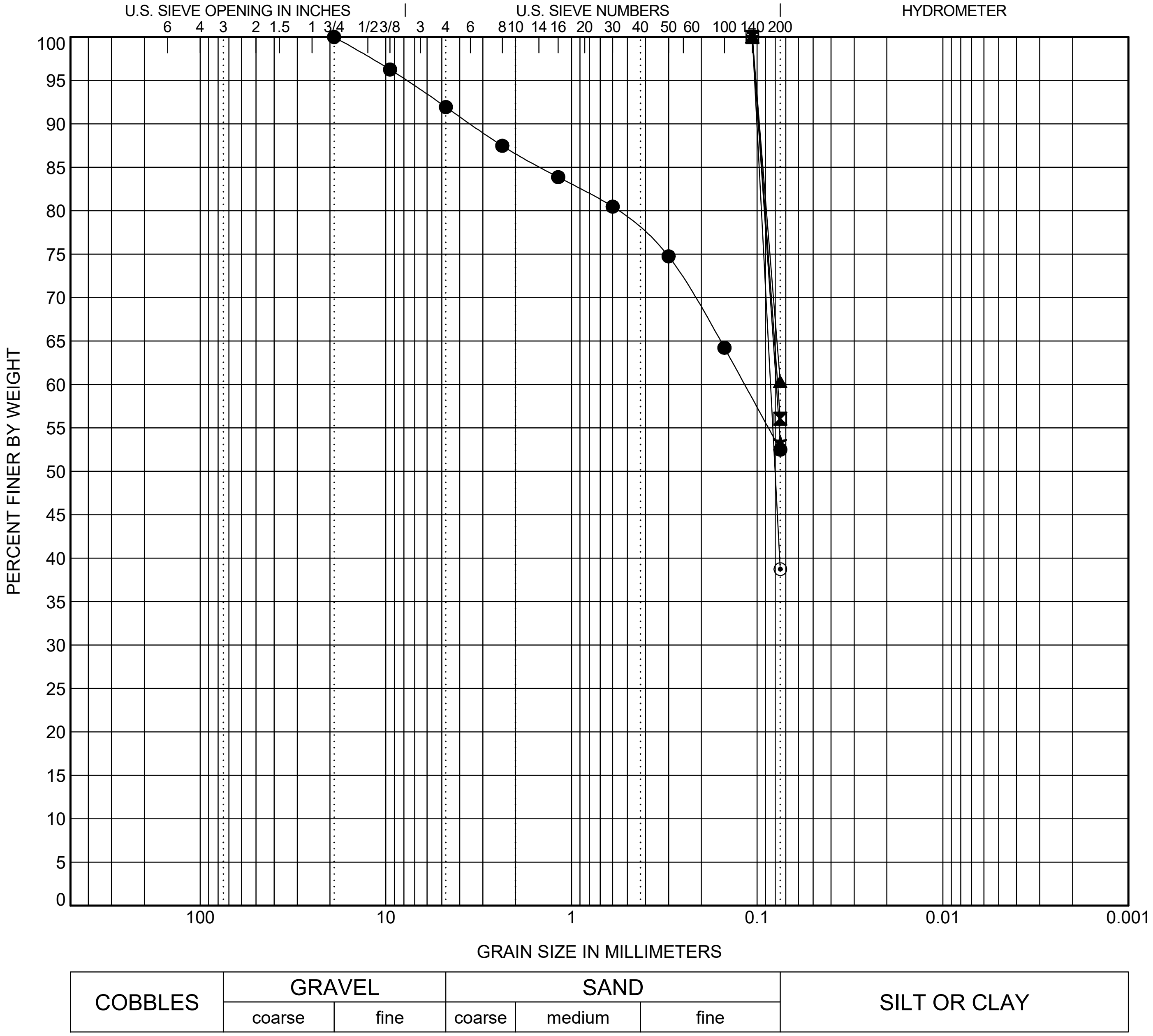
CLIENT HydroScience Engineers
PROJECT NAME Windsor Wastewater Treatment System Project
PROJECT NUMBER 220270
PROJECT LOCATION Windsor, CA



BOREHOLE	DEPTH	DATE TESTED	Classification	LL	PL	PI	Cc	Cu
● **P-1**	**2.0**	**4/29/2022**						
☒ **P-1**	**5.0**	**4/29/2022**	**SANDY LEAN CLAY(CL)**	**37**	**23**	**14**		
▲ **P-2**	**1.0**	**4/29/2022**						
★ **P-2**	**5.0**	**4/29/2022**	**SANDY LEAN CLAY(CL)**	**35**	**23**	**12**		
⊙ **P-3**	**3.0**	**4/29/2022**						

BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● **P-1**	**2.0**	**19**	**0.117**			**8.1**	**39.4**	**52.5**	
☒ **P-1**	**5.0**	**0.106**	**0.077**			**0.0**	**43.9**	**56.1**	
▲ **P-2**	**1.0**	**0.106**				**0.0**	**39.7**	**60.3**	
★ **P-2**	**5.0**	**0.106**	**0.079**			**0.0**	**46.6**	**53.4**	
⊙ **P-3**	**3.0**	**0.106**	**0.085**			**0.0**	**61.3**	**38.7**	

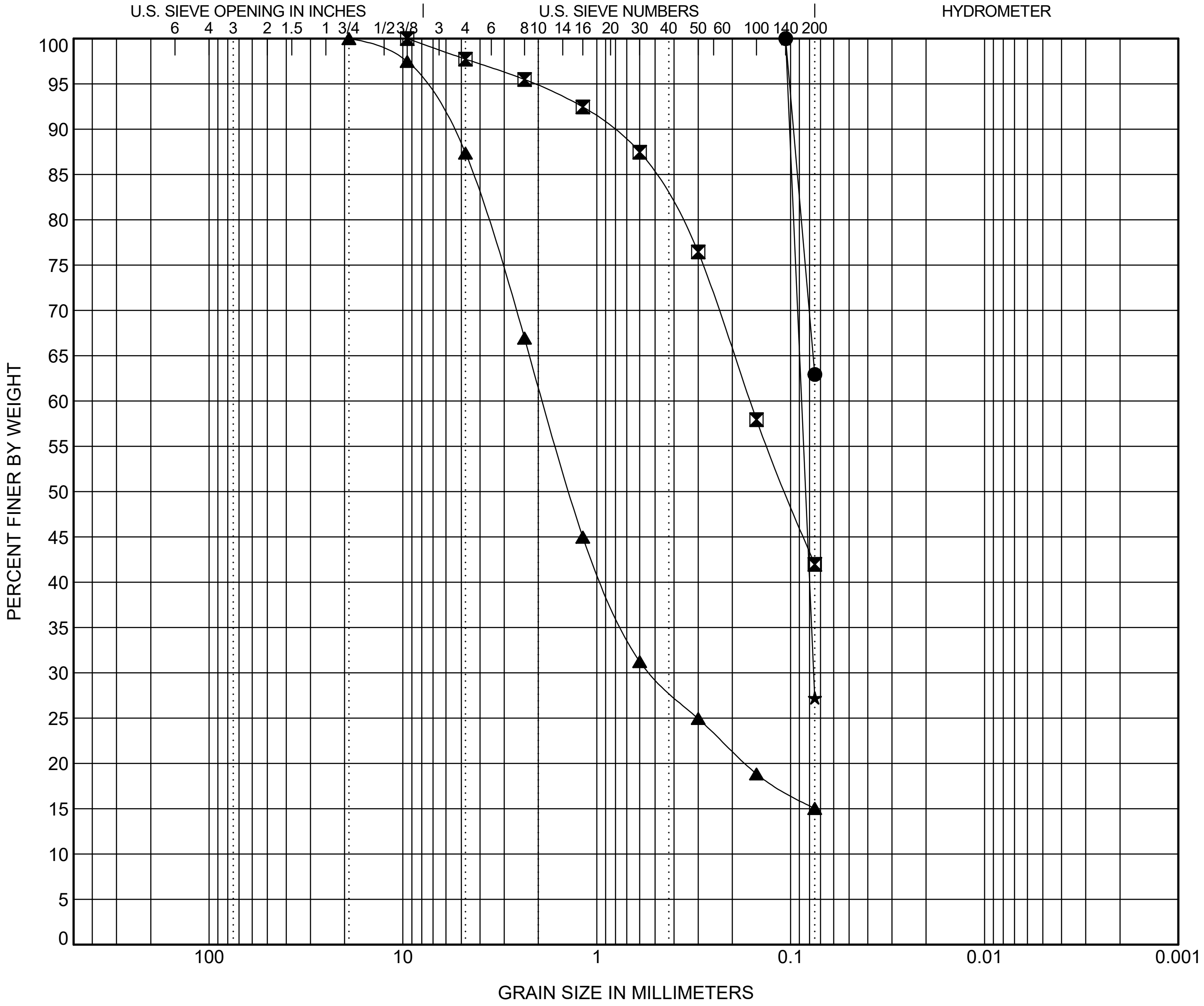
GRAIN SIZE DISTRIBUTION

CLIENT HydroScience Engineers

PROJECT NAME Windsor Wastewater Treatment System Project

PROJECT NUMBER 220270

PROJECT LOCATION Windsor, CA



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

BOREHOLE	DEPTH	DATE TESTED	Classification	LL	PL	PI	Cc	Cu
● **P-3**	**5.0**	**4/29/2022**	**SANDY LEAN CLAY(CL)**	**42**	**22**	**20**		
☒ **P-4**	**3.0**	**4/29/2022**						
▲ **P-4**	**4.0**	**4/29/2022**						
★ **P-4**	**5.0**	**4/29/2022**						

BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● **P-3**	**5.0**	**0.106**				**0.0**	**37.1**	**62.9**	
☒ **P-4**	**3.0**	**9.5**	**0.162**			**2.3**	**55.7**	**42.0**	
▲ **P-4**	**4.0**	**19**	**1.896**	**0.524**		**12.6**	**72.3**	**15.0**	
★ **P-4**	**5.0**	**0.106**	**0.088**	**0.076**		**0.0**	**72.8**	**27.2**	

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