# Appendix B

# Socioeconomic Information

# Appendix B-1

# Economic Impact Study for Shiloh Resort and Casino

Global Market Advisors

# Impact Study for the Shiloh Resort & Casino
## Sonoma County, California

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GMA 010-22

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Prepared for:
Koi Nation of Northern California

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# IMPACT STUDY OVERVIEW

The Koi Nation of Northern California ("Koi Nation") is interested in developing a casino on Shiloh Road in Santa Rosa, California ("Shiloh Road Casino" or "Project"). The Project's proposed location is on a 68.6-acre site at 222 E. Shiloh Road. Koi Nation has begun working on the Fee to Trust ("FTT") process for the Shiloh Road site and has engaged Acorn Environmental ("Acorn") to assist in the preparation of an Environmental Assessment (EA) pursuant to the National Environmental Policy Act (NEPA).

Acorn has engaged Global Market Advisors ("GMA") to prepare an Impact Study for the Shiloh Road Casino. This impact study includes three separate reports that examine various impacts:

1. The **Socioeconomic Analysis** examines relevant demographic data and the social impacts that a casino may have on a community.
2. The **Economic Impact Statement** examines the local economic impact of the Project in terms of total output, employment, and labor income on Sonoma County. Impacts were completed for:
    a. The Construction Phase – illustrates economic impacts stimulated by the construction of the Project and the development of its products, which are considered a non-recurring, one-time impact on the regional economy.
    b. The Operational Phase – economic impacts stimulated by the operation of the Project's facilities and products, which are considered recurring, continuous stimuli to the local economy.
3. The **Competitive Effects Study** examines the projected substitution effects on other regional gaming facilities.

Global Market Advisors is the leading international provider of consulting services to the gaming, entertainment, sports, and hospitality industries with offices located in Las Vegas, NV; Denver, CO; and Singapore. The company's market experience extends throughout all regions of the Americas, Eastern and Western Europe, Australia, and Asia. GMA provides clients with strategic planning, market feasibility studies, primary research, due diligence, general counsel, payroll control, operations analyses, government relations, responsible gaming initiatives, business and marketing plans, and reward program design. GMA's clients consist of the majority of public gaming companies, more than 80 Native American tribes, commercial and investment banks, and government agencies from around the world.

# SOCIOECONOMIC ANALYSIS

# I. SOCIOECONOMIC OVERVIEW

A socioeconomic analysis is necessary to gain a full understanding of the economic and social effects that a development may have on its host community. As such, GMA researched and evaluated population data for Sonoma County, California. Additionally, the Consulting Team quantified regional income levels to illustrate the relative affluence of the regions surrounding the site. Regional average annual household income levels ("AAHI") were quantified for 2021, 2026, and 2033. Given that educational levels are directly correlated to income levels, the Consulting Team additionally evaluated educational attainment levels for the selected region. Various metrics were also examined for the State of California as a whole to determine how the host county compares against a broader measure.

Along with these statistics, other key economic indicators were analyzed including historical housing values to illustrate how the region has recovered from the decline in home values experienced during the 2008 housing crisis, as well as potential impacts of the COVID-19 pandemic. In addition to housing values, GMA compared housing vacancy rates and total housing units available within the region.

GMA also evaluated empirical evidence regarding the social impact that a casino would have on its customers, employees, and the community. Casinos are generally believed to impose social costs such as increased crime, bankruptcies, and problem or pathological gambling, all of which are issues that can cause measurable economic costs to the host community when they occur. These costs may offset some of the benefits with respect to increased economic activity and tax revenues from gaming developments.

Despite the volume of research that this subject has generated, it is still difficult to draw clear conclusions about many of the social costs addressed in gaming research literature. Part of this difficulty stems from the nature of the subject. Many studies attempt to measure complex intangibles, which result in a wide array of conclusions. In addition, the majority of work has been written by proponents or opponents of casino gambling, resulting in skewed methodologies and biased conclusions. When reading the literature, such differences in perspectives must be kept in mind.

The Consulting Team identified those research studies that appeared to offer conclusions that were not predisposed to bias. In addition, the Consulting Team interviewed key constituents in communities that currently host casinos to better understand the impact those casinos have had on those communities. The goal was to present a reasonably clear view of the social impact that a casino can have on its host community.

## II. ECONOMIC ANALYSIS

GMA analyzed historical housing values to better understand the region's economic activity and trends. Housing values are key economic indicators that allude to the strength and stability of a regional economy. Housing value fluctuation often impacts expected population growth and disposable income. GMA also evaluated this data to understand how the most recent recession impacted the local economy and how the region has recovered. The Consulting Team also analyzed the number of total housing units and the associated housing vacancy rates to understand the overall health of the housing market. GMA utilized statistics collected by the U.S. Census Bureau to understand these housing market trends.

### POPULATION

The Consulting Team analyzed regional population estimates and projections to illustrate regional growth potential and trends within the analyzed areas. The Consulting Team also evaluated the region's total adult population (age 21 or older) to illustrate the number of potential gaming customers within the market area. Statistics in this report were derived primarily from PCensus/Claritas demographic mapping software, along with other publicly available and reliable sources.

Sonoma County was home to an estimated total population of 492,770 in 2021. Of that total, 379,842 were adults aged 21 years or older, representing 77.1% of the county's total population. The population is expected to gradually increase over five years, reaching 498,576 by 2026, and upwards of 506,820 by 2033. This represents a projected compound annual growth rate ("CAGR") of 0.23%. The adult population is expected to grow at a similar yet marginally higher rate, with a projected CAGR of 0.44% through 2026. The adult population of Sonoma County is expected to reach 388,220 in 2026, representing 77.9% of the total population. By 2033, the adult population is expected to increase to 400,261, or roughly 79.0% of the total population. With an adult population growing at a higher rate compared to the total population, this indicates an overall aging trend within the local population. The following table illustrates trends in the local and statewide population.

**Total Population**

| | 2021 | 2026 | 2033 | CAGR |
|---|---|---|---|---|
| Sonoma County, CA | 492,770 | 498,576 | 506,820 | 0.23% |
| State of California | 39,740,046 | 40,757,275 | 42,225,288 | 0.51% |

*Source: PCensus, GMA*

| Adult Population (Age 21+) | 2021 | 2026 | 2033 | CAGR |
|---|---|---|---|---|
| Sonoma County, CA | 379,842 | 388,220 | 400,261 | 0.44% |
| State of California | 29,204,220 | 30,202,006 | 31,656,437 | 0.67% |
| *Source: PCensus, GMA* | | | | |

## INCOME

Average annual household income ("AAHI") was evaluated for Sonoma County, and the State of California as a whole. By evaluating regional AAHI, the Consulting Team can better understand a market's economic expectations and evaluate a region's economy. Typically, higher income levels correlate to higher disposable income levels, leading to a greater spend on entertainment, which may include gambling. GMA analyzed AAHI estimates for 2021, projections for 2026 as well as 2033, and projected annual growth rates.

Sonoma County AAHI was estimated at $121,522 in 2021, and it is expected to grow somewhat significantly through 2026 at a projected CAGR of 2.79%. Overall, AAHI in Sonoma County is slightly higher than the statewide average, both in terms of its value, as well as in terms of expected growth. In 2021, it is estimated that the Sonoma County residents earned roughly 100.6% of the average household income achieved in the State of California. This figure is expected to be 6.0% higher than the statewide average by 2033.

| Average Annual Household Income | 2021 | 2026 | 2033 | CAGR |
|---|---|---|---|---|
| Sonoma County, CA | $121,522 | $139,429 | $169,017 | 2.79% |
| State of California | $120,852 | $135,653 | $159,469 | 2.34% |
| *Source: PCensus, GMA* | | | | |

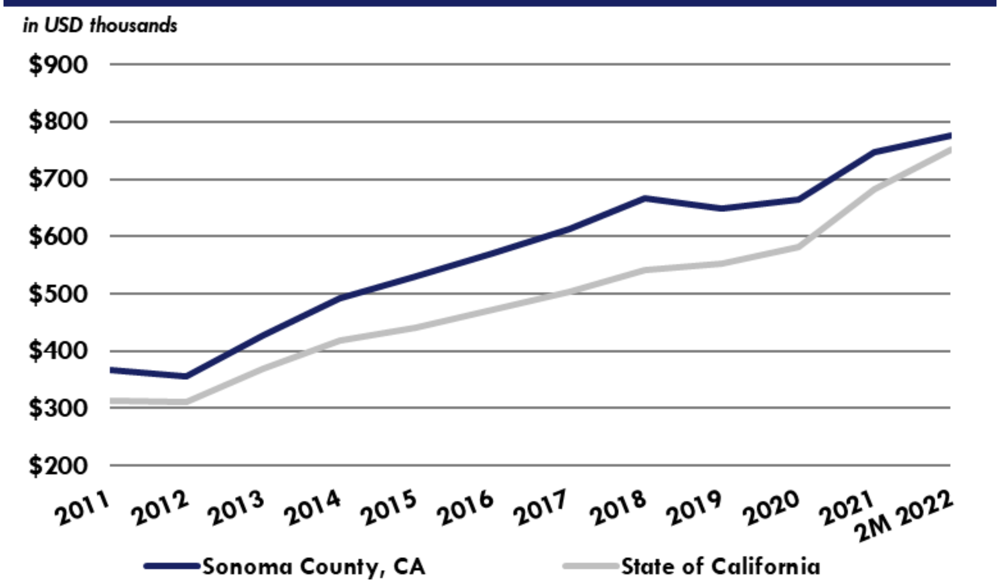
## HOUSING

GMA analyzed historical housing values to better understand the region's economic activity and trends. Housing values are key economic indicators that allude to the strength and stability of a regional economy. Housing value fluctuation often impacts expected population growth and disposable income. GMA also evaluated this data to understand how the most recent recession impacted the local economy and how the region has recovered. The Consulting Team also analyzed the number of total housing units and the associated housing vacancy rates to understand the overall health of the housing market. GMA utilized statistics collected by the U.S. Census Bureau to understand these housing market trends.

For both Sonoma County and the State of California, housing values reached their lowest levels in 2012. Since then, both housing values in either area have increased at a CAGR of at least 8.0% through 2021. In 2021, the median housing value for Sonoma County was estimated at $746,123. This represents an increase of 12.8% from the previous year's median housing value of $664,505. Currently, housing values in Sonoma County are significantly higher than both pre-recession and pre-pandemic levels. As of February 2022, median housing values are estimated to be $776,379, representing an increase of 109.4% since 2012. In comparison to the State of California as a whole, the housing values in Sonoma County are slightly higher, and have recovered at a higher rate since the recession.

In 2010, total housing units in Sonoma County were quantified at 204,572, while the number of housing units in the State of California were quantified at 13.7 million. While the number of housing units in the state had increased by 712,059 from 2010 to 2020, only 170 new homes were added to Sonoma County, indicating a relatively stable housing market.

**Historical Housing Value Trend**




Source: Zillow, GMA

**Total Units and Housing Vacancy Rates**

| | 2010 | | 2020 | |
|---|---|---|---|---|
| | Total Units | % Vacant | Total Units | % Vacant |
| Sonoma County, CA | 204,572 | 9.2% | 204,742 | 8.1% |
| State of California | 13,680,081 | 8.3% | 14,392,140 | 6.4% |

Source: U.S. Census Bureau, GMA

## EMPLOYMENT

GMA analyzed employment data for Sonoma County, and the State of California as a whole. The Consulting Team focused on evaluating regional unemployment rates, as this key economic indicator characterizes the strength and stability of a local economy. Additionally, GMA evaluated the largest employers in each respective county to understand the regional population's reliance on certain industries.

### UNEMPLOYMENT RATE

The unemployment rate in Sonoma County was quantified at 2.7% in 2019, maintaining the same level of unemployment as the previous year. The county's unemployment rate had steadily decreased from the post-recessionary high of 10.2% in 2011. Unemployment levels reached a ten-year low in 2019, before rising to 7.9% in 2020 as a result of the COVID-19 pandemic and related impacts. Unemployment levels have since improved slightly to 5.5% in 2021. The following table illustrates the ten-year unemployment trend for Sonoma County and the State of California.

**Annual Unemployment Rates**

| | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|---|---|---|---|---|
| Sonoma County | 8.9% | 7.1% | 5.6% | 4.5% | 4.0% | 3.4% | 2.7% | 2.7% | 7.9% | 5.5% |
| State of California | 10.4% | 8.9% | 7.5% | 6.2% | 5.5% | 4.8% | 4.2% | 4.2% | 10.1% | 7.3% |

*Source: U.S. Bureau of Labor Statistics, GMA*

GMA also analyzed unemployment rates on a monthly basis to understand more recent and seasonal trends in unemployment. When examining the past 24 months, unemployment levels peaked in April of 2020 for Sonoma County as well as the State. While unemployment rates have remained relatively higher over the course of the pandemic, Sonoma County reported unemployment levels near or below 3.0% prior to the pandemic, indicating a high level of economic vitality in the region under stable conditions. The unemployment rate in Sonoma County prior to the pandemic was 2.8% in February 2020, before rising to 15.4% two months later. While unemployment rates have yet to return to pre-pandemic levels, unemployment levels in 2022 have reached as low as 3.0%, and appear to be normalizing. Additionally, the rate of unemployment in April and May of 2021 significantly improved over the prior year. The following table illustrates unemployment rates for the trailing 12-month period versus the prior 12-month period.

| Sonoma County Monthly Unemployment Trend | | | | |
|---|---|---|---|---|
| Trailing 12-Month | | Prior Year | | % Change |
| Month | Rate | Month | Rate | Y-O-Y |
| Mar-22 | 3.0% | Mar-21 | 5.9% | -49.2% |
| Feb-22 | 3.5% | Feb-21 | 6.3% | -44.4% |
| Jan-22 | 4.0% | Jan-21 | 7.1% | -43.7% |
| Dec-21 | 3.5% | Dec-20 | 6.6% | -47.0% |
| Nov-21 | 3.7% | Nov-20 | 5.7% | -35.1% |
| Oct-21 | 4.2% | Oct-20 | 6.9% | -39.1% |
| Sep-21 | 4.4% | Sep-20 | 7.8% | -43.6% |
| Aug-21 | 5.3% | Aug-20 | 8.7% | -39.1% |
| Jul-21 | 5.6% | Jul-20 | 10.0% | -44.0% |
| Jun-21 | 5.8% | Jun-20 | 11.4% | -49.1% |
| May-21 | 5.3% | May-20 | 13.4% | -60.4% |
| Apr-21 | 5.7% | Apr-20 | 15.4% | -63.0% |

*Source: U.S. Bureau of Labor Statistics, GMA*

## MAJOR EMPLOYERS

Sonoma County lies on the northern edge of the greater San Francisco Bay Area, and it is home to a diverse and robust economy. As is typical for a larger metropolitan area, the largest employers in the region are primarily in the government, education, and healthcare industries. However, as Sonoma County is located within the heart of California wine country, hospitality and food & beverage constitute a large portion of employment in the county, estimated at 22,340 jobs in 2019. Major employers in these fields included the Graton Resort and Casino, which accounted for 2,000 employees and was one of the ten largest employers in the county. However, as a result of the COVID-19 pandemic, tourism and hospitality related businesses were among the hardest hit by the fallout from the pandemic. This included operational limits set by state and local governments and the need to socially distance that limited the ability of these facilities to operate with full employment. The following table lists the ten largest employers in Sonoma County prior to the pandemic.

| Major Employers in Sonoma County, Pre-Pandemic | | |
|---|---|---|
| | # Employees | Industry |
| County of Sonoma | 3,857 | Government |
| Kaiser Permanente | 3,508 | Healthcare |
| St Joseph Health | 2,500 | Healthcare |
| Graton Resort and Casino | 2,000 | Gaming/Hospitality |
| Santa Rosa City Schools | 1,691 | Education |
| City of Santa Rosa | 1,307 | Government |
| Keysight Technologies | 1,300 | Electronics |
| Jackson Family Wines | 1,152 | Food & Beverage |
| Sutter Santa Rosa Regional Hospital | 1,050 | Healthcare |
| Amy's Kitchen | 988 | Food & Beverage |
| *Source: Sonoma County CAFR, GMA* | | |

## EDUCATIONAL ATTAINMENT

Understanding the educational attainment of the local populace is useful to define the types of potential gaming customers in a specific region. GMA analyzed the estimated educational attainment data for Sonoma County as well as the State of California in 2021. In Sonoma County, 29.7% of the adult population obtained a high school degree or less, while 35.7% earned a bachelor's degree or higher in that year. The educational attainment in Sonoma County is relatively higher than the statewide average, with Sonoma County reporting that a higher share of its population had achieved an education beyond a bachelor's degree. The following table details educational attainment statistics for Sonoma County, as well as the State of California overall.

| 2021 Educational Attainment (Est. Population Aged 25+) | | | | |
|---|---|---|---|---|
| | Sonoma County, CA | | State of California | |
| | Total | % Total | Total | % Total |
| 9th Grade | 22,596 | 6.3% | 2,469,650 | 9.1% |
| Some High School | 17,569 | 4.9% | 2,010,073 | 7.4% |
| High School Graduate (or GED) | 66,013 | 18.5% | 5,610,259 | 20.7% |
| Some College, no degree | 89,430 | 25.0% | 5,683,919 | 21.0% |
| Associate Degree | 34,111 | 9.5% | 2,142,068 | 7.9% |
| Bachelor's Degree | 78,708 | 22.0% | 5,727,450 | 21.1% |
| Master's Degree | 31,794 | 8.9% | 2,360,153 | 8.7% |
| Professional School Degree | 11,129 | 3.1% | 657,655 | 2.4% |
| Doctorate Degree | 6,170 | 1.7% | 442,656 | 1.6% |
| **TOTAL** | **357,520** | **100.0%** | **27,103,883** | **100.0%** |
| *Source: PCensus, GMA* | | | | |

The following table shows the size of education systems in Sonoma County.

| Sonoma County Educational Facilities | |
|---|---|
| School Districts | 40 |
| Elementary | 102 |
| Middle | 24 |
| Alternative | 13 |
| High | 18 |
| Ind. Study | 5 |
| **TOTAL** | **162** |

*Source: Sonoma County Office of Education*

## III. SOCIAL IMPACT ANALYSIS

Understanding the social impact of gaming on a community is a difficult task and one that is not easily measured. Despite the growth and magnitude of the gaming industry and the widespread participation of the general population in gaming activities, there is not a large amount of scientific research on the subject. Much of what exists is not rigorous because of insufficient data, under-developed methodologies, or researchers' biases.[1] More specifically, studies are often commissioned by industry associations, non-profit advocacy groups, and other organizations that are predisposed to strong opinions either against or in favor of gaming.

To better understand the impact of a casino project on a community, the Consulting Team continuously performs an extensive review of literature including studies conducted for the U.S. government, industry-sponsored research, university research and research sponsored by political and religious institutions. Through this process, GMA attempts to identify those research studies that offer the most thorough analysis and could provide the host community with an understanding of how a casino would impact the region.

After careful review of various reports, the Consulting Team ultimately relied on the findings presented in the National Gambling Impact Study Commission ("NGISC") in its Report to the U.S. Congress and President that was completed in 1999[2] as well as a report titled "The Impact of Gambling: Economic Effects More Measurable Than Social Effects," prepared by the General Accounting Office (GAO) and presented to the Honorable Frank Wolf of the U.S. House of Representatives.[3] The latter report was viewed with a certain degree of skepticism by the gaming industry when it was released, since Representative Wolf had been an ardent opponent to the expansion of gaming in the United States. Nevertheless, the Consulting Team found that it was a well-researched study that both questioned and validated the findings of the NGISC report. Together, these studies provide an overview of best practices, a basis for how the concerns surrounding social impacts have evolved, and a sound understanding of how these issues are addressed in markets across the United States today.

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[1] "Gambling's Impacts on People and Places," National Gambling Impact Study Commission, June 1999, pp. 7-1.

[2] National Gambling Impact Study Commission, June 1999.

[3] "The Impact of Gambling: Economic Effects More Measurable Than Social Effects," General Accounting Office.

## UNDERSTANDING CASINO CUSTOMER BEHAVIOR

Gambling, in one form or another, is now legal in every state except Hawaii and Utah. A NGISC contractor stated that about 86% of Americans reported having gambled at least once during their lifetimes and 63% of Americans reported having gambled at least once during the previous year.[4] This estimate is based on participation in all forms of gambling including lotteries, poker, internet gambling, pari-mutuel wagering as well as casino gambling.

Before examining problem gambling, the Consulting Team believes it is best to first understand the various kinds of people who visit casinos and their motivations for doing so. Industry expert Andrew M. Klebanow published an article on the subject, and the article's findings are summarized in the following paragraphs.[5] Its purpose is to give the reader an understanding of casino customers from a psychographic standpoint.

### THE FIVE BEHAVIORAL SEGMENTS OF CASINO CUSTOMERS

The notion of examining gaming customers based on behavior was first broached by casino operators in Atlantic City in the mid-1980's. Casinos wanted to better understand what motivated people to visit their properties and how to better meet their needs. This behavior-based approach to customer segmentation was refined by the author to include five distinct behavior segments.

Early studies identified three basic behavioral segments among casino customers: Recognition Seekers, Escapists, and Reward Seekers. With the proliferation of local casinos throughout the United States over the past decade, additional behavioral segments have become evident. These include Socializers and Professionals.

### RECOGNITION SEEKERS

Recognition Seekers represent a small share of total players, yet they command a considerable amount of attention from a casino. These players have a high expectation of recognition from the property they patronize. They expect floor supervisors, restaurant maître D's, and dealers to quickly recognize them and acknowledge their presence. They expect hosts to promptly greet them when they appear on property. Player Development departments are designed, in large part, to provide the recognition and service that this segment demands. They are an expensive segment to attract, and it is the reason why casinos spend so much on luxury suites, fine dining

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[4] GAO Report, p. 4.

[5] "A Behavior Based Approach to Market Segmentation," Andrew M. Klebanow, Indian Gaming Magazine, October, 2003, pp. 62-63.

venues, and lush environments.  The reward to the casino property is an intensely loyal, profitable, and frequent visitor.

### ESCAPISTS

Escapists seek a getaway that does not resemble their everyday routine.  Escapists visit a casino to get away from their everyday lives.  They go to a casino to escape the pressures of their jobs, family, and the world around them.  By their nature, Escapists prefer to remain anonymous.  In other words, they enjoy coming into a casino and playing with minimal interaction with casino personnel.  They share their loyalty among a small number of properties and require minimal maintenance in the form of personal attention and complimentary services.  This group of consumers is therefore a very profitable segment.  The Escapist is an excellent example of a player that may not have previously visited a bingo hall due to the social atmosphere of a bingo game.  However, with the advent of slot machines, Escapists can go to a gaming facility and simply play a machine in solitude.  Those games that are less social are generally preferred by the escapist.

### REWARD SEEKERS

Reward Seekers are driven to visit a property by the casino's player rewards program or promotions that compensate them for their play.  They believe they have a vested interest in the promotions and bonuses that casinos have to offer.  It is their ability to identify the best "gaming value" that validates their superiority over other players and the casino in which they play. Reward seekers are also capricious in that they will patronize the casino that has the best monthly offer.  Their gaming play goes to the casino with the best deal.

### SOCIALIZERS

Socializers visit a casino in order to escape the mundane world around them and to be around others.  Even though gambling can sometimes require serious concentration and little distraction, it is the overall social environment of casinos that attracts these people to a particular property. One need only walk through a bingo hall prior to the start of a session to understand the social nature of the game.

Socializers are intensely loyal and build relationships with floor personnel and other gamblers. Once they identify with a particular property, they become a very loyal, very profitable segment with high levels of visitation and require very few marketing dollars to maintain their loyalty.  Day in and day out, they are the casino's best player segment.

### PROFESSIONALS

With the proliferation of liberal table game rules and full-pay video poker machines, a small cadre of players makes a living gambling in casinos.  They pay very close attention to the types of games casinos offer. They closely scrutinize the pay tables on video poker games, the value of the cash-back component of a casino's player rewards program, and casino complimentary policies.

Professionals generate large coin handle volume and accumulate voluminous amounts of slot club points. While an analysis of their theoretical win may indicate a profitable customer, more often than not their actual win/loss is difficult to gauge. Professionals readily pull their cards from reader boxes in the middle of a video poker hand if the outcome looks favorable in order to hide the true payout. This segment understands how reward programs work and how casino managers evaluate play.

Professionals will employ a variety of techniques to defend their position in a casino. They brag to hosts about the friends they bring who are not knowledgeable gamers. They readily turn to hosts for upgraded rooms and meals without debiting their comp dollar balances. This segment also poses the greatest threat to local gaming properties seeking to broaden their destination gambler segment. They prey on unsuspecting hosts eager to demonstrate their ability to bring in "big players."

Professionals also share their knowledge in internet discussion groups. Since their goal when visiting a casino is to consistently make money, they become resentful when a casino tightens up their promotional policies. Casinos do not make money off professionals and their loyalty goes to the casino where they can make the most money.

## SUMMARY OF CUSTOMER BEHAVIORS

Gaming customers are motivated to visit a casino for a variety of reasons. Some of those reasons may be viewed as criteria that define one as a problem gambler. However, as will be revealed in succeeding sections, the psychiatric community, in attempting to identify the characteristics of problem gamblers, sometimes misinterprets certain behaviors that are normal to people who participate in casino gaming activities. While the author of the article and the Consulting Team do not challenge those definitions, the reader is asked to keep an open mind to the subject and understand that, to many people who participate in gaming activities, their behaviors are not viewed as problems. Behavioral scientists and the psychiatric community's understanding of people's behavior with regards to casino gambling is evolving as casinos continue to open across the United States.

## PATHOLOGICAL GAMBLING

There are several terms used to describe "pathological gamblers." Currently, the American Psychiatric Association in its Diagnostic and Statistical Manual of Mental Disorders ("DSM-IV") classifies pathological gambling as an impulse control disorder and describes ten criteria to guide diagnoses. These range from repeated unsuccessful efforts to control, cut back or stop gambling to committing illegal acts such as forgery, fraud, theft or embezzlement to finance gambling.[6] The diagnostic criteria and their associated behavior patterns are listed in the following table.

**Criteria for Pathological Gambling**

| Diagnostic Criteria | Behavior Pattern |
|---|---|
| Pre-Occupation | Is pre-occupied with gambling (e.g. pre-occupied with reliving past gambling experiences, handicapping or planning the next venture, or thinking of ways to get money with which to gamble. |
| Tolerance | Needs to gamble with increasing amounts of money in order to achieve the desired excitement. |
| Withdrawal | Is restless or irritable when attempting to cut down or stop gambling. |
| Escape | Gambles as a way of escaping from problems or relieving dysphoric mood (e.g. feelings of helplessness, guilt, anxiety or depression). |
| Chasing | After losing money gambling, often returns another day in order to get even ("chasing one's losses"). |
| Lying | Lies to family members, therapists or others to conceal the extent of involvement with gambling. |
| Loss of Control | Has made repeated unsuccessful efforts to control, cut back or stop gambling. |
| Illegal Acts | Has committed illegal acts (e.g. forgery, fraud, theft or embezzlement) in order to finance gambling. |
| Risked Significant Relationship | Has jeopardized or lost a significant relationship, job, educational or career opportunity because of gambling. |
| Bailout | Has relied on others to provide money to relieve a desperate financial situation caused by gambling. |

*Source: National Gambling Impact Study Commission Report, p. 4-2*
*American Psychiatric Association Diagnostic and Statistic Manual of Medical Disorders (DSM-IV)*

The American Psychiatric Association uses the following criteria to classify gaming behaviors based on the previously listed criteria.

[6] National Gambling Impact Study Commission, p. 4-1-4-2.

| Classification of Gaming Behaviors | |
|---|---|
| # of Behavior Criteria | Diagnosis |
| 1 to 2 | At risk |
| 3 to 4 | Problem Gambler |
| 5 to 10 | Pathological Gambler |
| *Source: DSM-IV* | |

The NGISC Study reported on three studies completed in 1997 and 1998 that estimated the percentage of US adults classified as pathological gamblers, which ranged from 1.2% to 1.6%. An NGISC contractor, who conducted one of the three studies, estimated that about 2.5 million adults are pathological gamblers and another 3.0 million adults should be considered problem gamblers. The GAO study estimated that in 1990, 1.2% of New Jersey residents were probable pathological gamblers.[7]

## BI-PRODUCTS OF PATHOLOGICAL GAMBLING

The social effects of gambling on communities are more difficult to measure than the economic effects, primarily because of the limited quality of data on social effects, the complexity of identifying and measuring the social effects and the difficulty of establishing a cause-effect relationship between gambling and social problems.[8]

The NGISC reported that pathological gambling often occurs in conjunction with other behavioral problems, including substance abuse, mood disorders, and personality disorders. The NGISC further noted that mood disorders such as depression, suicidal thoughts, and anti-social hyperactivity often co-exist with pathological gambling. Joint occurrences are referred to as "co-morbidity."

Co-morbidity presents a wealth of challenges to the medical researcher. How does one isolate the effects of pathological gambling on say, marital stability, from the effects of co-existing conditions like substance abuse? Is pathological gambling a bi-product of say, substance abuse? Is substance abuse a bi-product of problem gambling or is the combination of disorders caused by a more fundamental personality disorder? Is the severity of one disorder related to the other?

Even if one were able to isolate the effects of problem gambling in people who suffer from co-morbidity, how does one then isolate the effects of casino gambling from other forms of gambling? Casino gambling is only one form of gaming that also includes lotteries, internet gambling, pari-mutuel gaming and card clubs. In fact, the most prevalent forms of gambling are the ones found in most neighborhoods: lottery scratch cards, lotto and video lottery terminals.

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7 GAO Report, p. 4.

8 GAO Report, p 26.

For the researcher, the challenge is to first identify the preferred gaming venue and then to determine that venue's effects on the pathological gambler.[9]

The Consulting Team presents these issues to the reader to better illustrate the challenges that medical and social researchers face when attempting to identify the social costs of gaming and the effects that pathological gamblers have on their communities. It is simply not an easy task to quantify their effects. However, for the purposes of the Project, it is important to note that gaming has existed in many forms in the subject market area for decades. A strong baseline of protections exists through Tribal gaming enterprises in the market today, whereas a newly established market would have no existing framework in place. As such, there is no sound research that would indicate that a new casino in an established market would have any discernable impact on social costs such as problem gaming. Rather, the introduction of a casino to such a mature market would only bring more resources to supplement the responsible gambling measures that exist in the market today.

## MEASURING SOCIAL COSTS

In its report, the Federal Reserve Bank of Philadelphia categorizes social costs from problem gambling or other socially undesirable behaviors potentially triggered by casinos, into three specific categories:

(1) Costs borne by the individual exhibiting that behavior

(2) Costs borne by the family and friends of that individual

(3) Costs borne by society

The first category is considered to be private expenses of the individual. In other words, if a gambler knowingly, or rationally, undertakes certain behavior and subsequently assumes the full cost of his or her behavior, there are no social costs associated with that behavior. Gambling losses, even if they are disproportionately borne by some individuals in a society, are not social costs any more than the cost of a ticket to a concert or sports event.[10]

The second and third categories are both external costs, but those that affect only the individual's family and friends may fall outside the scope of measurable costs. To the extent that we can quantify the increase in crime associated with a casino, we can then quantify the police, judicial, and penal costs associated with that crime. If problem gambling increases the suffering of the

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[9] National Gambling Impact Study Commission, p. 7-4.

[10] "Economic and Social Impact of Introducing Casino Gambling," Federal Reserve Bank of Philadelphia p. 19

gambler's family, that cost is as real as the cost of the police time needed to apprehend a criminal but may be impossible to quantify.[11]

Finally, the question of how much of any given cost is actually attributable to the casino is not straight-forward. Simply observing that gambling is correlated with such problems does not imply that gambling causes them. If gambling were not an option, a person who has a pathological disorder may still find ways to cause harm to the community. This idea of co-morbidity was addressed in the previous section and enforces the difficulty in measuring the different social costs. The following list addresses specific social issues and the impact that casino gaming has on the host community.

## SUICIDE

The NGISC reported that the suicide rate among pathological gamblers is higher than for any other addictive disorder but questioned whether a link existed between gambling and suicide in general. The report stated that it heard repeated testimony and received various reports about suicide and attempted suicide on the part of individuals suffering from pathological gambling.

The GAO report stated that the suicide rate in Atlantic County, the county where Atlantic City's casinos are located, was higher than the overall suicide rate in New Jersey, but lower than the national rate.[12]

## DIVORCE

An assumed byproduct of pathological gambling is divorce. Marriages, under financial and emotional strains when one or both spouses are pathological gamblers, often end in divorce. Both the NGISC and GAO reports examined divorce rates among pathological gamblers. The NGISC reported that, in one survey it examined, 53.5% of pathological gamblers reported having a divorce versus 18.2% for non-gamers and 29.2% for low-risk gamblers. The GAO report examined divorce rates in Atlantic County and found that the county's divorce rate was lower than the national average, but higher than New Jersey's rate in 1977, 1980, and 1990.[13]

## CRIME

There is a general belief that the introduction of legalized gambling in a community will increase crime within that community. Another belief is that legalized gaming reduces crime because it

[11] "Economic and Social Impact of Introducing Casino Gambling," Federal Reserve Bank of Philadelphia p. 20
[12] GAO, p. 34.
[13] GAO, p. 31.

eliminates incentives for illegal gambling.[14] Both these beliefs are based more on anecdotal rather than empirical evidence.

Destination casinos, by their nature, increase the volume of people into a given community. Whenever that volume of people is introduced into a community, the volume of crime is expected to increase. This holds true for any large-scale development, whether it is a shopping mall, family-oriented water park or destination casino. While more people bring more crime, for most communities, the crime rate stays the same or declines.

The NGISC Report investigated the causal relationship between casinos and crime. It stated:

> Jeremy Margolis, a former director of the Illinois State Police, who also served as assistant US attorney for the Northern District of Illinois and was the Illinois inspector general, published a comprehensive review of available information on gambling and crime. His study, "Casinos and Crime, an Analysis of the Evidence," was based upon ten jurisdictions that have commercial casinos. In testimony before the Commission, he stated that he found little documentation of a causal relationship between the two. Taken as a whole, the literature shows that communities with casinos are just as safe as communities that do not have casinos.[15]

Despite the statements made in the NGISC Report, the Consulting Team believes it is important to further understand the relationship of crime and casinos. In order to understand that relationship, it is first necessary to define the types of crime typically associated with destination casino gambling. These are generally divided into petty crime, violent crime, white collar crime and prostitution.

## PETTY CRIME

Petty crime includes vandalism, burglaries, purse snatching, pick-pocketing, and other non-violent crimes. These are the types of crime that are typically exhibited in any high-traffic development. They are common wherever large volumes of people gather, whether at an outdoor concert, water park, shopping mall or casino. Part of the reason is that within any large group of people there is a segment that is prone to commit petty crimes. Also, any gathering of people creates opportunities for petty crimes for people who are predisposed towards crime.

Casinos are slightly more susceptible to petty crimes due to the type of customers they attract. Casinos are attractive environments to mature adults who may have limited or reduced mobility. Women who leave their handbags near gaming devices are attractive targets for purse snatchers. People who display or count cash may also be targets for "grab and dash" thieves.

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[14] National Gambling Impact Study Commission p. 7-42.

[15] National Gambling Impact Study Commission, p. 7-14.

Petty crime is sometimes associated with pathological gambling. Petty thieves, having exhausted their money, may see a crime as an opportunity. However, the NGISC found little empirical data to support this argument. Nevertheless, the Consulting Team believes that a casino, regardless of its size, will experience petty crimes solely because of the volume of people that will visit the facility.

### VIOLENT CRIME

Violent crime is criminal behavior that involves physical violence on victims. Such crime is often associated with gangs and other forms of organized crime as well as armed robberies by individuals. Despite the large amounts of cash that are normally stored in casinos, there is a limited amount of violent crime inside casino properties. The highly visible security presence coupled with sophisticated surveillance systems that are normally found in casinos, preclude would be robbers from targeting casinos. Nonetheless, casinos are periodic targets of armed robberies and casinos in both Las Vegas and regional markets as these markets have been attacked by these types of criminals. Violent criminal behavior is not normally associated with pathological gamblers. Rather, these types of crime exist within the broader society.

### WHITE COLLAR CRIME

White collar crime is one form of crime that is often associated with pathological gambling. Pathological gamblers, having exhausted savings, may resort to fraud and embezzlement to support their gambling compulsion. These types of crime do not occur in a casino but at the workplace. However, the NGISC Report stated the following:

> An examination of arrest trends for embezzlement, forgery and fraud in nine of the largest casino markets shows no consistent pattern, although more jurisdictions report more decreases than increases in arrests.[16]

The GAO report came to a different conclusion. It analyzed the Atlantic City market and stated that embezzlement arrests in Atlantic City were higher in the city than New Jersey or the United States and presented the following table as evidence.

[16] National Gambling Impact Study Commission, p. 7-14.

| Embezzlement Arrests Per 10,000 Population<br>Atlantic City Market | | | |
|---|---|---|---|
| Year | United States | New Jersey | Atlantic City |
| 1977 | 0.36 | 0.58 | 0.23 |
| 1978 | 0.38 | 0.55 | 0.92 |
| 1979 | 0.40 | 0.52 | 0.94 |
| 1980 | 0.42 | 0.25 | 0.00 |
| 1981 | 0.42 | 0.17 | 0.00 |
| 1982 | 0.39 | 0.16 | 0.00 |
| 1983 | 0.38 | 0.21 | 0.26 |
| 1984 | 0.40 | 0.23 | 0.00 |
| 1985 | 0.48 | 0.15 | 0.00 |
| 1986 | 0.52 | 0.18 | 0.27 |
| 1987 | 0.53 | 0.29 | 0.55 |
| 1988 | 0.61 | 0.22 | 4.36 |
| 1989 | 0.65 | 0.20 | 0.85 |
| 1990 | 0.61 | 0.20 | 0.00 |
| 1991 | 0.55 | 0.15 | 0.00 |
| 1992 | 0.55 | 0.16 | 0.00 |
| 1993 | 0.56 | 0.12 | 0.00 |
| 1994 | 0.57 | 0.09 | 0.00 |
| 1995 | 0.60 | 0.12 | 2.44 |
| 1996 | 0.65 | 0.15 | 0.00 |
| *Source: GAO Report p. 39* | | | |

The table indicates that, during certain years, embezzlement arrests in Atlantic City increased over both the statewide average and national average. However, in most other years, there were no arrests in Atlantic City for such crimes.

It is impossible for a casino operator to determine which patrons participate in such forms of criminal behavior. However, the casino operator can provide valuable information to law enforcement personnel if an individual is suspected of fraud or embezzlement. A casino operator can investigate a suspect's spending patterns including check cashing habits, payment of markers and general spending patterns through the casino's player tracking system.

## PROSTITUTION

Prostitution is endemic in both Nevada and Atlantic City. In Nevada, prostitution is legal in certain rural counties through state sanctioned brothels. Prostitution also occurs illegally in urban counties through escort services, call girls, street prostitutes and prostitutes that loiter in casino bars. While the latter is limited by casino security and surveillance, the former forms do operate with only minimal hindrance by law enforcement. Demand for prostitution is probably greater in Las Vegas since the city attracts a large proportion of male visitors attending conventions. Prostitution also exists in Atlantic City, primarily in the form of street prostitution and the city suffers from a higher prostitution rate than the state or the U.S. as a whole.

| Prostitution Arrests Per 10,000 Population<br>Atlantic City Market | | | | |
|---|---|---|---|---|
| Year | United States | New Jersey | Atlantic City Pop Adjusted(1) | Atlantic City Pop Unadjusted(2) |
| 1977 | 4.34 | 1.44 | 14.26 | 20.89 |
| 1978 | 4.49 | 1.07 | 31.08 | 53.08 |
| 1979 | 4.49 | 1.03 | 20.73 | 42.61 |
| 1980 | 4.24 | 1.18 | 12.89 | 37.13 |
| 1981 | 5.07 | 1.34 | 15.67 | 55.52 |
| 1982 | 5.93 | 2.30 | 31.76 | 122.88 |
| 1983 | 5.94 | 2.27 | 23.88 | 100.27 |
| 1984 | 5.66 | 1.91 | 23.54 | 107.60 |
| 1985 | 5.53 | 3.15 | 36.35 | 169.33 |
| 1986 | 5.23 | 3.66 | 28.33 | 138.67 |
| 1987 | 4.99 | 2.31 | 16.82 | 88.89 |
| 1988 | 4.25 | 2.41 | 19.97 | 106.15 |
| 1989 | 4.42 | 2.56 | 14.12 | 76.58 |
| 1990 | 4.64 | 3.44 | 18.02 | 92.40 |
| 1991 | 4.53 | 3.33 | 21.20 | 105.69 |
| 1992 | 4.37 | 3.33 | 20.80 | 102.94 |
| 1993 | 4.43 | 3.99 | 19.55 | 96.97 |
| 1994 | 4.17 | 3.29 | 18.90 | 95.60 |
| 1995 | 4.46 | 2.97 | 12.93 | 69.38 |
| 1996 | 4.25 | 3.02 | 11.36 | 61.43 |
| 1997 | 4.19 | 3.91 | 9.59 | 52.08 |
| **Avg** | **4.74** | **2.57** | **20.08** | **85.53** |

*(1) Population was adjusted to include visitors and nonresident workers.*
*(2) Population was not adjusted and is based solely on the local resident population.*

The prostitution rate in Atlantic City is high for a number of reasons. First, the casinos are bordered to the east by large, poor residential neighborhoods where the incidence of substance abuse and street crime has historically been very high. Second, dark and poorly lit side streets to the west of the casinos create ideal conditions for street prostitution. Third, the casinos serve a purely adult market and attract male customers who may be predisposed to participating in street prostitution. While prostitution is found on the streets near the casino, casino security and surveillance systems are able to monitor and evict prostitutes from their properties.

The casino scenario under examination in this report do not lend themselves to street prostitution. Each of the proposed casinos is isolated from urban areas and/or is surrounded by rural or major roads. There are few sidewalks, buildings or other edifices that would lend themselves to street prostitution and a vigilant security presence on property will deter these crimes on property.

## SOCIAL SERVICES

According to a PricewaterhouseCoopers survey titled, "Gaming Industry Employee Impact Survey," the introduction of casino gaming eliminated the need for specific social services offered to local residents.[17] The survey polled nearly 178,000 employees, which represented more than half of the commercial casino industry workforce in the United States. The results of the survey indicated that 16% had used their casino jobs to replace unemployment benefits, 63% had improved their access to health care benefits and 43% had better access to day care for their children. In addition, 65% had developed new job skills as a result of their employment, and 78% indicated that their employer provided them with training to perform their job.

## BANKRUPTCY

On the issue of bankruptcy, there have been conflicting reports regarding the connection with casino gaming. The NGISC established that there was a connection in the location of a casino and the rate of bankruptcy filings in that area.[18] This was measured by either jurisdiction or proximity, for example, a 50-mile radius. However, this study has its share of opponents who say that the report did not factor in the additional number of visitors that the casino draws in.

The NGISC also acknowledged a counter argument made by Rudy Cerone, an active member of the American Bankruptcy Institute and the immediate past chair of the Bankruptcy Section of the Louisiana State Bar Association. Cerone told the Commission:

> The increase in consumer bankruptcies has little or nothing to do with gambling in the gross amount. It's mainly credit card companies pushing their products on the consumers and the ease of the bankruptcy laws allowing consumers an easy way out. Those are the two main factors for the great rise in bankruptcies, not only here in Louisiana, but across the country.[19]

Furthermore, the National Opinion Research Center at the University of Chicago performed a survey for the commission, compiling and examining information from 100 randomly selected communities as well as 10 communities within 50 miles of a casino. This survey found that casino proximity did not contribute to increased bankruptcy.[20]

[17] PricewaterhouseCoopers, 1997

[18] National Gambling Impact Study Commission

[19] National Gambling Impact Study Commission

[20] National Opinion Research Center (NORC)

## IV. PUTTING SOCIAL COSTS IN PERSPECTIVE

Although casino gaming comes with its share of social costs, it is important to put these costs in perspective when compared to other social problems. Industry expert Andrew Klebanow compares these numbers to other social problems in his report titled, “Putting Problem Gambling in Perspective.”[21] A summary of his findings are listed in the following paragraphs.

> In August of 2010 the U.S. Center for Disease Control issued a report stating that 27% of the U.S. population (72.5 million Americans) are now classified as obese. Unlike problem gambling, where the costs on society are hard to measure, obesity has some very real and significant costs. On average, an obese person incurs $1,400 more a year in medical costs than a person of normal weight. The U.S. Centers for Disease Control report estimates the costs to U.S. society at $147 billion a year. And unlike problem gambling, whose physical effects are for the most part, unknown, obesity is known to lead to heart disease, stroke, diabetes, cancer and premature death.
>
> Restaurant companies and food manufacturers have essentially adopted strategies developed by the tobacco industry, which is to deny their responsibility to the epidemic and oppose policies that would limit or tax consumption. It is common knowledge now that for over a half century, U.S. tobacco companies denied that their products were unhealthy and funded scientific studies to support their claims. Only in the face of overwhelming scientific evidence have tobacco companies modified those strategies. Nevertheless, tobacco companies continue to lobby against initiatives, such as bans on indoor smoking that would restrict exposure to second-hand smoke. Today, roughly 20% of adults smoke and their costs, both social and economic, are a significant burden on society.
>
> To put problem gambling in perspective, one must only look at three numbers: 1.4% (the percent of adults who are problem gamblers, 27% (the percent of adults who are obese) and 20% (the percent of adults who smoke). Problem gambling is real, and the casino industry acknowledges it, but its impact on society and on the lives of Americans is relatively small when compared to obesity and tobacco use.

[21] “Putting Problem Gambling in Perspective,” Andrew M. Klebanow, Indian Gaming Magazine, pp. 50-51, September 2010.

# ECONOMIC IMPACT STATEMENT

# I. ECONOMIC IMPACT STATEMENT OVERVIEW

The Economic Impact Statement ("EIS") examines economic impact projections that the Project would be expected to generate. To do so, it is first necessary to define an impacted region to calculate the economic impacts of development and operations in the projected scenario. There is no rule of thumb for this definition, as impacts would likely extend throughout the state of California and could be examined more finitely at the host city level. For the purposes of this analysis, GMA utilized Sonoma County as the defined subject region. The expected impacts are measured in terms of the net change in total spending (output), household incomes (labor income), and job creation (employment) in the county. The statistical information contained in the Socioeconomic Analysis was further utilized to understand relative effects on employment, housing, schools, and select municipal services.

## METHODOLOGY

GMA employed IMPLAN's Input-Output/Social Accounting Matrix Model ("I-O/SAM") to determine the potential economic impact of the Project. The Input-Output economic model depicts how the total output of each industry in an economy depends on inter-industry demands and final demands by putting transactions in a matrix framework. In other words, a tourism project, like a casino, has significant effects on other industries in its trade area. The I-O/SAM model measures those effects by using a series of multipliers. These multipliers consider all aspects of the input-output framework, including which inputs and outputs will come from the subject region.

The impacts of the Project will occur in two phases: the Construction Phase and the Operations Phase. Construction impacts are temporary in that they only are experienced during the construction and development of the Project, with some ripple effects[22] in the local economy for a short period after construction is completed. The second phase will result from the ongoing operations of the Project and will have an annual, recurring impact to the county. For each phase, GMA calculated the impacts on Total Output, Employment, and Labor Income for the construction phase and operations phase.

[22] Ripple effects are essentially a multiplier effect, meaning that money earned by construction employees and materials suppliers will then be re-spent in the local economy, further benefiting other businesses in the region, as well as the benefits resulting from the incremental spending ability of those businesses, and so on.

## DIRECT, INDIRECT, AND INDUCED EFFECTS

Throughout this report, GMA will refer to three types of effects: the Direct Effect, the Indirect Effect, and the Induced Effect. These effects are used to describe the types of output generated by the Project, and these terms are best defined in the context in which they are used. The effect on employment (jobs created) offers a very clear example:

### DIRECT EFFECT ON EMPLOYMENT

In this context Direct Effect refers to jobs created by patron expenditures in the study region. As an example, if 10,000 people a day visit a casino or casino-hotel, those people would be served by employees working at the property. In addition, some people may choose to spend the night at an area motel, eat at a nearby restaurant, shop in a local store or purchase fuel at a nearby service station or convenience store. Their demand for goods and services at these businesses would create additional employment. Direct Effect on Employment includes those jobs created by the casino as well as jobs created by businesses around the Project that service the casino's patrons.

### INDIRECT EFFECT ON EMPLOYMENT

Technically, the Indirect Effect is caused by *inter-industry transactions*. Simply put, in providing goods and services to its customers, the casino needs inputs from other sources such as utilities, food suppliers, laundry and janitorial supplies. A local food distributor will have to hire additional delivery drivers and warehouse personnel to properly serve the casino or casino-hotel. A local laundry provider will have to hire additional staff to keep up with the demands of the resort's restaurants and hotel. The demands of the Project for other industries' goods and services create jobs in other industrial sectors. This is the Indirect Effect on Employment.

### INDUCED EFFECT ON EMPLOYMENT

Induced Effects are the *factor-institution interactions of labor and capital*. Simply put, when newly employed people receive their paychecks, they go out and spend money. They shop at the local supermarket and buy products and services from other local and regional businesses. That consumption, which obviously has nothing to do with casino's customers' expenditures, creates another set of jobs at retail stores and service establishments. In addition, those new workers hired by merchants to service the casino's employees in turn spend their money at other area merchants, creating more jobs. This is the Induced Effect on Employment.

## KEY INPUTS

GMA based its construction impact forecasts on the construction and development costs prepared by other consultants hired by Koi Nation. These development costs were appropriately adjusted to account for factors such as local vs. non-local purchases. It is important to note that since the preparation of these construction and development cost estimates, prices of goods and services in this industry have grown considerably due to macroeconomic impacts.

GMA based its operating impact forecasts on a financial ProForma Income Statement analysis prepared by other consultants hired by Koi Nation. In accord with this analysis, it is important to note that all operating impact forecasts assume that the Project will perform to a level of $473.0 million in gross gaming revenue and $575.3 million in gross property revenue in a stabilized year of operations. In GMA's analysis of impacts from operations, GMA considered the impacts of casino resort revenues, staffing, and employee earnings as the Direct impacts, in addition to small amounts of spending by casino patrons in the county that would take place as a result of the casino trip. Indirect impacts are calculated based on the projected spending by the proposed Project on goods and services, as well as the ripple effects that result from this spending. Induced impacts are calculated through the IMPLAN model based on changes in consumption, driven by the Project's employees' earnings and the earnings of businesses benefiting from indirect expenditures.

# II. ECONOMIC IMPACT ANALYSIS

This chapter illustrates the projected economic impacts of construction and operations of the Shiloh Road Casino. This analysis assumes that the Project will feature a casino with 2,750 Class III gaming devices and 105 table games, as well as a 400-key hotel, approximately 74,000 sq. ft. of meeting space, a roughly 2,800-seat event center, seven (7) food & beverage outlets, spa facilities, and other amenities.

## CONSTRUCTION IMPACTS

The first phase of economic impacts will be the construction phase. As previously discussed, construction employment and spending are only temporary but can have substantial impacts on the regional economy. It is anticipated that the construction phase will last for a period of approximately 24 months. GMA notes that employment counts below are presented in terms of man-years of employment.[23]

### CONSTRUCTION COSTS

Construction expenditures generally fall into several different categories, each of which has some local and non-local components. Hard costs reflect the actual construction materials and labor. Soft costs reflect architectural services, other professional services, financing costs, start-up expenses, and other non-material expenses. Based on estimates provided to GMA by other consultants to the Project, the total construction cost for the Project is estimated at $689.2 million. In evaluating the inputs for this phase of the analysis, GMA paid close attention to those components of the development that would be considered non-local expenses and would not have an impact on the subject region. As such, GMA assumed that all hard costs would stem from within the state of California, and that only a fraction of soft costs would consist of in-state purchases. GMA further discounted these costs to consider only those components of the development that would stem from within Sonoma County.

### TOTAL OUTPUT

Total output measures the value of goods and services that go into the construction of the gaming facility, including the induced and indirect impacts experienced in the regional economy. The direct impact from construction related activities and local procurement is estimated at $308.5 million. The indirect outputs resulting from development are estimated at $57.2 million. The generation of direct and indirect employment will increase household incomes in the region. As a result, there will be an increase in consumption for the region. The increase in consumption,

[23] A "man-year" is a unit of measurement that amounts to the work of one person over one year.

or induced output, is estimated at $128.6 million. Overall, GMA projects that a total of approximately $494.3 million in economic output would be generated within Sonoma County during the construction phase.

| Total Output from Construction | | | | |
|---|---|---|---|---|
| *in USD millions* | **Direct** | **Indirect** | **Induced** | **TOTAL*** |
| 55 - Construction of new commercial structures, including farm structures | $308.5 | - | - | $308.5 |
| 449 - Owner-occupied dwellings | - | - | $22.6 | $22.6 |
| 447 - Other real estate | - | $5.0 | $5.2 | $10.2 |
| 396 - Wholesale - Other durable goods merchant wholesalers | - | $7.2 | $0.8 | $8.1 |
| 490 - Hospitals | - | - | $6.5 | $6.5 |
| 457 - Architectural, engineering, and related services | - | $5.3 | $0.4 | $5.7 |
| 448 - Tenant-occupied housing | - | - | $5.3 | $5.3 |
| 509 - Full-service restaurants | - | $0.3 | $4.1 | $4.4 |
| 441 - Monetary authorities and depository credit intermediation | - | $1.2 | $2.7 | $3.9 |
| 483 - Offices of physicians | - | - | $3.3 | $3.3 |
| 534 - Other local government enterprises | - | $0.6 | $2.8 | $3.3 |
| 510 - Limited-service restaurants | - | $0.1 | $3.1 | $3.1 |
| 413 - Retail - Nonstore retailers | - | $0.1 | $2.7 | $2.8 |
| 400 - Wholesale - Other nondurable goods merchant wholesalers | - | $1.1 | $1.6 | $2.8 |
| 394 - Wholesale - Household appliances and electrical and electronic goods | - | $2.3 | $0.4 | $2.7 |
| 453 - Commercial and industrial machinery and equipment rental and leasing | - | $2.4 | $0.2 | $2.6 |
| 472 - Employment services | - | $1.1 | $1.4 | $2.5 |
| 512 - Automotive repair and maintenance, except car washes | - | $0.4 | $2.1 | $2.4 |
| 469 - Management of companies and enterprises | - | $1.2 | $1.2 | $2.3 |
| 455 - Legal services | - | $1.0 | $1.3 | $2.3 |
| 417 - Truck transportation | - | $1.7 | $0.5 | $2.2 |
| 399 - Wholesale - Petroleum and petroleum products | - | $1.3 | $0.7 | $2.1 |
| 406 - Retail - Food and beverage stores | - | $0.0 | $2.0 | $2.0 |
| 456 - Accounting, tax preparation, bookkeeping, and payroll services | - | $1.1 | $0.9 | $2.0 |
| 442 - Other financial investment activities | - | $0.1 | $1.8 | $2.0 |
| 28 - Stone mining and quarrying | - | $1.9 | $0.0 | $1.9 |
| 207 - Other concrete product manufacturing | - | $1.8 | $0.0 | $1.8 |
| 405 - Retail - Building material and garden equipment and supplies stores | - | $1.1 | $0.7 | $1.8 |
| 47 - Electric power transmission and distribution | - | $0.6 | $1.2 | $1.8 |
| 444 - Insurance carriers, except direct life | - | $0.2 | $1.6 | $1.7 |
| Other | - | $18.2 | $51.4 | $69.6 |
| **TOTAL** | **$308.5** | **$57.2** | **$128.6** | **$494.3** |
| *Source: IMPLAN, GMA* | | ** minor inequalities due to rounding* | | |

## TOTAL JOBS (MAN-YEARS)

The following table summarizes the estimated man-years of employment that could be generated as a result of the development of the Shiloh Road Casino. The direct impact of construction is expected to result in 2,196 man-years of employment. Each of these direct jobs is anticipated to be generated in construction related fields. An additional 269 man-years of employment are projected to stem from indirect impacts, with an additional 751 man-years through induced impacts. In total, the construction phase is projected to result in 3,217 man-years of employment.

| Total Employment from Construction (Man-Years) | Direct | Indirect | Induced | TOTAL* |
|---|---|---|---|---|
| 55 - Construction of new commercial structures, including farm structures | 2,196 | - | - | 2,196 |
| 509 - Full-service restaurants | - | 3 | 51 | 54 |
| 447 - Other real estate | - | 23 | 24 | 48 |
| 493 - Individual and family services | - | - | 36 | 36 |
| 457 - Architectural, engineering, and related services | - | 32 | 2 | 34 |
| 510 - Limited-service restaurants | - | 1 | 32 | 33 |
| 396 - Wholesale - Other durable goods merchant wholesalers | - | 27 | 3 | 30 |
| 472 - Employment services | - | 12 | 15 | 27 |
| 490 - Hospitals | - | - | 27 | 27 |
| 511 - All other food and drinking places | - | 1 | 20 | 22 |
| 406 - Retail - Food and beverage stores | - | 0 | 21 | 21 |
| 483 - Offices of physicians | - | - | 21 | 21 |
| 512 - Automotive repair and maintenance, except car washes | - | 3 | 16 | 19 |
| 491 - Nursing and community care facilities | - | - | 18 | 18 |
| 411 - Retail - General merchandise stores | - | 0 | 15 | 16 |
| 456 - Accounting, tax preparation, bookkeeping, and payroll services | - | 8 | 6 | 14 |
| 412 - Retail - Miscellaneous store retailers | - | 0 | 14 | 14 |
| 417 - Truck transportation | - | 11 | 3 | 14 |
| 413 - Retail - Nonstore retailers | - | 0 | 14 | 14 |
| 455 - Legal services | - | 6 | 8 | 14 |
| 517 - Personal care services | - | - | 14 | 14 |
| 409 - Retail - Clothing and clothing accessories stores | - | 0 | 13 | 13 |
| 418 - Transit and ground passenger transportation | - | 3 | 10 | 13 |
| 405 - Retail - Building material and garden equipment and supplies stores | - | 7 | 5 | 13 |
| 521 - Religious organizations | - | - | 12 | 12 |
| 525 - Private households | - | - | 12 | 12 |
| 442 - Other financial investment activities | - | 1 | 11 | 11 |
| 484 - Offices of dentists | - | - | 11 | 11 |
| 477 - Landscape and horticultural services | - | 6 | 4 | 10 |
| 534 - Other local government enterprises | - | 2 | 8 | 10 |
| Other | - | 122 | 305 | 427 |
| **TOTAL** | **2,196** | **269** | **751** | **3,217** |

*Source: IMPLAN, GMA* | ** minor inequalities due to rounding*

## TOTAL LABOR INCOME

As a result of the creation of the direct jobs, $192.4 million in labor income is projected to accrue to Sonoma County residents. Indirect wages are projected at approximately $18.8 million. Incremental regional consumption attributable to these earnings is projected to create an induced impact of $41.9 million in regional earnings, for a total impact of $253.1 million in regional labor income.

| **Total Labor Income from Construction** | | | | |
|---|---|---|---|---|
| *in USD millions* | **Direct** | **Indirect** | **Induced** | **TOTAL*** |
| 55 - Construction of new commercial structures, including farm structures | $192.4 | - | - | $192.4 |
| 490 - Hospitals | - | - | $3.4 | $3.4 |
| 457 - Architectural, engineering, and related services | - | $2.7 | $0.2 | $2.9 |
| 396 - Wholesale - Other durable goods merchant wholesalers | - | $2.1 | $0.2 | $2.4 |
| 483 - Offices of physicians | - | - | $2.2 | $2.2 |
| 509 - Full-service restaurants | - | $0.1 | $1.8 | $1.9 |
| 512 - Automotive repair and maintenance, except car washes | - | $0.3 | $1.6 | $1.9 |
| 447 - Other real estate | - | $0.9 | $0.9 | $1.8 |
| 469 - Management of companies and enterprises | - | $0.7 | $0.7 | $1.3 |
| 472 - Employment services | - | $0.6 | $0.7 | $1.2 |
| 534 - Other local government enterprises | - | $0.2 | $0.9 | $1.1 |
| 486 - Outpatient care centers | - | - | $1.1 | $1.1 |
| 510 - Limited-service restaurants | - | $0.0 | $1.0 | $1.1 |
| 406 - Retail - Food and beverage stores | - | $0.0 | $1.0 | $1.0 |
| 455 - Legal services | - | $0.4 | $0.6 | $1.0 |
| 491 - Nursing and community care facilities | - | - | $0.9 | $0.9 |
| 417 - Truck transportation | - | $0.7 | $0.2 | $0.9 |
| 456 - Accounting, tax preparation, bookkeeping, and payroll services | - | $0.5 | $0.4 | $0.9 |
| 493 - Individual and family services | - | - | $0.9 | $0.9 |
| 441 - Monetary authorities and depository credit intermediation | - | $0.3 | $0.6 | $0.8 |
| 511 - All other food and drinking places | - | $0.0 | $0.7 | $0.7 |
| 484 - Offices of dentists | - | $0.0 | $0.7 | $0.7 |
| 405 - Retail - Building material and garden equipment and supplies stores | - | $0.4 | $0.3 | $0.7 |
| 521 - Religious organizations | - | - | $0.7 | $0.7 |
| 400 - Wholesale - Other nondurable goods merchant wholesalers | - | $0.3 | $0.4 | $0.7 |
| 517 - Personal care services | - | - | $0.6 | $0.6 |
| 453 - Commercial and industrial machinery and equipment rental and leasing | - | $0.6 | $0.1 | $0.6 |
| 411 - Retail - General merchandise stores | - | $0.0 | $0.6 | $0.6 |
| 513 - Car washes | - | $0.1 | $0.5 | $0.6 |
| 207 - Other concrete product manufacturing | - | $0.6 | $0.0 | $0.6 |
| Other | - | $7.5 | $17.9 | $25.4 |
| **TOTAL** | **$192.4** | **$18.8** | **$41.9** | **$253.1** |
| *Source: IMPLAN, GMA* | | ** minor inequalities due to rounding* | | |

## OPERATIONAL IMPACTS

For the operational phase, projections were prepared for calendar year 2033, representing a full year of fully stabilized operations of the Project. In 2033, the Project is anticipated to achieve a gross revenue level of $575.3 million. In preparing impact projections, GMA evaluated the percentage of net revenues (defined as gross revenues less promotional credits) that will have an impact on Sonoma County, in comparison to those that will be distributed outside of the county. Additionally, GMA considered the amount of ancillary revenue the Project could expect to generate inside and outside of the casino. This portion of the analysis also evaluated the Project's potential impact on hotel expenditure, food & beverage expenditure, retail expenditure and gas/local transport expenditure in the subject region.

The following table illustrates the projected revenue and expense levels that GMA utilized to estimate total salaries, employment, and other expenses associated with Project operations. A portion of these incomes – along with the other development expenditures made possible by the casino resort revenues and other direct spending by out of region customers – constitute the gross direct impacts of operations. This section of the report outlines the total output, jobs, labor income, and fiscal impact of Project operations as calculated using the IMPLAN model.

| Shiloh Casino & Resort<br>ProForma Income Statement (2033) | |
|---|---|
| # Slots | 2750 |
| Win Per Slot | $396 |
| # Tables | 105 |
| Win Per Table | $1,971 |
| **REVENUES** | |
| Slot Revenue | $ 397,485,000 |
| Table Revenue | $ 75,547,000 |
| **Gross Gaming Revenue** | **$ 473,032,000** |
| | |
| Ancillary Revenue | $ 102,260,000 |
| **GROSS REVENUE** | **$ 575,292,000** |
| | |
| Promotional Allowances | $ 66,224,000 |
| **NET REVENUE** | **$ 509,068,000** |
| | |
| **EXPENSES** | |
| Casino Expenses | $ 78,050,000 |
| Ancillary Expenses | $ 89,699,000 |
| Undistributed Operating Expe | $ 194,616,000 |
| **Total Expenses** | **$ 362,365,000** |
| | |
| **EBITDA** | **$ 146,703,000** |
| Margin (Net) | 28.8% |
| *Source: Meister Economic Consulting, Hospitality and Gaming Solutions* | |

## TOTAL OUTPUT

Direct output measures the total spending by the gaming facility patrons, including labor income from gratuities, less expenditures that occur outside of the study area. The net direct impact from operations is estimated at $185.6 million. The indirect output resulting from operation, which emanates from economic activities of suppliers and vendors and has a ripple effect in the regional economy, is estimated at $57.5 million. The induced spending, reflecting increased consumption attributable to the direct and indirect earnings, is projected to result in $48.9 million of output. Overall, GMA projects that approximately $292.0 million in economic output would be generated within Sonoma County on an annual basis once the gaming facility is operational, in 2033 dollars. The following table demonstrates these impacts on various sectors that would result from operational spending and employee spending, as well as the ripple effects throughout the economy.

**Total Output from Operations**

| *in USD millions* | Direct | Indirect | Induced | TOTAL* |
|---|---|---|---|---|
| 503 - Gambling industries (except casino hotels) | $127.8 | $0.0 | $0.2 | $128.0 |
| 509 - Full-service restaurants | $38.2 | $0.5 | $1.6 | $40.3 |
| 507 - Hotels and motels, including casino hotels | $18.5 | $0.0 | $0.0 | $18.5 |
| 449 - Owner-occupied dwellings | - | - | $8.6 | $8.6 |
| 455 - Legal services | - | $7.4 | $0.5 | $7.9 |
| 447 - Other real estate | - | $5.7 | $2.0 | $7.7 |
| 511 - All other food and drinking places | - | $3.5 | $0.5 | $4.0 |
| 469 - Management of companies and enterprises | - | $3.2 | $0.4 | $3.7 |
| 456 - Accounting, tax preparation, bookkeeping, and payroll services | - | $2.5 | $0.3 | $2.8 |
| 432 - Cable and other subscription programming | - | $2.2 | $0.3 | $2.6 |
| 490 - Hospitals | - | - | $2.4 | $2.4 |
| 534 - Other local government enterprises | - | $1.2 | $1.1 | $2.3 |
| 476 - Services to buildings | - | $1.9 | $0.2 | $2.1 |
| 448 - Tenant-occupied housing | - | - | $2.1 | $2.1 |
| 499 - Independent artists, writers, and performers | - | $1.8 | $0.1 | $2.0 |
| 441 - Monetary authorities and depository credit intermediation | - | $0.9 | $1.0 | $2.0 |
| 472 - Employment services | - | $1.4 | $0.5 | $1.9 |
| 400 - Wholesale - Other nondurable goods merchant wholesalers | - | $1.2 | $0.6 | $1.8 |
| 411 - Retail - General merchandise stores | $1.0 | $0.0 | $0.5 | $1.6 |
| 47 - Electric power transmission and distribution | - | $1.0 | $0.5 | $1.5 |
| 445 - Insurance agencies, brokerages, and related activities | - | $0.9 | $0.5 | $1.4 |
| 510 - Limited-service restaurants | - | $0.1 | $1.2 | $1.3 |
| 483 - Offices of physicians | - | - | $1.3 | $1.3 |
| 479 - Waste management and remediation services | - | $1.0 | $0.2 | $1.2 |
| 433 - Wired telecommunications carriers | - | $0.7 | $0.5 | $1.2 |
| 444 - Insurance carriers, except direct life | - | $0.6 | $0.6 | $1.1 |
| 413 - Retail - Nonstore retailers | - | $0.1 | $1.0 | $1.1 |
| 60 - Maintenance and repair construction of nonresidential structures | - | $0.8 | $0.3 | $1.1 |
| 477 - Landscape and horticultural services | - | $0.9 | $0.2 | $1.1 |
| 512 - Automotive repair and maintenance, except car washes | - | $0.2 | $0.8 | $1.0 |
| Other | - | $17.6 | $18.9 | $36.5 |
| **TOTAL** | **$185.6** | **$57.5** | **$48.9** | **$292.0** |

*Source: IMPLAN, GMA*    ** minor inequalities due to rounding*

## TOTAL JOBS (FTE)

The following table summarizes the expected total employment impact, in terms of full-time equivalent ("FTE") jobs, that is anticipated to stem from Project operations. The direct impact of operations reflects the staffing level that will create incremental jobs to Sonoma County, which equates to 1,571 jobs primarily in the gambling, food & beverage, hospitality, and retail industries. An additional 364 jobs are projected to be generated through indirect impacts, with an additional 285 jobs through induced impacts. Based on the IMPLAN results, key sectors that are expected to experience indirect and induced employment impacts include other food & beverage establishments, real estate, and professional services.

| Total Employment from Operations (FTE) | Direct | Indirect | Induced | TOTAL* |
|---|---|---|---|---|
| 503 - Gambling industries (except casino hotels) | 915 | - | 1 | 916 |
| 509 - Full-service restaurants | 472 | 6 | 19 | 497 |
| 507 - Hotels and motels, including casino hotels | 173 | 0 | 0 | 173 |
| 511 - All other food and drinking places | - | 49 | 8 | 56 |
| 455 - Legal services | - | 44 | 3 | 47 |
| 447 - Other real estate | - | 27 | 9 | 36 |
| 499 - Independent artists, writers, and performers | - | 25 | 2 | 26 |
| 476 - Services to buildings | - | 21 | 2 | 23 |
| 472 - Employment services | - | 15 | 6 | 21 |
| 456 - Accounting, tax preparation, bookkeeping, and payroll services | - | 18 | 2 | 20 |
| 411 - Retail - General merchandise stores | 11 | 0 | 6 | 17 |
| 469 - Management of companies and enterprises | - | 13 | 2 | 14 |
| 510 - Limited-service restaurants | - | 1 | 12 | 14 |
| 493 - Individual and family services | - | - | 14 | 14 |
| 477 - Landscape and horticultural services | - | 9 | 2 | 10 |
| 490 - Hospitals | - | - | 10 | 10 |
| 500 - Promoters of performing arts and sports and agents for public figures | - | 7 | 2 | 9 |
| 406 - Retail - Food and beverage stores | - | 1 | 8 | 9 |
| 496 - Performing arts companies | - | 7 | 2 | 8 |
| 512 - Automotive repair and maintenance, except car washes | - | 2 | 6 | 8 |
| 483 - Offices of physicians | - | - | 8 | 8 |
| 491 - Nursing and community care facilities | - | - | 7 | 7 |
| 462 - Management consulting services | - | 6 | 1 | 7 |
| 534 - Other local government enterprises | - | 4 | 3 | 7 |
| 418 - Transit and ground passenger transportation | - | 3 | 4 | 6 |
| 412 - Retail - Miscellaneous store retailers | - | 1 | 5 | 6 |
| 413 - Retail - Nonstore retailers | - | 1 | 5 | 6 |
| 520 - Other personal services | - | 2 | 3 | 6 |
| 517 - Personal care services | - | - | 5 | 5 |
| 465 - Advertising, public relations, and related services | - | 5 | 1 | 5 |
| Other | - | 100 | 128 | 228 |
| **TOTAL** | **1,571** | **364** | **285** | **2,220** |
| *Source: IMPLAN, GMA* | | ** minor inequalities due to rounding* | | |

## TOTAL LABOR INCOME

As a result of the creation of new direct jobs, $59.5 million in annual labor income is projected to accrue to Sonoma County residents. Net indirect wages in other sectors is projected at $21.5 million, and incremental regional consumption attributable to these direct and indirect earnings is projected to result in an induced impact of $15.9 million. Overall, the Project is expected to generate $96.8 million in labor income on an annual basis, in projected 2033 dollars.

**Total Labor Income from Operations**

| *in USD millions* | Direct | Indirect | Induced | TOTAL* |
|---|---|---|---|---|
| 503 - Gambling industries (except casino hotels) | $35.1 | $0.0 | $0.0 | $35.2 |
| 509 - Full-service restaurants | $16.6 | $0.2 | $0.7 | $17.5 |
| 507 - Hotels and motels, including casino hotels | $7.3 | $0.0 | $0.0 | $7.3 |
| 455 - Legal services | - | $3.2 | $0.2 | $3.4 |
| 469 - Management of companies and enterprises | - | $1.8 | $0.2 | $2.1 |
| 511 - All other food and drinking places | - | $1.7 | $0.3 | $1.9 |
| 447 - Other real estate | - | $1.0 | $0.3 | $1.4 |
| 490 - Hospitals | - | - | $1.3 | $1.3 |
| 456 - Accounting, tax preparation, bookkeeping, and payroll services | - | $1.1 | $0.2 | $1.3 |
| 472 - Employment services | - | $0.7 | $0.3 | $1.0 |
| 476 - Services to buildings | - | $0.8 | $0.1 | $0.9 |
| 483 - Offices of physicians | - | - | $0.8 | $0.8 |
| 512 - Automotive repair and maintenance, except car washes | - | $0.2 | $0.6 | $0.8 |
| 534 - Other local government enterprises | - | $0.4 | $0.4 | $0.8 |
| 432 - Cable and other subscription programming | - | $0.6 | $0.1 | $0.7 |
| 411 - Retail - General merchandise stores | $0.4 | $0.0 | $0.2 | $0.7 |
| 477 - Landscape and horticultural services | - | $0.5 | $0.1 | $0.6 |
| 499 - Independent artists, writers, and performers | - | $0.5 | $0.0 | $0.5 |
| 431 - Radio and television broadcasting | - | $0.4 | $0.1 | $0.5 |
| 462 - Management consulting services | - | $0.4 | $0.1 | $0.4 |
| 400 - Wholesale - Other nondurable goods merchant wholesalers | - | $0.3 | $0.1 | $0.4 |
| 510 - Limited-service restaurants | - | $0.0 | $0.4 | $0.4 |
| 439 - Nondepository credit intermediation and related activities | - | $0.3 | $0.2 | $0.4 |
| 526 - Postal service | - | $0.3 | $0.1 | $0.4 |
| 479 - Waste management and remediation services | - | $0.4 | $0.1 | $0.4 |
| 441 - Monetary authorities and depository credit intermediation | - | $0.2 | $0.2 | $0.4 |
| 486 - Outpatient care centers | - | - | $0.4 | $0.4 |
| 445 - Insurance agencies, brokerages, and related activities | - | $0.3 | $0.2 | $0.4 |
| 406 - Retail - Food and beverage stores | - | $0.0 | $0.4 | $0.4 |
| 60 - Maintenance and repair construction of nonresidential structures | - | $0.3 | $0.1 | $0.4 |
| Other | - | $5.9 | $7.8 | $13.7 |
| **TOTAL** | **$59.5** | **$21.5** | **$15.9** | **$96.8** |

*Source: IMPLAN, GMA* ** minor inequalities due to rounding*

## FISCAL IMPACT

There will be fiscal impacts resulting from the construction and operation of the gaming facility at the local, county, state, and federal levels from a variety of taxes. At the state and local level, adjustments were made to sales taxes, property taxes, and State/Local non-taxes by the ratio of indirect and induced output to total output to reflect the likely exemption status of direct spending occurring at the facility. In some cases, there may be tax exemptions due to purchases by the Koi Nation. The IMPLAN model creates a projection of the total taxes, such that these discounts are not reflected in the resulting tables. Additionally, the Project will have a fiscal impact related to the agreed upon revenue sharing structure that is negotiated as a part of the gaming compact.

### CONSTRUCTION

The total federal tax contribution during the construction phase is projected at $51.4 million, primarily consisting of social insurance and personal income taxes. The state and local taxes during the construction phase are projected at $18.1 million, the majority of which would be taxes on construction materials and property taxes.

**Tax Revenue from Project Construction**

| *in USD millions* | Employee Compensation | Proprietor Income | Production & Imports | Households | Corporations | TOTAL |
|---|---|---|---|---|---|---|
| **FEDERAL** | | | | | | |
| Social Insurance Tax- Employee Contribution | $15.3 | $0.5 | - | - | - | $15.9 |
| Social Insurance Tax- Employer Contribution | $14.1 | - | - | - | - | $14.1 |
| Tax on Production and Imports: Excise Taxes | - | - | $0.6 | - | - | $0.6 |
| Tax on Production and Imports: Custom Duty | - | - | $0.5 | - | - | $0.5 |
| Corporate Profits Tax | - | - | - | - | $1.2 | $1.2 |
| Personal Tax: Income Tax | - | - | - | $19.1 | - | $19.1 |
| Personal Tax: Estate and Gift Tax | - | - | - | - | - | - |
| **TOTAL** | **$29.4** | **$0.5** | **$1.1** | **$19.1** | **$1.2** | **$51.4** |
| **STATE & COUNTY** | | | | | | |
| Social Insurance Tax- Employee Contribution | $0.5 | - | - | - | - | $0.5 |
| Social Insurance Tax- Employer Contribution | $0.8 | - | - | - | - | $0.8 |
| Tax on Production and Imports: Sales Tax | - | - | $5.6 | - | - | $5.6 |
| Tax on Production and Imports: Property Tax | - | - | $2.0 | - | - | $2.0 |
| Tax on Production and Imports: Motor Vehicle License | - | - | $0.1 | - | - | $0.1 |
| Tax on Production and Imports: Severance Tax | - | - | $0.0 | - | - | $0.0 |
| Tax on Production and Imports: Other Taxes | - | - | $0.6 | - | - | $0.6 |
| Tax on Production and Imports: Special Assessments | - | - | $0.0 | - | - | $0.0 |
| Corporate Profits Tax | - | - | - | - | $0.6 | $0.6 |
| Personal Tax: Income Tax | - | - | - | $7.5 | - | $7.5 |
| Personal Tax: Motor Vehicle License | - | - | - | $0.2 | - | $0.2 |
| Personal Tax: Property Taxes | - | - | - | $0.1 | - | $0.1 |
| Personal Tax: Other Tax (Fish/Hunt) | - | - | - | $0.0 | - | $0.0 |
| **TOTAL** | **$1.3** | **-** | **$8.4** | **$7.9** | **$0.6** | **$18.1** |

*Source: GMA* ** minor inequalities due to rounding*

## OPERATIONS

During the operations phase, the Project is expected to generate $21.8 million in federal taxes and $13.1 million in state and local taxes annually. It is important to note that the Koi Nation is a sovereign nation that receives tax exemptions. As such, the actual tax benefits will likely vary from those presented in the following tables addressing tax revenues during the operations phase for the Project.

**Tax Revenue from Project Operations**

| *in USD millions* | Employee Compensation | Proprietor Income | Production & Imports | Households | Corporations | TOTAL |
|---|---|---|---|---|---|---|
| **FEDERAL** | | | | | | |
| Social Insurance Tax- Employee Contribution | $5.6 | $0.4 | - | - | - | $6.0 |
| Social Insurance Tax- Employer Contribution | $5.1 | - | - | - | - | $5.1 |
| Tax on Production and Imports: Excise Taxes | - | - | $0.6 | - | - | $0.6 |
| Tax on Production and Imports: Custom Duty | - | - | $0.5 | - | - | $0.5 |
| Corporate Profits Tax | - | - | - | - | $2.0 | $2.0 |
| Personal Tax: Income Tax | - | - | - | $7.5 | - | $7.5 |
| Personal Tax: Estate and Gift Tax | - | - | - | - | - | - |
| **FEDERAL TOTAL** | **$10.8** | **$0.4** | **$1.1** | **$7.5** | **$2.0** | **$21.8** |
| **STATE** | | | | | | |
| Social Insurance Tax- Employee Contribution | $0.2 | - | - | - | - | $0.2 |
| Social Insurance Tax- Employer Contribution | $0.3 | - | - | - | - | $0.3 |
| Tax on Production and Imports: Sales Tax | - | - | $5.4 | - | - | $5.4 |
| Tax on Production and Imports: Property Tax | - | - | $0.2 | - | - | $0.2 |
| Tax on Production and Imports: Motor Vehicle License | - | - | $0.2 | - | - | $0.2 |
| Tax on Production and Imports: Severance Tax | - | - | $0.0 | - | - | $0.0 |
| Tax on Production and Imports: Other Taxes | - | - | $0.5 | - | - | $0.5 |
| Tax on Production and Imports: Special Assessments | - | - | - | - | - | - |
| Corporate Profits Tax | - | - | - | - | $0.9 | $0.9 |
| Personal Tax: Income Tax | - | - | - | $2.9 | - | $2.9 |
| Personal Tax: Motor Vehicle License | - | - | - | $0.1 | - | $0.1 |
| Personal Tax: Property Taxes | - | - | - | $0.0 | - | $0.0 |
| Personal Tax: Other Tax (Fish/Hunt) | - | - | - | $0.0 | - | $0.0 |
| **STATE TOTAL** | **$0.5** | **-** | **$6.2** | **$3.1** | **$0.9** | **$10.7** |
| **COUNTY** | | | | | | |
| Social Insurance Tax- Employee Contribution | - | - | - | - | - | - |
| Social Insurance Tax- Employer Contribution | - | - | - | - | - | - |
| Tax on Production and Imports: Sales Tax | - | - | $0.5 | - | - | $0.5 |
| Tax on Production and Imports: Property Tax | - | - | $1.8 | - | - | $1.8 |
| Tax on Production and Imports: Motor Vehicle License | - | - | - | - | - | - |
| Tax on Production and Imports: Severance Tax | - | - | - | - | - | - |
| Tax on Production and Imports: Other Taxes | - | - | $0.2 | - | - | $0.2 |
| Tax on Production and Imports: Special Assessments | - | - | $0.0 | - | - | $0.0 |
| Corporate Profits Tax | - | - | - | - | - | - |
| Personal Tax: Income Tax | - | - | - | - | - | - |
| Personal Tax: Motor Vehicle License | - | - | - | - | - | - |
| Personal Tax: Property Taxes | - | - | - | $0.0 | - | $0.0 |
| Personal Tax: Other Tax (Fish/Hunt) | - | - | - | - | - | - |
| **COUNTY TOTAL** | **-** | **-** | **$2.5** | **$0.0** | **-** | **$2.5** |

*Source: GMA* | ** minor inequalities due to rounding*

Based on the revenue share structure set forth in recent gaming compacts for other tribes, it is assumed that the Tribe would annually pay 4.0% of net gaming revenue directly to the State in exchange for the right to offer Class III gaming at the Project site. Based on the projected $473.0

million in gaming revenue, the revenue share payment to the state is estimated at $16.3 million in a stabilized year.

## COMMUNITY EFFECTS

### EMPLOYMENT

The construction and operation of the subject facility will have a positive impact on local employment (thereby reducing the unemployment level). As the incremental number of people employed represents a comparatively small percentage of the unemployed population within the county, there is likely a good degree of availability of people currently residing in the area to fulfill the available positions. Furthermore, a large influx of new residents to the host county and/or workforce is not expected to occur due to the construction of the facility as the Project site is proximate to a sizeable workforce in the subject county as well as nearby counties.

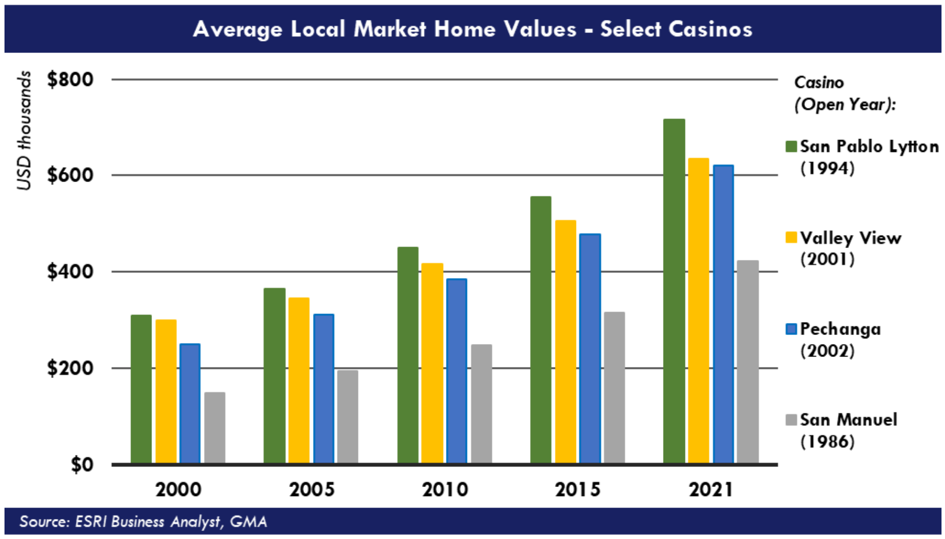
### HOUSING AND SCHOOLS

As the economic activity of the Project represents only a small percentage of the Sonoma County economy, the subject development would be expected to have, at best, a nominal impact on the housing market. This is attributable to two primary factors. For a housing market to experience changes, a change in population must occur, and/or existing residents need to have large increases or decreases in wages. These factors generally result in residents seeking improved housing options or a forced downsize. As the subject development would not require a large influx of residents to fill positions, and as the new positions will only have a small impact on the amount of unemployed, the housing market will not experience a large increase in home values or demand for new homes, and there would be only a nominal impact on the school system.

Sonoma County is a densely populated area that has a sufficient labor force focused on the hospitality industry. With many other casino resorts in the market area, as well as other hospitality developments, the population already consists of people that are seeking casino and/or hospitality-based employment. The population of Sonoma County was nearly 500,000 in 2021 and is located adjacent to another large county: Marin County. As the Project will only employ 1,859 individuals (with 1,571 stemming from Sonoma County), which represents 0.25% of the combined Marin County and Sonoma County total population, there are more than enough people in the region to provide employment to the Project. As a result, GMA does not believe there will be a need for increased housing or any growth in population due to the employment needs of the resort.

The only increase in population that could potentially occur would stem from senior level management needs. These individuals may not live in the region and may require a move to the region. However, the total impact associated with these positions would not total more than 10 families. The Sonoma County Economic Development Board recently posted that housing vacancy rates have risen to 9.3% in the market, from 8.2% in 2020, which indicates there are more than enough homes in the area to accommodate these individuals.

The following chart illustrates housing prices within a five-mile radius of select casinos in California from 2000 through 2021. Overall, these housing value trends have shown minimal, if any, deviation from the market average. The openings of Valley View and Pechanga in particular did not appear to have a material impact on housing values.




## POLICE, FIRE, AND EMS

As with any commercial development of this scale, a casino opening can generate an increase in local emergency services, including police, fire, and emergency medical services. Through an evaluation of historical staffing levels, activity volume, and anecdotal commentary by department officials in comparable jurisdictions, GMA finds that casinos do not generally require additional emergency services staff or costs to manage casino related incidents. Fluctuations in staffing levels may be attributable to events such as recessions and other factors, and the volume of incident calls and arrests varies from market to market, although the types of crime reported remain fairly consistent. Traffic related incidents and DUI/DWI arrests were the most common and prevalent issues reported.

In 2014, when a new casino resort was being contemplated for Orange County, NY, the county conducted a study on the possible impact of the facility, particularly to address any potential increases in DUI/DWI cases and felony crimes such as murder and assault. In this study, the Orange County Department of Emergency Services contacted numerous emergency services agencies in New York and Connecticut to understand the impact that casinos have had in these jurisdictions. According to that study,

> The overall finding from these telephonic interviews is that the casinos have had a minimal impact in terms of crime rates, medical calls, fire-related incidents, and emergency management activities. The common theme from all the representatives interviewed for this study was that the impact of the casinos caused some initial issues but as the facilities matured, the impact was minimized.[24]

GMA further analyzed the impact that the nearby Graton Resort & Casino, located in Rohnert Park, CA, had on the nearby police force. Specifically, GMA evaluated annual incident calls and arrests for the property during its first year of operations. In this assessment, GMA learned that there were a total number of 1,700 annual police calls and 39 arrests at the casino during the first year of the property's operations. This equated to a police call rate of .41 calls per gaming position and an arrest rate equivalent to 2% of calls (with Graton having 4,134 gaming positions at that time – with 3,000 slot machines and 162 table games at 7 positions per table). Based on these metrics and with an assumed 3,485 gaming positions at the Shiloh Resort & Casino, GMA estimates that the Project would generate 1,433 annual police calls and 33 arrests during its first year of operations.

GMA also observed recent combined Fire and EMS related incidents at Graton Resort & Casino. Through this study, it learned that the property experienced incident rates that ranged from .83 incidents per day in 2020 (with a total of 303 incidents) and .88 incidents per day in 2021 (with a total of 321 incidents). Today, the facility offers 3,840 gaming positions, which means that it garnered approximately .084 Fire and EMS related incidents per gaming position in 2021. With this factor applied to the Project's number of gaming positions, it is estimated the Project would have approximately 291 Fire and EMS incidents annually.

As a result of this quantitative and qualitative analysis, GMA finds that the negative impacts on community services in areas in which a casino has opened are generally minimal. The incremental increase of criminal and or Fire/EMS activity attributable to these facilities has warranted little or no additional departmental resources. Given the size of this facility in comparison to the local community, it is unlikely that additional staffing would be required by outside services.

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[24] Orange County Department of Emergency Services, "Impact of Casinos on Emergency Services in Orange County", www.co.orange.ny.us, April 2014.

# III. SUMMARY OF ECONOMIC IMPACTS

The following tables summarize the anticipated economic impacts of the construction and operations phase, illustrating the projected overall impact of the Project after all ripple effects of indirect and induced spending flow through the County. While these tables illustrate the impacts on the immediate local market in Sonoma County, additional impacts will be generated outside of the county but within the State of California. Nevertheless, GMA expects that Sonoma County residents will account for roughly 60% of all jobs created in the construction phase and 77% in the operations phase.

**Sonoma County Economic Impacts - Construction Phase**

| Impact | Employment | Labor Income | Output |
|---|---|---|---|
| Direct | 2,196 | $192,384,132 | $308,537,768 |
| Indirect | 269 | $18,827,034 | $57,169,536 |
| Induced | 751 | $41,878,054 | $128,580,059 |
| **TOTAL** | **3,217** | **$253,089,220** | **$494,287,363** |

*Source: IMPLAN, GMA*

**Sonoma County Economic Impacts - Operations Phase**

| Impact | Employment | Labor Income | Output |
|---|---|---|---|
| Direct | 1,571 | $59,459,585 | $185,622,254 |
| Indirect | 364 | $21,486,167 | $57,549,279 |
| Induced | 285 | $15,903,551 | $48,863,843 |
| **TOTAL** | **2,220** | **$96,849,304** | **$292,035,375** |

*Source: IMPLAN, GMA*

# COMPETITIVE EFFECTS STUDY

## I. COMPETITIVE EFFECTS OVERVIEW

GMA relied on the same gross gaming revenue projections as outlined in the Economic Impact Statement to perform the Competitive Effects Study. With gross gaming revenue for the Project defined, GMA utilized gravity model methodology to calibrate the market as well as the Project's impact on the market.

First, GMA created a Calibration Scenario, in which the Consulting Team estimated the performance of each competitive gaming facility in the greater market area. Then, GMA grew the model to the defined subject year (2033) by factoring in the expected changes in local market demographics as well as anticipated changes to the competitive set, including new facilities, expansions, etc. Finally, GMA layered in the impact of the Project, assuming gross gaming revenue potential of $473.0 million in a stabilized year, and adjusted the model to calculate potential impacts to the market area, including market growth and substitution effects on casino competitors.

### SUMMARY OF FINDINGS

In performing the competitive effects analysis, GMA considered the following casinos: Graton, River Rock, San Pablo Lytton, Twin Pine, Coyote Valley, Konocti Vista, Robinson Rancheria, Running Creek, Sherwood Valley, Garcia River, Colusa, Cache Creek, Hard Rock Sacramento, Harrah's NorCal, Thunder Valley, Red Hawk, Jackson Rancheria, and upcoming new market entrants including the Wilton Elk Grove casino and Ione Band Plymouth casino.

For the purposes of this analysis, GMA focused on evaluating local market gaming revenue as this gaming revenue will be impacted by a new market entrant. With an estimated $473.0 million in gross gaming revenue produced at the Project, the Project is expected to garner $449.4 million in gaming revenue from the local market. GMA estimates that this would represent a 13.7% capture of the defined local market.

Local market revenue for the Project is anticipated to stem from two primary sources: new market growth (i.e., revenue stemming from an increase in gaming factors in the market) and a substitution effect on regional gaming competitors. By estimating the sources of local market revenue to the Project, GMA was able to estimate the substitution effect on each gaming market participant and quantify the amount of expected new market growth that is expected to occur as a result of the Project.

With the addition of a new casino in the greater Bay Area market, it is anticipated that total gaming spend will increase as a percentage of total income in various market segments. As such, in the proposed development scenario, the Project is anticipated to generate an 8.0% increase in local market gaming revenue, or an estimated $244.2 million in local market growth. The remainder of local market revenue generated by the Project ($205.2 million) is expected to result from substitution effects on local market competitors. The following sections of this report illustrate how these substitution effects are expected to impact nearby existing gaming properties.

## II. METHODOLOGY

GMA initiated this engagement with a review of primary and secondary market research. The Consulting Team estimated the gaming performance for the gaming facilities in close proximity to the Project by utilizing information available in the public domain as well as its understanding of the market's historical performance. With this information compiled, the Consulting Team was better positioned to understand the trends that are experienced within the market.

The Consulting Team has visited each of the primary and secondary competitors in the market area on multiple occasions. For each facility, the Consulting Team has previously evaluated the gaming facility's overall appeal, gaming and non-gaming amenities, parking, access to the regional highway network, and proximity to regional population centers. This is a critical step in building a forecasting model as each facility's attributes and deficiencies impact their overall level of attraction and associated share of local market gaming revenue.

### LOCAL MARKET GRAVITY MODEL

To understand the potential substitution effects created by the Project, GMA developed a series of gravity models. The gravity model is a business forecasting model based on Newton's Universal Law of Gravitation. Newton's Law of Gravitation simply states that every particle in the universe attracts every other particle with a force that is directly proportional to the product of their masses and inversely proportional to the square of the distance between them. Newton's theory, which was first published in his 1687 work, "Mathematical Principles of Natural Philosophy," started to be adapted for commercial applications early in the 20$^{th}$ century.

Through a number of modifications, Newton's Law of Gravitation can be applied to the gaming industry. While a casino twice the size of another may not have twice the attraction of another, it does have some constant increased factor of attraction. In terms of distance, squaring the distance is not necessarily always the right figure. Typically, the power to which the distance is taken varies from a factor 1.5 to 2.5. The reason for this is that actual distance between two objects will have a different impact on communities throughout the United States. This is primarily attributed to varying traffic patterns and geographical barriers between different communities, which results in significant changes in drive time. For example, for an individual living in rural Texas, traveling 100 miles to reach a business may not be perceived as a barrier as it would likely take less than 1.5 hours to reach. However, for someone living in the middle of Los Angeles, 100 miles could take up to three or more hours due to traffic congestion.

By estimating revenue levels at each of the gaming properties within the competitive set, researching the number of gaming positions provided within each, visiting each facility to understand their relative aesthetic attractiveness (including a consideration of non-gaming amenities), and utilizing gaming factors from proprietary and public sources, the model was calibrated to current market performance. Once calibrated, GMA grew the model to the subject year of 2033 creating a Base Scenario in which the Project is not introduced. Then, GMA layered in the impact of the Project utilizing gaming revenue projections for the Project, as previously outlined in the Economic Impact Statement.

To estimate the Project's substitution effects on other regional gaming facilities, GMA compared the Base Scenario, in which the Project is not introduced, to the Projected Scenario in which the Project is introduced to the market. This comparison yielded the substitution effect on each regional gaming facility and any anticipated new market growth that is expected to occur.

It is important to note that the substitution effects presented in this report only illustrate local market revenue impacts. Each property, including the Project, would be expected to capture additional revenues from non-local patrons. However, these revenues are not expected to be materially impacted by the introduction of the Project.

# III. COMPETITIVE SUMMARY

The Project will compete with a number of other market area casinos for a share of the greater Sonoma County and Bay Area gaming market. The Consulting Team has visited every casino in the region during multiple site visits to the market area in the past several years. Based on location, quality level, and amenities the Consulting Team categorized these properties as primary and secondary competitors. The following sections provide an overview of these competitors.

## PRIMARY CASINO COMPETITION

### GRATON RESORT & CASINO

Graton Resort & Casino is owned and operated by the Federated Indians of Graton Rancheria. The casino opened on November 5, 2013, at a total cost of $850 million under a seven-year management agreement with Red Rock Resorts. Just over a year later, the Tribe secured a second $450 million loan to build their six-story, 200-room hotel, which opened in November 2016.

#### LOCATION AND ACCESS

The Graton Resort & Casino is located approximately 50 miles north of San Francisco, just south of Rohnert Park and west of US-101. Graton's location makes it one of the closest full-service casino resorts to the Bay Area. It offers excellent access from US-101. The property incorporates modern design elements in a very attractive facility.

#### PROPERTY FEATURES

##### CASINO

- 3,000 EGDs
- 120 table games
- High-limit table game room
- High-limit bar and lounge
- High-limit slot room
- 20-table poker room

##### HOTEL

- 200-key hotel
- 10,000 square foot spa
- Fitness center
- Outdoor pool with cabanas and day beds

### Food & Beverage

- 630 Park Steakhouse
- Marketplace with eight (8) quick-serve outlets
- Daily Grill
- Tony's of North Beach
- Lobby Bar
- Pool Bar
- Sky Center Bar
- G Bar (sports bar)
- 8 (VIP lounge)

### Entertainment/Meeting Space

- 20,000 square foot flexible event and convention space
- Two small meeting rooms next to pool area

### Parking

- Five-story parking garage with high-speed ramps and 1,900 covered parking spaces
    - Valet parking on first level at casino porte cochère
    - Second Valet at hotel porte cochère
- 3,900 surface parking total spaces

### Other Amenities

- Gift shop

In April 2022, Graton announced that it is moving forward with an expansion including roughly 144,000 square feet of new gaming space, a new 221-room hotel tower, a 3,500-seat theater, additional F&B, parking, and other property improvements.

**Graton Resort & Casino**

## CACHE CREEK CASINO RESORT

Cache Creek Casino Resort is owned and operated by the Yocha Dehe Winton Nation. It is one of the most attractive and successful casinos in California. Situated in a picturesque rural valley, the property sits on a hillside overlooking fruit trees and vineyards. The property is sited along CA-16, running south to north. A tribal-owned golf course is located approximately one mile to the east in an adjacent valley.

Cache Creek has evolved over the past three decades, starting as a bingo hall in 1985 and then adding gray market slot machines in the 1990s. After signing the Davis Compact in 1999, the Tribe was able to offer Class III table games and electronic gaming devices and secured conventional financing. The Tribe replaced its original structure with its current facility in 2004 at a cost of $200 million.

The casino has benefited from very steady and visionary management. The management team had long recognized the value of the Asian populations residing in the Bay Area, well before Asian-American gamers came on the industry's radar screen. Going back to the original casino building, one could find collateral material in Mandarin, Cantonese, Vietnamese, and Tagalog. Over the past two decades the casino has cultivated relationships with high-worth Chinese players residing in the Bay Area.

Cache Creek Casino recently opened a hotel expansion that includes a 459-key hotel, outdoor pool, restaurants, conference and meeting spaces, and events center.

### LOCATION AND ACCESS

Cache Creek is located in the Capay Valley, approximately 90 miles northeast of San Francisco and 110 miles from San Mateo. Access to the casino from the Bay Area is via Interstate 80/Interstate 505. The trip involves approximately 13 miles of rural roads that wind through small towns and the Capay Valley.

### PROPERTY FEATURES

#### CASINO

- 2,900 EGDs
- 120 table games
- High-limit Asian table game room
- High-limit traditional table game room
- High-limit bar and lounge
- VIP cage
- High-limit slot room
- 10-table poker area

### Hotel

- 659-key hotel (including expansion)
- Outdoor swimming pool with cabanas
- Fitness center
- Room service
- Spa
- Conference and meeting spaces
- Events center

### Food & Beverage

- C2 Steak Seafood – Steakhouse
- Chang Shou – Chinese and Pacific Rim
- Asian Kitchen – Noodle room
- Canyon Cafe – 24-hour, three meal room
- Harvest Buffet
- The Sports Page Pub & Grill
- Enso Sushi
- 16 West Bar and Lounge
- Three station food court:
  - Loco Express – Mexican quick serve
  - The Deli
  - Sweets Etc. – 24-hour pastries and coffee counter

### Entertainment

- Club 88 – a 600-seat showroom featuring headline acts and cover bands

### Parking

- 1,883-space, five-level garage with high-speed ramps through the center of the structure
- Surface parking to the south and north sides of the property

### Other Amenities

- Yocha Dehe Golf Club
  - 18-hole championship course
  - Clubhouse
  - Bahtenta Grill
  - Bar and lounge
- Convenience store and gas station

**Rendering of Cache Creek Casino Resort Expansion**

## RIVER ROCK CASINO

River Rock Casino is a business enterprise of the Dry Creek Rancheria Band of Pomo Indians. The casino is located on a hillside overlooking Alexander Valley in the heart of Sonoma Valley's wine growing region, approximately 23 miles north of Santa Rosa and 37 miles south of Ukiah. The casino is approximately four miles southeast of US-101. The route from the highway to the casino crosses Alexander Valley, before turning southeast and up a fairly steep grade to the casino and parking garage.

Despite being housed in two Sprung structures, the casino, dining outlets, and other amenities are well-maintained. A vast, six-level parking garage is located immediately behind the casino. The casino, parking garage, and support facilities are built at various grades along the eastern slope of the hillside. The existing casino offers a commanding view of Alexander Valley – one of the most attractive views from any Indian casino in California.

### PROPERTY FEATURES

#### CASINO

- 1,100 Class III slot machines
- 18 table games
- High limit gaming area

#### FOOD & BEVERAGE

- Center Stage Bar & Grill
- Quail Run Buffet
- Fortune Café

#### PARKING

- 6-story parking garage with 1,317 spaces
- Surface valet parking lot and garage parking

**River Rock Casino**

## SAN PABLO LYTTON CASINO

The San Pablo Lytton Casino is located in San Pablo, CA, approximately 20 minutes outside of San Francisco, Oakland and Berkeley. It is a Class II facility, having never been able to secure a compact with the Governor. It has long attracted the ire of U.S. Senator Feinstein, who has a distaste for Indian casinos in urban areas and in the East Bay in particular.

The casino has managed to overcome restrictions on the kinds of games that it can offer, owing in part to improvements to Class II electronic gaming products. The tribe's greatest obstacle to revenue growth is its limited site footprint. Its reservation is surrounded by urban development, and it simply has little room to grow. As such, it does not offer non-gaming amenities beyond those dining options needed to support casino customers when they are hungry. The property is capacity-constrained despite being limited to Class II gaming machines.

### PROPERTY FEATURES

#### Casino

- 1,526 electronic gaming devices (electronic bingo games)
- 31,419 square feet of gaming space

#### Food & Beverage

- Broiler Restaurant and Lounge
- Casino Snack Bar

### Parking

- Surface parking
- Valet parking

**San Pablo Lytton Casino**

## SECONDARY CASINO COMPETITION

### TWIN PINE CASINO & HOTEL

The Twin Pine Casino & Hotel is owned and operated by the Middletown Rancheria of Pomo Indians. Located just outside the northern edge of Napa Valley near Middletown, the casino-hotel is 35 miles east of River Rock and 44 miles north of the city of Napa.

Twin Pine opened in 1994 as a small slots-only casino housed in a mobile building. In 2000, the casino moved into a larger Sprung structure, and in 2008 the casino was relocated into a new, purpose-built facility. A hotel opened in 2009. Despite being value-engineered at an estimated cost per lodging key of $110,000, the hotel rooms offer a relatively attractive lodging experience. Overall, Twin Pine is an attractive 3-star casino-hotel that primarily targets residents living in Napa Valley.

## PROPERTY FEATURES

### Casino

- 523 Class III slot machines
- 7 table games
- 1 poker table

### Food & Beverage

- Manzanita Restaurant (3-meal)
- Marketplace Express (quick-serve)
- Grapevine Bar and Lounge
- Twisted Vine Bar

### Hotel

- 56 standard rooms
- 3 suites

### Other Amenities

- 10,000 sq. ft entertainment venue
- Gift shop

**Twin Pine Casino & Hotel**

## COYOTE VALLEY CASINO AND HOTEL

The Coyote Valley Casino is owned and operated by the Coyote Valley Band of Pomo Indians. Up until 2019, the Coyote Valley Casino was considered by the Consulting Team as one of the least attractive casinos in California. This has since changed as casino operations have moved into a new purpose-built casino closer to US-101. The facility will also be complemented by limited-service Wyndham Lodge Hotel that is expected to open in 2022.

### PROPERTY FEATURES (NEW BUILDING)

#### CASINO

- 400 Class III slot machines
- 7 table games
- 4 poker tables

#### HOTEL

- 101-key hotel built to a 3-star grade, branded as a Wyndham Lodge Hotel
    - 75 standard rooms, 15 suites
- Fitness Center

* *Still under construction, expected to open 2022*

#### FOOD & BEVERAGE

- Angelina's Grill – American/Mexican
- Sage House – American/Italian
- 101 Tap House

#### OTHER AMENITIES

- Convenience store and gas station
- 4,000 square feet of flexible meeting and event space, capable of hosting casino events, banquets and meetings
- 18+ Mini Casino (non-smoking)

**Coyote Valley (new casino)**

**Wyndham Lodge Hotel (rendering)**

## ROBINSON RANCHERIA RESORT & CASINO

The Robinson Rancheria Resort & Casino is located on the northwest side of Clear Lake, approximately 58 miles north of River Rock. The property enjoys a location directly off CA-20 in the Clear Lake resort district. The property primarily serves residents and vacationers of Clear Lake and the residential markets of Willits and Ukiah.

### PROPERTY FEATURES

#### CASINO

- 349 Class III slot machines
- 13 table games
- 700-seat bingo hall

#### Food & Beverage

- Rancheria Grille
- R Bar
- How Sweet It is (quick-serve outlet)
- Bingo Lings (quick-serve outlet)

#### Hotel

- 48 standard rooms
- 2 suites
- 24-hour fitness center
- Business center

**Robinson Rancheria Resort & Casino**

## RUNNING CREEK CASINO

The Habematolel Pomo Tribe of Upper Lake opened the Running Creek Casino in May of 2013. Housed in a sprung structure and located approximately 1 ½ miles west of Robinson Rancheria, the Running Creek Casino competes primarily with Robinson Rancheria, Konocti Vista, Coyote Valley and the Sherwood Valley Casino.

Despite being housed in a Sprung structure, the Running Creek Casino offers an attractive and comfortable gaming environment that is superior to Robinson Rancheria and Konocti Vista. Air quality is excellent; the centrally located bar acts as a good focal point and both dining outlets offer an attractive food product.

### PROPERTY FEATURES

#### Casino

- 277 Class III slot machines
- 6 table games

### Food & Beverage

- The Wild Creek Restaurant
- Hot Springs Express (quick-serve outlet)
- On the Rocks (casino bar)
- Fire Water (bar and lounge)

**Running Creek Casino**

## KONOCTI VISTA CASINO RESORT

The Konocti Vista Casino Resort is located in Lakeport on the south side of Clear Lake. It does not enjoy a particularly convenient location. Visitors must drive across the reservation to access the casino. The property features an exterior corridor motel, RV park and marina.

The property recently underwent a remodel. All hotel rooms were renovated; the casino interior was redone, and the exterior received new facia.

Konocti Vista primarily competes with Robinson Rancheria, Twin Pine, and the Running Creek Casino.

## PROPERTY FEATURES

### Casino

- 349 Class III slot machines
- 4 table games

### Food & Beverage

- Valentino's Restaurant
- Taste of Konocti (quick-serve outlet)
- The Point
- Marina Grill

### Hotel

- 74 standard rooms

### Other Amenities

- 74-space RV Park
- 90-slip marina
- Convenience store
- Outdoor Swimming Pool
- Fitness Center in the RV Park

**Konocti Vista Casino Resort**

## SHERWOOD VALLEY CASINO

The Sherwood Valley Casino in Willits was rebranded in 2009 but remains physically unchanged. The property, previously called the Black Bart Casino, suffers from certain deficiencies including a poor location that requires a drive through a residential neighborhood, a poorly located surface parking lot, no sit-down dining facility, and a cramped casino.

Sherwood Valley serves a very limited market area in and around Willits and Fort Bragg. The casino was severely impacted by the 2017 wildfires along with a collapse of the illegal marijuana industry in the market area. Also, US-101 used to pass through the center of Willits. A recently completed bypass now diverts traffic one mile to the east.

**Sherwood Valley Casino**

## POSSIBLE FUTURE CASINO COMPETITION

### WILTON RANCHERIA

The Wilton Rancheria has been planning a new casino development just south of Sacramento, CA off CA-99. While several locations were considered during the development process, including Elk Grove, Galt, and their Historic Rancheria, the final development location will be at the Elk Grove site. The $500 million resort casino is expected to feature over 110,000, square feet of gaming space with 2,000 slot machines and 84 table games. Resort amenities are expected to include 302 hotel rooms in a 12-story hotel, spa and fitness center and a luxury pool, a movie theater, several food and beverage venues, a ballroom, conference & entertainment venue, and retail outlets. Wilton Rancheria has partnered with Boyd Gaming to operate the facility. The developers broke ground on the former site of "Ghost Mall" at CA-99 and Kammerer Road. The new development, named Sky River Casino, will be the closest casino to both Sacramento and the south Bay Area. The target date for the casino opening is late 2022.

### IONE BAND PLYMOUTH CASINO

The Ione Band of Miwok Indians have long planned a casino roughly one mile west of Plymouth, 11 miles from the city of Ione, and 30 miles southeast of Sacramento. Since 2006, several lawsuits to stop construction of the casino have been filed, and each have been unsuccessful. The most recent case was appealed to the U.S. the Supreme Court and was rejected in October 2018.

In August 2020, Gov. Gavin Newsom signed a compact with the Ione Band of Miwok Indians, allowing the tribe to build a gaming facility with up 1,200 slot machines and 40 table games. As of the issuance of this report, the development timeline for this project is unclear, and no expected opening date has been announced. However, GMA assumed that this casino would be operational within the forecasted period.

## PINOLEVILLE CASINO

The Pinoleville Pomo Nation has long pursued a casino development in Ukiah. In August of 2011, the tribe signed a compact with the Governor of California, allowing it to build a 28,500 sq. ft. casino with up to 900 slot machines at a former car dealership on North State Street, north of Orr Springs Road in central Ukiah. The tribe had originally proposed a $50 million project with a casino, 125-room hotel, multiple restaurants and 950 parking spaces. Subsequent to that, the Tribe scaled down their project into a far smaller $18 million facility comprised of 349 electronic gaming devices and six tables.

JW Gaming, the tribe's original partner, had initially invested $5.8 million. In March of 2018, JW Gaming filed a lawsuit against the Pinoleville Pomo Nation and the Canneles Group, alleging fraud and breach of contract. An attempt by the tribe and the Canneles Group to have the lawsuit dismissed was denied by the U.S. District Court in October of 2018. Undeterred, the tribe obtained a new development partner. For the purposes of this analysis, given uncertainties surrounding the project's future, GMA did not assume the project would come to fruition during the analyzed forecast period.

**Pinoleville Casino Proposed Development Site**

## CLOVERDALE RANCHERIA CASINO

The Cloverdale Rancheria of Pomo Indians is a federally recognized tribe of the Pomo Indians of California. Classified as landless, the tribe obtained 80 acres of land on the south side of Cloverdale at the intersection of US-101 and Asti Road, approximately nine miles north of Geyserville.

In 2016, the Bureau of Indian Affairs approved 62 acres of land be set aside for the tribe's reservation. The Cloverdale Rancheria then developed a plan to build a $320 million casino with 2,000 slot machines and 45 table games, a 244-key hotel, spa, 1,300-seat entertainment center, and convention center. The exact timing associated with this project's development is still not fully understood. As such, this casino was not assumed to open within the forecast period.

# IV. SUBSTITUTION EFFECTS ANALYSIS

## MAJOR ASSUMPTIONS

GMA considered the following major assumptions in performing the Substitution Effects Analysis, which were consistent with assumptions utilized by other consultants hired by the Koi Nation, to project the substitution effects on local market competitors.

- The Project will commence operations in 2028.
- Calendar Year 2033 represents a stabilized year of Project operations for the fully built-out facility.
- Graton Resort and Casino builds and opens an expanded gaming floor, an additional hotel tower, and other non-gaming amenities within the forecast period.
- Wilton Rancheria Casino opens within the forecast period.
- The Ione Band Plymouth Casino opens within the forecast period.
- The new Coyote Valley Casino is open today, and the associated Wyndham hotel facility will open and stabilize operations within the forecast period.
- Consumer behaviors, income growth, and spending patterns will recover from impacts of the COVID-19 pandemic by the end of calendar year 2022.
- No other changes in the competitive environment occur other than those discussed in this report.

## REGIONAL MARKET CARVEOUT MAP

The first step in performing the Gaming Market Assessment was to divide the greater market area into market segments based on variations in the demographic composition of the various communities, access to the subject facility as well as competing facilities, and the availability of other (non-gaming) entertainment activities. Provided on the following page is a map illustrating the ten segments used in this analysis and the location of each casino in the region. For each market segment, total population, adult (21+) population, and average annual household income ("AAHI") were quantified.

Sherwood Valley
Coyote Valley
Running Creek
Robinson Rancheria
Colusa
Konocti Vista
Garcia River
Twin Pine
Cache Creek
River Rock
Sliloh Road Site
Graton
San Pablo Lytton
North
Northeast
West
Southeast
South
Secondary Southeast
Secondary South
Tertiary South
Pacific Ocean
Project Site
Primary Competition
Secondary / Tertiary Competition

## SUMMARY OF KEY MARKET SEGMENTS

The following table summarizes the demographics of each of the ten market segments. For each segment, total population, adult population, and average annual household income ("AAHI") were quantified. For the purpose of this analysis and forecast, GMA examined Bay Area market segments by Asian and Non-Asian sub-segments to further understand their demographic compositions. GMA performed this detailed analysis for those markets with considerable levels of Asian population, as the Asian demand segment generally demonstrates a much higher level of gaming propensity and spend compared to the Non-Asian segment. Demographic statistics compiled for each market segment were derived at the zip code level and aggregated accordingly.

The following table summarizes current and projected levels of total population, adult population, and average annual household income ("AAHI"). The total population of the market area was estimated at roughly 7.4 million in 2021, of which 5.6 million (76.5%) are aged 21 or older. By 2033, the adult population is expected to surpass 6.1 million. With an AAHI of $171,865 in 2021 and a projected AAHI of more than $225,000 in 2033, income levels in the market area are among the highest in the United States. As such, GMA significantly discounted projected growth rates for AAHI in order to maintain conservative projections for the market.

**Regional Market Demographic Summary**

| | *ADULT POPULATION (21+)* | | | *AAHI* | | |
|---|---|---|---|---|---|---|
| | 2021 | 2033 | CAGR | 2021 | 2033 | CAGR |
| North | 38,727 | 39,711 | 0.21% | $92,015 | $117,789 | 2.08% |
| South | 563,958 | 597,312 | 0.48% | $148,164 | $198,688 | 2.48% |
| West | 14,023 | 14,284 | 0.15% | $89,773 | $114,167 | 2.02% |
| Northeast | 48,612 | 48,545 | -0.01% | $78,693 | $112,260 | 3.00% |
| Southeast | 420,279 | 452,771 | 0.62% | $122,976 | $168,619 | 2.67% |
| San Francisco Non-Asian | 851,600 | 845,314 | -0.06% | $193,170 | $245,471 | 2.02% |
| East Bay Non-Asian | 1,233,366 | 1,251,334 | 0.12% | $157,164 | $213,538 | 2.59% |
| South Bay Non-Asian | 890,005 | 822,746 | -0.65% | $196,637 | $253,354 | 2.13% |
| San Francisco Asian | 455,465 | 558,383 | 1.71% | $193,170 | $245,471 | 2.02% |
| East Bay Asian | 430,703 | 592,605 | 2.69% | $157,164 | $213,538 | 2.59% |
| South Bay Asian | 696,555 | 929,005 | 2.43% | $196,637 | $253,354 | 2.13% |
| **TOTAL** | **5,643,293** | **6,152,010** | **0.68%** | **$171,865** | **$225,766** | **2.29%** |

*Source: PCensus, GMA*

## GAMING REVENUE CALIBRATION AND PROJECTIONS

In 2021, GMA estimates that the local market generated approximately $2.3 billion in local market gaming revenue.  In the Base Scenario, which factors in anticipated changes to demographics and competitive market dynamics, the local market is expected to grow by $716.0 million, or an average of 2.3% annual growth, reaching $3.0 billion in 2033.  This projection includes a consideration for the impacts of the gaming and non-gaming expansion at Graton, as well as other key assumptions outlined in the sections above.

With the Base Scenario complete, GMA layered in the impact of the Project in the Projected Scenario.  Based on the projected revenues for the Project, local market gaming revenue is projected to increase by $244.2 million, or 8.0% over the Base, reaching $3.3 million in total local market gaming revenue.

With an understanding of the total local market size, the Project is expected to capture 13.7% of local market gaming revenue from new market growth and substitution effects, in addition to approximately $23.7 million from outer market patrons.

| Gaming Revenue Projections Summary | | |
|---|---|---|
| *in USD millions* | **Base** | **Projected Scenario** |
| Total Local Market Revenue | $ 3,035.1 | $ 3,279.3 |
| Shiloh Resort & Casino: | | |
| Local Market | | $ 449.4 |
| Outer Market | | $ 23.7 |
| **TOTAL** | | **$ 473.0** |
| *Source: Meister Economic Consulting, GMA* | | |

## SUBSTITUTION EFFECTS

To quantify the impact of the Project on the region's casinos, GMA completed a Substitution Effect Analysis.  GMA compared each market participant's projected 2033 local market revenue levels between the Projected Scenario and the Base Scenario, in which the Project does not occur. As revenues are not publicly reported for the market participants, GMA utilized its proprietary knowledge of market gaming factors in conjunction with available data in the public domain and other sources to estimate revenues for each gaming facility.

As mentioned, local market revenue for the Project is anticipated to stem from two primary sources:  new market growth and a substitution effect on regional competitors.  In the Projected Scenario, three tribal gaming facilities are anticipated to experience a substitution effect on local market gaming revenue of greater than 10%, including River Rock, Sherwood Valley, and Graton.

The following table details the estimated percentage impact that each regional gaming facility is expected to experience on their local market gaming revenue.

| Projected Local Market Substitution Effects | |
|---|---|
| River Rock | -24.24% |
| Sherwood Valley | -14.77% |
| Graton | -11.45% |
| Konocti Vista | -9.39% |
| Twin Pine | -9.11% |
| Robinson Rancheria | -8.93% |
| Running Creek | -8.34% |
| Coyote Valley | -7.33% |
| Garcia River | -7.27% |
| Colusa | -5.11% |
| Cache Creek | -4.51% |
| Hard Rock Sacramento | -4.38% |
| Harrah's NorCal | -4.30% |
| Thunder Valley | -4.13% |
| Red Hawk | -4.07% |
| Ione Plymouth | -4.04% |
| Jackson Rancheria | -4.04% |
| Wilton Rancheria | -4.02% |
| San Pablo Lytton | -3.87% |
| | |
| **TOTAL LOCAL MARKET** | **8.05%** |
| *Source: GMA* | |

As mentioned previously in this document, there are a handful of casinos, namely the Pinoleville and Cloverdale casinos, that have been proposed in the market but were not assumed in this analysis. Should these or other similar developments move forward, there would be material impact to the overall market size and competitive effects projections outlined in this report.

## DISCLAIMER

Global Market Advisors has made its best effort to secure accurate information, however, much of the information contained in this report was received from third parties, which Global Market Advisors did not validate or verify. Accordingly, Global Market Advisors makes no warranty, real or implied, regarding the data contained in this report. This report also contains projections of future events based upon certain assumptions. As it is not possible to predict future outcomes with absolute accuracy, these projections should be treated only as estimates of potential future results. Actual results may differ due to unforeseen events. Consequently, Global Market Advisors assumes no liability for the accuracy of these projections.

# APPENDICES

## FIRM QUALIFICATIONS

Global Market Advisors, LLC provides clients with market feasibility studies, primary research, economic impact studies, due diligence, payroll control, operations analysis, business and marketing plan development, and player reward program design for the gaming, hospitality and tourism industries. The principals and associates of GMA have hands-on experience in nearly all aspects of the gaming industry including domestic and international operations, project development, marketing expertise, and detailed market analysis.

Global Market Advisors is a (Nevada) Limited Liability Corporation with offices in Las Vegas, NV; Denver, CO; and Singapore.

## BIOGRAPHIES OF THE CONSULTING TEAM

### STEVEN M. GALLAWAY

Steve Gallaway is Managing Partner at Global Market Advisors. His areas of expertise include gaming market assessments, hotel and casino feasibility studies, operational reviews and marketing analysis.

Mr. Gallaway has spent his entire career in the gaming and hospitality industry, starting as a valet attendant and eventually rising to chief operating officer and managing partner of a casino in Colorado. Prior to forming GMA, he served as senior vice president of a hospitality consulting firm where he honed his craft in the fields of gaming market assessments and feasibility analysis. During the span of his career, Steve developed hands-on experience in operations management, organizational development, project development, business development, process improvement, contract negotiations, employee development, and customer service training.

In 2005, Mr. Gallaway formed Gaming Market Advisors. In 2014, the firm was rebranded as Global Market Advisors, reflecting the company's evolution as an international gaming, tourism and hospitality consulting firm.

Mr. Gallaway has completed over 500 feasibility studies, with a strong focus on international gaming operations and integrated resort development. Mr. Gallaway has worked on more than 1,000 projects in Asia, Western and Eastern Europe, the Caribbean, Central America, Canada, and Australia. His knowledge and understanding of emerging markets, particularly those in Asia, has led him to advise institutional investors on new market opportunities in that region, as well as an advisor on established markets. Today, Steve's clients include most public gaming companies, investment banks, private developers and government institutions.

Mr. Gallaway is a visiting lecturer at the University of Nevada Reno's School of Continuing Education where he teaches a class on casino feasibility analysis and marketing measurement. He is a periodic contributor to Global Gaming Business Magazine and Indian Gaming Magazine, and has spoken at G2E Las Vegas and the Asian Gaming Congress.

Mr. Gallaway graduated from Boston College with a B.A. in Economics.

## KIT L. SZYBALA

Kit L. Szybala is a Partner and the Executive Director of Operations at GMA. Mr. Szybala oversees the output and quality of GMA's feasibility studies, due diligence assignments, strategic planning assessments, and market assessments.

While at GMA, Kit has created over 200 robust financial models in various markets globally. As a part of completing these financial models, he has evaluated over 300 casinos and integrated resorts. Mr. Szybala has written a multitude of extensive, analytical reports, including feasibility studies, impact and cannibalization studies, gaming market assessments, hotel market assessments, non-gaming amenity analyses, and strategic planning assessments.

Kit has in-depth experience in various markets with broad knowledge of markets in the United States, Canada, India, Japan, and Australia. Recently, he completed a white paper entitled "Gaming in India: An Evaluation of the Market's Potential" and assisted in the completion of the white paper entitled "Japan Integrated Resorts."

Mr. Szybala is a visiting lecturer on casino feasibility analysis at the University of Nevada, Reno's School of Continuing Education. He is a periodic contributor to Global Gaming Business (GGB) Magazine and Asia Gaming Brief and is often referenced for market insights in gaming industry articles. Kit frequently participates on panels and presents at industry conferences, seminars, and events, including ICE Totally Gaming and Sports Betting and Gaming India. Kit was appointed to the 2018-2019 Class of the Emerging Leaders of Gaming 40 Under 40, a program that recognizes gaming industry professionals under the age of 40 who are making significant impacts on the industry.

He began his career in hospitality working with Vail Resorts as a member of the Vail Resorts College Program. This program gave him valuable insight into hospitality management and operations by giving him various opportunities to meet with chief members of resort management. It also afforded him the opportunity to work in several different capacities for the corporation, giving him the opportunity to understand the intricacies of resort operations.

Kit graduated from Southern Methodist University as a Hunt Leadership Scholar with a B.B.A. in Finance, B.A. in International Studies – European Concentration, and minor in History.

### JACK GALLAWAY

Jack Gallaway is an Associate at Global Market Advisors. Jack works with the Research and Analysis team to conduct primary research and due diligence, as well as prepare forecasting models, feasibility studies, market assessments, and other analytical reports.

Since starting with GMA as an Analyst in 2017, Jack has worked on projects covering all areas of GMA's expertise in various markets in North America, Asia, and Europe. He has also played a central role in growing the team and crafting new and evolving methodologies. This includes research and revenue forecasting in many of the first legal sports betting and iGaming jurisdictions in the United States, as well as actively monitoring the performance of gaming markets worldwide.

In addition to his role in Research and Analysis, Jack directly supports GMA's Government Affairs team, including legislative and regulatory analysis, communications, strategy, and RFP oversight and review. He also assists with GMA's marketing and public relations efforts, including maintaining the company's internal client database and working with its strategic partners for events and content programming.

Jack has contributed to several of GMA's White Papers and Research Briefs, including the Economics of Sports Betting. His writing has also been featured in Global Gaming Business Magazine on topics including sports betting, iGaming, and political economy.

Jack graduated from the University of Wisconsin-Madison with a B.A. in Political Science and a Certificate in Environmental Studies.

# Appendix B-2

# Economic Impact Study for Non-Gaming Winery and Hotel Alternative

# Global Market Advisors

Economic Impact Statement
for Alternative Development Scenario
Sonoma County, CA

GMA 010-22

November 2022

Prepared for:
Koi Nation of Northern California

# Table of Contents

# I. EXECUTIVE SUMMARY

The Koi Nation of Northern California ("Koi Nation") is interested in developing a casino on Shiloh Road in Santa Rosa, California ("Shiloh Road Casino" or "Project"). The Project's proposed location is 222 E. Shiloh Road. Today, the site is an operational vineyard (Shiloh Vineyard Estate) that spans 68.6 acres. Koi Nation has begun working on the Fee to Trust ("FTT") process for the Shiloh Road site and has engaged Acorn Environmental ("Acorn") to assist in the preparation of an Environmental Impact Study.

Acorn previously engaged Global Market Advisors ("GMA") to assist with social and economic impact related tasks for the gaming development scenario. Recently, Acorn asked GMA to complete a market assessment and economic impact assessment for an alternative development scenario, in which the site only features a hotel, food & beverage component and winery offering ("Project"). In this scenario, GMA assumed the following development program is utilized:

- Hotel – 200 rooms
- Dining – 4,700 square feet
- Spa – 14,000 square feet
- Winery – 20,000 square feet
- Visitor Center – 5,000 square feet

As a part of this scope of work, GMA prepared a market assessment for this alternative scenario, including projected revenues, expenses and earnings before interest, taxes, depreciation, and amortization ("EBITDA") for the Project. With the performance of the Project understood in this alternative scenario, GMA prepared the following economic impact assessment, which calculated impacts the Project would have on the host county (Sonoma County) in terms of total output, employment, and labor income during both the Construction Phase and Operational Phase.

## ABOUT GMA

Global Market Advisors is the leading international provider of consulting services to the gaming, entertainment, sports, and hospitality industries with offices located in Las Vegas, NV; Denver, CO; and Singapore. The company's market experience extends throughout all regions of the Americas, Eastern and Western Europe, Australia, and Asia. GMA provides clients with strategic planning, market feasibility studies, primary research, due diligence, general counsel, payroll control, operations analyses, government relations, responsible gaming initiatives, business and marketing plans, and reward program design. GMA's clients consist of the majority of public gaming companies, more than 80 Native American tribes, commercial and investment banks, and government agencies from around the world.

## II. ECONOMIC IMPACT STATEMENT OVERVIEW

The Economic Impact Statement ("EIS") examines economic impact projections that the Project would be expected to generate. To do so, it is first necessary to define an impacted region to calculate the economic impacts of development and operations in the projected scenario. There is no rule of thumb for this definition, as impacts would likely extend throughout the state of California and could be examined more finitely at the host city level. For the purposes of this analysis, GMA utilized Sonoma County as the defined subject region. The expected impacts are measured in terms of the net change in total spending (output), household incomes (labor income), and job creation (employment) in the county. The statistical information contained in the previously completed Socioeconomic Analysis was further utilized to understand relative effects on employment, housing, schools, and select municipal services.

### METHODOLOGY

GMA employed IMPLAN's Input-Output/Social Accounting Matrix Model ("I-O/SAM") to determine the potential economic impact of the Project. The Input-Output economic model depicts how the total output of each industry in an economy depends on inter-industry demands and final demands by putting transactions in a matrix framework. In other words, a tourism project, like a hotel and/or winery, has effects on other industries in its trade area. The I-O/SAM model measures those effects by using a series of multipliers. These multipliers consider all aspects of the input-output framework, including which inputs and outputs will come from the subject region.

The impacts of the Project will occur in two phases: the Construction Phase and the Operations Phase. Construction impacts are temporary in that they only are experienced during the construction and development of the Project, with some ripple effects[1] in the local economy for a short period after construction is completed. The second phase will result from the ongoing operations of the Project and will have an annual, recurring impact to the county. For each phase, GMA calculated the impacts on Total Output, Employment, and Labor Income for the construction phase and operations phase.

[1] Ripple effects are essentially a multiplier effect, meaning that money earned by construction employees and materials suppliers will then be re-spent in the local economy, further benefiting other businesses in the region, as well as the benefits resulting from the incremental spending ability of those businesses, and so on.

## DIRECT, INDIRECT, AND INDUCED EFFECTS

Throughout this report, GMA will refer to three types of effects: the Direct Effect, the Indirect Effect, and the Induced Effect. These effects are used to describe the types of output generated by the Project, and these terms are best defined in the context in which they are used. The effect on employment (jobs created) offers a very clear example:

### DIRECT EFFECT ON EMPLOYMENT

In this context Direct Effect refers to jobs created by patron expenditures in the study region. As an example, if 100 people a day visit a hotel, those people would be served by employees working at the property. In addition, some people may choose to eat at a nearby restaurant, shop in a local store or purchase fuel at a nearby service station or convenience store. Their demand for goods and services at these businesses would create additional employment. Direct Effect on Employment includes those jobs created by the development as well as jobs created by businesses around the Project that service the development's patrons.

### INDIRECT EFFECT ON EMPLOYMENT

Technically, the Indirect Effect is caused by *inter-industry transactions*. Simply put, in providing goods and services to its customers, the hotel needs inputs from other sources such as utilities, food suppliers, laundry and janitorial supplies. A local food distributor will have to hire additional delivery drivers and warehouse personnel to properly serve the hotel and winery. A local laundry provider will have to hire additional staff to keep up with the demands of the resort's restaurants and hotel. The demands of the Project for other industries' goods and services create jobs in other industrial sectors. This is the Indirect Effect on Employment.

### INDUCED EFFECT ON EMPLOYMENT

Induced Effects are the *factor-institution interactions of labor and capital*. Simply put, when newly employed people receive their paychecks, they go out and spend money. They shop at the local supermarket and buy products and services from other local and regional businesses. That consumption, which obviously has nothing to do with hotel's customers' expenditures, creates another set of jobs at retail stores and service establishments. In addition, those new workers hired by merchants to service the resort's employees in turn spend their money at other area merchants, creating more jobs. This is the Induced Effect on Employment.

## KEY INPUTS

GMA based its construction impact forecasts for this alternative scenario on the construction and development costs prepared by other consultants hired by Koi Nation. These development costs were appropriately adjusted to account for factors such as local vs. non-local purchases as well as the difference in overall amenity program and quality level of those amenities. It is important to note that since the preparation of these construction and development cost estimates, prices of goods and services in this industry have grown considerably due to macroeconomic impacts. As a result of these high-level development cost estimates, GMA expects that the Project would incur a development cost of ~$230 million in this scenario.

GMA based its operating impact forecasts on the financial ProForma Income Statement analyses the consulting team prepared as a part of the alternative development scenario market assessment. ProForma Income Statements were prepared for both the hotel and winery.

In GMA's analysis of impacts from operations, GMA considered the impacts of resort and winery revenues, staffing, and employee earnings as the Direct impacts, in addition to small amounts of spending by hotel patrons in the county that would take place as a result of their trips. Indirect impacts are calculated based on the projected spending by the proposed Project on goods and services, as well as the ripple effects that result from this spending. Induced impacts are calculated through the IMPLAN model based on changes in consumption, driven by the Project's employees' earnings and the earnings of businesses benefiting from indirect expenditures.

# III. ECONOMIC IMPACT ANALYSIS

This chapter illustrates the projected economic impacts of construction and operations of the Shiloh Resort.

## CONSTRUCTION IMPACTS

The first phase of economic impacts will be the construction phase. As previously discussed, construction employment and spending are only temporary but can have substantial impacts on the regional economy. It is anticipated that the construction phase will last for a period of approximately 24 months. GMA notes that employment counts below are presented in terms of man-years of employment.[2]

### CONSTRUCTION COSTS

Construction expenditures generally fall into several different categories, each of which has some local and non-local components. Hard costs reflect the actual construction materials and labor. Soft costs reflect architectural services, other professional services, financing costs, start-up expenses, and other non-material expenses. Based on GMA's estimates which were based on the benchmark costs other consultants provided for the casino development scenario, the total construction cost for the Project is estimated at ~$230 million. In evaluating the inputs for this phase of the analysis, GMA paid close attention to those components of the development that would be considered non-local expenses and would not have an impact on the subject region. As such, GMA assumed that all hard costs would stem from within the state of California, and that only a fraction of soft costs would consist of in-state purchases. GMA further discounted these costs to consider only those components of the development that would stem from within Sonoma County.

### TOTAL OUTPUT

Total output measures the value of goods and services that go into the construction of the Project, including the induced and indirect impacts experienced in the regional economy. The direct impact from construction related activities and local procurement is estimated at $187.4 million. The indirect outputs resulting from development are estimated at $35.7 million. The generation of direct and indirect employment will increase household incomes in the region. As a result, there will be an increase in consumption for the region. The increase in consumption, or induced output, is estimated at $78.0 million. Overall, GMA projects that a total of

[2] A "man-year" is a unit of measurement that amounts to the work of one person over one year.

approximately $301.0 million in economic output would be generated within Sonoma County during the construction phase.

| **Total Output from Construction** *in USD millions* | Direct | Indirect | Induced | TOTAL* |
|---|---|---|---|---|
| 55 - Construction of new commercial structures, including farm structures | $181.6 | - | - | $181.6 |
| 449 - Owner-occupied dwellings | - | - | $13.7 | $13.7 |
| 457 - Architectural, engineering, and related services | $5.8 | $3.3 | $0.2 | $9.3 |
| 447 - Other real estate | - | $3.2 | $3.2 | $6.3 |
| 396 - Wholesale - Other durable goods merchant wholesalers | - | $4.3 | $0.5 | $4.8 |
| 490 - Hospitals | - | - | $3.9 | $3.9 |
| 448 - Tenant-occupied housing | - | - | $3.2 | $3.2 |
| 509 - Full-service restaurants | - | $0.2 | $2.5 | $2.7 |
| 441 - Monetary authorities and depository credit intermediation | - | $0.7 | $1.7 | $2.4 |
| 483 - Offices of physicians | - | - | $2.0 | $2.0 |
| 534 - Other local government enterprises | - | $0.4 | $1.7 | $2.0 |
| 510 - Limited-service restaurants | - | $0.0 | $1.9 | $1.9 |
| 472 - Employment services | - | $1.0 | $0.8 | $1.8 |
| 413 - Retail - Nonstore retailers | - | $0.1 | $1.6 | $1.7 |
| 400 - Wholesale - Other nondurable goods merchant wholesalers | - | $0.7 | $1.0 | $1.7 |
| 394 - Wholesale - Household appliances and electrical and electronic goods | - | $1.4 | $0.3 | $1.6 |
| 453 - Commercial and industrial machinery and equipment rental and leasing | - | $1.4 | $0.1 | $1.5 |
| 512 - Automotive repair and maintenance, except car washes | - | $0.2 | $1.3 | $1.5 |
| 469 - Management of companies and enterprises | - | $0.8 | $0.7 | $1.5 |
| 455 - Legal services | - | $0.6 | $0.8 | $1.4 |
| 417 - Truck transportation | - | $1.0 | $0.3 | $1.3 |
| 456 - Accounting, tax preparation, bookkeeping, and payroll services | - | $0.7 | $0.5 | $1.3 |
| 399 - Wholesale - Petroleum and petroleum products | - | $0.8 | $0.4 | $1.2 |
| 406 - Retail - Food and beverage stores | - | $0.0 | $1.2 | $1.2 |
| 442 - Other financial investment activities | - | $0.1 | $1.1 | $1.2 |
| 28 - Stone mining and quarrying | - | $1.1 | $0.0 | $1.1 |
| 47 - Electric power transmission and distribution | - | $0.4 | $0.7 | $1.1 |
| 207 - Other concrete product manufacturing | - | $1.1 | $0.0 | $1.1 |
| 405 - Retail - Building material and garden equipment and supplies stores | - | $0.6 | $0.5 | $1.1 |
| 444 - Insurance carriers, except direct life | - | $0.1 | $0.9 | $1.1 |
| Other | - | $11.5 | $31.2 | $42.6 |
| **TOTAL** | **$187.4** | **$35.7** | **$78.0** | **$301.0** |

** minor inequalities due to rounding*

## TOTAL JOBS (MAN-YEARS)

The following table summarizes the estimated man-years of employment that could be generated as a result of the development of the Shiloh Resort. The direct impact of construction is expected to result in 1,327 man-years of employment. Each of these direct jobs is anticipated to be generated in construction related fields. An additional 173 man-years of employment are projected to stem from indirect impacts, with an additional 455 man-years through induced impacts. In total, the construction phase is projected to result in 1,955 man-years of employment.

| Total Employment from Construction (Man-Years) | Direct | Indirect | Induced | TOTAL* |
|---|---|---|---|---|
| 55 - Construction of new commercial structures, including farm structures | 1,293 | - | - | 1,293 |
| 457 - Architectural, engineering, and related services | 35 | 20 | 1 | 56 |
| 396 - Wholesale - Other durable goods merchant wholesalers | - | 16 | 2 | 18 |
| 447 - Other real estate | - | 15 | 15 | 30 |
| 472 - Employment services | - | 11 | 9 | 20 |
| 417 - Truck transportation | - | 6 | 2 | 8 |
| 456 - Accounting, tax preparation, bookkeeping, and payroll services | - | 5 | 4 | 9 |
| 207 - Other concrete product manufacturing | - | 5 | 0 | 5 |
| 405 - Retail - Building material and garden equipment and supplies stores | - | 4 | 3 | 7 |
| 477 - Landscape and horticultural services | - | 4 | 2 | 6 |
| 455 - Legal services | - | 4 | 5 | 8 |
| 453 - Commercial and industrial machinery and equipment rental and leasing | - | 4 | 0 | 4 |
| 470 - Office administrative services | - | 3 | 2 | 5 |
| 469 - Management of companies and enterprises | - | 3 | 3 | 6 |
| 394 - Wholesale - Household appliances and electrical and electronic goods | - | 3 | 1 | 3 |
| 509 - Full-service restaurants | - | 3 | 31 | 33 |
| 475 - Investigation and security services | - | 3 | 3 | 5 |
| 28 - Stone mining and quarrying | - | 2 | 0 | 2 |
| 476 - Services to buildings | - | 2 | 4 | 6 |
| 462 - Management consulting services | - | 2 | 2 | 4 |
| 395 - Wholesale - Machinery, equipment, and supplies | - | 2 | 0 | 2 |
| 421 - Couriers and messengers | - | 2 | 2 | 4 |
| 473 - Business support services | - | 2 | 1 | 3 |
| 400 - Wholesale - Other nondurable goods merchant wholesalers | - | 2 | 3 | 5 |
| 441 - Monetary authorities and depository credit intermediation | - | 2 | 4 | 6 |
| 512 - Automotive repair and maintenance, except car washes | - | 2 | 10 | 12 |
| 418 - Transit and ground passenger transportation | - | 2 | 6 | 8 |
| 198 - Brick, tile, and other structural clay product manufacturing | - | 2 | 0 | 2 |
| 440 - Securities and commodity contracts intermediation and brokerage | - | 1 | 4 | 6 |
| 204 - Ready-mix concrete manufacturing | - | 1 | 0 | 1 |
| Other | - | 40 | 338 | 378 |
| **TOTAL** | **1,327** | **173** | **455** | **1,955** |

** minor inequalities due to rounding*

## TOTAL LABOR INCOME

As a result of the creation of the direct jobs, $73.7 million in labor income is projected to accrue to Sonoma County residents. Indirect wages are projected at approximately $9.0 million. Incremental regional consumption attributable to these earnings is projected to create an induced impact of $20.2 million in regional earnings, for a total impact of $103.0 million in regional labor income.

| Total Labor Income from Construction | | | | |
|---|---|---|---|---|
| *in USD millions* | **Direct** | **Indirect** | **Induced** | **TOTAL*** |
| 55 - Construction of new commercial structures, including farm structures | $71.9 | - | - | $71.9 |
| 457 - Architectural, engineering, and related services | $1.9 | $1.1 | $0.1 | $3.0 |
| 490 - Hospitals | - | - | $2.0 | $2.0 |
| 396 - Wholesale - Other durable goods merchant wholesalers | - | $1.1 | $0.1 | $1.3 |
| 483 - Offices of physicians | - | - | $1.2 | $1.2 |
| 509 - Full-service restaurants | - | $0.1 | $0.9 | $1.0 |
| 469 - Management of companies and enterprises | - | $0.4 | $0.3 | $0.7 |
| 534 - Other local government enterprises | - | $0.1 | $0.6 | $0.7 |
| 472 - Employment services | - | $0.4 | $0.3 | $0.7 |
| 486 - Outpatient care centers | - | - | $0.6 | $0.6 |
| 406 - Retail - Food and beverage stores | - | $0.0 | $0.5 | $0.5 |
| 491 - Nursing and community care facilities | - | - | $0.5 | $0.5 |
| 510 - Limited-service restaurants | - | $0.0 | $0.5 | $0.5 |
| 512 - Automotive repair and maintenance, except car washes | - | $0.1 | $0.4 | $0.5 |
| 441 - Monetary authorities and depository credit intermediation | - | $0.2 | $0.3 | $0.5 |
| 493 - Individual and family services | - | - | $0.5 | $0.5 |
| 455 - Legal services | - | $0.2 | $0.2 | $0.4 |
| 521 - Religious organizations | - | - | $0.4 | $0.4 |
| 511 - All other food and drinking places | - | $0.0 | $0.4 | $0.4 |
| 405 - Retail - Building material and garden equipment and supplies stores | - | $0.2 | $0.2 | $0.4 |
| 484 - Offices of dentists | - | $0.0 | $0.4 | $0.4 |
| 456 - Accounting, tax preparation, bookkeeping, and payroll services | - | $0.2 | $0.2 | $0.4 |
| 447 - Other real estate | - | $0.2 | $0.2 | $0.4 |
| 400 - Wholesale - Other nondurable goods merchant wholesalers | - | $0.1 | $0.2 | $0.4 |
| 417 - Truck transportation | - | $0.3 | $0.1 | $0.4 |
| 411 - Retail - General merchandise stores | - | $0.0 | $0.3 | $0.4 |
| 439 - Nondepository credit intermediation and related activities | - | $0.0 | $0.3 | $0.3 |
| 207 - Other concrete product manufacturing | - | $0.3 | $0.0 | $0.3 |
| 394 - Wholesale - Household appliances and electrical and electronic goods | - | $0.3 | $0.0 | $0.3 |
| 445 - Insurance agencies, brokerages, and related activities | - | $0.0 | $0.2 | $0.3 |
| Other | - | $3.7 | $8.0 | $11.7 |
| **TOTAL** | **$73.7** | **$9.0** | **$20.2** | **$103.0** |

** minor inequalities due to rounding*

## OPERATIONAL IMPACTS

For the operational phase, projections were prepared for calendar year 2027, representing a full year of fully stabilized operations of the Project. However, for comparison purposes, GMA adjusted the model year input in IMPLAN to 2033 to provide a direct comparison to the previously completed scenario projections.

In 2027, the Project is anticipated to achieve a gross revenue level of $50.8 million. In preparing impact projections, GMA evaluated the percentage of revenues that will have an impact on Sonoma County, in comparison to those that will be distributed outside of the county. This portion of the analysis also evaluated the Project's potential impact on vineyard and winery expenditure, food & beverage expenditure, retail expenditure and gas/local transport expenditure in the subject region.

The following table illustrates the projected revenue and expense levels that GMA utilized to estimate total salaries, employment, and other expenses associated with Project operations. A portion of these incomes – along with the other development expenditures made possible by the resort revenues and other direct spending by out of region customers – constitute the gross direct impacts of operations. This section of the report outlines the total output, jobs, labor income, and fiscal impact of Project operations as calculated using the IMPLAN model.

| ProForma Income Statement Summary, Overall Project | 2027 |
|---|---|
| **Revenue** | |
| Hotel Asset Revenue | $ 42,694,479 |
| Winery Asset Revenue | $ 8,064,000 |
| **TOTAL PROJECT REVENUE** | **$ 50,758,479** |
| | |
| **Expenses** | |
| Hotel Asset Expenses | $ 30,096,402 |
| Winery Asset Expenses | $ 5,827,230 |
| **TOTAL PROJECT EXPENSES** | **$ 35,923,632** |
| | |
| **TOTAL PROJECT EBITDA** | **$ 14,834,847** |

*Source: GMA*

## TOTAL OUTPUT

Direct output measures the total spending by the Project patrons, including labor income from gratuities, less expenditures that occur outside of the study area. The net direct impact from operations is estimated at $39.9 million. The indirect output resulting from operation, which emanates from economic activities of suppliers and vendors and has a ripple effect in the regional economy, is estimated at $12.0 million. The induced spending, reflecting increased consumption attributable to the direct and indirect earnings, is projected to result in $11.9 million of output. Overall, GMA projects that approximately $63.9 million in economic output would be generated within Sonoma County on an annual basis once the Project is operational, in 2033 dollars. The following table demonstrates these impacts on various sectors that would result from operational spending and employee spending, as well as the ripple effects throughout the economy.

| Total Output from Operations | | | | |
|---|---|---|---|---|
| *in USD millions* | Direct | Indirect | Induced | TOTAL* |
| 507 - Hotels and motels, including casino hotels | $24.4 | $0.0 | $0.0 | $24.4 |
| 509 - Full-service restaurants | $10.5 | $0.1 | $0.4 | $11.0 |
| 107 - Wineries | $5.0 | $0.2 | $0.0 | $5.1 |
| 449 - Owner-occupied dwellings | - | - | $2.1 | $2.1 |
| 447 - Other real estate | - | $1.4 | $0.5 | $1.9 |
| 469 - Management of companies and enterprises | - | $1.0 | $0.1 | $1.1 |
| 511 - All other food and drinking places | - | $0.8 | $0.1 | $1.0 |
| 432 - Cable and other subscription programming | - | $0.8 | $0.1 | $0.9 |
| 47 - Electric power transmission and distribution | - | $0.5 | $0.1 | $0.6 |
| 490 - Hospitals | - | - | $0.6 | $0.6 |
| 534 - Other local government enterprises | - | $0.3 | $0.3 | $0.5 |
| 400 - Wholesale - Other nondurable goods merchant wholesalers | - | $0.4 | $0.2 | $0.5 |
| 448 - Tenant-occupied housing | - | - | $0.5 | $0.5 |
| 472 - Employment services | - | $0.3 | $0.1 | $0.5 |
| 441 - Monetary authorities and depository credit intermediation | - | $0.1 | $0.3 | $0.4 |
| 476 - Services to buildings | - | $0.3 | $0.0 | $0.4 |
| 456 - Accounting, tax preparation, bookkeeping, and payroll services | - | $0.3 | $0.1 | $0.4 |
| 60 - Maintenance and repair construction of nonresidential structures | - | $0.3 | $0.1 | $0.3 |
| 413 - Retail - Nonstore retailers | - | $0.1 | $0.3 | $0.3 |
| 510 - Limited-service restaurants | - | $0.0 | $0.3 | $0.3 |
| 4 - Fruit farming | - | $0.3 | $0.0 | $0.3 |
| 445 - Insurance agencies, brokerages, and related activities | - | $0.2 | $0.1 | $0.3 |
| 483 - Offices of physicians | - | - | $0.3 | $0.3 |
| 455 - Legal services | - | $0.2 | $0.1 | $0.3 |
| 512 - Automotive repair and maintenance, except car washes | - | $0.1 | $0.2 | $0.3 |
| 479 - Waste management and remediation services | - | $0.2 | $0.0 | $0.2 |
| 526 - Postal service | - | $0.2 | $0.0 | $0.2 |
| 444 - Insurance carriers, except direct life | - | $0.1 | $0.1 | $0.2 |
| 431 - Radio and television broadcasting | - | $0.2 | $0.0 | $0.2 |
| 433 - Wired telecommunications carriers | - | $0.1 | $0.1 | $0.2 |
| Other | ($0.0) | $3.5 | $4.8 | $8.3 |
| **TOTAL** | **$39.9** | **$12.0** | **$11.9** | **$63.9** |

** minor inequalities due to rounding*

## TOTAL JOBS (FTE)

The following table summarizes the expected total employment impact, in terms of full-time equivalent ("FTE") jobs, that is anticipated to stem from Project operations. The direct impact of operations reflects the staffing level that will create incremental jobs to Sonoma County, which equates to 372 jobs primarily in the gambling, food & beverage, hospitality, and retail industries. An additional 70 jobs are projected to be generated through indirect impacts, with an additional 70 jobs through induced impacts. Based on the IMPLAN results, key sectors that are expected to experience indirect and induced employment impacts include other food & beverage establishments, real estate, and professional services.

| Total Employment from Operations (Man-Years) | Direct | Indirect | Induced | TOTAL* |
|---|---|---|---|---|
| 507 - Hotels and motels, including casino hotels | 228 | - | 0 | 228 |
| 509 - Full-service restaurants | 130 | 1 | 5 | 136 |
| 107 - Wineries | 14 | 0 | 0 | 14 |
| 511 - All other food and drinking places | - | 12 | 2 | 14 |
| 447 - Other real estate | - | 7 | 2 | 9 |
| 469 - Management of companies and enterprises | - | 4 | 0 | 4 |
| 472 - Employment services | - | 4 | 1 | 5 |
| 476 - Services to buildings | - | 4 | 1 | 4 |
| 4 - Fruit farming | - | 4 | 0 | 4 |
| 456 - Accounting, tax preparation, bookkeeping, and payroll services | - | 2 | 1 | 3 |
| 526 - Postal service | - | 2 | 0 | 2 |
| 477 - Landscape and horticultural services | - | 2 | 0 | 2 |
| 499 - Independent artists, writers, and performers | - | 1 | 0 | 2 |
| 400 - Wholesale - Other nondurable goods merchant wholesalers | - | 1 | 0 | 1 |
| 60 - Maintenance and repair construction of nonresidential structures | - | 1 | 0 | 1 |
| 465 - Advertising, public relations, and related services | - | 1 | 0 | 1 |
| 455 - Legal services | - | 1 | 1 | 2 |
| 462 - Management consulting services | - | 1 | 0 | 1 |
| 519 - Dry-cleaning and laundry services | - | 1 | 0 | 1 |
| 534 - Other local government enterprises | - | 1 | 1 | 2 |
| 479 - Waste management and remediation services | - | 1 | 0 | 1 |
| 398 - Wholesale - Grocery and related product wholesalers | - | 1 | 0 | 1 |
| 470 - Office administrative services | - | 1 | 0 | 1 |
| 445 - Insurance agencies, brokerages, and related activities | - | 1 | 0 | 1 |
| 417 - Truck transportation | - | 1 | 0 | 1 |
| 19 - Support activities for agriculture and forestry | - | 1 | 0 | 1 |
| 512 - Automotive repair and maintenance, except car washes | - | 1 | 2 | 2 |
| 457 - Architectural, engineering, and related services | - | 1 | 0 | 1 |
| 475 - Investigation and security services | - | 1 | 0 | 1 |
| 396 - Wholesale - Other durable goods merchant wholesalers | - | 1 | 0 | 1 |
| Other | - | 16 | 50 | 66 |
| **TOTAL** | **372** | **70** | **70** | **512** |

** minor inequalities due to rounding*

## TOTAL LABOR INCOME

As a result of the creation of new direct jobs, $13.5 million in annual labor income is projected to accrue to Sonoma County residents. Net indirect wages in other sectors is projected at $3.2 million, and incremental regional consumption attributable to these direct and indirect earnings is projected to result in an induced impact of $3.1 million. Overall, the Project is expected to generate $19.8 million in labor income on an annual basis, in projected 2033 dollars.

| **Total Labor Income from Operations** <br> *in USD millions* | **Direct** | **Indirect** | **Induced** | **TOTAL*** |
|---|---|---|---|---|
| 507 - Hotels and motels, including casino hotels | $8.5 | $0.0 | $0.0 | $8.5 |
| 509 - Full-service restaurants | $3.9 | $0.0 | $0.1 | $4.1 |
| 107 - Wineries | $1.1 | $0.0 | $0.0 | $1.1 |
| 469 - Management of companies and enterprises | - | $0.5 | $0.1 | $0.5 |
| 511 - All other food and drinking places | - | $0.4 | $0.1 | $0.4 |
| 490 - Hospitals | - | - | $0.3 | $0.3 |
| 526 - Postal service | - | $0.2 | $0.0 | $0.2 |
| 483 - Offices of physicians | - | - | $0.2 | $0.2 |
| 534 - Other local government enterprises | - | $0.1 | $0.1 | $0.2 |
| 472 - Employment services | - | $0.1 | $0.0 | $0.2 |
| 476 - Services to buildings | - | $0.1 | $0.0 | $0.1 |
| 447 - Other real estate | - | $0.1 | $0.0 | $0.1 |
| 400 - Wholesale - Other nondurable goods merchant wholesalers | - | $0.1 | $0.0 | $0.1 |
| 456 - Accounting, tax preparation, bookkeeping, and payroll services | - | $0.1 | $0.0 | $0.1 |
| 512 - Automotive repair and maintenance, except car washes | - | $0.0 | $0.1 | $0.1 |
| 406 - Retail - Food and beverage stores | - | $0.0 | $0.1 | $0.1 |
| 486 - Outpatient care centers | - | - | $0.1 | $0.1 |
| 510 - Limited-service restaurants | - | $0.0 | $0.1 | $0.1 |
| 445 - Insurance agencies, brokerages, and related activities | - | $0.1 | $0.0 | $0.1 |
| 491 - Nursing and community care facilities | - | - | $0.1 | $0.1 |
| 479 - Waste management and remediation services | - | $0.1 | $0.0 | $0.1 |
| 4 - Fruit farming | - | $0.1 | $0.0 | $0.1 |
| 47 - Electric power transmission and distribution | - | $0.1 | $0.0 | $0.1 |
| 477 - Landscape and horticultural services | - | $0.1 | $0.0 | $0.1 |
| 455 - Legal services | - | $0.0 | $0.0 | $0.1 |
| 441 - Monetary authorities and depository credit intermediation | - | $0.0 | $0.1 | $0.1 |
| 60 - Maintenance and repair construction of nonresidential structures | - | $0.1 | $0.0 | $0.1 |
| 493 - Individual and family services | - | - | $0.1 | $0.1 |
| 439 - Nondepository credit intermediation and related activities | - | $0.0 | $0.0 | $0.1 |
| 411 - Retail - General merchandise stores | - | $0.0 | $0.1 | $0.1 |
| Other | ($0.0) | $1.0 | $1.3 | $2.3 |
| **TOTAL** | **$13.5** | **$3.2** | **$3.1** | **$19.8** |

** minor inequalities due to rounding*

## FISCAL IMPACT

There will be fiscal impacts resulting from the construction and operation of the Project at the local, county, state, and federal levels from a variety of taxes. At the state and local level, adjustments were made to sales taxes, property taxes, and State/Local non-taxes by the ratio of indirect and induced output to total output to reflect the likely exemption status of direct spending occurring at the facility. In some cases, there may be tax exemptions due to purchases by the Koi Nation. The IMPLAN model creates a projection of the total taxes, such that these discounts are not reflected in the resulting tables.

## CONSTRUCTION

The total federal tax contribution during the construction phase is projected at $29.1 million, primarily consisting of social insurance and personal income taxes. The state and local taxes during the construction phase are projected at $11.1 million, the majority of which would be taxes on construction materials and property taxes.

**Tax Revenue from Project Construction**

| *in USD millions* | Employee Compensation | Proprietor Income | Production & Imports | Households | Corporations | TOTAL |
|---|---|---|---|---|---|---|
| **FEDERAL** | | | | | | |
| Social Insurance Tax- Employee Contribution | $6.6 | $2.0 | - | - | - | $8.6 |
| Social Insurance Tax- Employer Contribution | $6.0 | - | - | - | - | $6.0 |
| Tax on Production and Imports: Excise Taxes | - | - | $0.4 | - | - | $0.4 |
| Tax on Production and Imports: Custom Duty | - | - | $0.3 | - | - | $0.3 |
| Corporate Profits Tax | - | - | - | $0.8 | $0.8 | $0.8 |
| Personal Tax: Income Tax | - | - | - | $13.0 | - | $13.0 |
| Personal Tax: Estate and Gift Tax | - | - | - | - | - | - |
| **TOTAL** | **$12.6** | **$2.0** | **$0.6** | **$13.8** | **$0.8** | **$29.1** |
| **STATE & County** | | | | | | |
| Social Insurance Tax- Employee Contribution | $0.2 | - | - | - | - | $0.2 |
| Social Insurance Tax- Employer Contribution | $0.3 | - | - | - | - | $0.3 |
| TOPI: Sales Tax | - | - | $3.4 | - | - | $3.4 |
| TOPI: Property Tax | - | - | $1.2 | - | - | $1.2 |
| TOPI: Motor Vehicle License | - | - | $0.1 | - | - | $0.1 |
| TOPI: Severance Tax | - | - | $0.0 | - | - | $0.0 |
| TOPI: Other Taxes | - | - | $0.4 | - | - | $0.4 |
| TOPI: Special Assessments | - | - | $0.0 | - | - | $0.0 |
| OPI: Corporate Profits Tax | - | - | - | - | $0.3 | $0.3 |
| Personal Tax: Income Tax | - | - | - | $5.0 | - | $5.0 |
| Personal Tax: Motor Vehicle License | - | - | - | $0.1 | - | $0.1 |
| Personal Tax: Property Taxes | - | - | - | $0.0 | - | $0.0 |
| Personal Tax: Other Tax (Fish/Hunt) | - | - | - | $0.0 | - | $0.0 |
| **TOTAL** | **$0.5** | **-** | **$5.1** | **$5.2** | **$0.3** | **$11.1** |

*Source: GMA* ** minor inequalities due to rounding*

## OPERATIONS

During the operations phase, the Project is expected to generate $5.1 million in federal taxes and $3.1 million in state and local taxes annually. It is important to note that the Koi Nation is a sovereign nation that receives tax exemptions. As such, the actual tax benefits will likely vary from those presented in the following tables addressing tax revenues during the operations phase for the Project.

| **Tax Revenue from Project Operations** *in USD millions* | Employee Compensation | Proprietor Income | Production & Imports | Households | Corporations | TOTAL |
|---|---|---|---|---|---|---|
| **FEDERAL** | | | | | | |
| Social Insurance Tax- Employee Contribution | $1.3 | $0.2 | - | - | - | $1.4 |
| Social Insurance Tax- Employer Contribution | $1.2 | - | - | - | - | $1.2 |
| Tax on Production and Imports: Excise Taxes | - | - | $0.1 | - | - | $0.1 |
| Tax on Production and Imports: Custom Duty | - | - | $0.1 | - | - | $0.1 |
| Corporate Profits Tax | - | - | - | - | $0.3 | $0.3 |
| Personal Tax: Income Tax | - | - | - | $1.9 | - | $1.9 |
| Personal Tax: Estate and Gift Tax | - | - | - | - | - | - |
| **TOTAL** | **$2.5** | **$0.2** | **$0.3** | **$1.9** | **$0.3** | **$5.1** |
| **STATE** | | | | | | |
| Social Insurance Tax- Employee Contribution | $0.0 | - | - | - | - | $0.0 |
| Social Insurance Tax- Employer Contribution | $0.1 | - | - | - | - | $0.1 |
| TOPI: Sales Tax | - | - | $1.3 | - | - | $1.3 |
| TOPI: Property Tax | - | - | $0.1 | - | - | $0.1 |
| TOPI: Motor Vehicle License | - | - | $0.0 | - | - | $0.0 |
| TOPI: Severance Tax | - | - | $0.0 | - | - | $0.0 |
| TOPI: Other Taxes | - | - | $0.1 | - | - | $0.1 |
| TOPI: Special Assessments | - | - | - | - | - | - |
| OPI: Corporate Profits Tax | - | - | - | - | $0.1 | $0.1 |
| Personal Tax: Income Tax | - | - | - | $0.7 | - | $0.7 |
| Personal Tax: Motor Vehicle License | - | - | - | $0.0 | - | $0.0 |
| Personal Tax: Property Taxes | - | - | - | $0.0 | - | $0.0 |
| Personal Tax: Other Tax (Fish/Hunt) | - | - | - | $0.0 | - | $0.0 |
| **TOTAL** | **$0.1** | **-** | **$1.5** | **$0.8** | **$0.1** | **$2.5** |
| **COUNTY** | | | | | | |
| Social Insurance Tax- Employee Contribution | - | - | - | - | - | - |
| Social Insurance Tax- Employer Contribution | - | - | - | - | - | - |
| TOPI: Sales Tax | - | - | $0.1 | - | - | $0.1 |
| TOPI: Property Tax | - | - | $0.4 | - | - | $0.4 |
| TOPI: Motor Vehicle License | - | - | - | - | - | - |
| TOPI: Severance Tax | - | - | - | - | - | - |
| TOPI: Other Taxes | - | - | $0.0 | - | - | $0.0 |
| TOPI: Special Assessments | - | - | $0.0 | - | - | $0.0 |
| OPI: Corporate Profits Tax | - | - | - | - | - | - |
| Personal Tax: Income Tax | - | - | - | - | - | - |
| Personal Tax: Motor Vehicle License | - | - | - | - | - | - |
| Personal Tax: Property Taxes | - | - | - | $0.0 | - | $0.0 |
| Personal Tax: Other Tax (Fish/Hunt) | - | - | - | - | - | - |
| **TOTAL** | **-** | **-** | **$0.6** | **$0.0** | **-** | **$0.6** |

*Source: GMA* ** minor inequalities due to rounding*

## IV. SUMMARY OF ECONOMIC IMPACTS

The following tables summarize the anticipated economic impacts of the construction and operations phase, illustrating the projected overall impact of the Project after all ripple effects of indirect and induced spending flow through the County. While these tables illustrate the impacts on the immediate local market in Sonoma County, additional impacts will be generated outside of the county but within the State of California.

**Sonoma County Economic Impacts - Construction Phase**

| Impact | Employment | Labor Income | Output |
|---|---|---|---|
| Direct | 1,327 | $116,141,986 | $187,366,435 |
| Indirect | 173 | $11,917,925 | $77,955,515 |
| Induced | 455 | $25,389,806 | $35,653,272 |
| TOTAL | 1,955 | $153,449,717 | $300,975,222 |

*Source: IMPLAN, GMA*

**Sonoma County Economic Impacts - Operations Phase**

| Impact | Employment | Labor Income | Output |
|---|---|---|---|
| Direct | 372 | $15,325,481 | $39,921,014 |
| Indirect | 70 | $4,497,807 | $12,011,455 |
| Induced | 70 | $3,888,430 | $11,949,464 |
| **TOTAL** | **512** | **$23,711,718** | **$63,881,934** |

*Source: IMPLAN, GMA*

## DISCLAIMER

Global Market Advisors has made its best effort to secure accurate information, however, much of the information contained in this report was received from third parties, which Global Market Advisors did not validate or verify. Accordingly, Global Market Advisors makes no warranty, real or implied, regarding the data contained in this report. This report also contains projections of future events based upon certain assumptions. As it is not possible to predict future outcomes with absolute accuracy, these projections should be treated only as estimates of potential future results. Actual results may differ due to unforeseen events. Consequently, Global Market Advisors assumes no liability for the accuracy of these projections.

# APPENDICES

## FIRM QUALIFICATIONS

Global Market Advisors, LLC provides clients with market feasibility studies, primary research, economic impact studies, due diligence, payroll control, operations analysis, business and marketing plan development, and player reward program design for the gaming, hospitality and tourism industries. The principals and associates of GMA have hands-on experience in nearly all aspects of the gaming industry including domestic and international operations, project development, marketing expertise, and detailed market analysis.

Global Market Advisors is a (Nevada) Limited Liability Corporation with offices in Las Vegas, NV; Denver, CO; and Singapore. Below is the contact information for the company's primary point of contact for this engagement.

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## BIOGRAPHIES OF THE CONSULTING TEAM

### STEVEN M. GALLAWAY

Steve Gallaway is Managing Partner at Global Market Advisors. His areas of expertise include gaming market assessments, hotel and casino feasibility studies, operational reviews and marketing analysis.

Mr. Gallaway has spent his entire career in the gaming and hospitality industry, starting as a valet attendant and eventually rising to chief operating officer and managing partner of a casino in Colorado. Prior to forming GMA, he served as senior vice president of a hospitality consulting firm where he honed his craft in the fields of gaming market assessments and feasibility analysis. During the span of his career, Steve developed hands-on experience in operations management, organizational development, project development, business development, process improvement, contract negotiations, employee development, and customer service training.

In 2005, Mr. Gallaway formed Gaming Market Advisors. In 2014, the firm was rebranded as Global Market Advisors, reflecting the company's evolution as an international gaming, tourism and hospitality consulting firm.

Mr. Gallaway has completed over 500 feasibility studies, with a strong focus on international gaming operations and integrated resort development. Mr. Gallaway has worked on more than 1,000 projects in Asia, Western and Eastern Europe, the Caribbean, Central America, Canada, and Australia. His knowledge and understanding of emerging markets, particularly those in Asia, has led him to advise institutional investors on new market opportunities in that region, as well as an advisor on established markets. Today, Steve's clients include most public gaming companies, investment banks, private developers and government institutions.

Mr. Gallaway is a visiting lecturer at the University of Nevada Reno's School of Continuing Education where he teaches a class on casino feasibility analysis and marketing measurement. He is a periodic contributor to Global Gaming Business Magazine and Indian Gaming Magazine, and has spoken at G2E Las Vegas and the Asian Gaming Congress.

Mr. Gallaway graduated from Boston College with a B.A. in Economics.

### KIT L. SZYBALA

Kit L. Szybala is a Partner and the Executive Director of Operations at GMA. Mr. Szybala oversees the output and quality of GMA's feasibility studies, due diligence assignments, strategic planning assessments, and market assessments.

While at GMA, Kit has created over 250 robust financial models in various markets globally. As a part of completing these financial models, he has evaluated over 300 casinos and integrated resorts. Mr. Szybala has written a multitude of extensive, analytical reports, including feasibility studies, impact and cannibalization studies, gaming market assessments, hotel market assessments, non-gaming amenity analyses, and strategic planning assessments.

Kit has in-depth experience in various markets with broad knowledge of markets in the United States, Canada, India, Japan, and Australia. Recently, he completed a white paper entitled "Gaming in India: An Evaluation of the Market's Potential" and assisted in the completion of the white paper entitled "Japan Integrated Resorts."

Mr. Szybala is a visiting lecturer on casino feasibility analysis at the University of Nevada, Reno's School of Continuing Education. He is a periodic contributor to Global Gaming Business (GGB) Magazine and Asia Gaming Brief and is often referenced for market insights in gaming industry articles. Kit frequently participates on panels and presents at industry conferences, seminars, and events, including ICE Totally Gaming and Sports Betting and Gaming India. Kit was appointed to the 2018-2019 Class of the Emerging Leaders of Gaming 40 Under 40, a program that recognizes gaming industry professionals under the age of 40 who are making significant impacts on the industry.

He began his career in hospitality working with Vail Resorts as a member of the Vail Resorts College Program. This program gave him valuable insight into hospitality management and operations by giving him various opportunities to meet with chief members of resort management. It also afforded him the opportunity to work in several different capacities for the corporation, giving him the opportunity to understand the intricacies of resort operations.

Kit graduated from Southern Methodist University as a Hunt Leadership Scholar with a B.B.A. in Finance, B.A. in International Studies – European Concentration, and minor in History.

# Appendix B-3

# Supplemental Competitive Effects Assessment

A MODERN CONSULTING FIRM

# MEMORANDUM

**To:** **Acorn Environmental – Koi Nation**

**From:** **GMA Consulting**

**DATE:** **March 12, 2024**

**RE:** **Koi – Supplemental Competitive Effects Discussion**

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## RESULTS AND ANALYSIS

### CASE STUDY: IMPACT OF SIGNIFICANT REVENUE DECLINES

After conducting extensive research and analysis, the consulting team at GMA has identified several markets where casinos have experienced impacts to their gaming revenues by more than 20% and yet managed to remain open. This analysis was focused on commercial gaming markets, as information was readily and publicly available (whereas this data is not available in tribal gaming markets). The markets analyzed within this report were selected as they had experienced some level of market expansion in the last two decades.

Within its analysis, the Consulting Team found that gaming revenue disruptions were caused by various factors beyond gaming expansion, including the economic recession, regulatory factors, and increased competition from new entrants into the market.

The COVID-19 pandemic also resulted in significant gaming revenue impacts across multiple jurisdictions; however, as many businesses received economic aid via governmental programs like the Paycheck Protection Program and recovered more quickly due to economic impact or stimulus checks being utilized for discretionary expenditures, GMA chose not to focus on these examples for its analysis.

GMA observed several instances of properties facing significant challenges due to the emergence of new competitors, regulatory changes (like smoking bans) and/or macro-economic market factors, resulting in substantial impacts to gaming revenues. However, despite these obstacles, these casinos were able to adapt and regrow revenue after impact via strategic initiatives, operational changes, and/or product improvement/expansion. Of the analyzed markets presented in this memorandum, there were no casino closures as a result of the measured gaming revenue impacts.[1]

***Revenue figures presented in the following section are either presented as net revenue (with freeplay removed) or gross revenue (inclusive of freeplay) depending on the statistics reported in each jurisdiction.***

## CHICAGOLAND MARKET AREA

The wake of the 2008 financial crisis presented challenges for businesses across the nation, and the casino industry was especially negatively impacted by the economic downturn. In the greater Chicagoland market, comprising casinos in northern Illinois and northern Indiana, each casino within the market area experienced substantial declines in gaming revenues, surpassing 20% in year-over-year ("Y-O-Y") comparisons.

While most establishments saw quick recovery from the financial crisis, casinos like the Grand Victoria were not so quickly revived. Grand Victoria Casino saw a 13.5% decrease in net gaming revenue, falling from $338.7 million to $293.0 million. When compared to 2007 figures, the casino saw a 33.0% decline in net gaming revenue over the two-year span.

In advance of the Great Recession, the implementation of the Smoke Free Illinois Act in January 2008, which prohibited smoking in enclosed workplaces, markedly decreased casino attendance with rippling effects throughout casino operations in Illinois. Several casinos in the market experienced gaming revenue declines near or over 20% in comparison to the prior year of 2007, including Grand Victoria (-22.4%), Hollywood Casino Aurora (-19.3%), Harrah's Joliet Hotel & casino (-21.9%), and Hollywood Casino Joliet (-23.4%). Each of these casinos is still in operation today.

Further challenges for Grand Victoria were ahead after the opening of Rivers Casino in July 2011, which lead to a significant decline in gaming revenue for Grand Victoria, which is situated just 30

[1] In 2014, GMA did note the closures of multiple casinos in the Atlantic City market, including Showboat and Trump Plaza. These casinos had experienced several years of declining gaming revenue before closure, indicative of inadequate management and failure to adapt to evolving markets such as NY, PA, and others, as opposed to new players entering their respective market. Revel Casino, burdened by substantial debt from development expenses, also ceased operations that year. Today, rebranded as Ocean Casino, it is one of the highest ranking Atlantic City casinos.

minutes away from the new property. The opening of the new Rivers Casino in 2011 marked a 17.4% Y-O-Y decrease in net gaming revenues, which ballooned to 26.0% in 2012 when comparing over the two-year period. While this revenue impact was significant, the Grand Victoria remained open for business until 2018, when ownership eventually sold from MGM and Hyatt to Eldorado Resorts (later renamed Caesars Entertainment). Ceasars Entertainment still operates the casino today, which just recently underwent a $4 million expansion in 2022, underscoring its continued longevity in the market today.

Elsewhere in the market, casinos continued to face challenges alongside the economic turmoil of the time. The Hollywood Casino Joliet encountered this firsthand when the establishment experienced a fire during a renovation in 2009. This led to a sharp decline in net gaming revenue of roughly $63.9 million from the previous year (-34.8% impact), and an exaggerated spike the following year in 2010. As a result of the fire, it took the casino longer to establish a new baseline for revenue returns. While not fully recovering to pre-recession levels, the Hollywood Joliet adapted to the changing economic landscape, stabilizing its operations and achieving stabilized revenue figures between 2015 and 2019.

## CINCINNATI/SOUTHERN INDIANA MARKET AREA

In the Cincinnati/Southern Indiana market area, GMA observed gross gaming revenue decreases of 31.8% and 21.2% from 2012 to 2013 for the Hollywood Casino Lawrenceburg and the Grand Victoria Casino & Resort Rising Star, respectively. These same casinos experienced further declines in gaming revenues of 27.3% and 26.0% into 2014. GMA attributes this decline to the opening of the Hard Rock Casino in Cincinnati in 2013, following Ohio's 2009 constitutional amendment authorizing one casino in each of the state's four largest cities: Cleveland, Cincinnati, Columbus, and Toledo.

The Hard Rock facility is located just over 30 minutes away from the Hollywood Casino & Hotel in Lawrenceburg and is within an hour’s drive away from the Grand Victoria Rising Star. According to the Indiana Gaming Commission, the Hard Rock Cincinnati became the region’s top casino within its seventh month of operation.

Once again, each casino within the Cincinnati Indianapolis market area faced similar significant declines in gaming revenues to the Chicagoland market region due to the 2008 financial crisis. Particularly, the Grand Victoria Rising Star experienced the most pronounced single-year decline of 17.6%. Moreover, when considering a biennial Y-O-Y comparison, this establishment sustained a 25.0% decrease in gaming revenue figures in 2009 comparative to 2007 revenues.

While both of Grand Victoria Rising Star and Hollywood Casino faced challenges from new market entrants as well as economic conditions, both establishments remain open and continue to serve patrons today.

## ATLANTIC CITY MARKET AREA

In the Atlantic City market region, GMA noted a significant 27.0% decline in gross gaming revenue for Harrah's Atlantic City Casino in their biennial Y-O-Y comparison between 2009 and 2011. This decrease occurred after the sale and renovation of Trump Marina, previously owned by Trump Entertainment Resorts, to Landry's, Inc., which in turn renamed the facility the Golden Nugget Atlantic City. Prior to the renovation of Golden Nugget, Harrah's had experienced several negative single-year and biennial Y-O-Y comparisons.

Despite facing challenges, Harrah's successfully remained below a 20% decrease in gaming revenue threshold during the 2008 financial crisis. However, the opening of the Golden Nugget further exacerbated Harrah's situation, resulting in negative Y-O-Y growth each year from 2011 to 2016, peaking at a 31.0% drop from 2013 to 2015. Ultimately, Harrah's underwent a renovation in 2016, and by 2019, began reporting gaming figures comparable to its pre-2011 numbers.

Although Harrah's may not have been impacted to the degree of other properties during the 2008 recession, the region as a whole was not immune to market fluctuations. Caesar's Atlantic City saw declining biennial Y-O-Y gaming revenues of 21.1% from 2007 to 2009 and 24.8% from 2008 to 2010. While the recession hit the property extremely hard, Caesar's was able to remain open after withstanding such a loss.

## GREATER CONNECTICUT MARKET AREA

Over the past decade, both Foxwoods Resort Casino and Mohegan Sun have experienced an almost continuous decrease in gaming revenues due to constant market expansion across the market area, including gaming expansion in New York, Massachusetts, and Rhode Island.

Even with Foxwoods undergoing renovation and opening its second hotel tower in 2008 and the addition of the Tanger Outlet Mall, a luxury retail complex, in 2015, the establishment continued to experience negative year-over-year comparisons from 2006-2017. Likewise, Mohegan Sun introduced their 400-room, 242,000 square-foot hotel tower in 2016, and it was only in that same year that they reversed their trend of declining revenue, reporting a 3.0% increase in gaming revenue from the year prior. During this time, Mohegan sun saw slot revenue fall from $917.6 million in 2006 to $597.4 million in 2016, representing a 34.9% decrease over this time period.

Like Mohegan Sun, Foxwoods Resort reported slot revenues of $816.8 million in 2006 and saw its revenue drop to $456.2 million by the end of 2016, representing a staggering 44.2% decrease over this timespan. This negative trend continued into 2019 for both casinos, with Foxwood reporting $432.3 million and Mohegan Sun reporting $549.9 million in slot revenue that year, a 47.1% and 40.1% decline, respectively. Although revenues never returned to pre-recession levels, both Foxwoods and Mohegan Sun successfully repositioned themselves to remain open.

## RIVER ROCK EXPANSION IMPACT ANALYSIS

In the initial scope of work, GMA estimated the expected impact a new Koi Nation casino, located northeast of Sata Rosa, California, would have on gross gaming revenues at competing casinos within the market in calendar year 2033. This analysis was predicated on gaming revenue projections prepared for the Project by another consultant of the Nation. River Rock, a tribal casino owned by the Dry Creek Rancheria Band of Pomo Indians, is in relatively close proximity to the proposed site of the Koi Nation casino compared to other casinos in the region, and thus was projected to experience a local market gaming revenue impact of -24.2%.

As the market continues to develop, River Rock Casino recently received approval from Sonoma County to expand its gaming offering to 1,500 slot machines, which would come in tandem with an allowance for a host of upgrades and renovations aimed to increase the quality of casino and non-gaming product offering.

To demonstrate the impact that these proposed improvements would have within the previously completed model, GMA prepared an additional impact scenario assuming that River Rock expands with these amenities. As a result of this analysis, it is anticipated if River Rock were to expand before the Koi project opens, it would experience a -17.6% impact to local market gaming revenue.

# Appendix B-4

# EJScreen Community Report and Climate and Economic Justice Screen Tool Results

# EJScreen Community Report

This report provides environmental and socioeconomic information for user-defined areas, and combines that data into environmental justice and supplemental indexes.

## Larkfield-Wikiup, CA

1 mile Ring Centered at 38.524054,-122.770425
Population: 4,095
Area in square miles: 3.14

A3 Landscape

March 12, 2024

Search Result (point)

1:4,514

Esri Community Maps Contributors, Sonoma County, California State Parks, © OpenStreetMap, Microsoft, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, US Census Bureau, USDA, USFWS

### COMMUNITY INFORMATION

Low income: 18 percent

People of color: 51 percent

Less than high school education: 16 percent

Limited English households: 5 percent

Unemployment: 4 percent

Persons with disabilities: 11 percent

Male: 51 percent

Female: 49 percent

79 years
Average life expectancy

$52,071
Per capita income

Number of households: 1,569

Owner occupied: 64 percent

### LANGUAGES SPOKEN AT HOME

| LANGUAGE | PERCENT |
|---|---|
| English | 71% |
| Spanish | 26% |
| Other Indo-European | 1% |
| Other Asian and Pacific Island | 1% |
| Total Non-English | 29% |

### BREAKDOWN BY RACE

White: 49%

Black: 0%

American Indian: 0%

Asian: 2%

Hawaiian/Pacific Islander: 2%

Other race: 0%

Two or more races: 2%

Hispanic: 44%

### BREAKDOWN BY AGE

| | |
|---|---|
| From Ages 1 to 4 | 5% |
| From Ages 1 to 18 | 23% |
| From Ages 18 and up | 77% |
| From Ages 65 and up | 22% |

### LIMITED ENGLISH SPEAKING BREAKDOWN

| | |
|---|---|
| Speak Spanish | 100% |
| Speak Other Indo-European Languages | 0% |
| Speak Asian-Pacific Island Languages | 0% |
| Speak Other Languages | 0% |

Notes: Numbers may not sum to totals due to rounding. Hispanic population can be of any race. Source: U.S. Census Bureau, American Community Survey (ACS) 2017 -2021. Life expectancy data comes from the Centers for Disease Control.

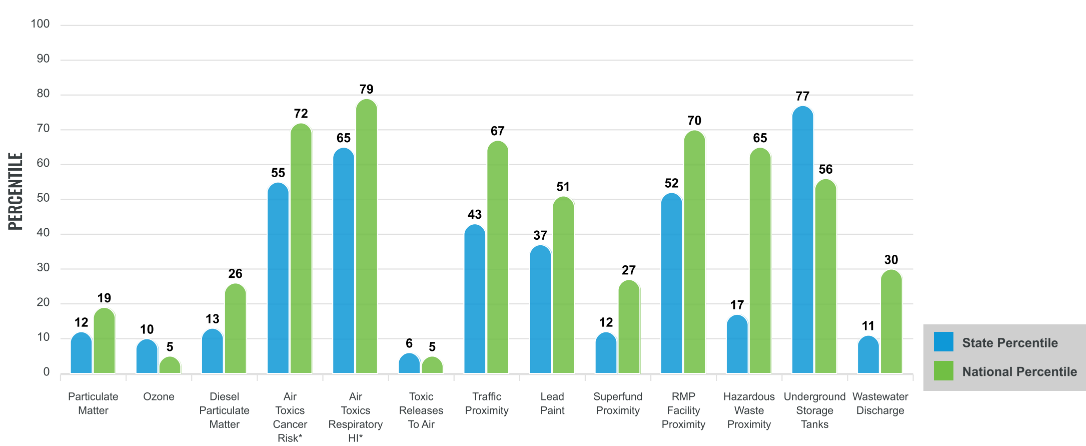
# Environmental Justice & Supplemental Indexes

The environmental justice and supplemental indexes are a combination of environmental and socioeconomic information. There are thirteen EJ indexes and supplemental indexes in EJScreen reflecting the 13 environmental indicators. The indexes for a selected area are compared to those for all other locations in the state or nation. For more information and calculation details on the EJ and supplemental indexes, please visit the EJScreen website.

## EJ INDEXES

The EJ indexes help users screen for potential EJ concerns. To do this, the EJ index combines data on low income and people of color populations with a single environmental indicator.

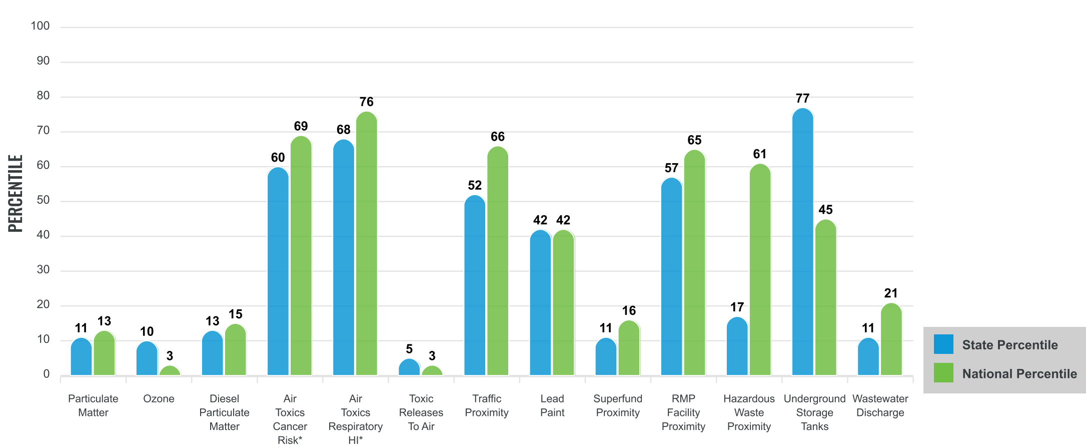
### EJ INDEXES FOR THE SELECTED LOCATION




## SUPPLEMENTAL INDEXES

The supplemental indexes offer a different perspective on community-level vulnerability. They combine data on percent low-income, percent linguistically isolated, percent less than high school education, percent unemployed, and low life expectancy with a single environmental indicator.

### SUPPLEMENTAL INDEXES FOR THE SELECTED LOCATION




These percentiles provide perspective on how the selected block group or buffer area compares to the entire state or nation.

Report for 1 mile Ring Centered at 38.524054,-122.770425

# EJScreen Environmental and Socioeconomic Indicators Data

| SELECTED VARIABLES | VALUE | STATE AVERAGE | PERCENTILE IN STATE | USA AVERAGE | PERCENTILE IN USA |
|---|---|---|---|---|---|
| **POLLUTION AND SOURCES** | | | | | |
| Particulate Matter ($\mu g/m^3$) | 6.24 | 8.65 | 9 | 8.08 | 10 |
| Ozone (ppb) | 50.8 | 65.9 | 8 | 61.6 | 2 |
| Diesel Particulate Matter ($\mu g/m^3$) | 0.0911 | 0.26 | 10 | 0.261 | 13 |
| Air Toxics Cancer Risk* (lifetime risk per million) | 30 | 27 | 42 | 25 | 52 |
| Air Toxics Respiratory HI* | 0.4 | 0.34 | 58 | 0.31 | 70 |
| Toxic Releases to Air | 0.13 | 780 | 5 | 4,600 | 3 |
| Traffic Proximity (daily traffic count/distance to road) | 270 | 510 | 60 | 210 | 81 |
| Lead Paint (% Pre-1960 Housing) | 0.12 | 0.31 | 38 | 0.3 | 38 |
| Superfund Proximity (site count/km distance) | 0.018 | 0.17 | 9 | 0.13 | 15 |
| RMP Facility Proximity (facility count/km distance) | 0.35 | 0.57 | 63 | 0.43 | 70 |
| Hazardous Waste Proximity (facility count/km distance) | 0.99 | 5.9 | 14 | 1.9 | 61 |
| Underground Storage Tanks (count/$km^2$) | 1.1 | 1.5 | 76 | 3.9 | 49 |
| Wastewater Discharge (toxicity-weighted concentration/m distance) | 1.2E-05 | 4 | 10 | 22 | 18 |
| **SOCIOECONOMIC INDICATORS** | | | | | |
| Demographic Index | 34% | 45% | 35 | 35% | 57 |
| Supplemental Demographic Index | 12% | 15% | 42 | 14% | 44 |
| People of Color | 51% | 61% | 38 | 39% | 67 |
| Low Income | 18% | 28% | 38 | 31% | 33 |
| Unemployment Rate | 4% | 7% | 37 | 6% | 47 |
| Limited English Speaking Households | 5% | 9% | 49 | 5% | 74 |
| Less Than High School Education | 16% | 16% | 62 | 12% | 74 |
| Under Age 5 | 5% | 6% | 52 | 6% | 54 |
| Over Age 64 | 22% | 16% | 79 | 17% | 74 |
| Low Life Expectancy | 19% | 18% | 62 | 20% | 42 |

*Diesel particulate matter, air toxics cancer risk, and air toxics respiratory hazard index are from the EPA's Air Toxics Data Update, which is the Agency's ongoing, comprehensive evaluation of air toxics in the United States. This effort aims to prioritize air toxics, emission sources, and locations of interest for further study. It is important to remember that the air toxics data presented here provide broad estimates of health risks over geographic areas of the country, not definitive risks to specific individuals or locations. Cancer risks and hazard indices from the Air Toxics Data Update are reported to one significant figure and any additional significant figures here are due to rounding. More information on the Air Toxics Data Update can be found at: https://www.epa.gov/haps/air-toxics-data-update.

**Sites reporting to EPA within defined area:**

| | |
|---|---|
| Superfund | 0 |
| Hazardous Waste, Treatment, Storage, and Disposal Facilities | 0 |
| Water Dischargers | 0 |
| Air Pollution | 0 |
| Brownfields | 0 |
| Toxic Release Inventory | 0 |

**Other community features within defined area:**

| | |
|---|---|
| Schools | 1 |
| Hospitals | 0 |
| Places of Worship | 1 |

**Other environmental data:**

| | |
|---|---|
| Air Non-attainment | Yes |
| Impaired Waters | Yes |

| | |
|---|---|
| Selected location contains American Indian Reservation Lands* | No |
| Selected location contains a "Justice40 (CEJST)" disadvantaged community | No |
| Selected location contains an EPA IRA disadvantaged community | No |

*Report for 1 mile Ring Centered at 38.524054,-122.770425*

# EJScreen Environmental and Socioeconomic Indicators Data

| HEALTH INDICATORS | | | | | |
|---|---|---|---|---|---|
| INDICATOR | VALUE | STATE AVERAGE | STATE PERCENTILE | US AVERAGE | US PERCENTILE |
| Low Life Expectancy | 19% | 18% | 62 | 20% | 42 |
| Heart Disease | 6.3 | 5.2 | 80 | 6.1 | 54 |
| Asthma | 10.1 | 9.5 | 65 | 10 | 55 |
| Cancer | 7.1 | 5.3 | 84 | 6.1 | 72 |
| Persons with Disabilities | 11.5% | 10.9% | 62 | 13.4% | 42 |

| CLIMATE INDICATORS | | | | | |
|---|---|---|---|---|---|
| INDICATOR | VALUE | STATE AVERAGE | STATE PERCENTILE | US AVERAGE | US PERCENTILE |
| Flood Risk | 19% | 13% | 79 | 12% | 84 |
| Wildfire Risk | 0% | 30% | 0 | 14% | 0 |

| CRITICAL SERVICE GAPS | | | | | |
|---|---|---|---|---|---|
| INDICATOR | VALUE | STATE AVERAGE | STATE PERCENTILE | US AVERAGE | US PERCENTILE |
| Broadband Internet | 9% | 10% | 57 | 14% | 43 |
| Lack of Health Insurance | 3% | 7% | 28 | 9% | 23 |
| Housing Burden | No | N/A | N/A | N/A | N/A |
| Transportation Access | No | N/A | N/A | N/A | N/A |
| Food Desert | No | N/A | N/A | N/A | N/A |

*Report for 1 mile Ring Centered at 38.524054,-122.770425*

**www.epa.gov/ejscreen**

# Climate and Economic Justice Screen Tool Results

| | |
|---|---|
| Census tract 2010 ID | 06097152701 |
| County Name | Sonoma County |
| State/Territory | California |
| Percent Black or African American alone | 0 |
| Percent American Indian / Alaska Native | 0 |
| Percent Asian | 0.03 |
| Percent Native Hawaiian or Pacific | 0 |
| Percent two or more races | 0.06 |
| Percent White | 0.66 |
| Percent Hispanic or Latino | 0.25 |
| Percent other races | 0.06 |
| Percent age under 10 | 0.06 |
| Percent age 10 to 64 | 0.69 |
| Percent age over 64 | 0.23 |
| Total threshold criteria exceeded | 0 |
| Total categories exceeded | 0 |
| Identified as disadvantaged without considering neighbors | FALSE |
| Identified as disadvantaged based on neighbors and relaxed low income threshold only | FALSE |
| Identified as disadvantaged due to tribal overlap | |
| Identified as disadvantaged | FALSE |
| Percentage of tract that is disadvantaged by area | 0 |
| Share of neighbors that are identified as disadvantaged | 0 |
| Total population | 4804 |
| Adjusted percent of individuals below 200% Federal Poverty Line (percentile) | 0.36 |
| Adjusted percent of individuals below 200% Federal Poverty Line | 0.15 |
| Is low income? | FALSE |
| Income data has been estimated based on geographic neighbor income | FALSE |
| Greater than or equal to the 90th percentile for expected agriculture loss rate and is low income? | FALSE |

| | |
|---|---|
| **Expected agricultural loss rate (Natural Hazards Risk Index) (percentile)** | 99 |
| **Expected agricultural loss rate (Natural Hazards Risk Index)** | 9.7198 |
| **Greater than or equal to the 90th percentile for expected building loss rate and is low income?** | FALSE |
| **Expected building loss rate (Natural Hazards Risk Index) (percentile)** | 84 |
| **Expected building loss rate (Natural Hazards Risk Index)** | 0.0576 |
| **Greater than or equal to the 90th percentile for expected population loss rate and is low income?** | FALSE |
| **Expected population loss rate (Natural Hazards Risk Index) (percentile)** | 9 |
| **Expected population loss rate (Natural Hazards Risk Index)** | 0 |
| **Share of properties at risk of flood in 30 years (percentile)** | 46 |
| **Share of properties at risk of flood in 30 years** | 7 |
| **Greater than or equal to the 90th percentile for share of properties at risk of flood in 30 years** | FALSE |
| **Greater than or equal to the 90th percentile for share of properties at risk of flood in 30 years and is low income?** | FALSE |
| **Share of properties at risk of fire in 30 years (percentile)** | 75 |
| **Share of properties at risk of fire in 30 years** | 15 |
| **Greater than or equal to the 90th percentile for share of properties at risk of fire in 30 years** | FALSE |
| **Greater than or equal to the 90th percentile for share of properties at risk of fire in 30 years and is low income?** | FALSE |
| **Greater than or equal to the 90th percentile for energy burden and is low income?** | FALSE |
| **Energy burden (percentile)** | 24 |

| | |
|---|---|
| **Energy burden** | 2 |
| **Greater than or equal to the 90th percentile for PM2.5 exposure and is low income?** | FALSE |
| **PM2.5 in the air (percentile)** | 67 |
| **PM2.5 in the air** | 9.17 |
| **Greater than or equal to the 90th percentile for diesel particulate matter and is low income?** | FALSE |
| **Diesel particulate matter exposure (percentile)** | 10 |
| **Diesel particulate matter exposure** | 0.08 |
| **Greater than or equal to the 90th percentile for traffic proximity and is low income?** | FALSE |
| **Traffic proximity and volume (percentile)** | 54 |
| **Traffic proximity and volume** | 349.29 |
| **Greater than or equal to the 90th percentile for DOT transit barriers and is low income?** | FALSE |
| **DOT Travel Barriers Score (percentile)** | 13 |
| **Greater than or equal to the 90th percentile for housing burden and is low income?** | FALSE |
| **Housing burden (percent) (percentile)** | 66 |
| **Housing burden (percent)** | 28 |
| **Greater than or equal to the 90th percentile for lead paint, the median house value is less than 90th percentile and is low income?** | FALSE |
| **Percent pre-1960s housing (lead paint indicator) (percentile)** | 27 |
| **Percent pre-1960s housing (lead paint indicator)** | 8 |
| **Median value ($) of owner-occupied housing units (percentile)** | 91 |
| **Median value ($) of owner-occupied housing units** | 584000 |
| **Greater than or equal to the 90th percentile for share of the tract's land area that is covered by impervious surface or cropland as a percent and is low income?** | FALSE |

| | |
|---|---|
| **Greater than or equal to the 90th percentile for share of the tract's land area that is covered by impervious surface or cropland as a percent** | FALSE |
| **Share of the tract's land area that is covered by impervious surface or cropland as a percent** | 1216 |
| **Share of the tract's land area that is covered by impervious surface or cropland as a percent (percentile)** | 15 |
| **Does the tract have at least 35 acres in it?** | TRUE |
| **Tract experienced historic underinvestment and remains low income** | FALSE |
| **Tract experienced historic underinvestment** | |
| **Share of homes with no kitchen or indoor plumbing (percentile)** | 0.75 |
| **Share of homes with no kitchen or indoor plumbing (percent)** | 0.01 |
| **Greater than or equal to the 90th percentile for proximity to hazardous waste facilities and is low income?** | FALSE |
| **Proximity to hazardous waste sites (percentile)** | 49 |
| **Proximity to hazardous waste sites** | 0.74 |
| **Greater than or equal to the 90th percentile for proximity to superfund sites and is low income?** | FALSE |
| **Proximity to NPL (Superfund) sites (percentile)** | 25 |
| **Proximity to NPL (Superfund) sites** | 0.02 |
| **Greater than or equal to the 90th percentile for proximity to RMP sites and is low income?** | FALSE |
| **Proximity to Risk Management Plan (RMP) facilities (percentile)** | 47 |
| **Proximity to Risk Management Plan (RMP) facilities** | 0.32 |
| **Is there at least one Formerly Used Defense Site (FUDS) in the tract?** | |
| **Is there at least one abandoned mine in this census tract?** | |

| | |
|---|---|
| **There is at least one abandoned mine in this census tract and the tract is low income.** | FALSE |
| **There is at least one Formerly Used Defense Site (FUDS) in the tract and the tract is low income.** | FALSE |
| **Is there at least one Formerly Used Defense Site (FUDS) in the tract, where missing data is treated as False?** | FALSE |
| **Is there at least one abandoned mine in this census tract, where missing data is treated as False?** | FALSE |
| **Greater than or equal to the 90th percentile for wastewater discharge and is low income?** | FALSE |
| **Wastewater discharge (percentile)** | |
| **Wastewater discharge** | |
| **Greater than or equal to the 90th percentile for leaky underground storage tanks and is low income?** | FALSE |
| **Leaky underground storage tanks (percentile)** | 60 |
| **Leaky underground storage tanks** | 2.7 |
| **Greater than or equal to the 90th percentile for asthma and is low income?** | FALSE |
| **Current asthma among adults aged greater than or equal to 18 years (percentile)** | 52 |
| **Current asthma among adults aged greater than or equal to 18 years** | 969 |
| **Greater than or equal to the 90th percentile for diabetes and is low income?** | FALSE |
| **Diagnosed diabetes among adults aged greater than or equal to 18 years (percentile)** | 31 |
| **Diagnosed diabetes among adults aged greater than or equal to 18 years** | 900 |
| **Greater than or equal to the 90th percentile for heart disease and is low income?** | FALSE |
| **Coronary heart disease among adults aged greater than or equal to 18 years (percentile)** | 49 |

| | |
|---|---|
| **Coronary heart disease among adults aged greater than or equal to 18 years** | 590 |
| **Greater than or equal to the 90th percentile for low life expectancy and is low income?** | FALSE |
| **Low life expectancy (percentile)** | 49 |
| **Life expectancy (years)** | 78.59 |
| **Greater than or equal to the 90th percentile for low median household income as a percent of area median income and has low HS attainment?** | FALSE |
| **Low median household income as a percent of area median income (percentile)** | 49 |
| **Median household income as a percent of area median income** | 94 |
| **Greater than or equal to the 90th percentile for households in linguistic isolation and has low HS attainment?** | FALSE |
| **Linguistic isolation (percent) (percentile)** | 59 |
| **Linguistic isolation (percent)** | 2 |
| **Greater than or equal to the 90th percentile for unemployment and has low HS attainment?** | FALSE |
| **Unemployment (percent) (percentile)** | 22 |
| **Unemployment (percent)** | 2 |
| **Greater than or equal to the 90th percentile for households at or below 100% federal poverty level and has low HS attainment?** | FALSE |
| **Percent of individuals below 200% Federal Poverty Line (percentile)** | 42 |
| **Percent of individuals below 200% Federal Poverty Line** | 26 |
| **Percent of individuals < 100% Federal Poverty Line (percentile)** | 37 |
| **Percent of individuals < 100% Federal Poverty Line** | 8 |
| **Percent individuals age 25 or over with less than high school degree (percentile)** | 52 |

| | |
|---|---|
| **Percent individuals age 25 or over with less than high school degree** | 10 |
| **Percent of residents who are not currently enrolled in higher ed** | 89 |
| **Unemployment (percent) in 2009 (island areas) and 2010 (states and PR)** | 5 |
| **Percentage households below 100% of federal poverty line in 2009 (island areas) and 2010 (states and PR)** | 8 |
| **Greater than or equal to the 90th percentile for unemployment and has low HS education in 2009 (island areas)?** | FALSE |
| **Greater than or equal to the 90th percentile for households at or below 100% federal poverty level and has low HS education in 2009 (island areas)?** | FALSE |
| **Greater than or equal to the 90th percentile for low median household income as a percent of area median income and has low HS education in 2009 (island areas)?** | FALSE |
| **Number of Tribal areas within Census tract for Alaska** | |
| **Names of Tribal areas within Census tract** | |
| **Percent of the Census tract that is within Tribal areas** | |

# Appendix C

# Casino Site Lighting Design

PIVOTAL lighting design
1414 Raleigh Road.
Suite 305
Chapel Hill, NC 27517
919.419.9802

March 15, 2024

Jeff Barnes
Principal
Dale Partners

Re: Koi Shiloh Casino Site Lighting Design Approach

Dear Jeff:

In review of the numerous concerns over the impact of the site and building lighting for the proposed Shiloh Casino, I offer my professional recommendations specific to the Shiloh Casino site in Windsor, CA. Comparisons have been made to other casinos and even large shopping malls, but it is unlikely that these other projects have been cognizant enough of their neighbors to include the services of a lighting designer charged with developing and implementing measures to limit the impact of electric light beyond the premises. While the project cannot claim zero impact to the surrounding community, there are a number of measures that can be incorporated into the design to reduce the impact to the nighttime environment. Acorn Environmental has recommended a number of guidelines for the project, and Pivotal Lighting Design can assist the design team and client with implementation of these strategies for the best outcomes relative to project goals and being a responsible neighbor to the residents of Windsor, CA.

The recommendations from Acorn stress careful selection and placement of luminaires which are shielded and filtered for reduced brightness and impact on the site. The prescriptive requirements include no strobe lights, flood lights, or spotlights. To this end, the project team has eliminated the large digital displays on the exterior of the events center in favor of a semi-open copper rainscreen. These screens will serve as a filter itself for a lighting system devised to backlight and provide a low-intensity dappled glow. This is the first of several mitigating efforts the team has undertaken.

Acorn also references the Model Lighting Ordinance (MLO) a joint publication from the Illumination Engineering Society (IES) and International Dark-Sky Association (IDA) which offers best practices for protecting the nighttime environment by reducing or eliminating light waste into the night sky (light pollution) or beyond the proposed property boundary (light trespass). One major recommendation from the MLO is to utilize a warm correlated color temperatures (3000K or less) for exterior lighting for reduced likelihood of blue wavelengths which stimulate the photoreceptors of humans and some wildlife.

Further, much like energy codes limit the amount of watts available for a lighting installation, the MLO proposes limits on lumens, the unit of light energy, based upon application and the context of the site. Both energy codes and the MLO propose default lighting zones to determine what tier of limitations apply based on five tiers from 0-4. For this project site, the MLO context is LZ1 (lighting zone level 1) for low-density residential areas, though pockets within the site are permitted to be zoned for LZ2 for light commercial and business districts. The attached site graphic denotes the intended pockets in which the LZ2 designation is desired whereas the site overall will be designed for LZ1 to maintain a nighttime condition consistent with the surrounding residential areas. In addition to total allowable lumens, the MLO governs how light can be distributed out of the luminaires with stricter requirements for lower lighting zones in proximity to the project boundaries.

With these guidelines in mind, various strategies and mitigating efforts have been discussed with the architectural team based on the early imagery.

Strategy #1 – Identify an appropriate project boundary. The property line shall be considered the boundary where abutting vineyards and undeveloped areas along the south and east of the site. For property lines separated by public roadways, the centerline of such roadway can be considered as the project boundary, but in deference to the existing condition, the proposed site wall surrounding along Old Redwood and Shiloh Roads will be considered the boundary to create a buffer zone to the residential areas. The only exception will be at the three entrances. The project boundary will be extended to the centerline of the roadway only at those locations. No illumination will be permitted beyond this project boundary, and lighting equipment at these entrances will target aiming downward and backward toward the site so that only even, indirect luminances are visible to neighbors. All signage would be illuminated in this way rather than to be internally illuminated.

Strategy #2 – Keep light oriented downward. Luminaires which emit light upward, above horizontal, allow the potential for that light to propagate quite far and reflect back off of cloud cover contributing to sky-glow. Discussion with the architectural team has identified accent lighting at the entry canopy to the casino which can be re-integrated in a downward orientation to avoid this.

Strategy #3 – Capture any upward light. To aid this strategy, the glazed entry canopy is being revised to a solid material. This will also capture light reflected off the ground hardscape material. The lighting and landscape teams will work to coordinate less reflective materials in uncovered areas. Additionally, the MLO permits for limited lumens above horizontal in LZ1 and LZ2 zones, but effort shall be made to "capture" the light emitted upward with built or natural material.

Strategy #4 – Allow roadways to be dark. The loop road is designated for vehicular traffic, and vehicles have headlamps. The loop road will be allowed to be dark except where there is potential conflict with pedestrians or hazards such as bus parking, sharp curves, and intersections. Poles will be minimized to not more than 16ft in height to reduce area of coverage. Lighting at the front roadways will be concentrated at the points of entry, the roundabout, and intersections. Lighting between these points may be considered where shielded by sufficiently mature landscape.

Strategy #5 – Establish "no fly" zones. A buffer zone around the site will be created in which no lighting equipment will be located. This zone is indicated by the hatch pattern on the attached site graphic starting just inside the project boundary and extending inward toward roadways or structures encompassing the vineyards. These no-fly zones illustrate the intent to allow these spaces to go dark. No permanent lighting will be installed in the paved area indicated for surface parking.

Strategy #6 – Control interior spill light. The planned structures for the site require various openings and various sub-strategies are needed to address them.

- Casino/Events windows – Glazing will be minimized and primarily facing the main entryway; spill light will be utilized for backlighting of rain screens or contributing to illumination below canopies.
- Casino skylights – Shading devices will be used to black out interior light that would otherwise be wasted into the night sky.
- Hotel – Guest room windows facing Shiloh Road and the creek will be minimized, and automated shading and lighting sequences will be employed. A reliable presence detection method such as room-key docking will be used to enable lighting and also lower shades at sunset. The interior room lighting will also be developed with consideration of luminaire placement relative to windows.
- Parking structure lighting – A minimum of openness is required around the structure. Solid walls are planned for the most sensitive exposures with a parapet wall wrapping all other exposures to contain reflected light. Lighting placement and luminaire distribution will be carefully coordinated to contain direct light onto the parking garage footprint. Further, automated controls will reduce light levels when occupants are not detected. The top level poses the greatest challenge to controlling light pollution. Pole lights will be located interior to the parking surfaces so that all emitted light can be useable on the parking surface. Sight lines will be studied to ensure the lighting equipment is not visible from common angles of adjacent properties, and the lighting team will explore material options for the parking surface to reduce reflectance.

Additional strategies have been developed specifically to protect the wildlife within the creek running through the site.

Strategy #7 – Create internal project boundary at the creek. The riparian line will be used to establish an internal project boundary in which no illumination will be permitted. Consequently, a lighting "no-fly" zone is also created on either side of the creek riparian lines extending to the building structures and out to the project site boundary. As the width of the riparian line narrows toward the north of the site, the no-fly zone will be maintained to at least the width set by the building separation.

Strategy #8 – Cordon off utilitarian light. As noted for control of interior light spill, the sides of the parking deck facing the creek will be solid. A wall with a gate will also be constructed around the service yard to shield the creek from work lights which will be automatically controlled-off when not in use.

Strategy #9 – Leverage technology. The compelling natural, daylit views from the bridge over the creek can be maintained by incorporating electrochromic glass which can be automatically shaded when electric pathway lighting is required to contain electric light within the bridge. The glass can be fully transparent when daylight is present.

All of these strategies will be employed, but the success of the aggregate implementation will be evaluated with a full 3-dimensional light spill analysis performed at the conclusion of design development allowing corrective action to be implemented prior to construction documents.

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Best Regards,

Leah Robinson, PE, LC, MIES
Senior Lighting Designer

project boundary
SHILOH ROAD
OLD REDWOOD HIGHWAY
LZ-2
LZ-2
CASINO FLOOR
Internal project boundary at creek riparian line - NO ILLUMINATION
Screen wall created around service drive
Solid parking structure toward creek
LZ-2
Wastewater treatment facility with screenwall
Scale: 1:100

# Appendix D

# Water, Wastewater, and Stormwater Reports

# Appendix D-1

# Water and Wastewater Feasibility Study

Acorn Environmental

# Water and Wastewater Feasibility Study

Prepared by HydroScience Engineers


HydroScience
Strategic Water Solutions

February 2023

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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 |

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# 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

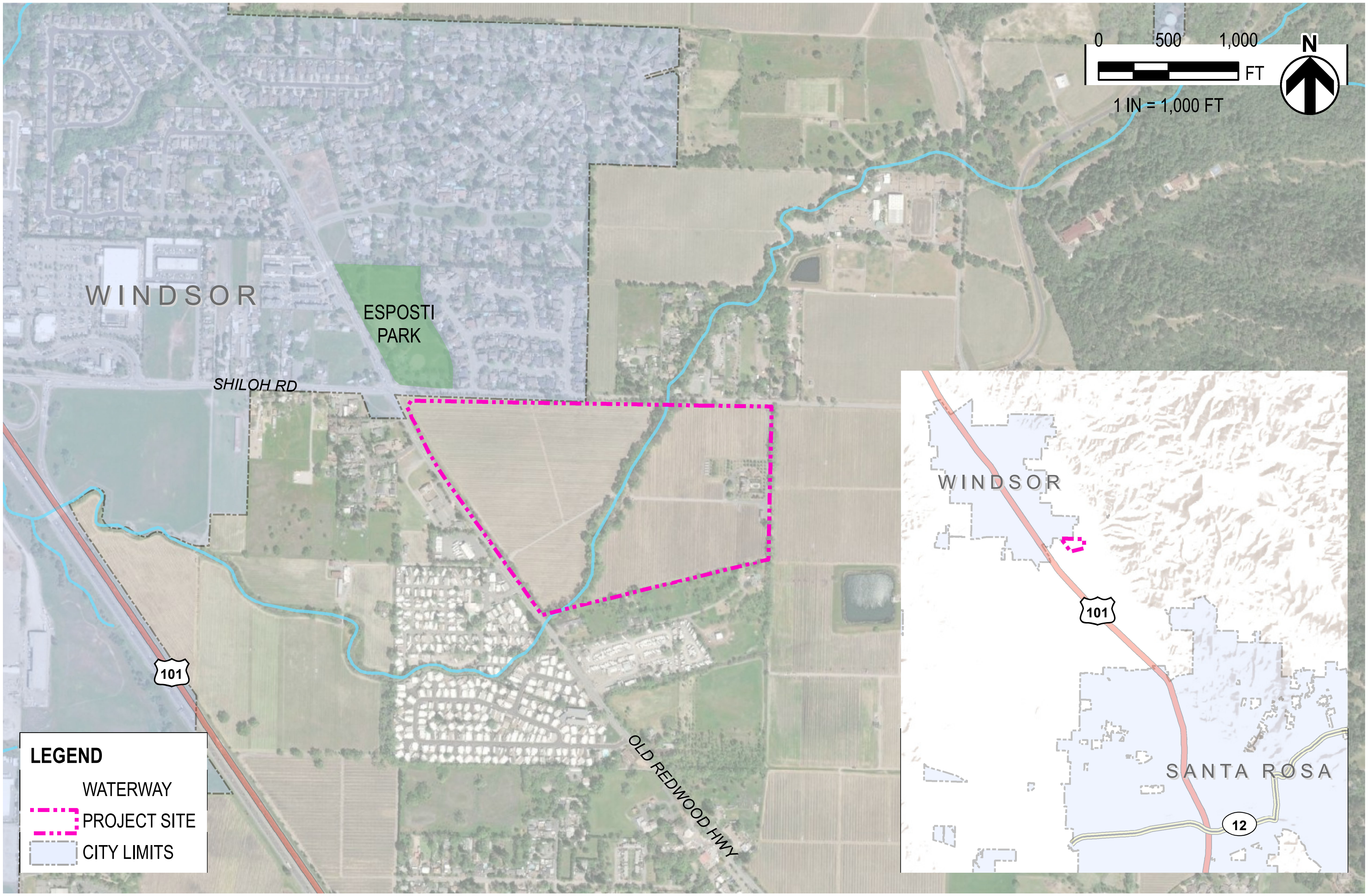



**Figure 1-1**
Acorn Environmental
Shiloh Resort and Casino Project Water and Wastewater Feasibility Study
Vicinity and Project Location Map

HydroScience

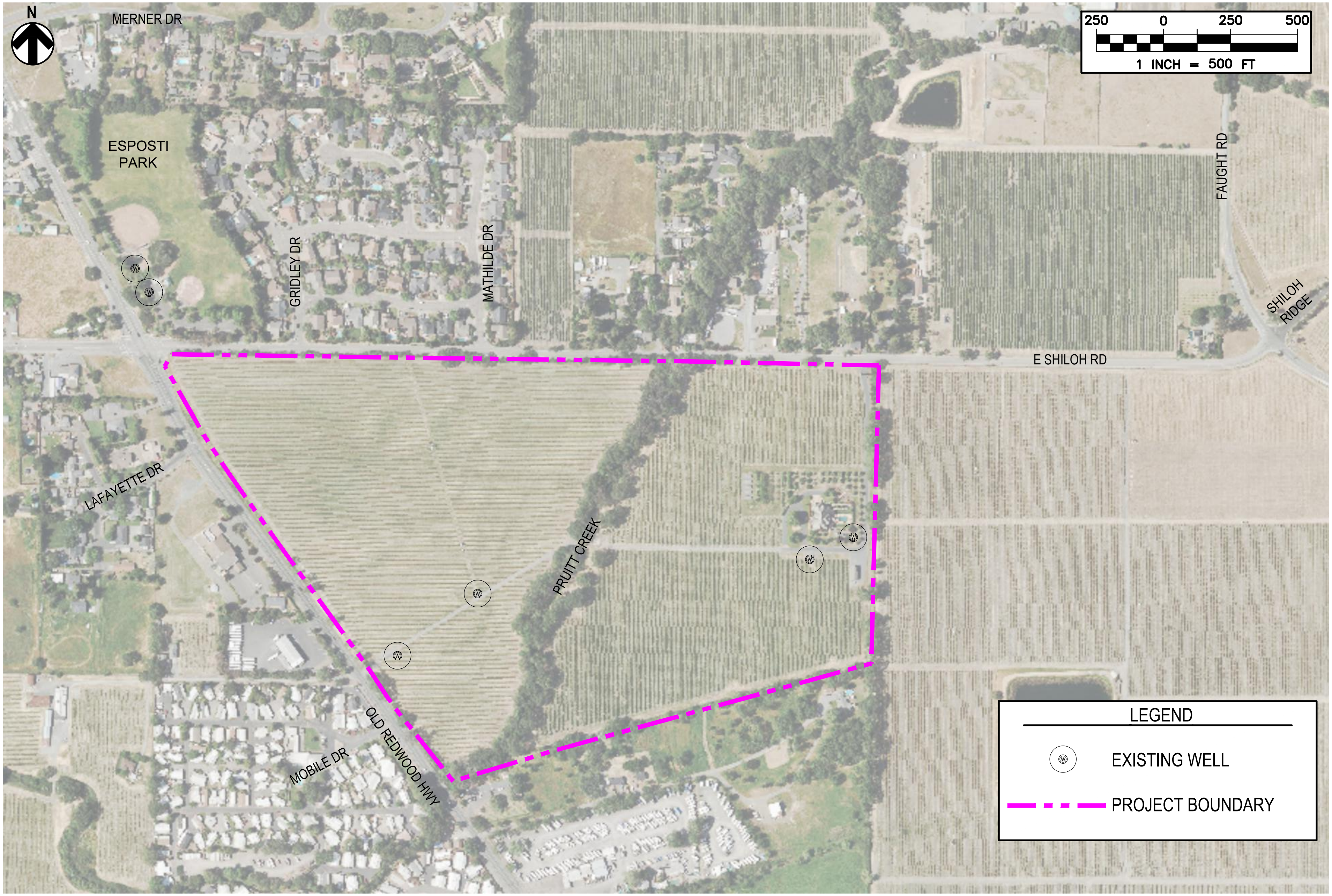



**Figure 1-2**
Acorn Environmental
Shiloh Resort and Casino Project Water and Wastewater Feasibility Study
Aerial Site Plan

HydroScience

# 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.

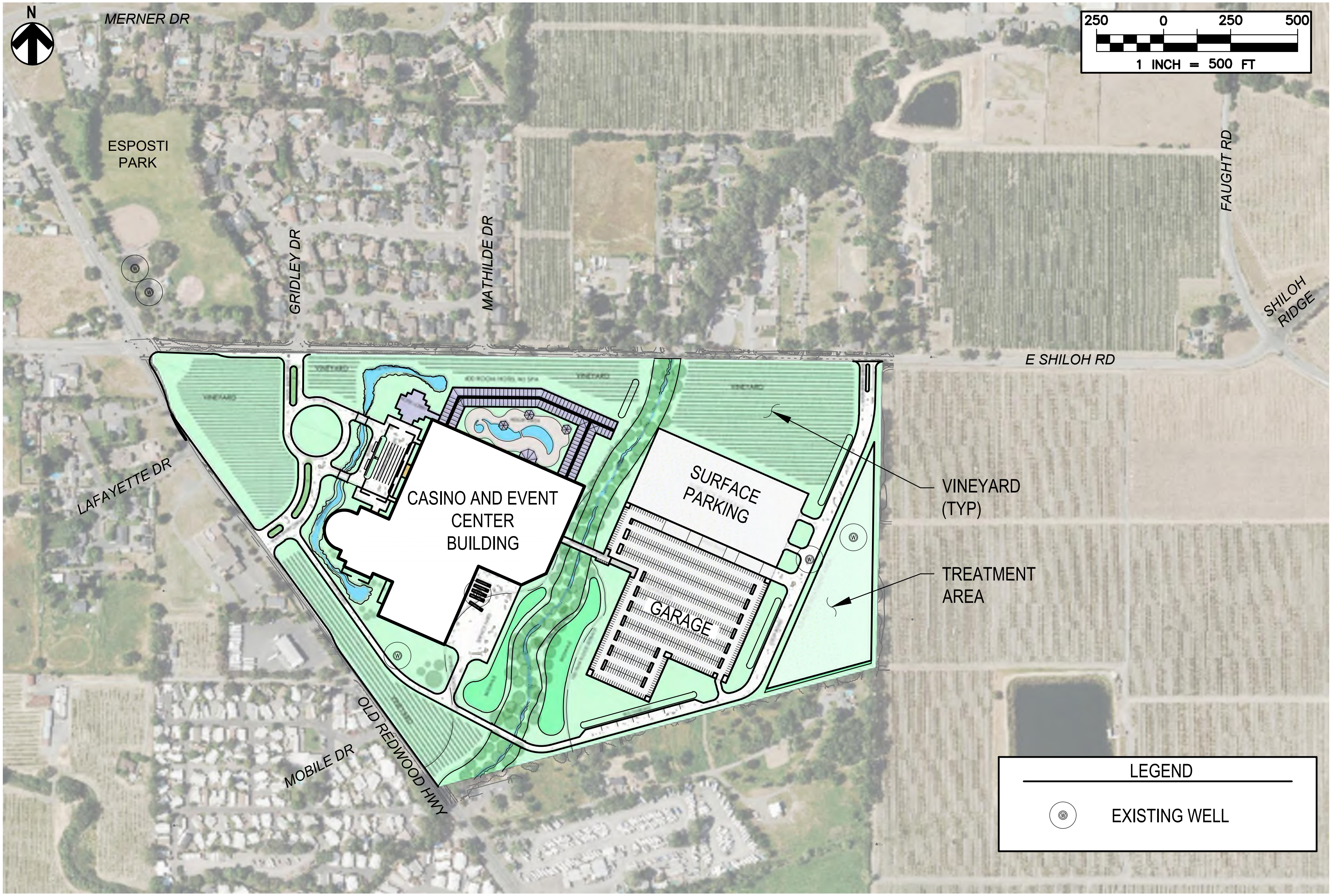
Preliminary projections of the water supply needed to reliably meet water demand for both programs are summarized in **Table 2-3**. These projections are based on estimated average wastewater flows (see **Table 2-5**) and include a 20% allowance for system losses as well as a safety factor to ensure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




HydroScience

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

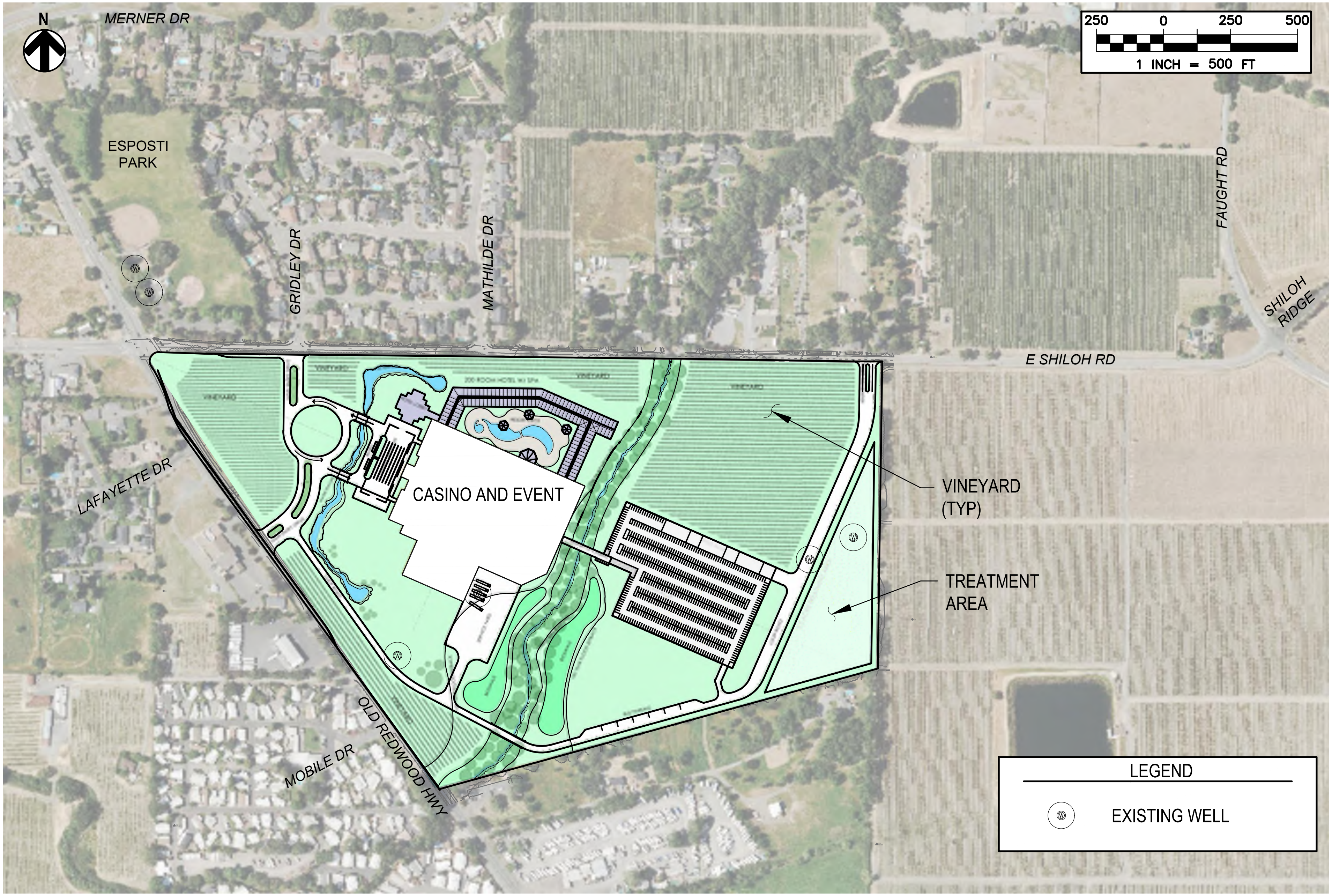



**Figure 2-2**
Acorn Environmental
Shiloh Resort and Casino Project Water and Wastewater Feasibility Study
Proposed Site Plan - Alternative B

HydroScience

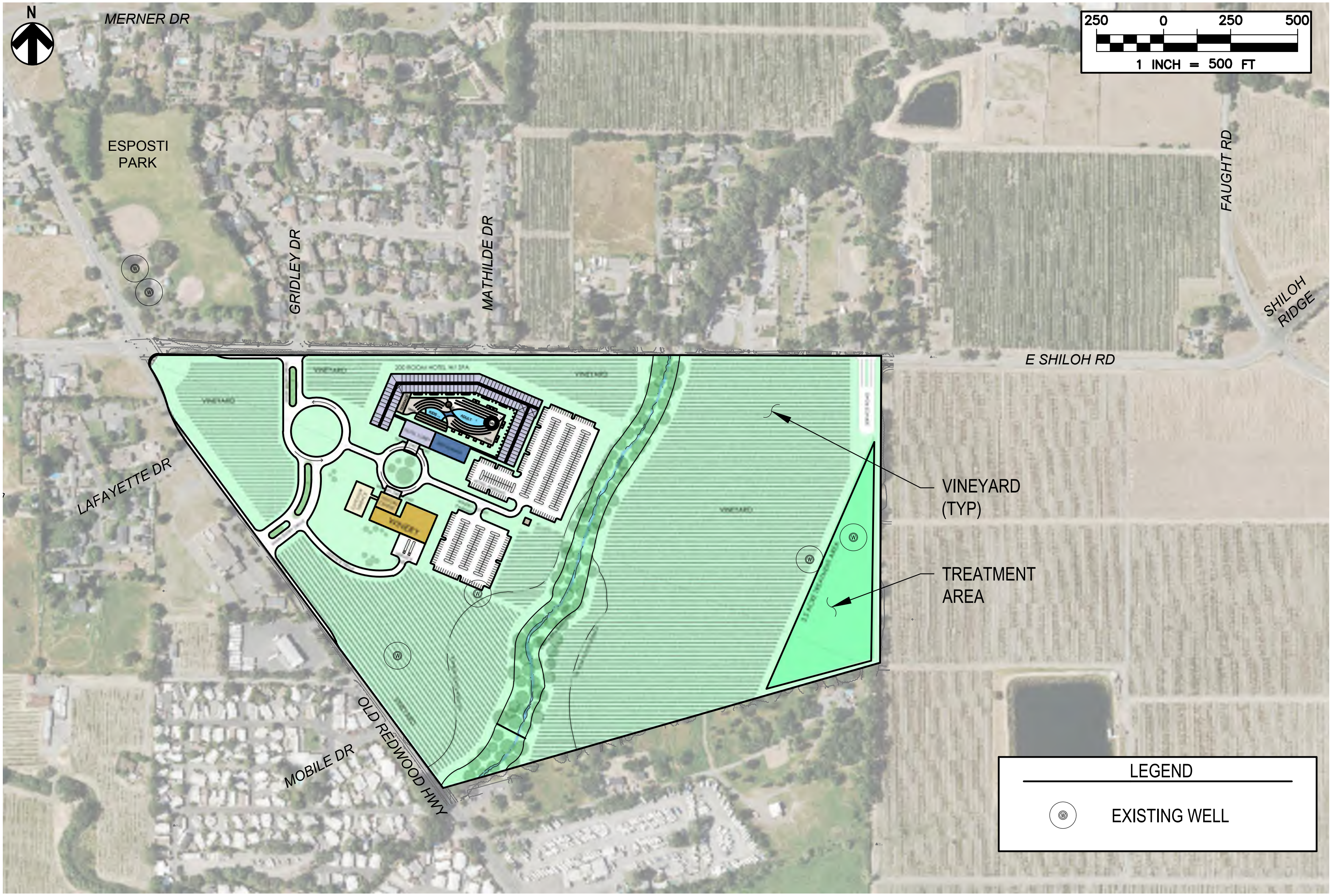



**Figure 2-3**
Acorn Environmental
Shiloh Resort and Casino Project Water and Wastewater Feasibility Study
Proposed Site Plan - Alternative C

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**.

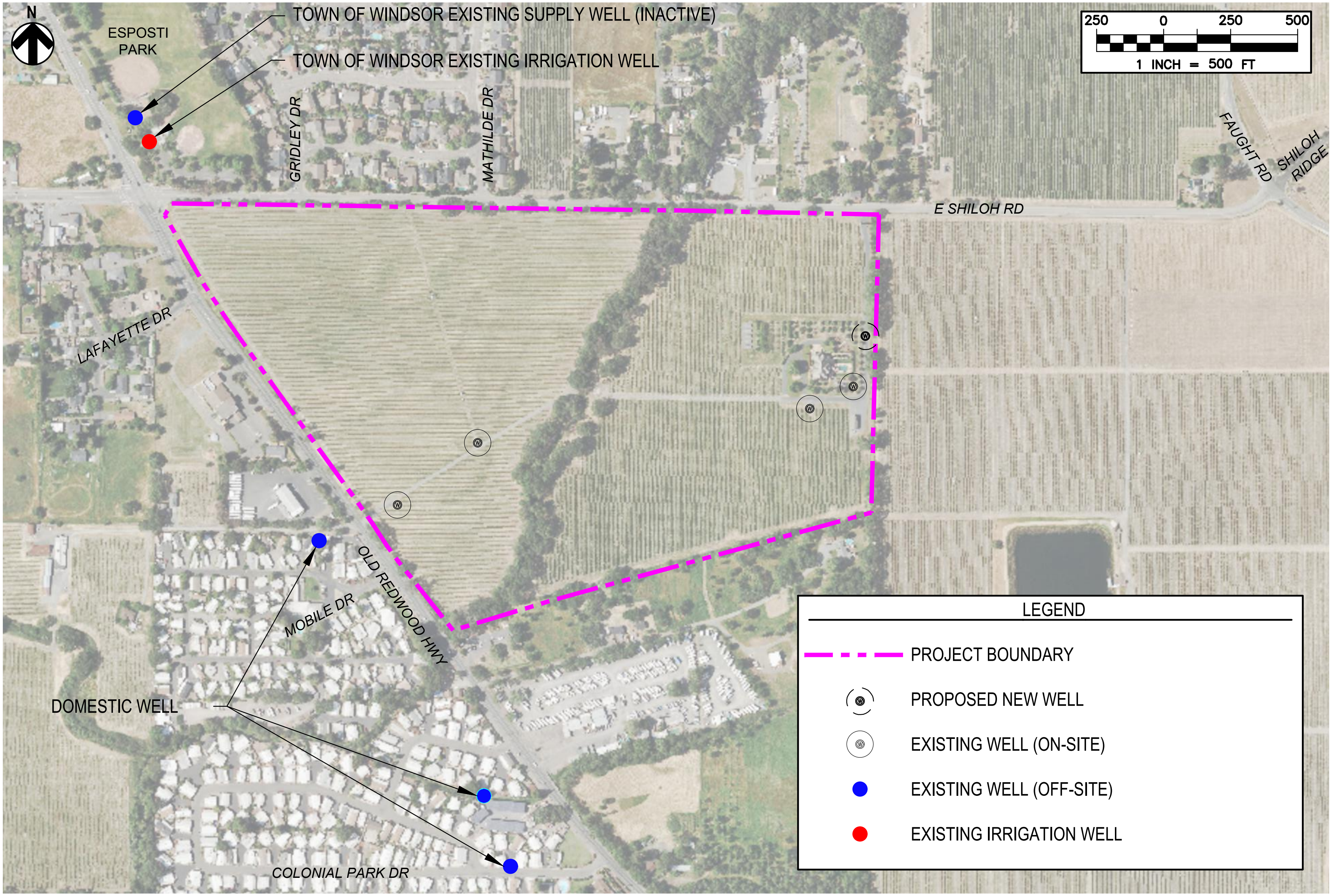



**Figure 2-4**
Acorn Environmental
Shiloh Resort and Casino Project Water and Wastewater Feasibility Study
Local Groundwater Well Site Map

HydroScience

## 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**.

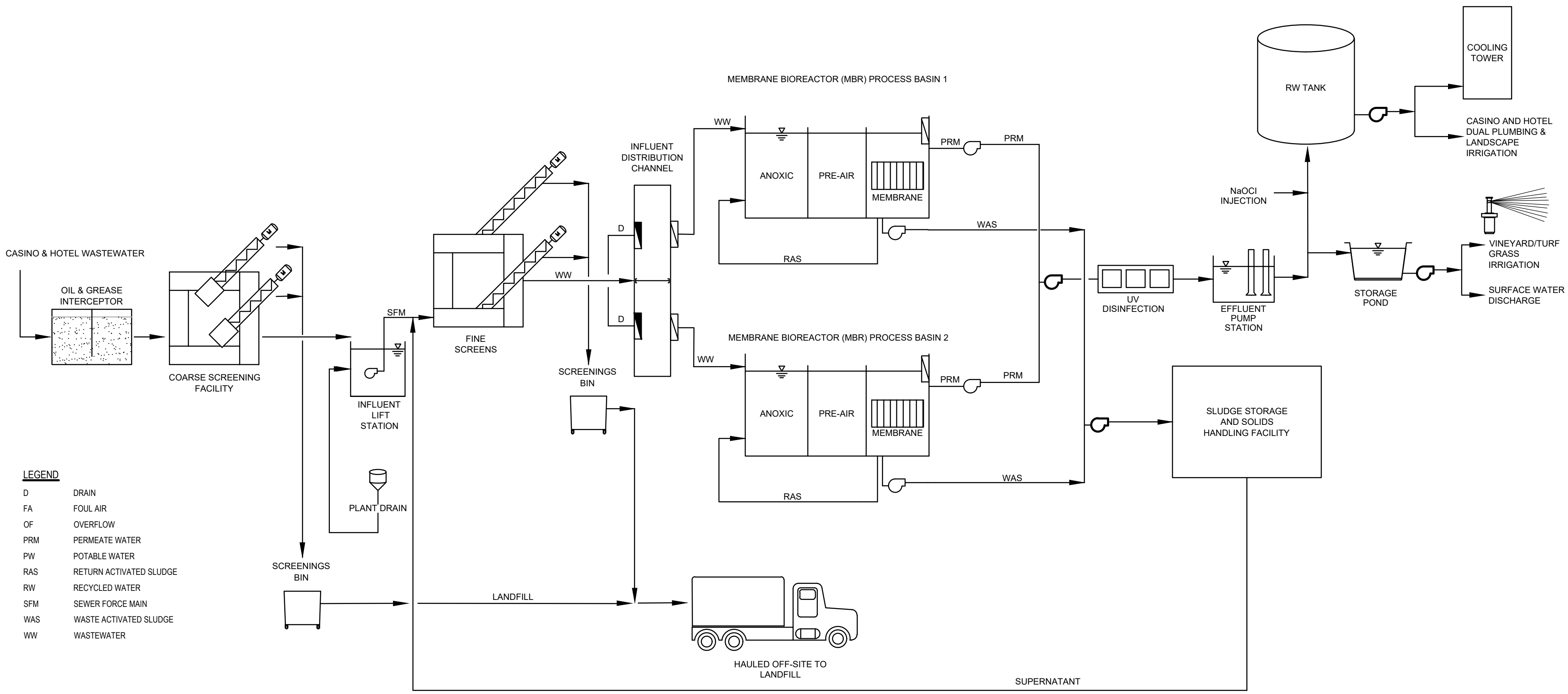



**Figure 2-5**
Acorn Environmental
Shiloh Resort and Casino Project Water and Wastewater Feasibility Study
Wastewater Treatment Process Flow Diagram

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### 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.

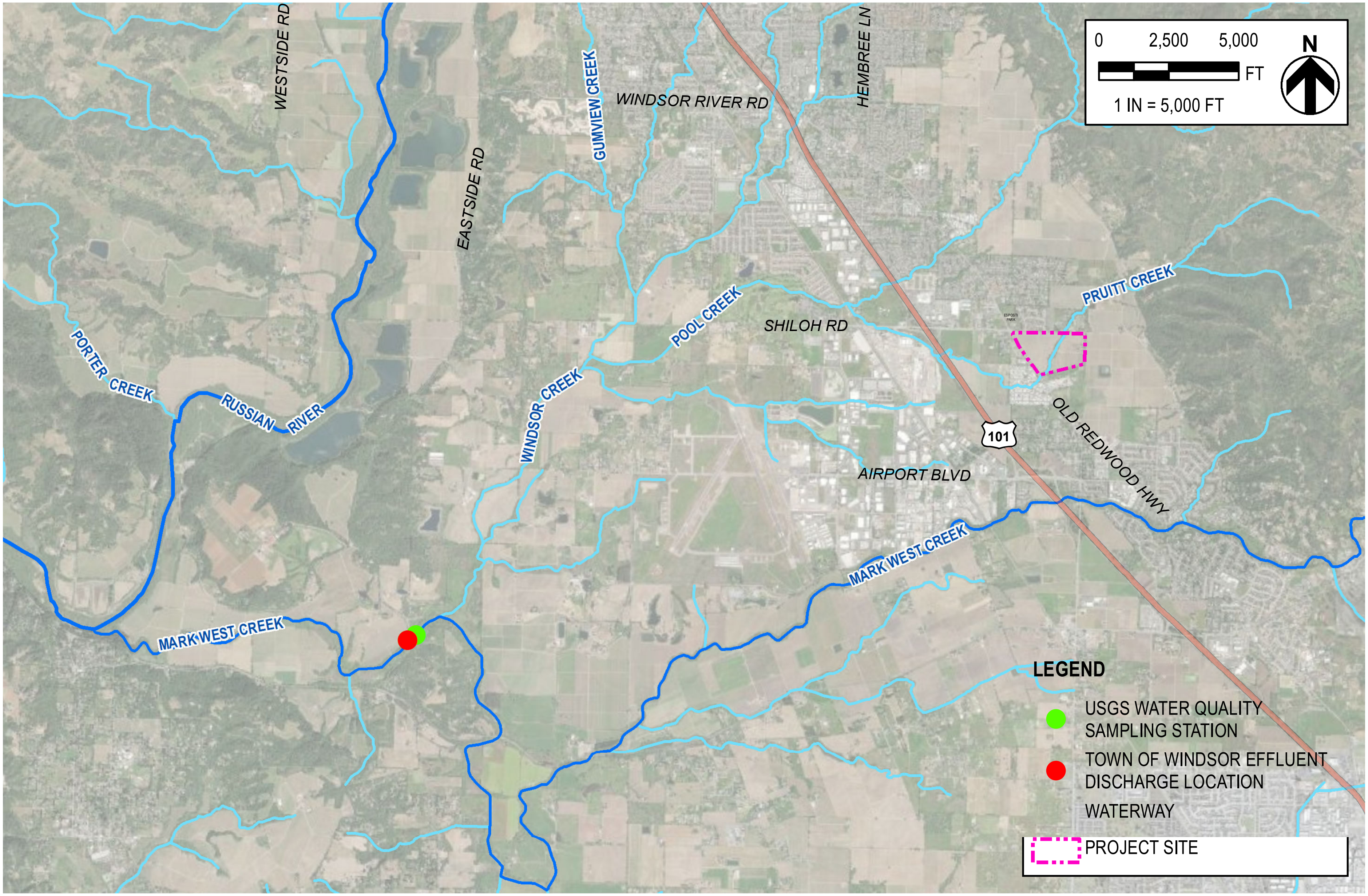


**Figure 2-6**
Acorn Environmental
Shiloh Resort and Casino Project Water and Wastewater Feasibility Study
USGS Gauging Station Location

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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.<br><br>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.<br><br>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.<br><br>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.

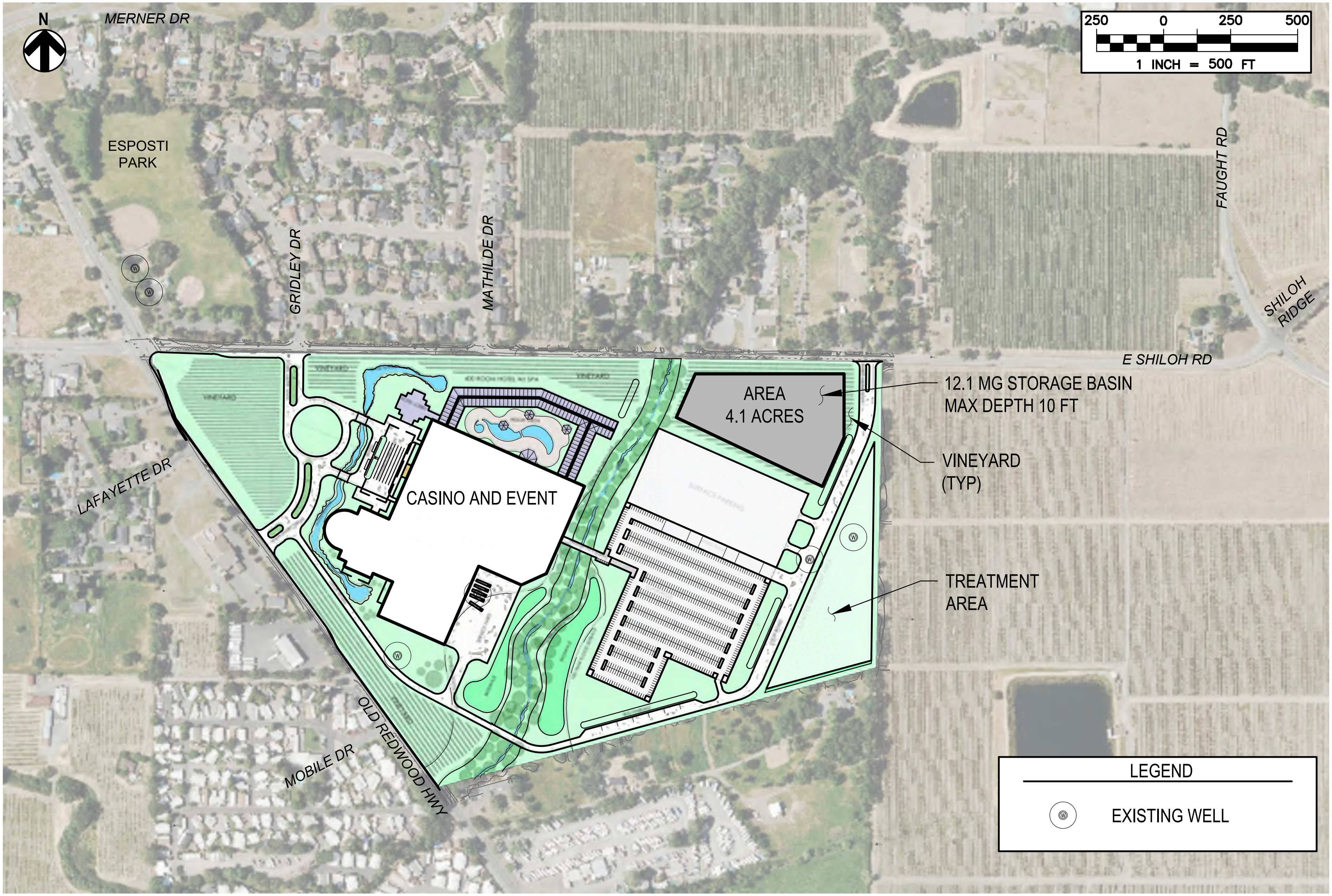


**Figure 2-7**
Acorn Environmental
Shiloh Resort and Casino Project Water and Wastewater Feasibility Study
Option 1 - Alternative A

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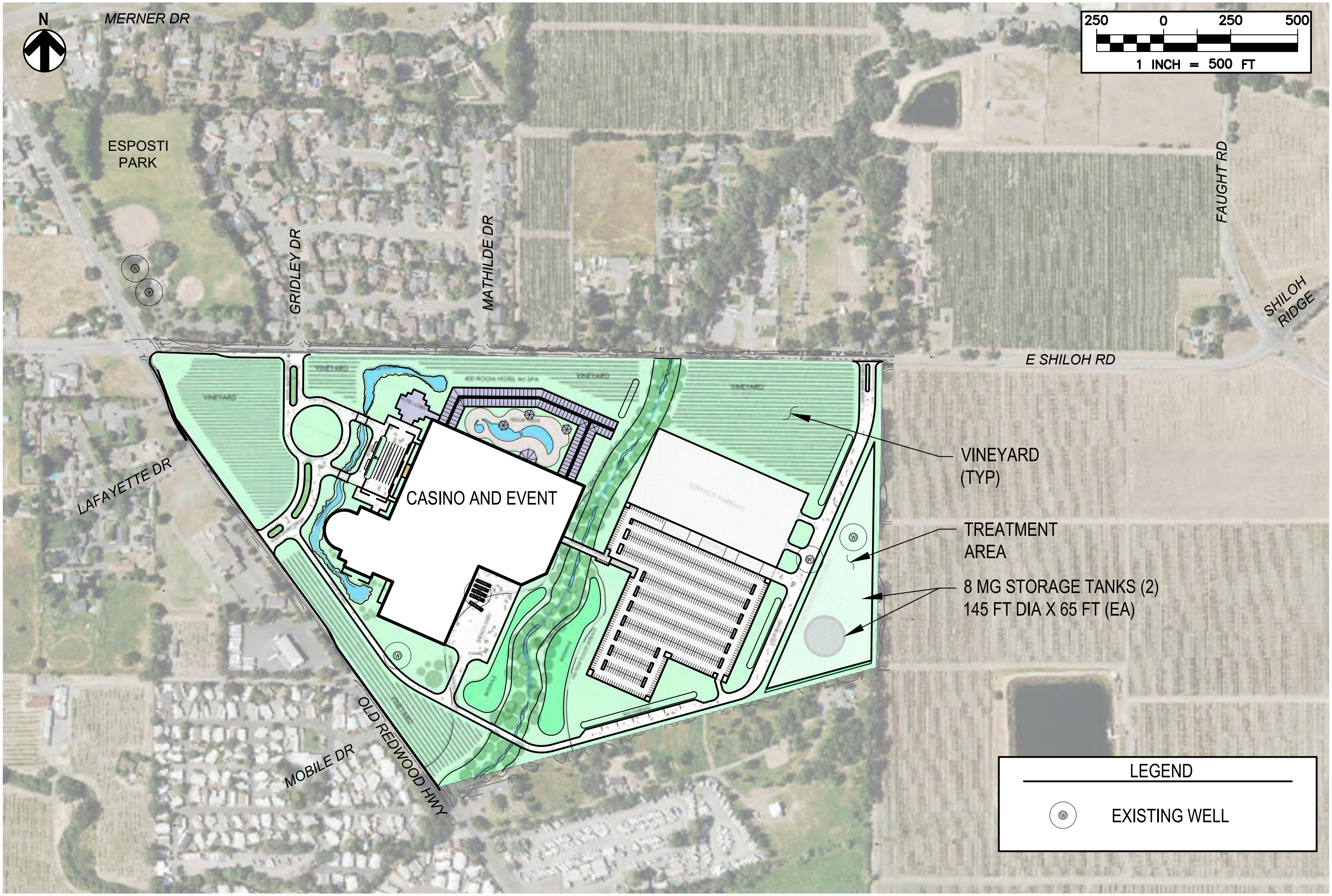


**Figure 2-8**
Acorn Environmental
Shiloh Resort and Casino Project Water and Wastewater Feasibility Study
Option 2 - Alternative A

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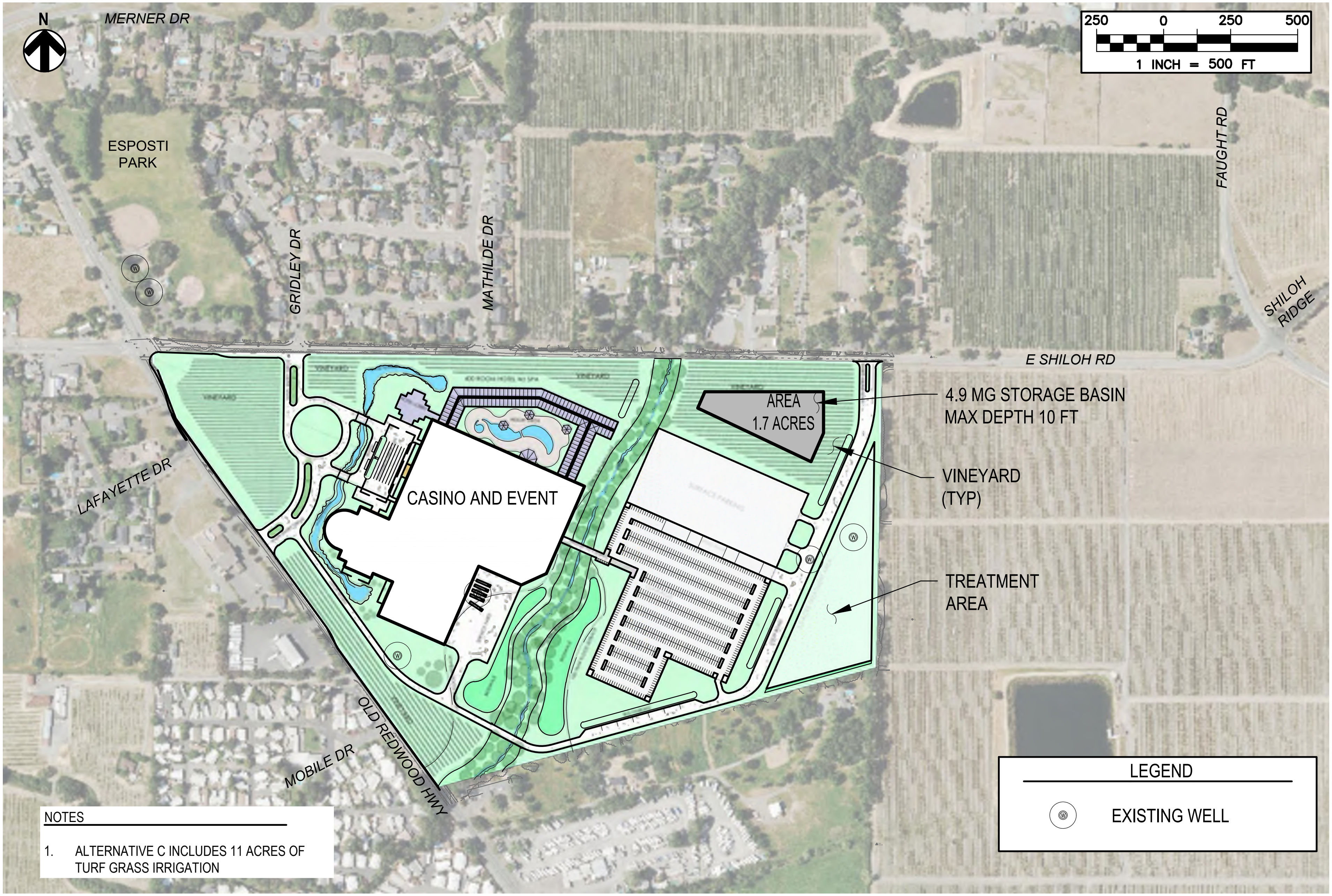


**Figure 2-9**
Acorn Environmental
Shiloh Resort and Casino Project Water and Wastewater Feasibility Study
Option 3 - Alternative A

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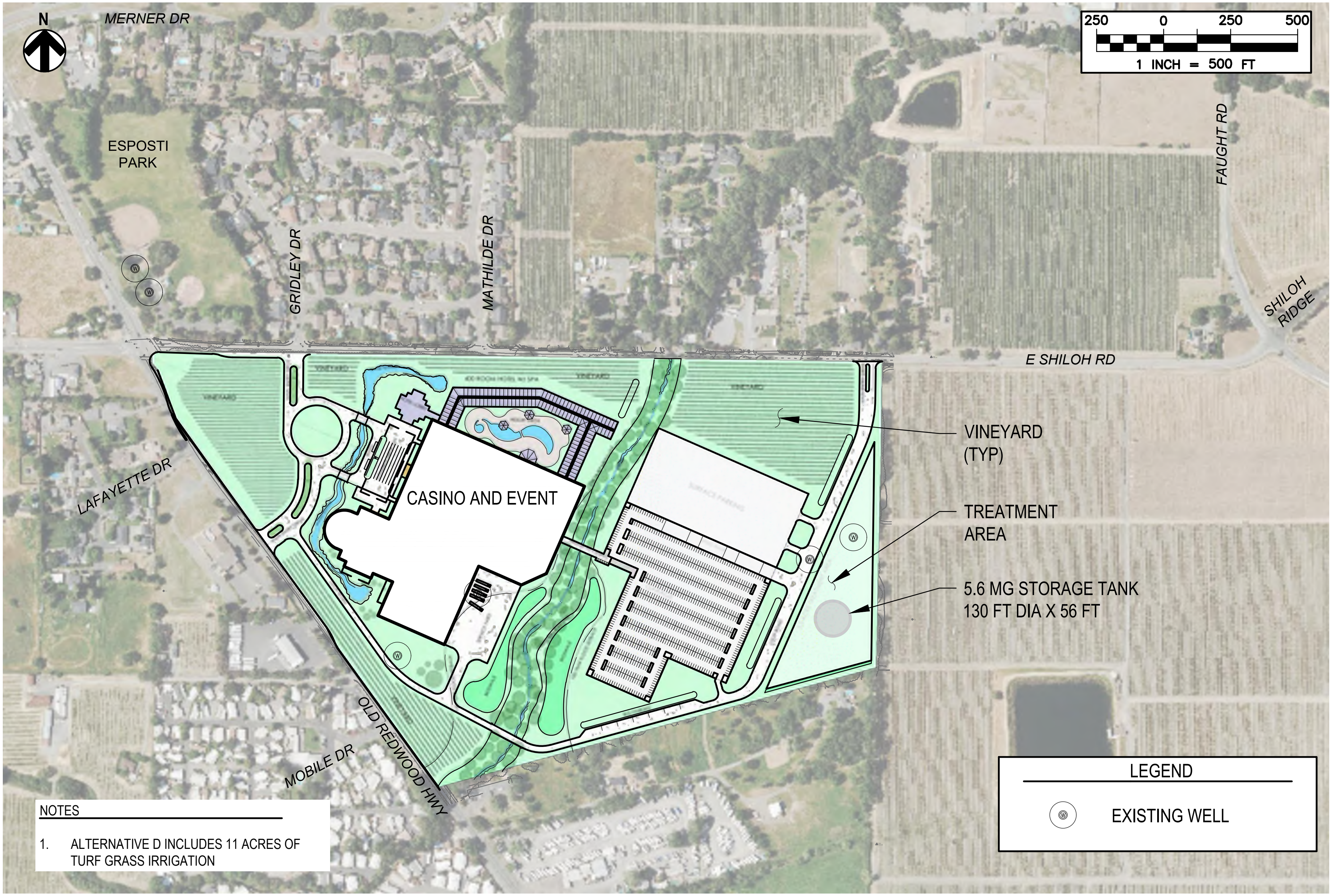


**Figure 2-10**
Acorn Environmental
Shiloh Resort and Casino Project Water and Wastewater Feasibility Study
Option 4 - Alternative A

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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).

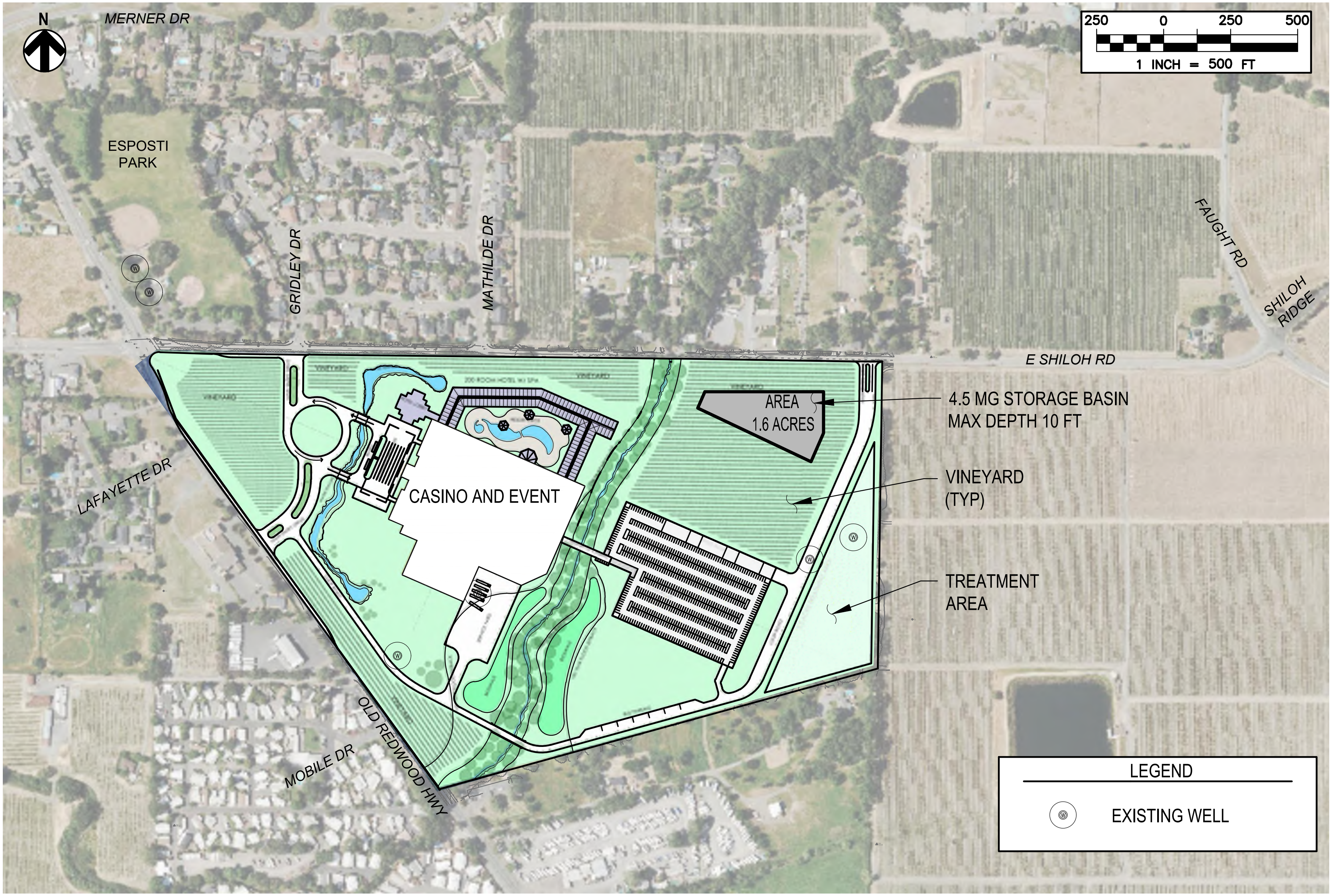


**Figure 2-11**
Acorn Environmental
Shiloh Resort and Casino Project Water and Wastewater Feasibility Study
Option 1 - Alternative B

HydroScience

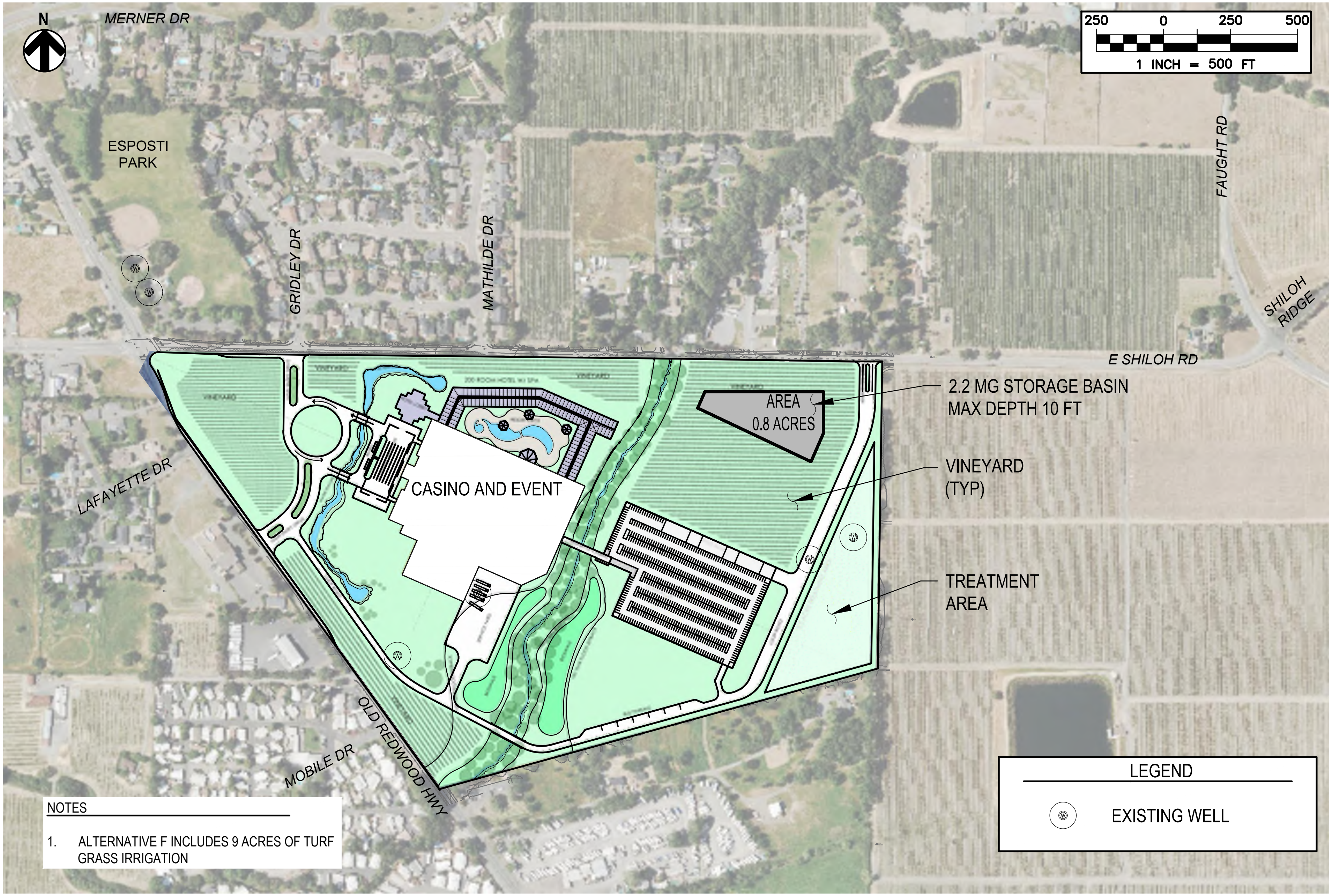


**Figure 2-12**
Acorn Environmental
Shiloh Resort and Casino Project Water and Wastewater Feasibility Study
Option 2 - Alternative B

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.

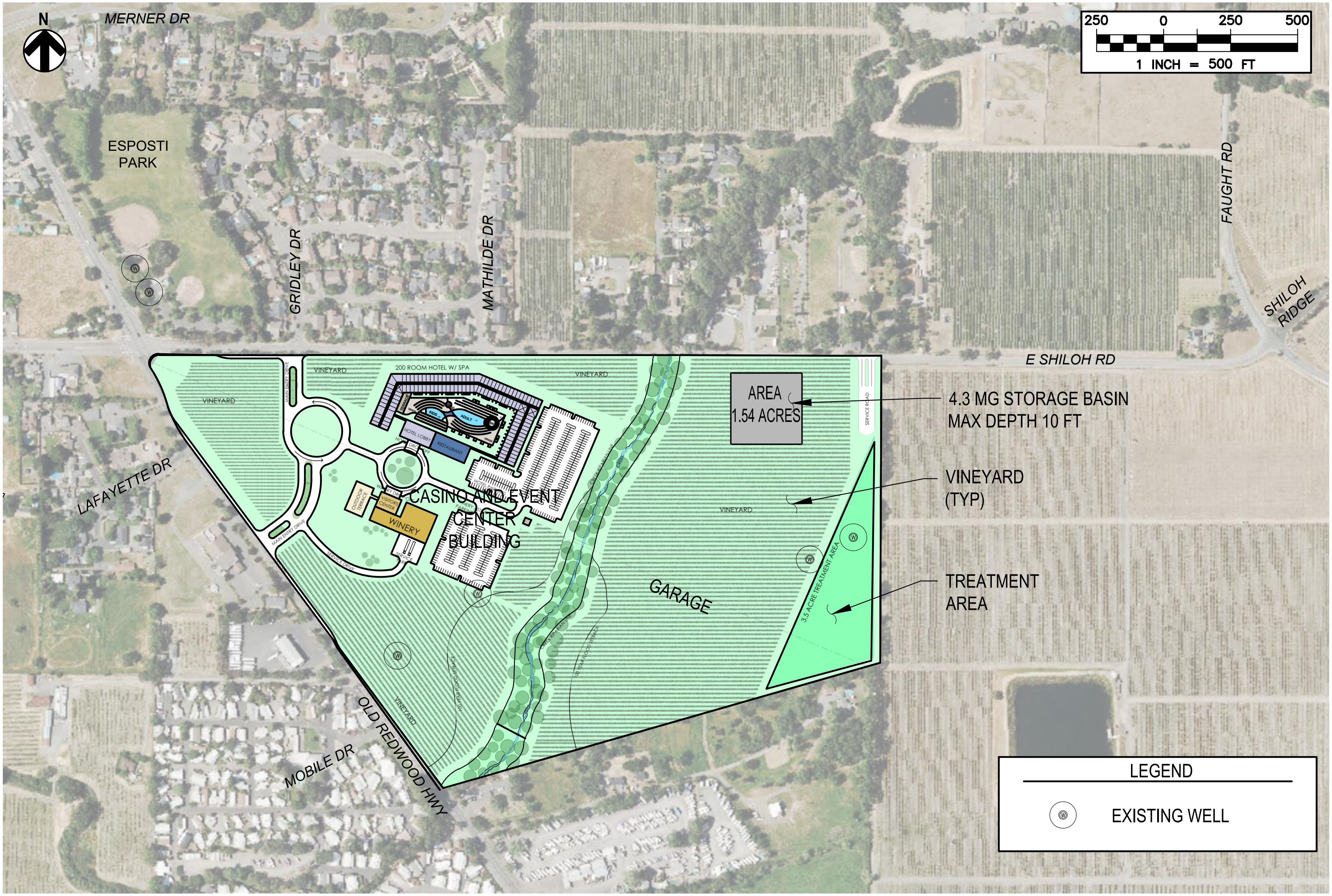


**Figure 2-13**
Acorn Environmental
Shiloh Resort and Casino Project Water and Wastewater Feasibility Study
Option 1 - Alternative C

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

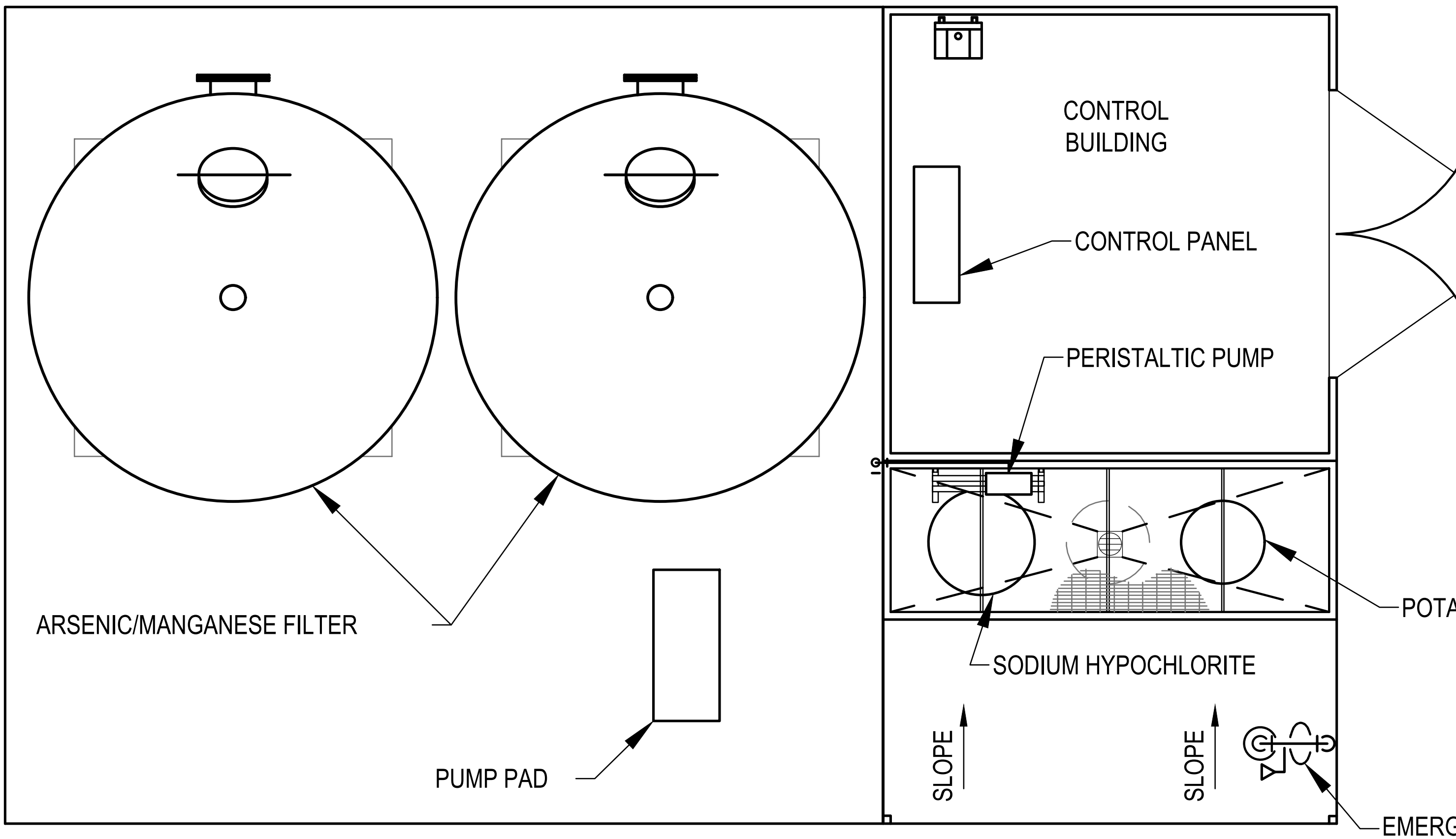
FRAME: 2" x 2" x 120 STEEL TUBE ALL
WELDED WALL SECTIONS TO BE BOLTED IN
FIELD

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

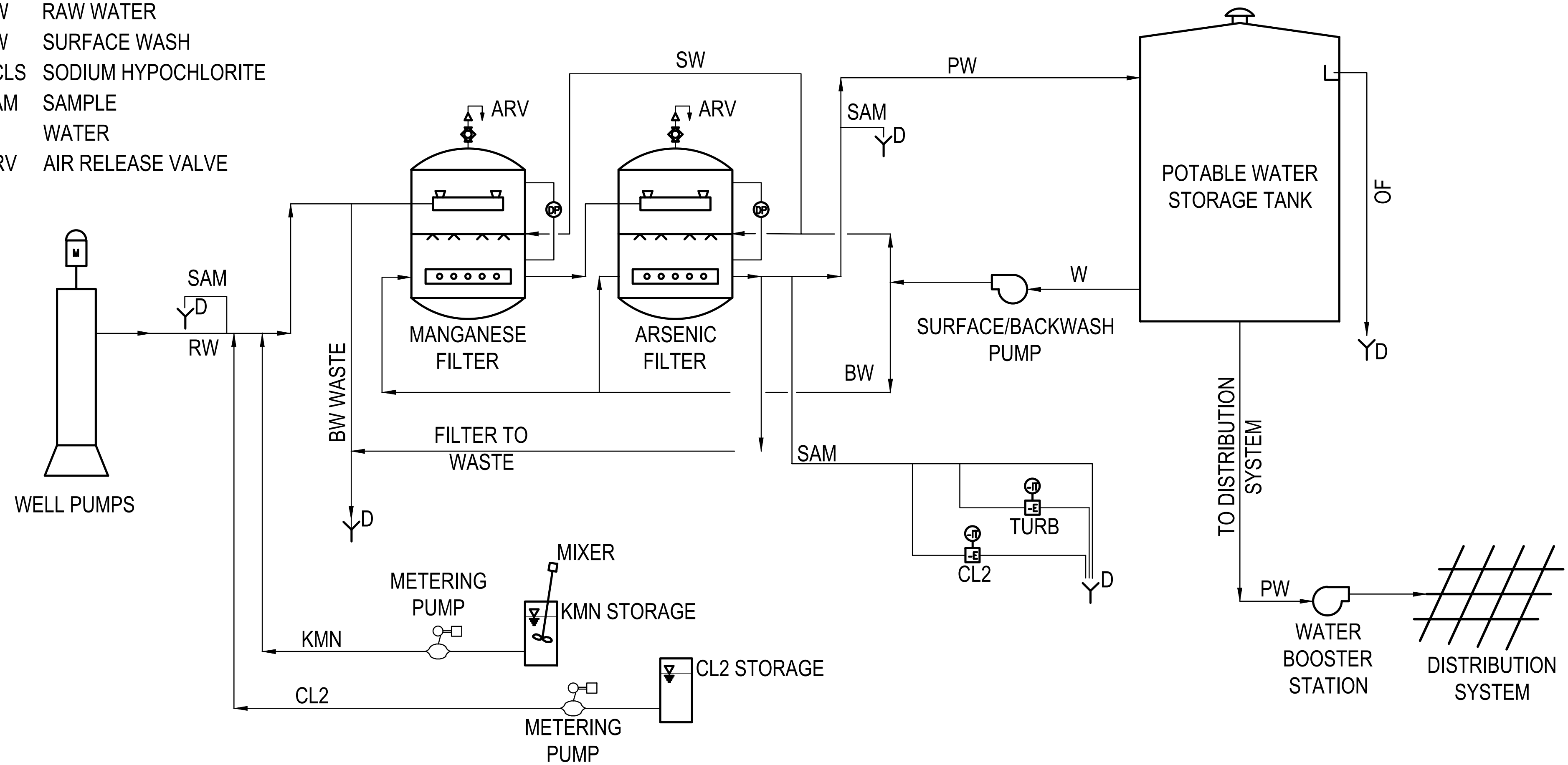


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**Figure 5-2**
Acorn Environmental
Shiloh Resort and Casino Project Water and Wastewater Feasibility Study
Preliminary Process Flow Diagram

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.

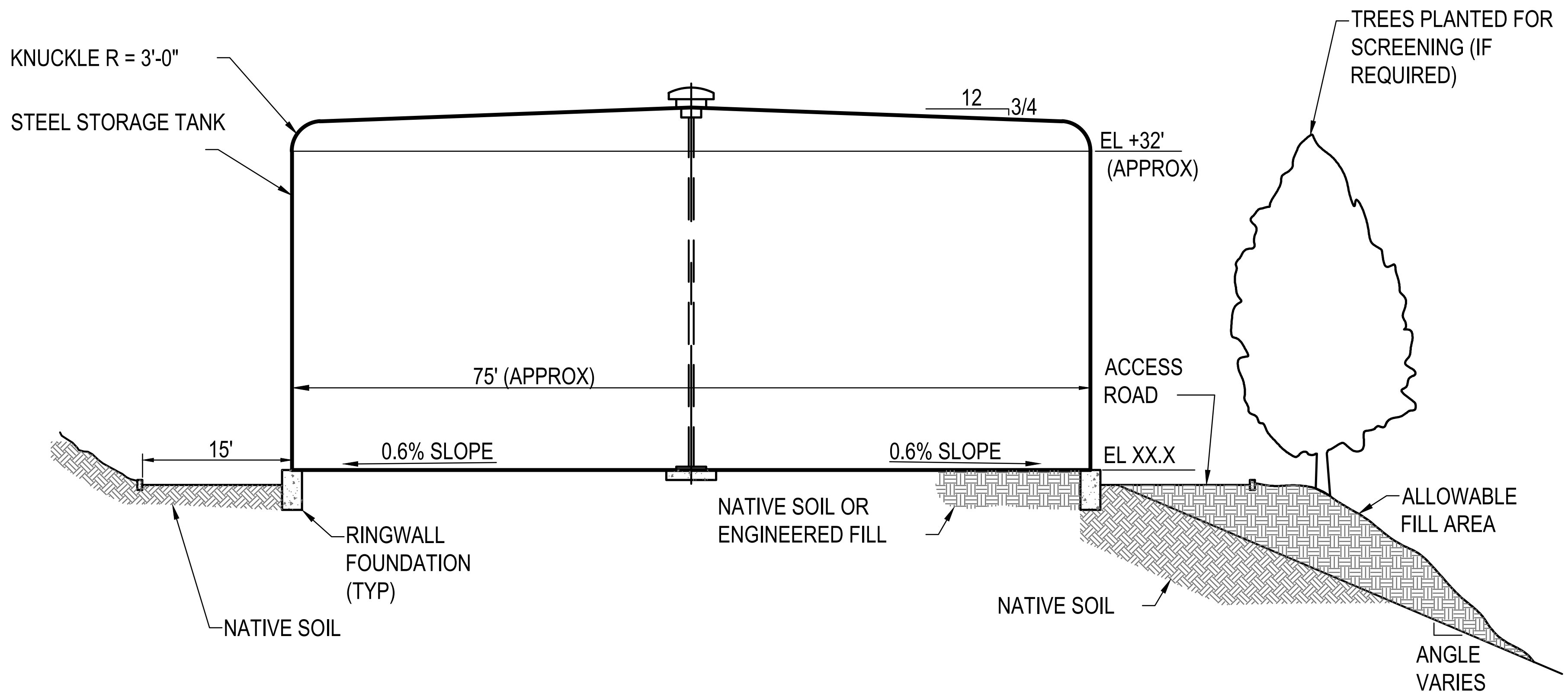


**Figure 5-3**
Acorn Environmental
Shiloh Resort and Casino Project Water and Wastewater Feasibility Study
Typical Potable Water Storage Tank

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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 |

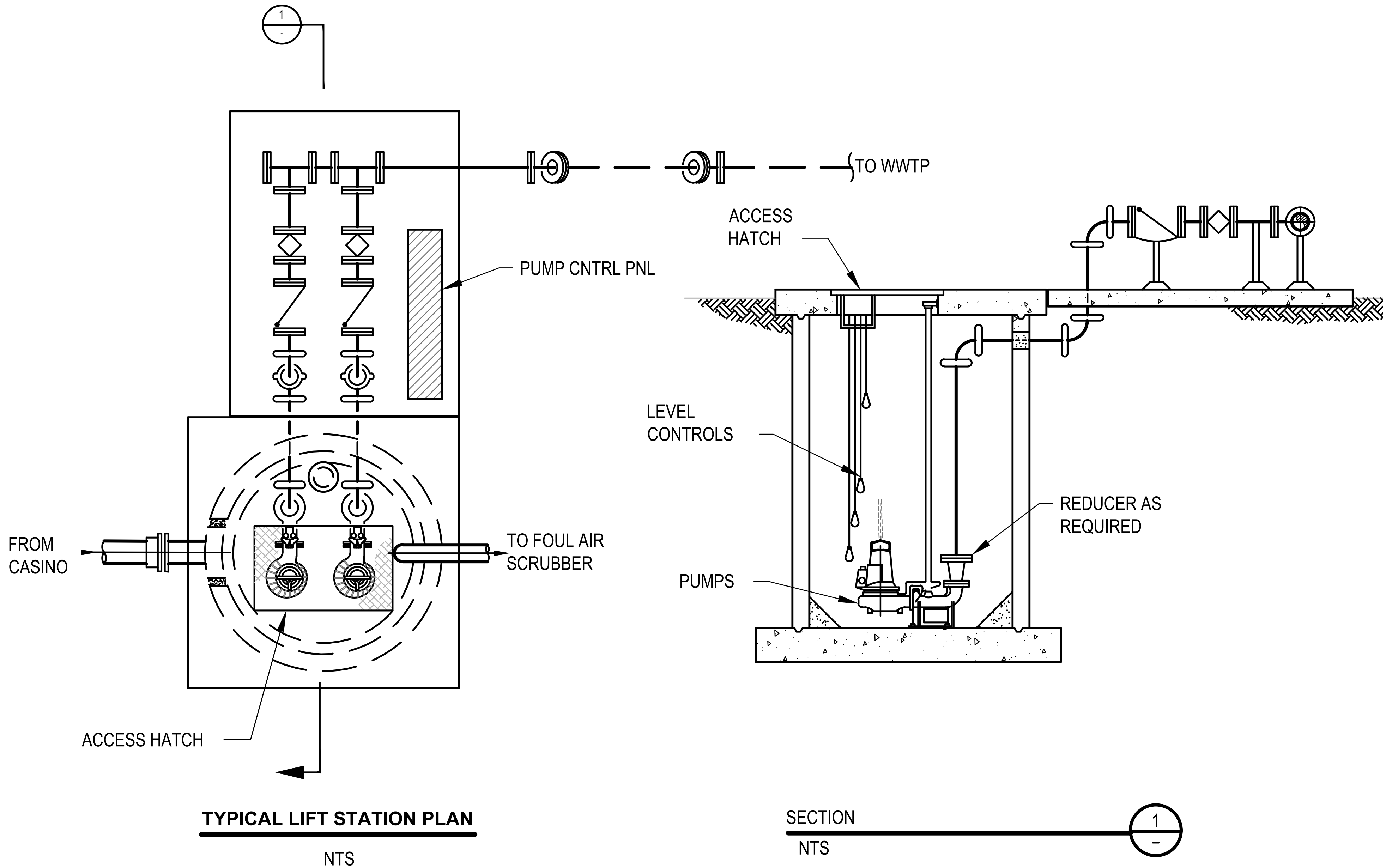


**Figure 6-1**
Acorn Environmental
Shiloh Resort and Casino Project Water and Wastewater Feasibility Study
Typical Influent Lift Station

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## 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:

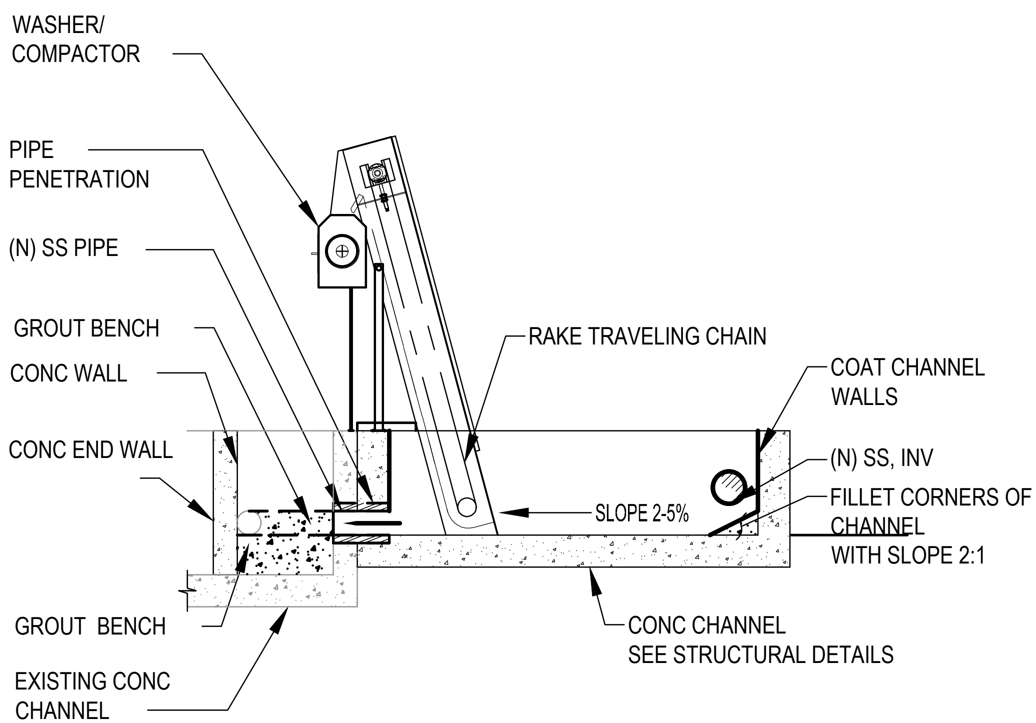
- Coarse Screening Facility;
- Headworks;
- Immersed Membrane Bioreactors;
- UV Disinfection;
- Chlorine Disinfection;

### 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.

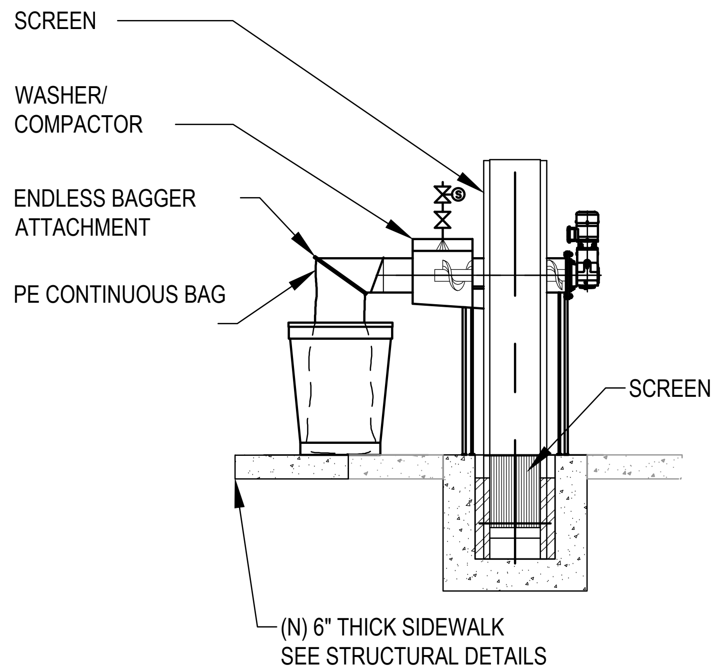
**Table 6-2: Coarse Screen Design Criteria**

| 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 / –)

SCALE: 3/4" = 1'-0"




**TYPICAL SCREEN SECTION** (B / –)

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 |

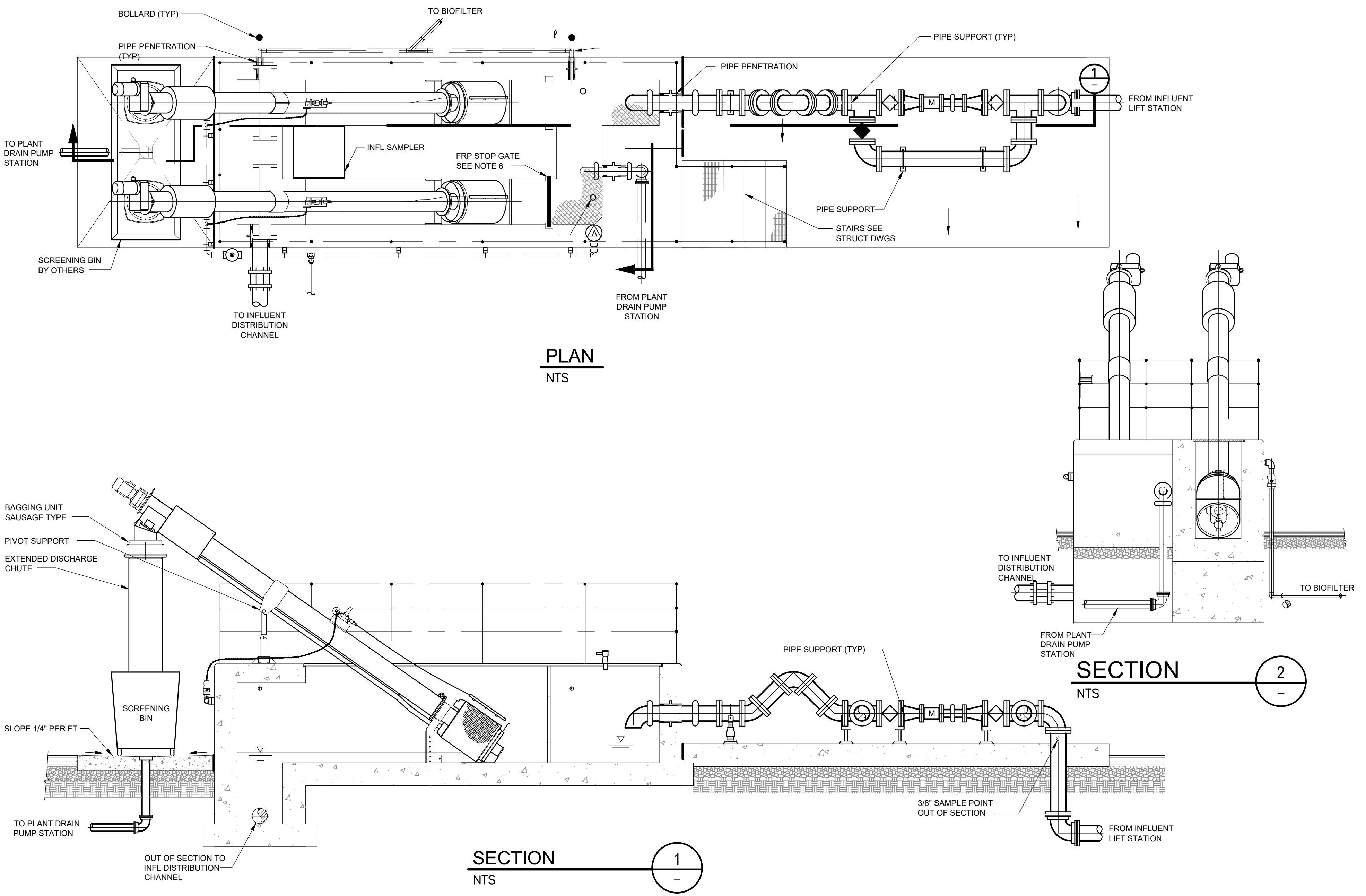


**Figure 6-3**
Acorn Environmental
Shiloh Resort and Casino Project Water and Wastewater Feasibility Study
Typical Headworks Facility

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### 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.

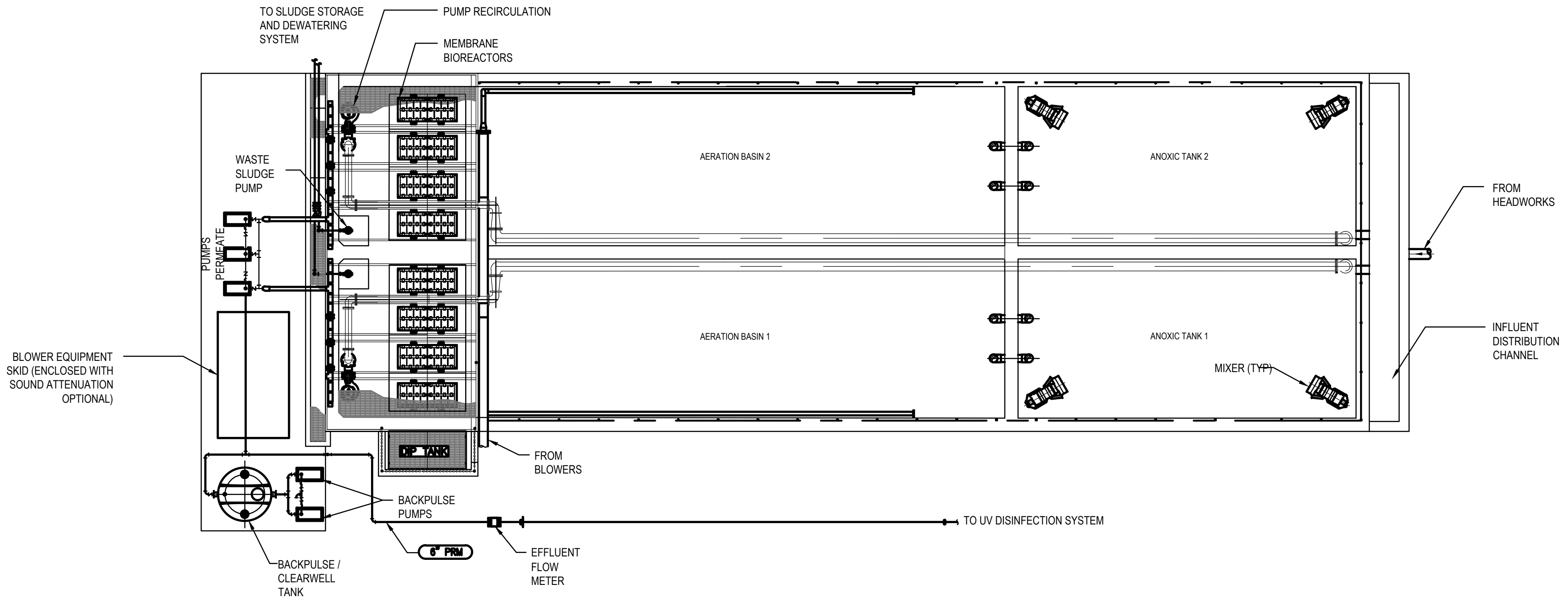
**Aeration Basins:** The mixed liquor produced by the anoxic basin would flow by gravity through a short channel to the adjacent aeration basin. The aeration basin differs from the anoxic basin in that this basin contains DO, which is introduced to the tank through a series of fine bubble diffusers, 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.




**PLAN**

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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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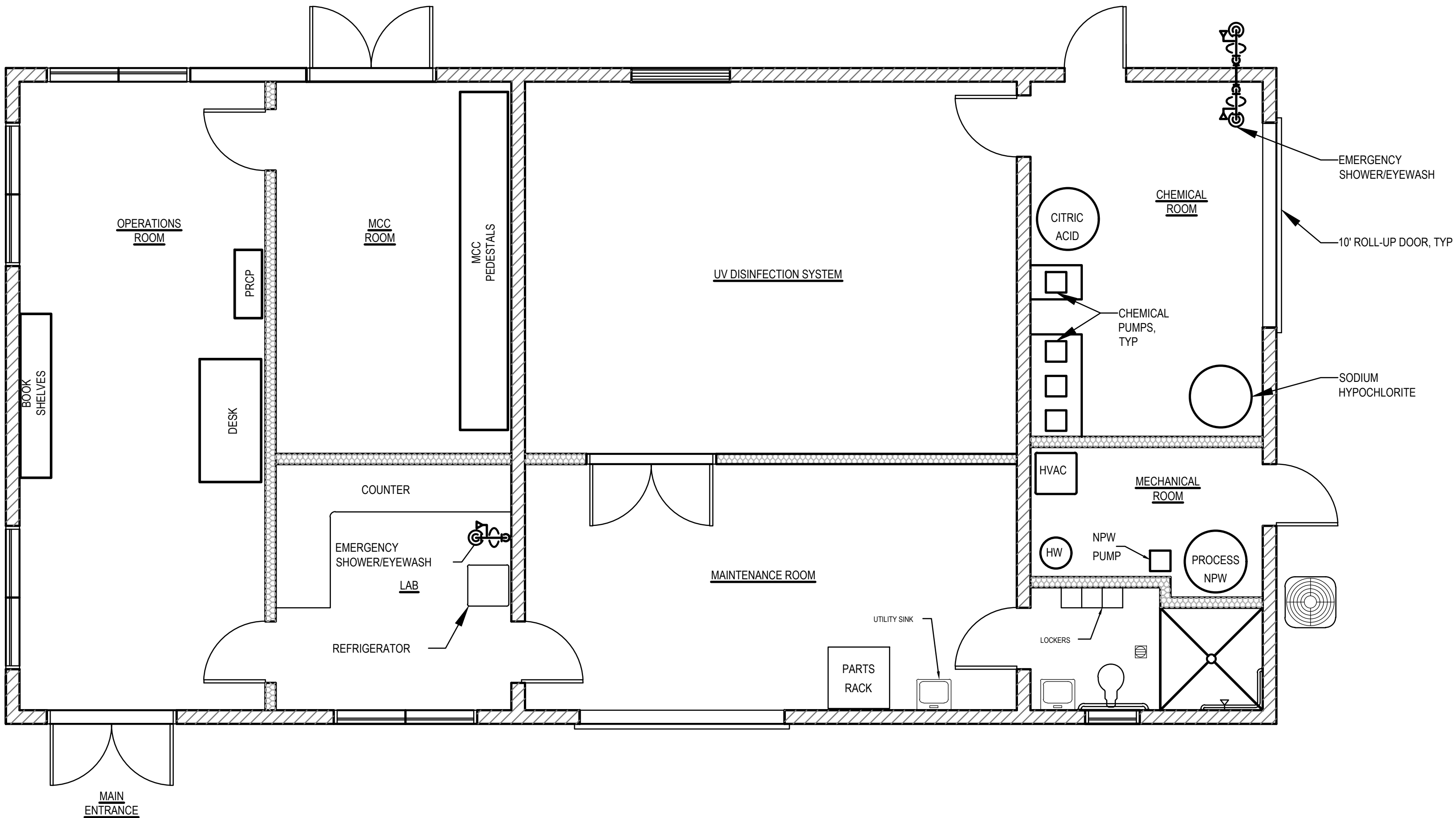


**PLAN**

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

### 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.

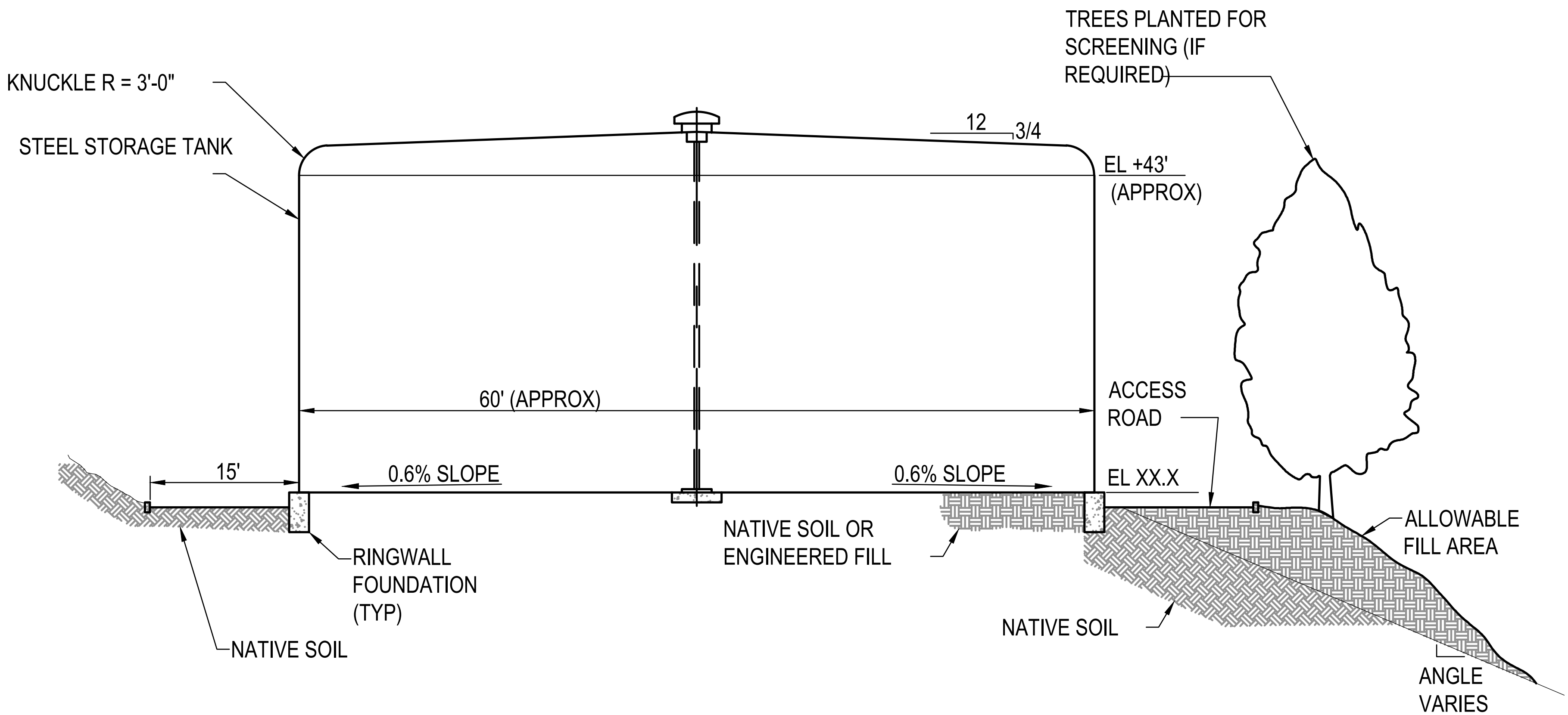


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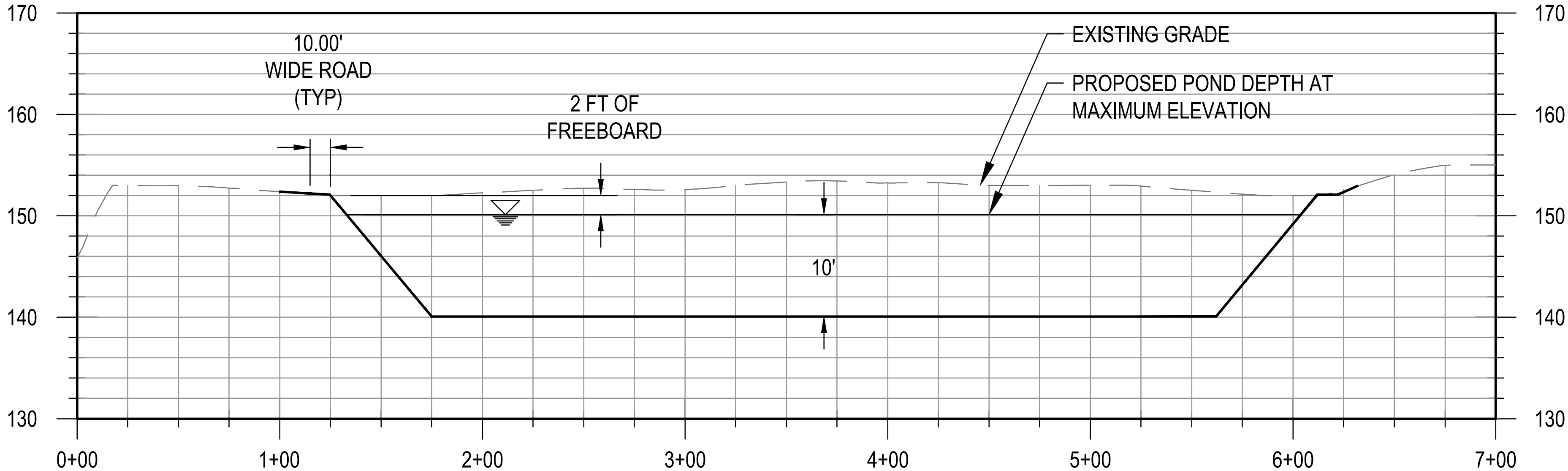
**Figure 6-6**
Acorn Environmental
Shiloh Resort and Casino Project Water and Wastewater Feasibility Study
Typical Recycled Water Storage Tank




**TYPICAL BASIN SECTION**

(ELEVATIONS SHOWN ARE FOR INFORMATIONAL PURPOSES ONLY)

HydroScience

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

# 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)

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## 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 | | | | |

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

| | 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** | | | | | |

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

| | 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 | | | STORAGE DATA | | | OTHER INPUTS | | |
|---|---|---|---|---|---|---|---|---|
| Daily Average Wastewater Influent Flow | 231,900 | gpd | Basin Volume | 12.1 | MG | 100-YR Multiplier | 2.06 | unitless |
| I/I (PWWF-PDWF) | 250,452 | gpd | Basin Area | 4.08 | acres | 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 | | | STORAGE DATA | | | OTHER INPUTS | | | RECYCLED WATER DISTRIBUTION AND DISPOSAL ALTERNATIVES [2] | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Daily Average Wastewater Influent Flow | 231,900 | gpd | Tank(s) Total Volume | 15.9 | MG | 100-YR Multiplier | 2.06 | unitless | andscape Irrigation (Casino) | 4.4 | acres | Vineyards (Casino) | 17.4 | acres | Landscpe Irrig (TBD) | 0.0 | acres |
| I/I (PWWF-PDWF) | 250,452 | gpd | | | | Pan Evap Coefficient | 0.75 | unitless | 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 | 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

| | 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 | 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 | | | STORAGE DATA | | | OTHER INPUTS | | | RECYCLED WATER DISTRIBUTION AND DISPOSAL ALTERNATIVES[2] | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Daily Average Wastewater Influent Flow | 231,900 | gpd | Basin Volume | 4.9 | MG | 100-YR Multiplier | 2.06 | unitless | andscape Irrigation (Casino) | 4.4 | acres | Vineyards (Casino) | 15.0 | acres | Landscpe Irrig (TBD) | 11.0 | acres | |
| I/I (PWWF-PDWF) | 250,452 | gpd | Basin Area | 1.74 | acres | Pan Evap Coefficient | 0.75 | unitless | Dual Plumbing | 26.4 | MG | Surface Water Discharge | 301 | MG | 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 | | | STORAGE DATA | | | OTHER INPUTS | | | RECYCLED WATER DISTRIBUTION AND DISPOSAL ALTERNATIVES [2] | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Daily Average Wastewater Influent Flow | 231,900 | gpd | Tank(s) Total Volume | 5.6 | MG | 100-YR Multiplier | 2.06 | unitless | andscape Irrigation (Casino) | 4.4 | acres | Vineyards (Casino) | 17.4 | acres | Landscpe Irrig (TBD) | 11.0 | acres | |
| I/I (PWWF-PDWF) | 250,452 | gpd | | | | Pan Evap Coefficient | 0.75 | unitless | Dual Plumbing | 26.4 | MG | Surface Water Discharge | 301 | MG | Additonal Turf Grass | 0.0 | acres | 9.9 |

## 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 | 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

| | 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 | 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 | | | STORAGE DATA | | | OTHER INPUTS | | | RECYCLED WATER DISTRIBUTION AND DISPOSAL ALTERNATIVES [2] | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Daily Average Wastewater Influent Flow | 157,800 | gpd | Basin Volume | 4.5 | MG | 100-YR Multiplier | 2.06 | unitless | andscape Irrigation (Casino) | 6.7 | acres | Vineyards (Casino) | 19.8 | acres | Landscape Irrig (TBD) | 0.0 | acres |
| I/I (PWWF-PDWF) | 170,424 | gpd | Basin Area | 1.61 | acres | Pan Evap Coefficient | 0.75 | unitless | Dual Plumbing | 18.2 | MG | Surface Water Discharge | 301 | MG | Additional 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 | 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**

| | 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 | 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 | | | STORAGE DATA | | | OTHER INPUTS | | | RECYCLED WATER DISTRIBUTION AND DISPOSAL ALTERNATIVES [2] | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Daily Average Wastewater Influent Flow | 157,800 | gpd | Basin Volume | 2.2 | MG | 100-YR Multiplier | 2.06 | unitless | andscape Irrigation (Casino) | 6.7 | acres | Vineyards (Casino) | 20.7 | acres | Landscpe Irrig (TBD) | 8.9 | acres |
| I/I (PWWF-PDWF) | 170,424 | gpd | Basin Area | 0.83 | acres | Pan Evap Coefficient | 0.75 | unitless | Dual Plumbing | 18.2 | 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 | 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

| | 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 | 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 | | | STORAGE DATA | | | OTHER INPUTS | | | RECYCLED WATER DISTRIBUTION AND DISPOSAL ALTERNATIVES[2] | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Daily Average Wastewater Influent Flow | 37,900 | gpd | Basin Volume | 4.3 | MG | 100-YR Multiplier | 2.06 | unitless | andscape Irrigation (Casino) | 8.3 | acres | Vineyards (Casino) | 43.2 | acres |
| I/I (PWWF-PDWF) | 40,932 | gpd | Basin Area | 1.54 | acres | Pan Evap Coefficient | 0.75 | unitless | Dual Plumbing | 7.0 | MG | Surface Water Discharge | 0.7 | 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 | 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

| | 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 | 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

# Windsor Groundwater Well Installation and Testing Project Summary Report

Prepared by:

In Association with:

E-Pur

September 2010

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## Appendices

## List of Abbreviations

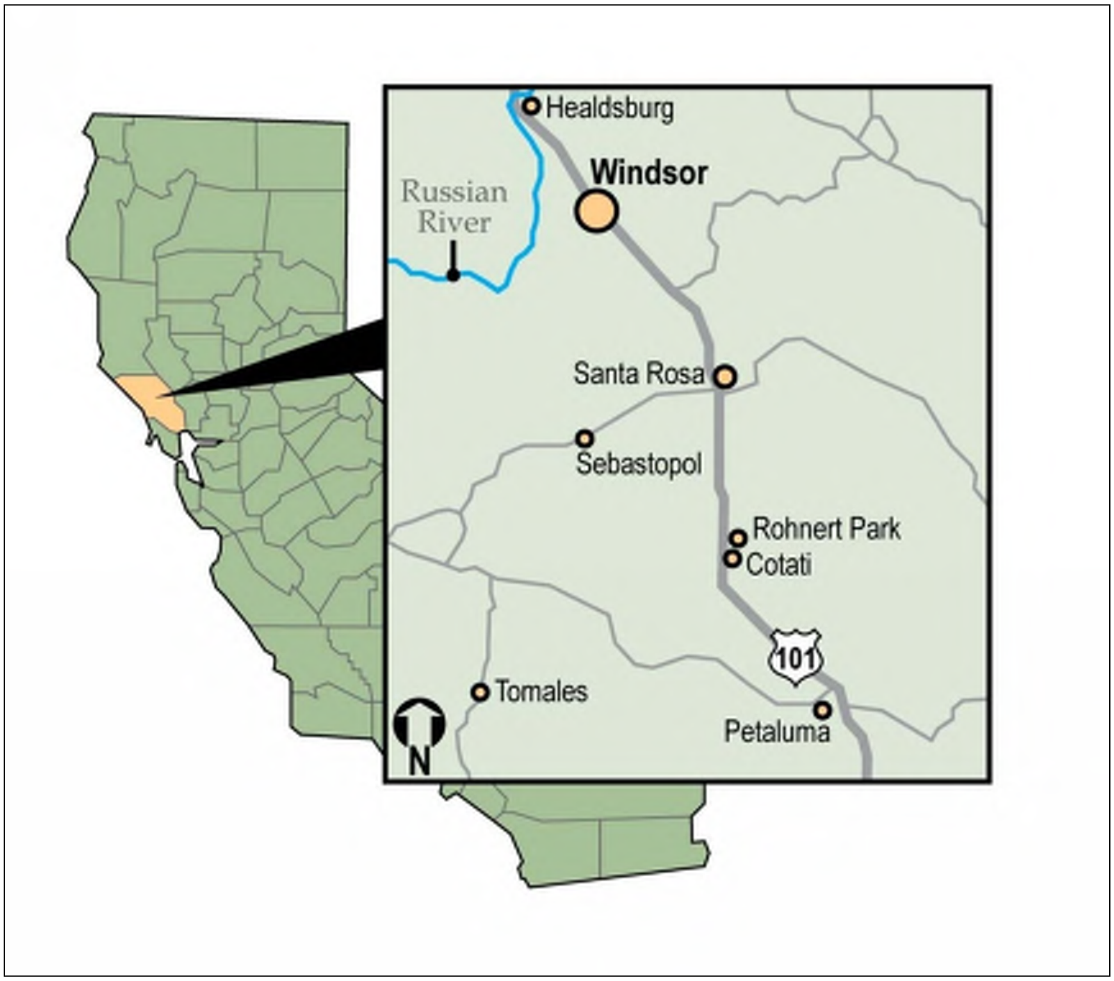
| | |
|---|---|
| AWWA | American Water Works Association |
| bgs | below the ground surface |
| DWR | California Department of Water Resources |
| gpd | gallons per day |
| gpd/ft | gallons per day per foot |
| gpm | gallons per minute |
| GPS | Global Positioning System |
| mg/L | milligrams per liter |
| 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:

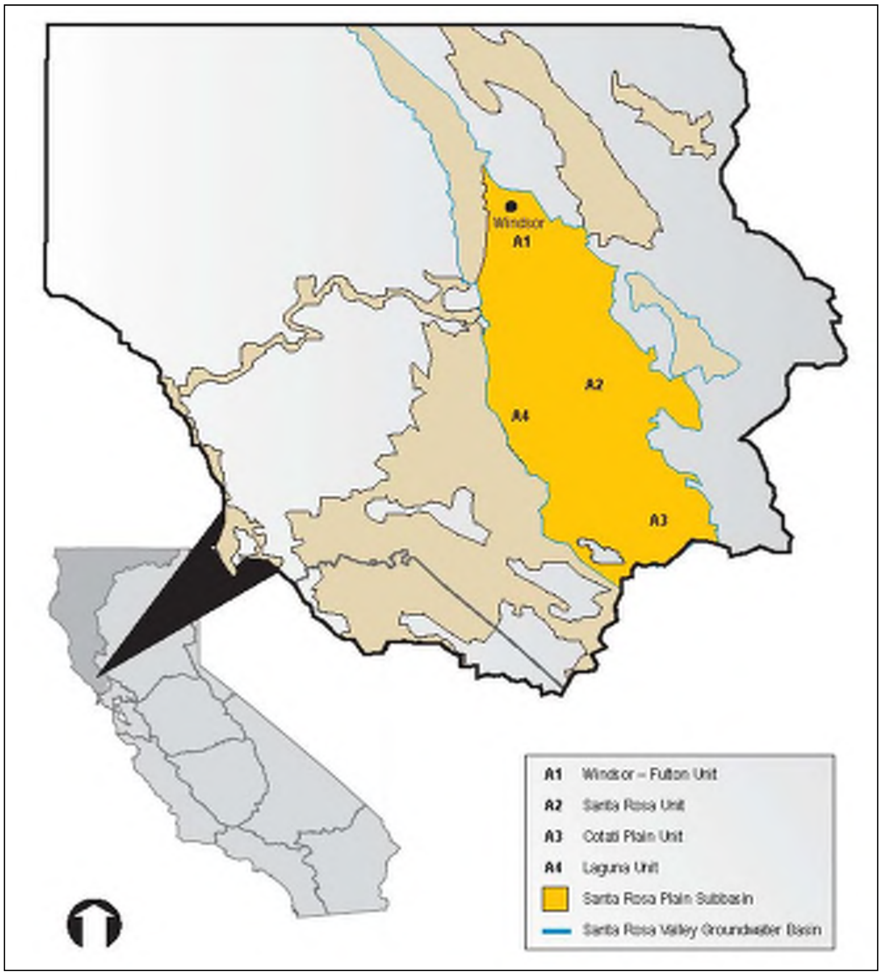
- Accurate and depth-correlated sediment data;
- Sediment samples for grain size analysis in certain intervals;
- Formation water-quality samples in the prospective production intervals for metals and ions; and,
- Geophysical data on the subsurface strata for lithostratigraphic correlation regionally.

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.

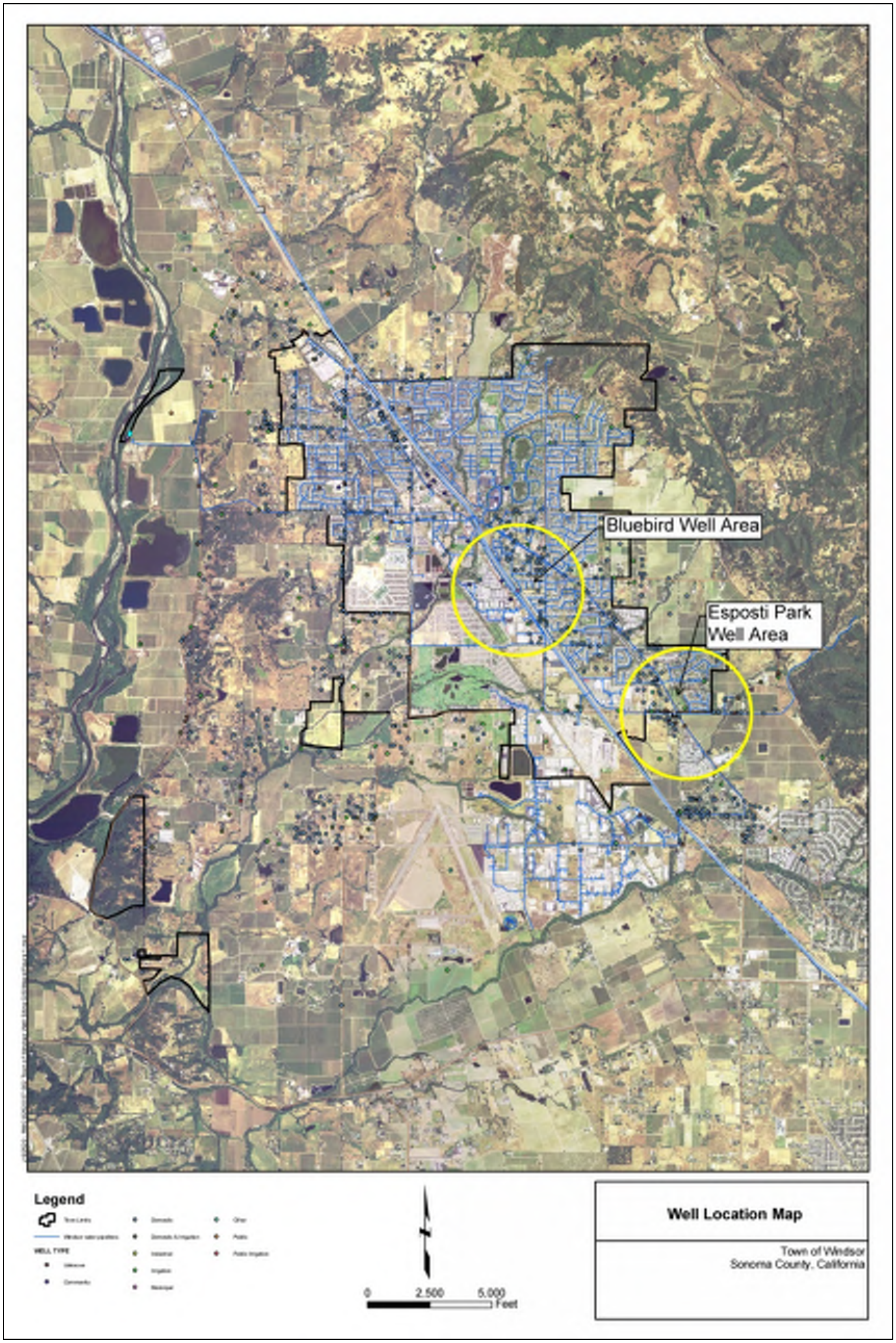
Borehole geophysical surveys that were conducted are summarized in Chapter 6 of this report, while Chapter 3 documents the well development, Chapter 4 documents the aquifer pump testing, and Chapter 5 document water quality testing conducted at each well site.

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.

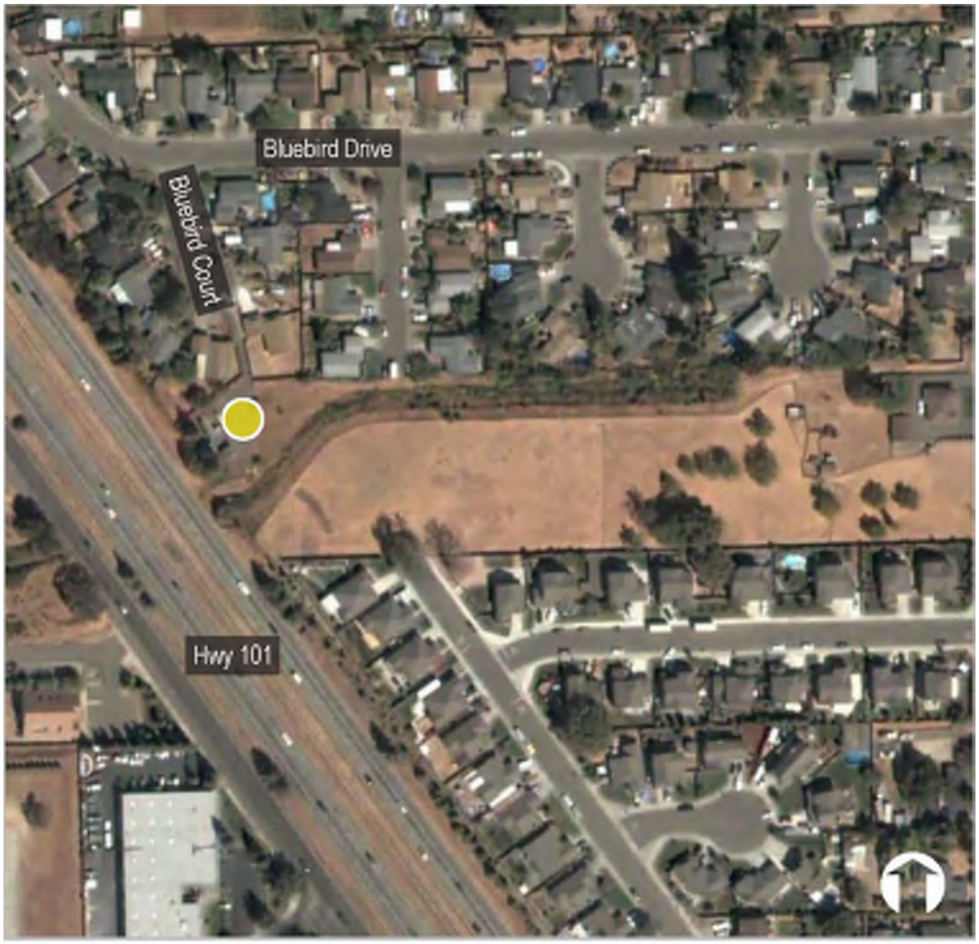
Figure 2-1: Borehole Locations in Windsor



## 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**

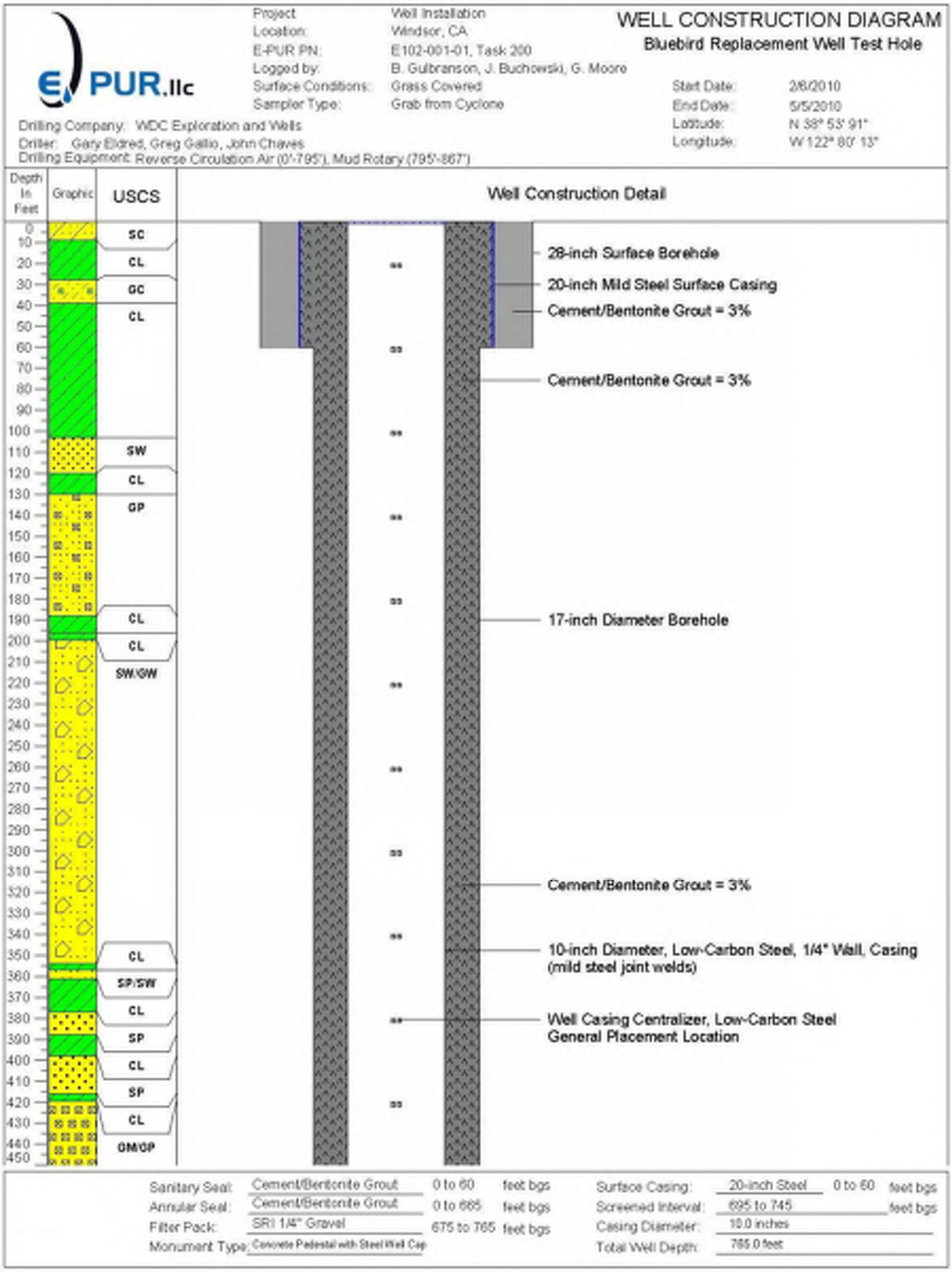
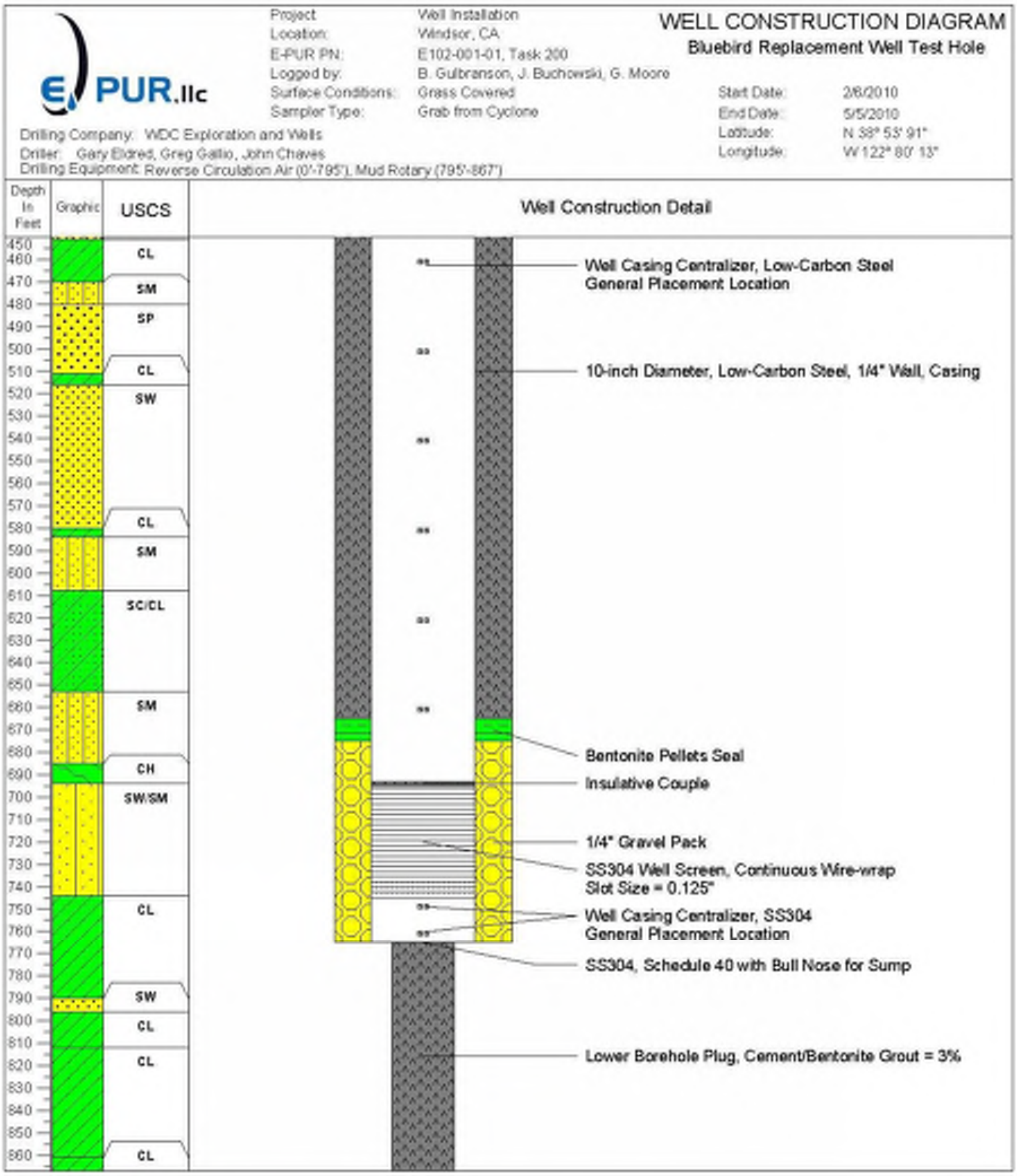


**Figure 2-3: Bluebird Boring Log and Well Construction Diagram (cont'd)**



### 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.

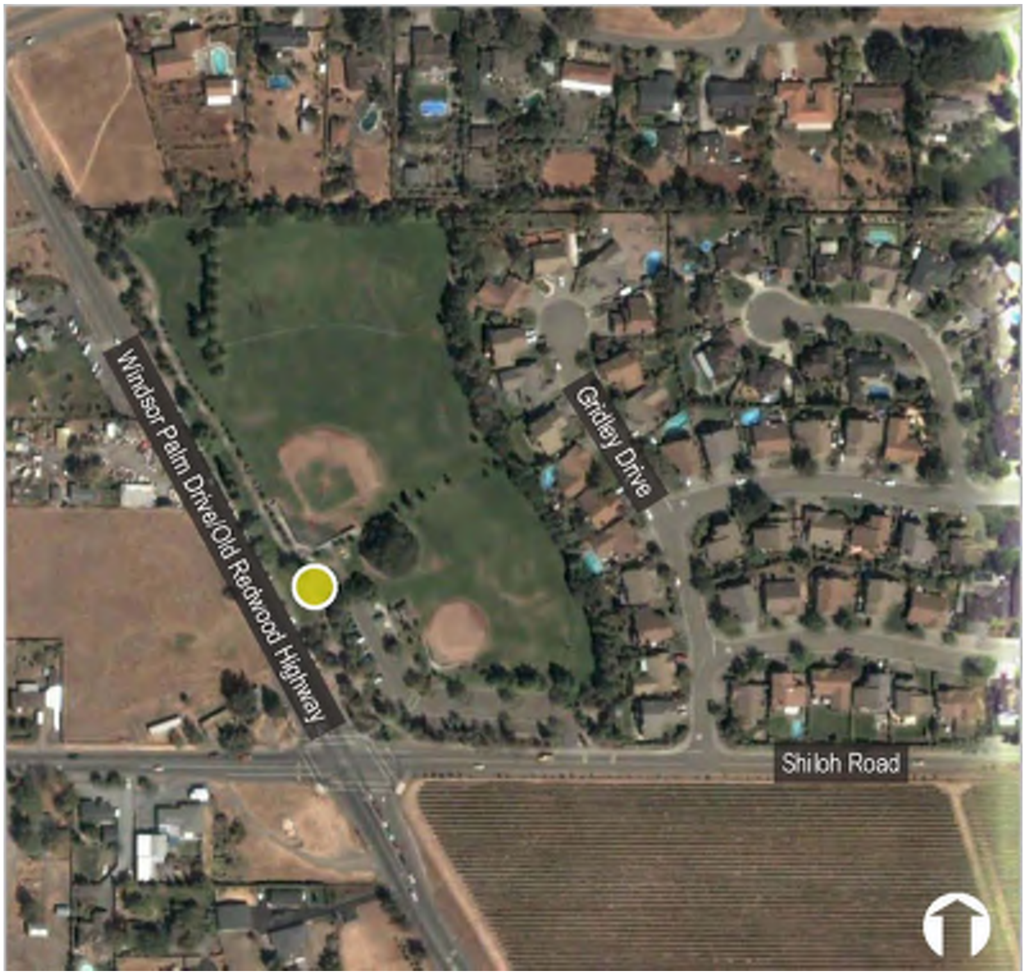
The screen filter pack consists of ¼-inch SRI Supreme gravel material. The gravel pack was place in the annual space between the borehole and well casing using a tremie pipe and potable water. A 10 foot bentonite seal was placed on top of the gravel pack. This was followed by a hot patch (short lift 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**

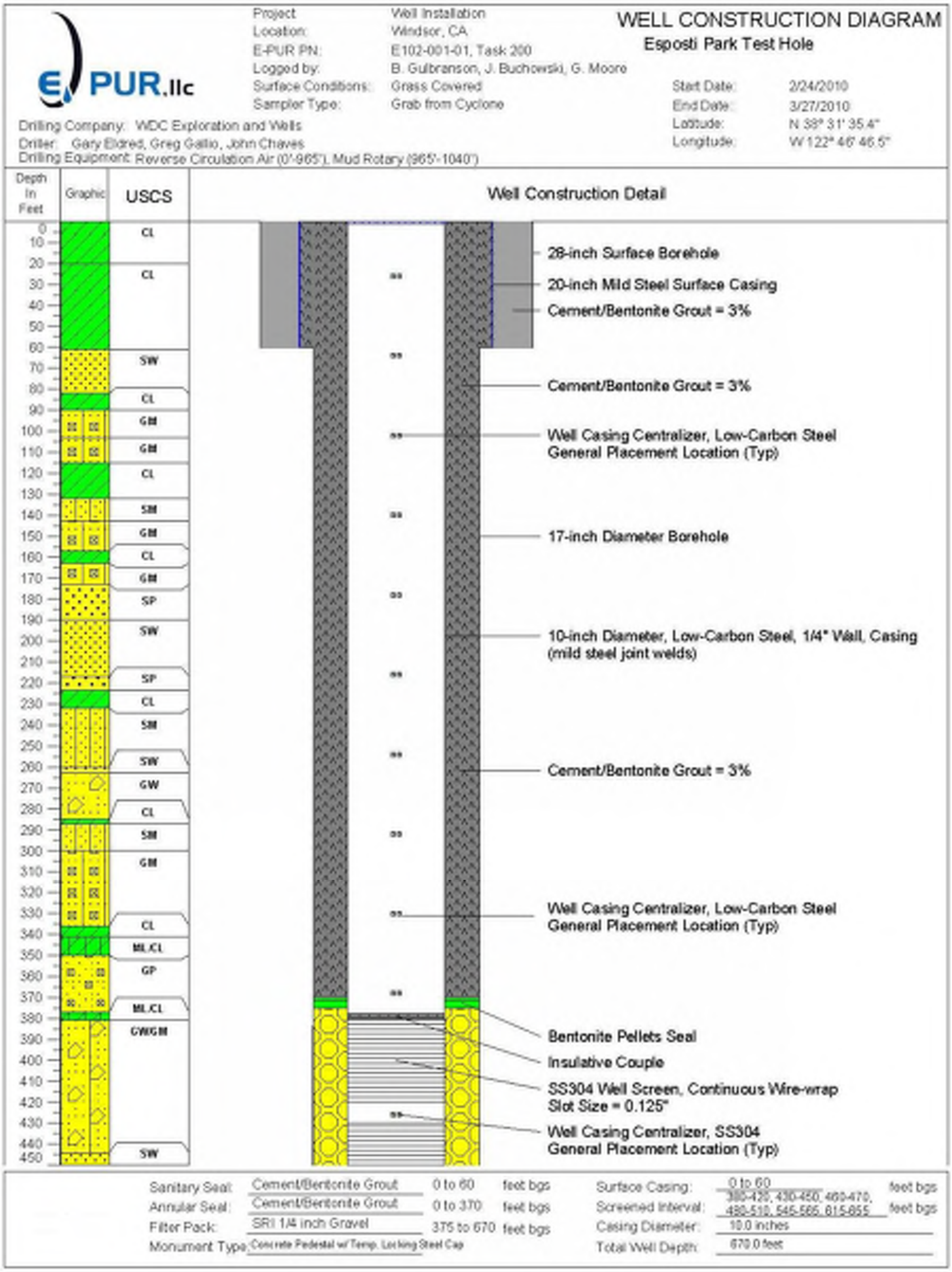


**Figure 2-5: Esposti Park Boring Log and Well Construction Diagram (cont'd)**

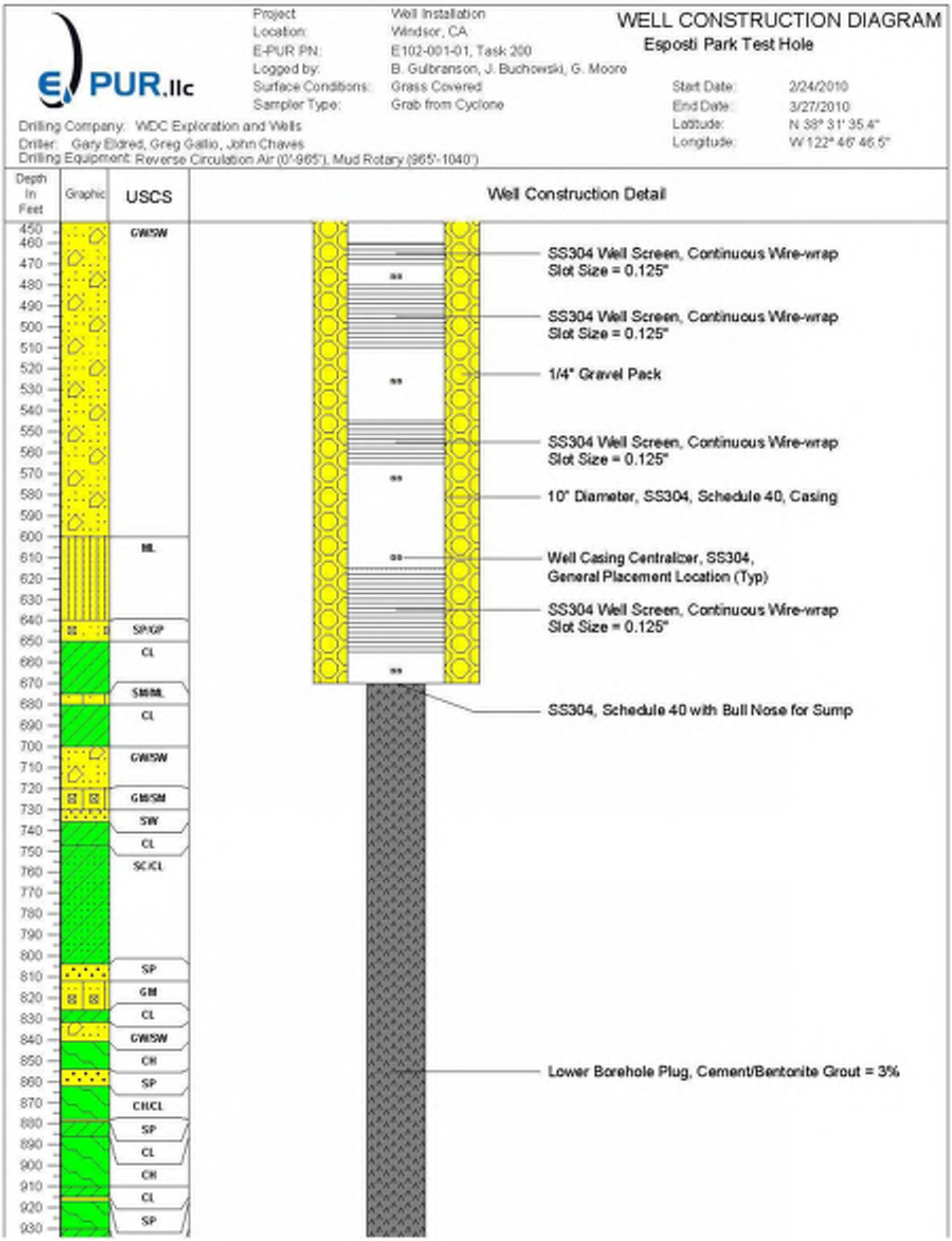
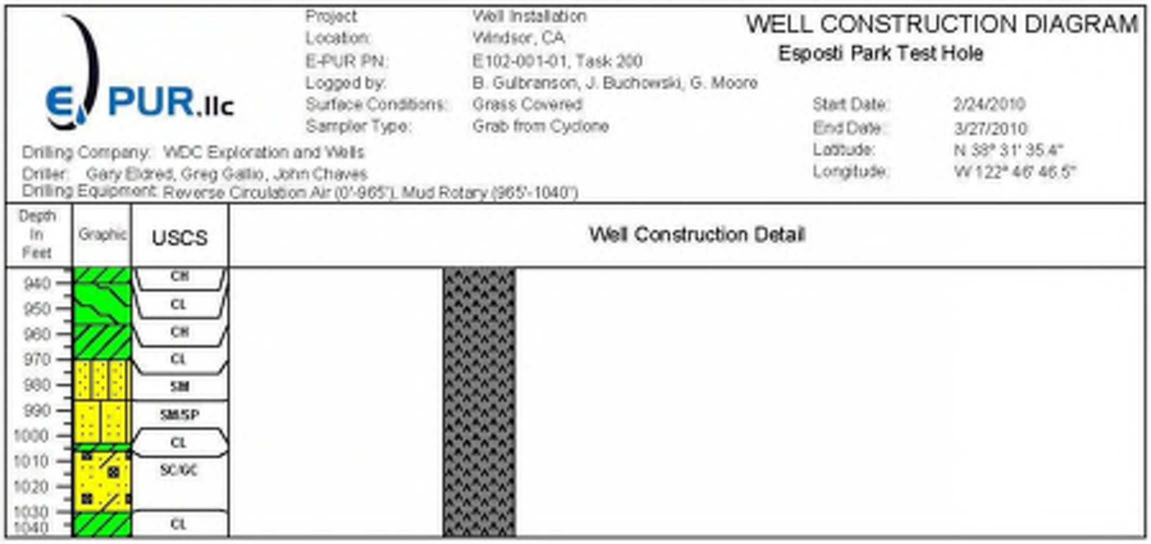


**Figure 2-5: Esposti Park Boring Log and Well Construction Diagram (cont'd)**



### 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 15$^{th}$). 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

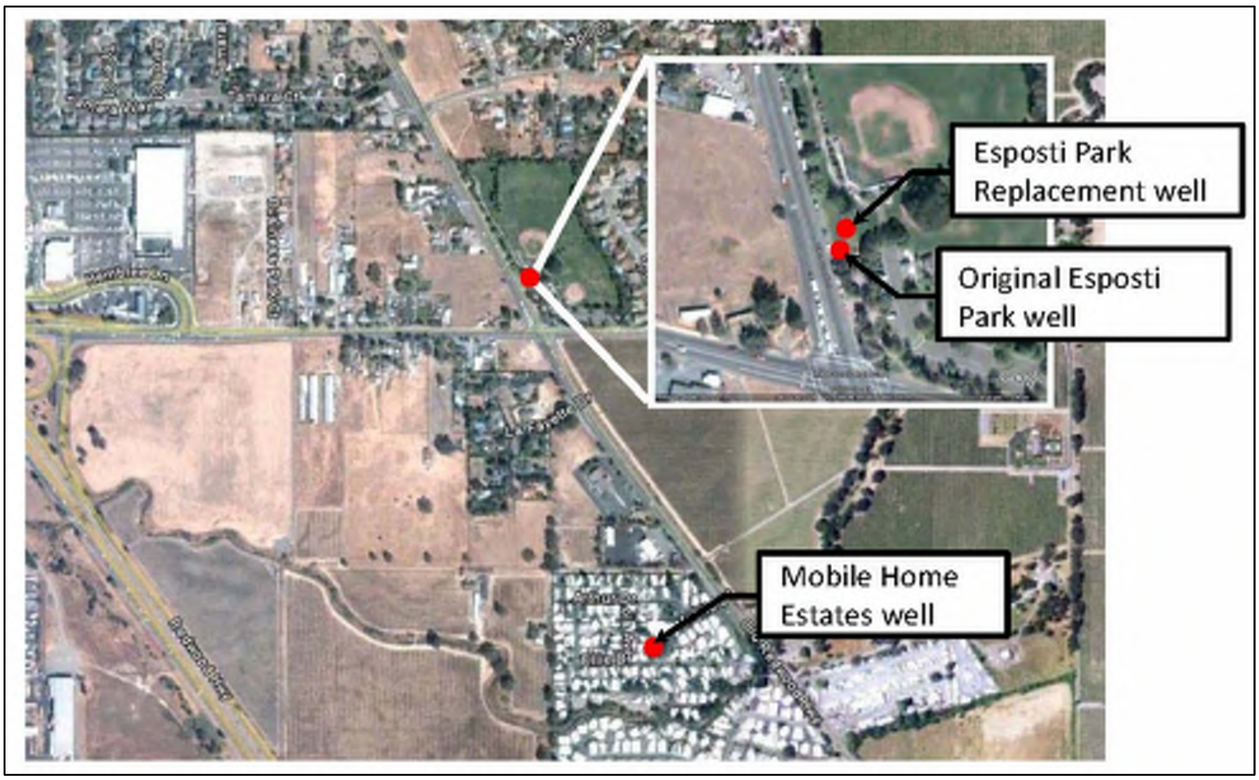
As scoped in the project specifications, aquifer testing of both the Bluebird and Esposti Park wells was to be conducted, consisting of an 8-hour step-rate discharge test and a 24-hour constant-rate discharge test. Dynamic profiling of both wells was also to occur during the constant rate testing, providing 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

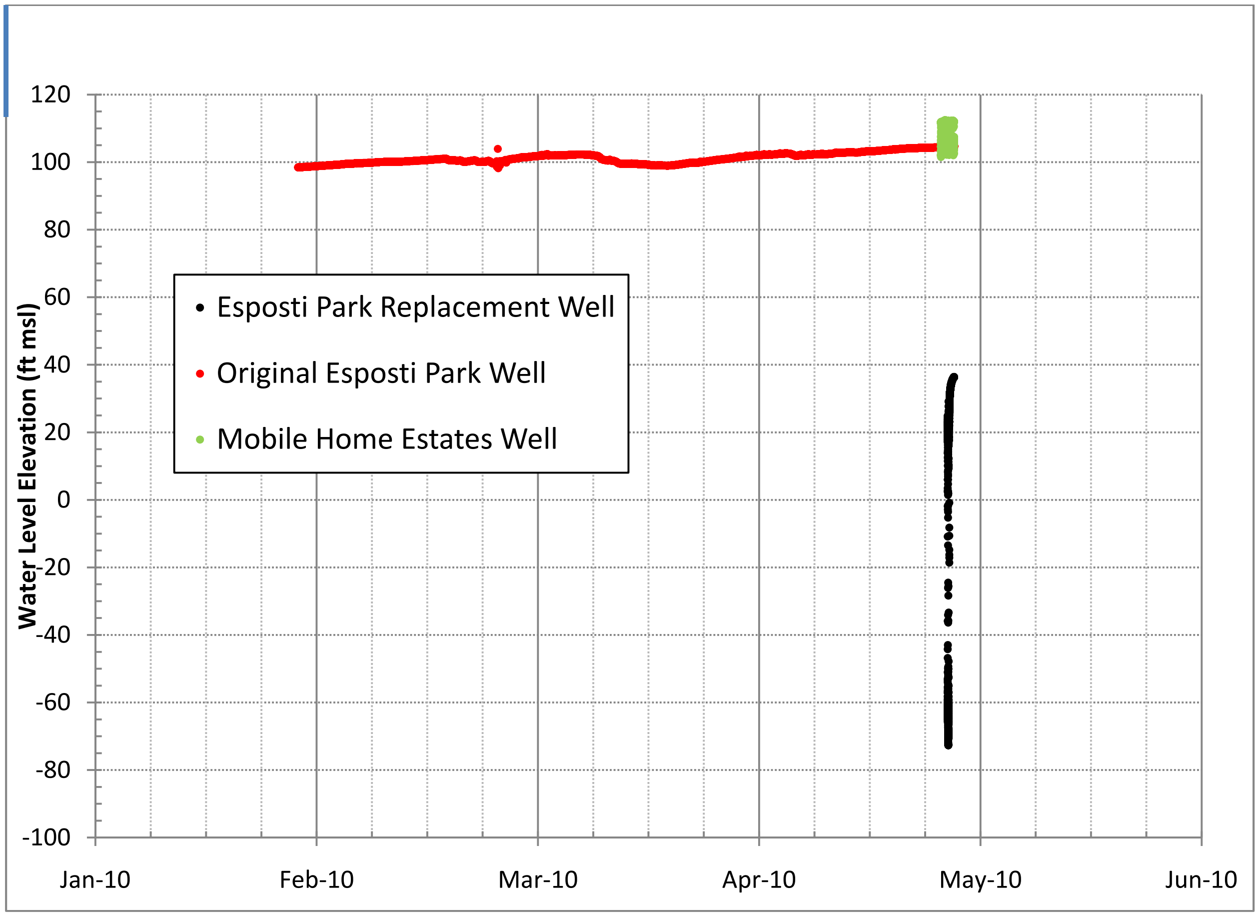
Background and pumping groundwater levels were monitored during the Esposti Park aquifer testing with water levels measured in the pumping well (the Esposti Park replacement well), the original Esposti Park well, and at the water supply well serving Mobile Home Estates (located at 5761 Old Redwood Highway, 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**



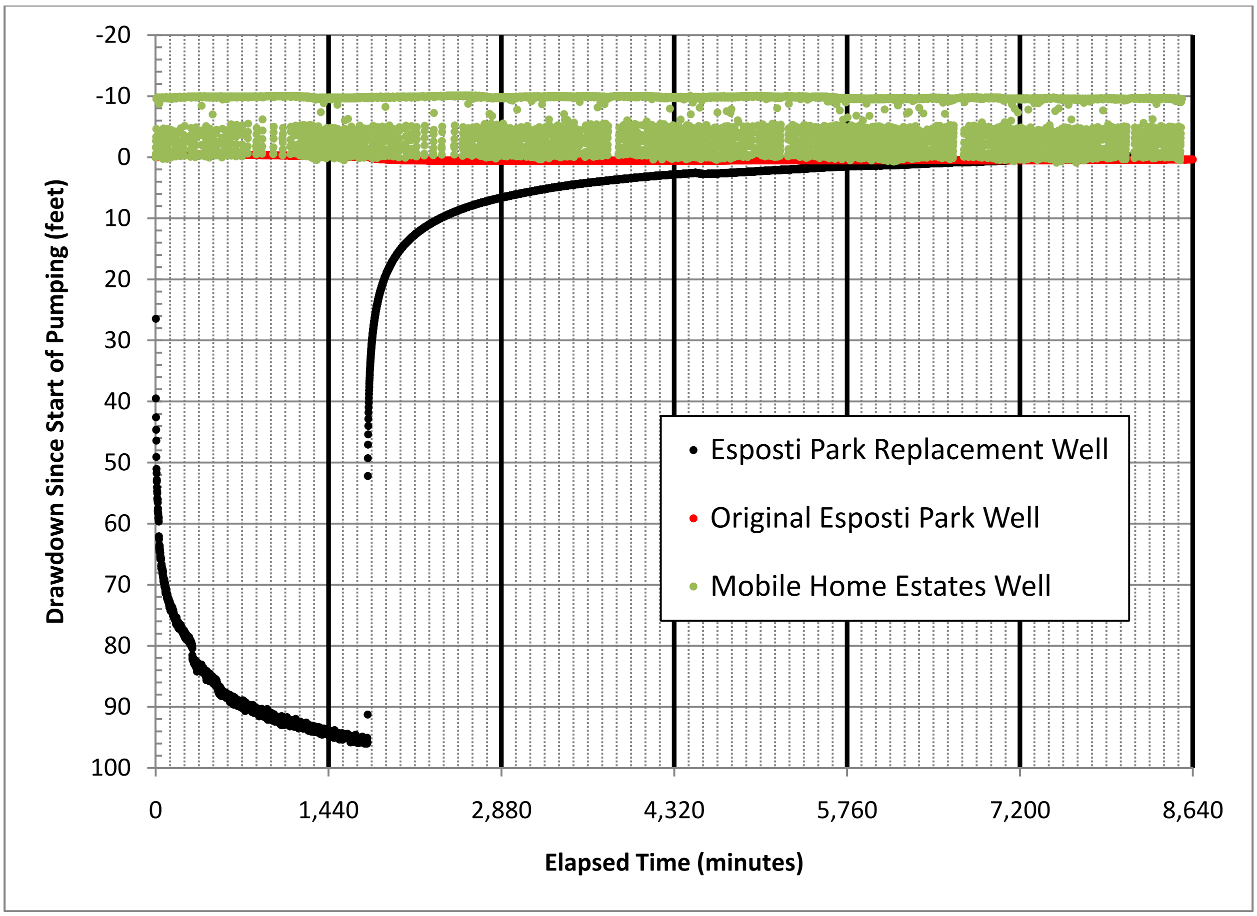

Changes in groundwater levels in the Esposti Park replacement well, as shown in the figure above, are the results of test pumping in the that well prior to commencement of the constant-rate pump testing. As can be seen in the figure above, the original Esposti Park well and the Mobile Home Estates well 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.

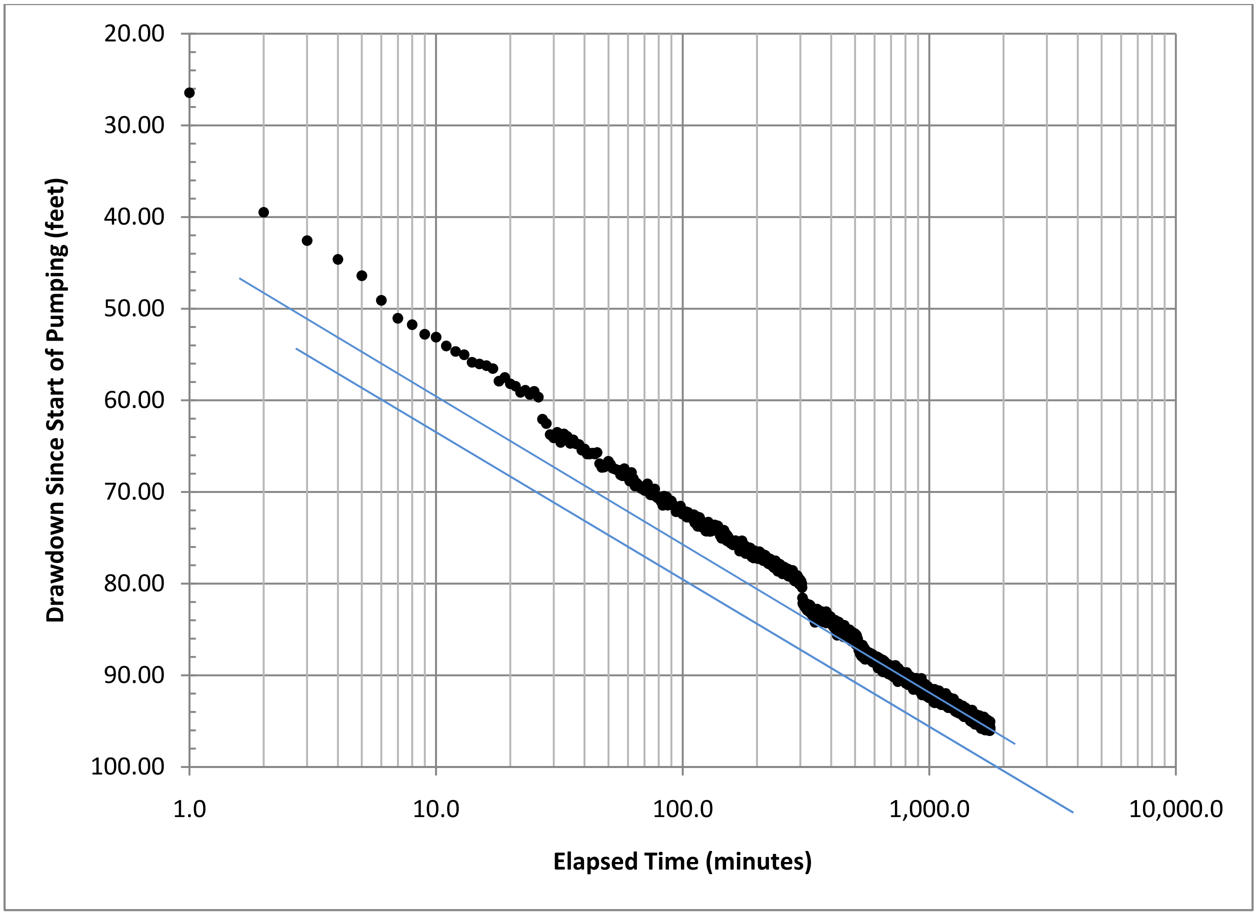
Groundwater drawdown data was plotted simultaneously with observation well data. These data are presented in Figure 4-3. As can be seen from these data, neither the original Esposti Park well nor the Mobile Home Estates well appear to be impacted by pumping in the Esposti Park replacement well. This 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

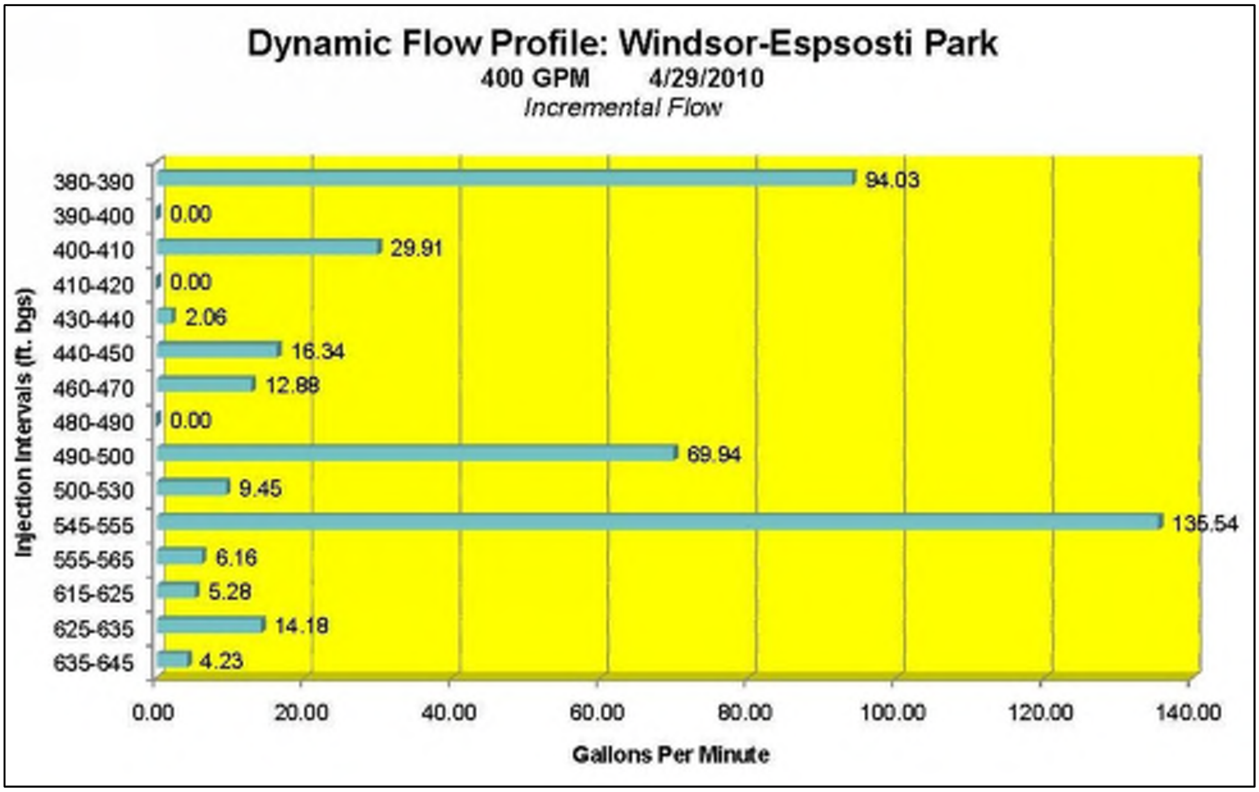
Dynamic profile testing was performed on the Esposti Park replacement well by BESST, Inc. concurrently with the constant-rate pumping testing. Dynamic Flow Profile and Water Quality Analysis testing is generally a two-part procedure in which flow rates across the screened portions of the well are first 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.<br>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.)<br>3. Store each filtered sample in an iced cooler at approximately 4 degrees Celsius out of direct sunlight.<br>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.<br>2. Store each sample in an iced cooler at approximately 4 degrees Celsius.<br>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.<br>2. Store each sample in an iced cooler at approximately 4 degrees Celsius.<br>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.<br>2. Store each sample in an iced cooler at approximately 4 degrees Celsius.<br>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**

| Analyte | Units | MCL | Depth (feet below ground surface) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | 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 | $^oC$ | | 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

# References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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

Prepared for:
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8400 Windsor Road, Bldg. 100
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11110001 | 10 | October 3, 2017

## 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 1$^{st}$ 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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# Appendices

# 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™. 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:

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

Where:

$Q$ = pumping rate in gpm (800 gpm)

$\Delta s$ = 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 $\Delta s$ 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 $\Delta s$ 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:

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

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™. 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 $ft^2$) 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-<br>This process relies on living bacteria to degrade or mineralize soluble contaminants to non-soluble forms. This technology is in<br>fewer vendors to support installations. Operation requires<br>continuous operation is preferred. Technology is unproven for | Moderate capital ($0.9 M) cost, moderate operation cost, new technology, limited competition. | Poor – May require<br>manganese. Instability of suppliers and<br>do not align with |
| **Membranes** – Membrane treatment can remove manganese,<br>contaminants. However, oxides of manganese and arsenic will<br>backwash. Membranes cannot be shut down easily or remain<br>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<br>managed. Resins are also sensitive to adsorption of non-target<br>breakthrough curve that requires frequent sampling and a<br>Resins are not cost-effective for manganese because of the low | Moderate capital ($0.7 M) cost, high<br>is directly<br>arsenic loading rate.<br>process is required | Poor – requires removal of manganese<br>arsenic. Resin systems<br>management requirement. Cost and |
| **Iron Coprecipitation** – Removes manganese and arsenic. Well<br>provide soluble iron. Oxidation of the iron produces a flocculent<br>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<br>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.

- o 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<br>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** |

| DESCRIPTION | QUANTITY | | ESTIMATE | |
|---|---|---|---|---|
| | NUMBER | UNIT | UNIT COST | TOTAL |
| **Esposti Supply Well Capital Cost For Two Step Treatment** | | | | |
| **Catalytic Oxidation (Mn) With Adsorptive Media (As) Conceptual Estimate for System Installation** | | | | |
| **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

This Report: has been prepared by GHD in association with Hazen and Sawyer for the Town of Windsor and may only be used and relied on by the Town of Windsor for the purpose agreed between GHD and the Town of Windsor. GHD otherwise disclaims responsibility to any person other than the Town of Windsor arising in connection with this Report. GHD also excludes implied warranties and conditions, to the extent legally permissible. The services undertaken by GHD in connection with preparing this Report were limited to those specifically detailed in the Report and are subject to the scope limitations set out in the Report. The opinions, conclusions, and any recommendations in this Report are based on conditions encountered and information reviewed at the date of preparation of the Report. GHD has no responsibility or obligation to update this Report to account for events or changes occurring subsequent to the date that the Report was prepared. The opinions, conclusions, and any recommendations in this Report are based on assumptions made by GHD described in this Report. GHD disclaims liability arising from any of the assumptions being incorrect. If GHD has relied on information provided by the Town and/or others when preparing the document: GHD has prepared this Report on the basis of information provided by the Town of Windsor and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the Report which were caused by errors or omissions in that information. The opinions, conclusions, and any recommendations in this Report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points. Investigations undertaken in respect of this Report are constrained by the particular site conditions, such as the time of year and rainfall conditions. As a result, not all relevant site features and conditions may have been identified in this Report. Site conditions may change after the date of this Report. GHD does not accept responsibility arising from, or in connection with, any change to the site conditions. GHD is also not responsible for updating this Report if the site conditions change.

# Figures

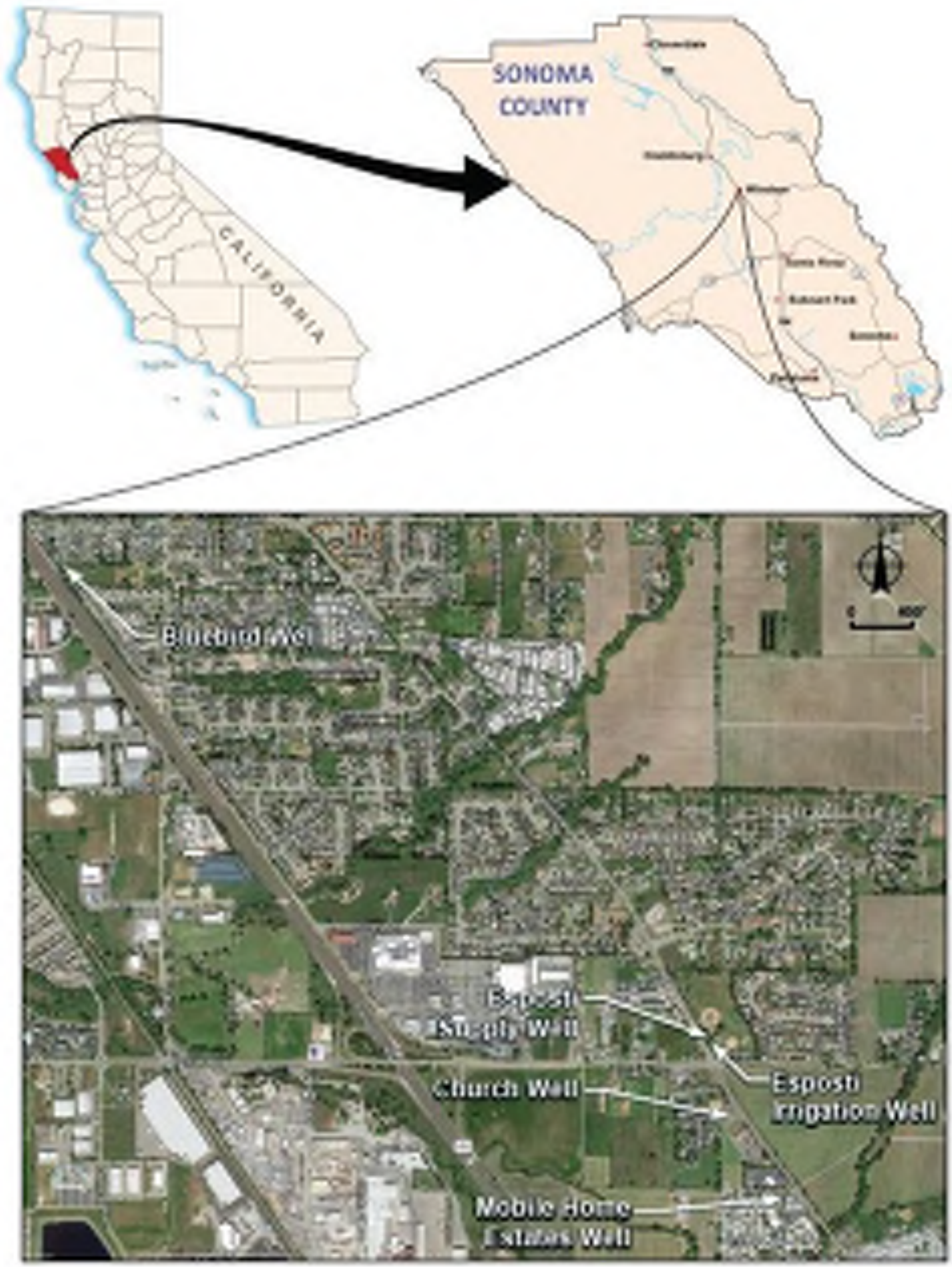



Figure 1 Site Location


Figure 2 Aerial Location Map

Figure 3 Esposti Supply Well With Camera Tool

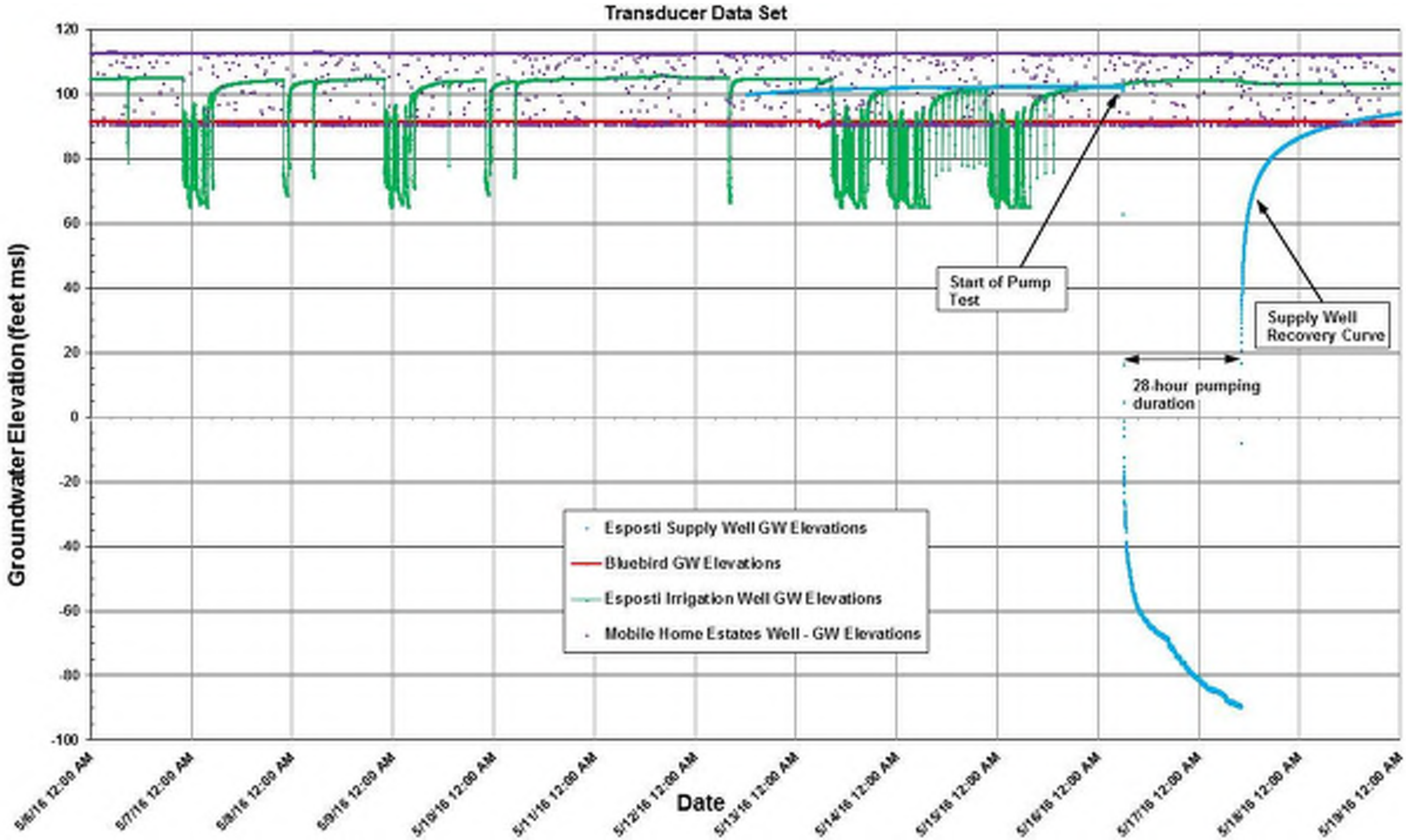



Figure 4 28-Hour Pumping Test All Wells

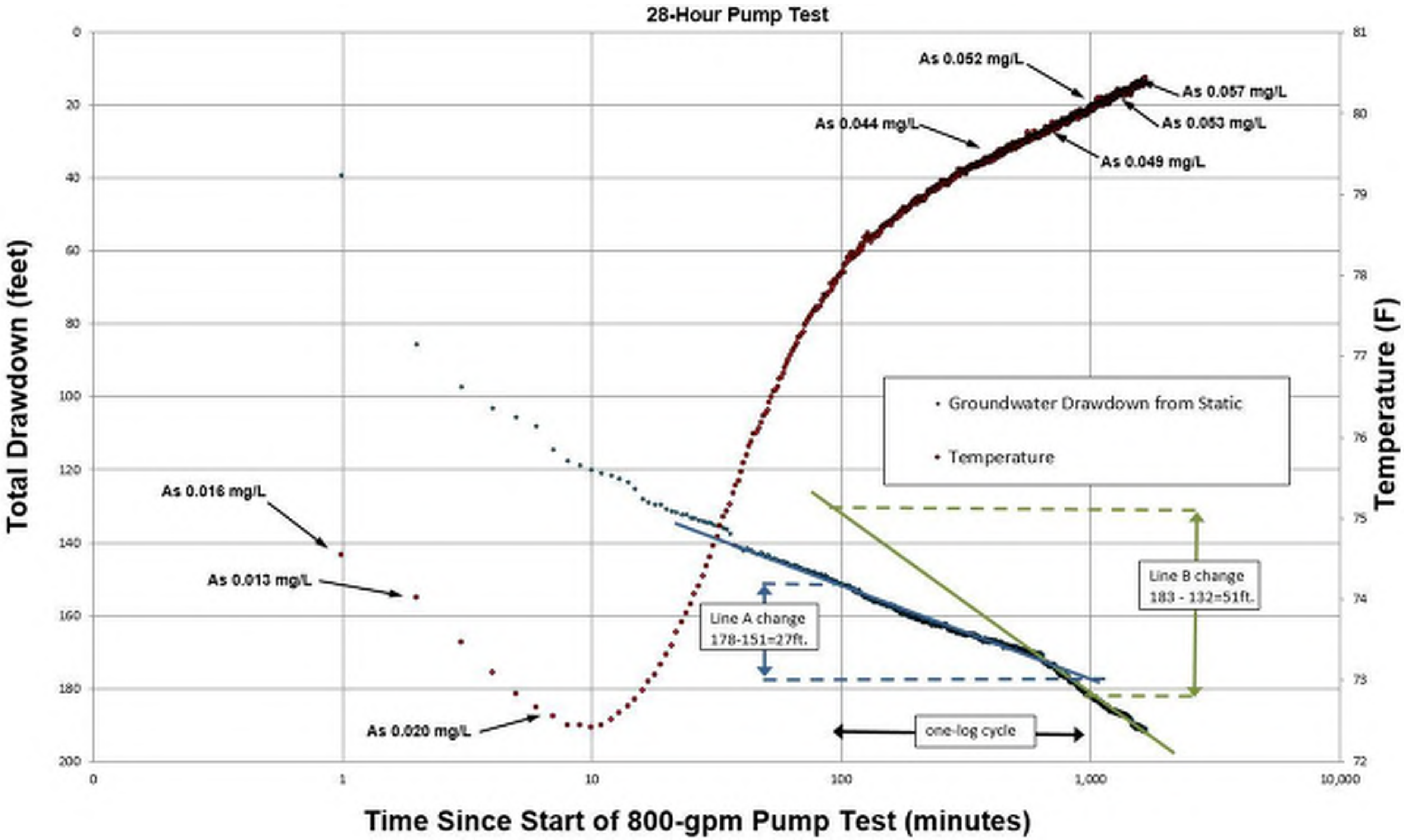



Figure 5 28-Hour Pumping Test Semi-Log Plot

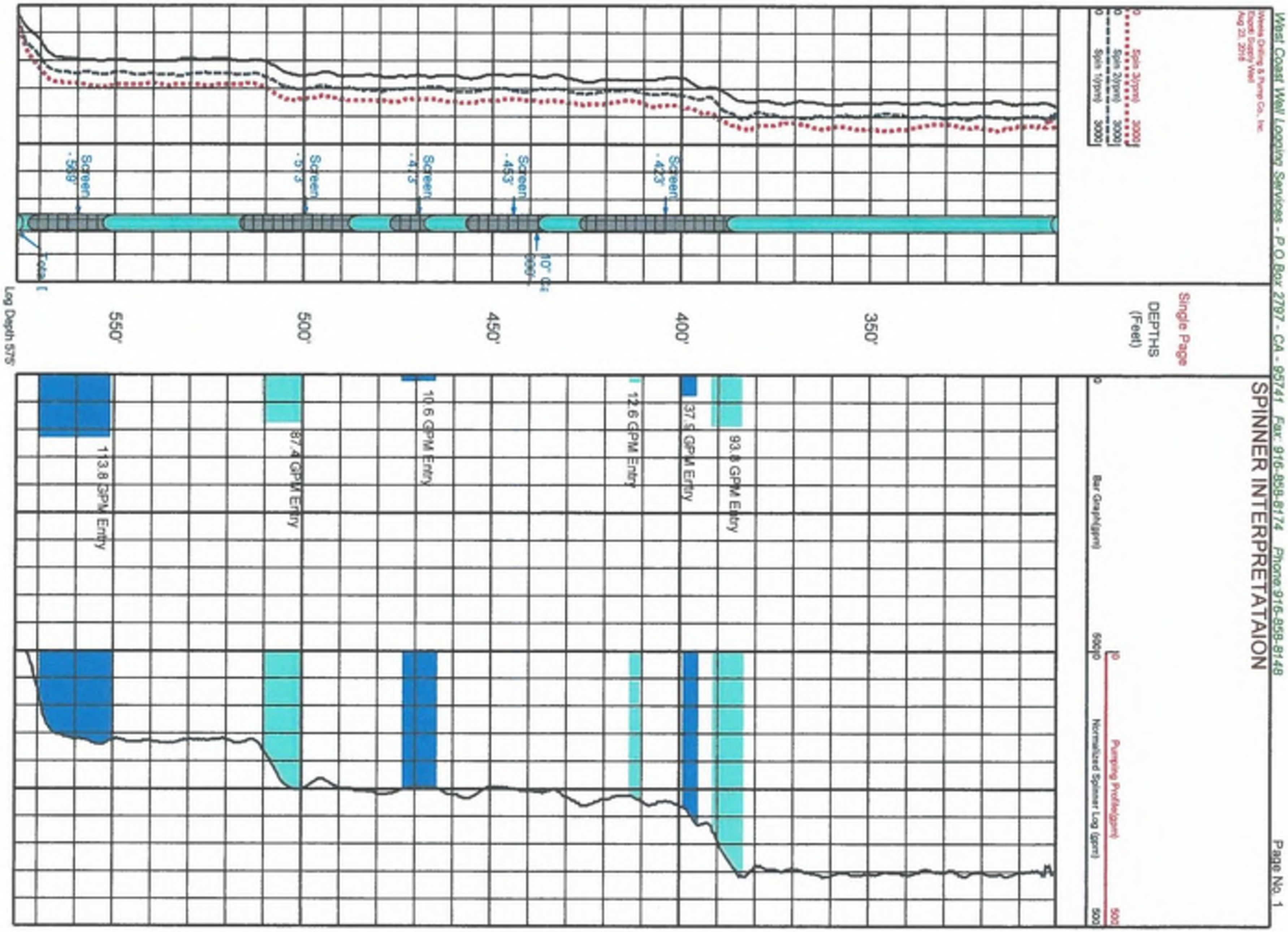



Figure 6 Active Spinner Log 400 gpm Pumping Rate

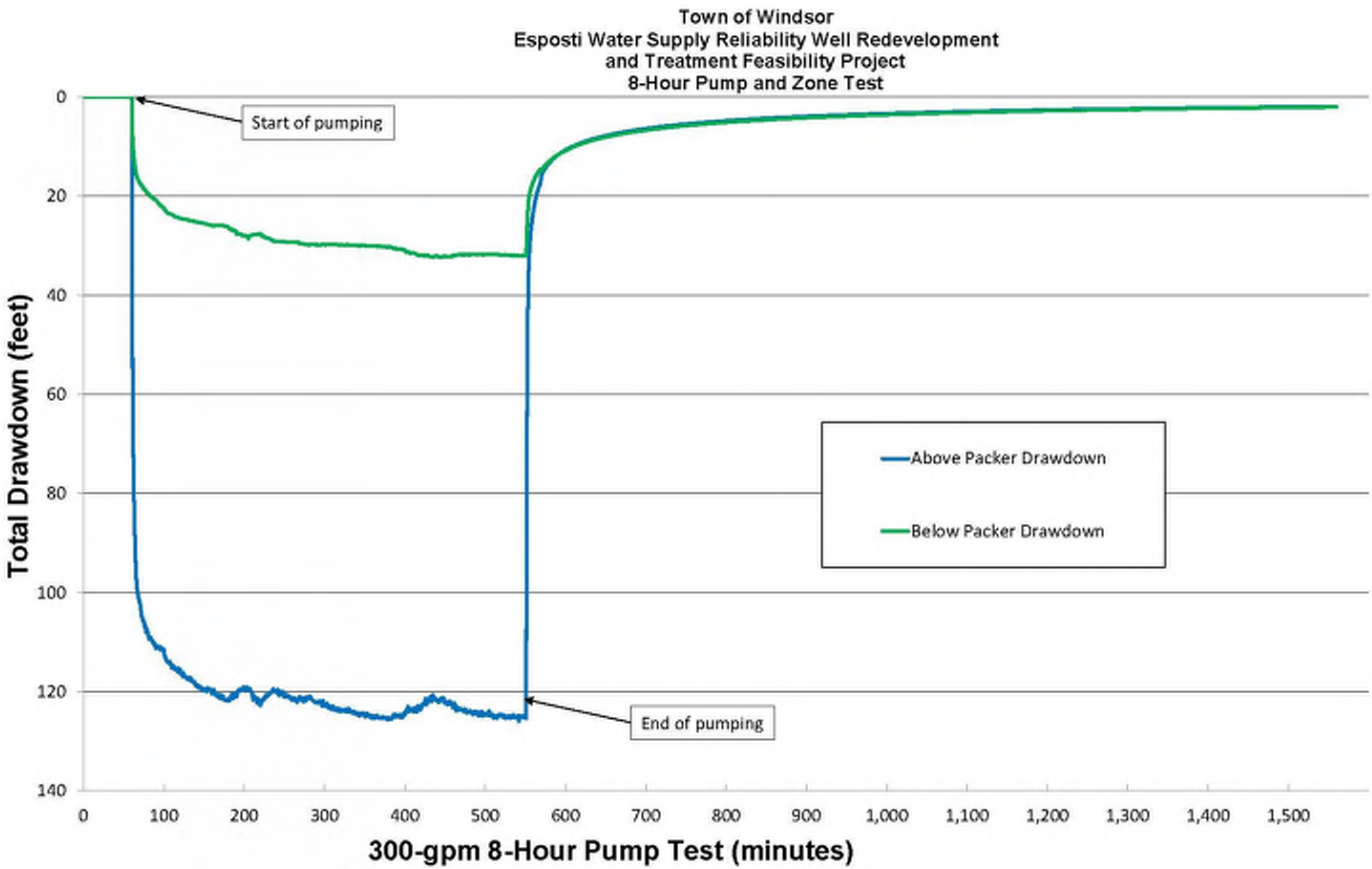



Figure 7 8-Hour First Screen Zone Test Above and Below Packer Groundwater Drawdown

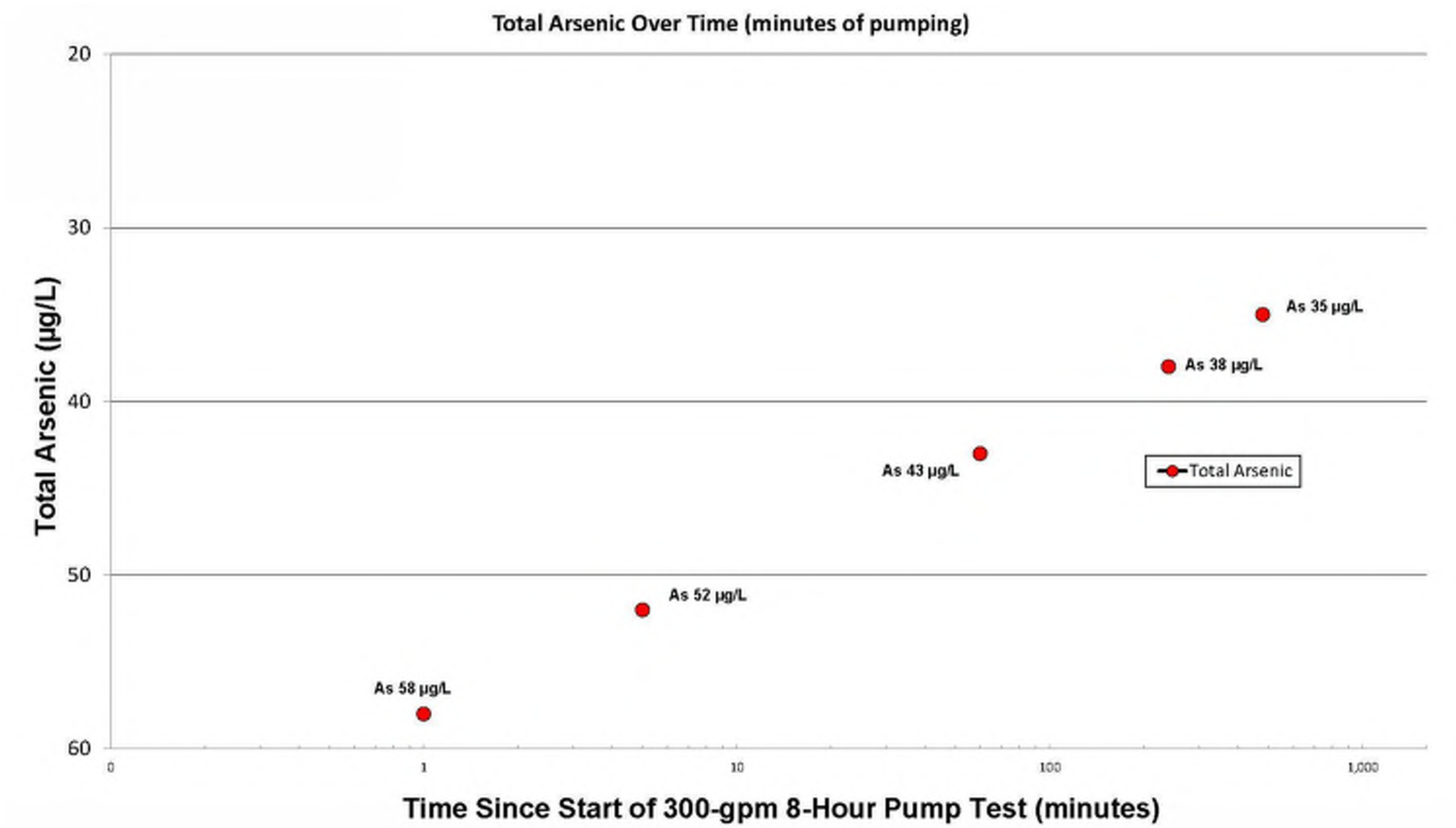



Figure 8 8-Hour First Screen Zone Test Arsenic Concentrations

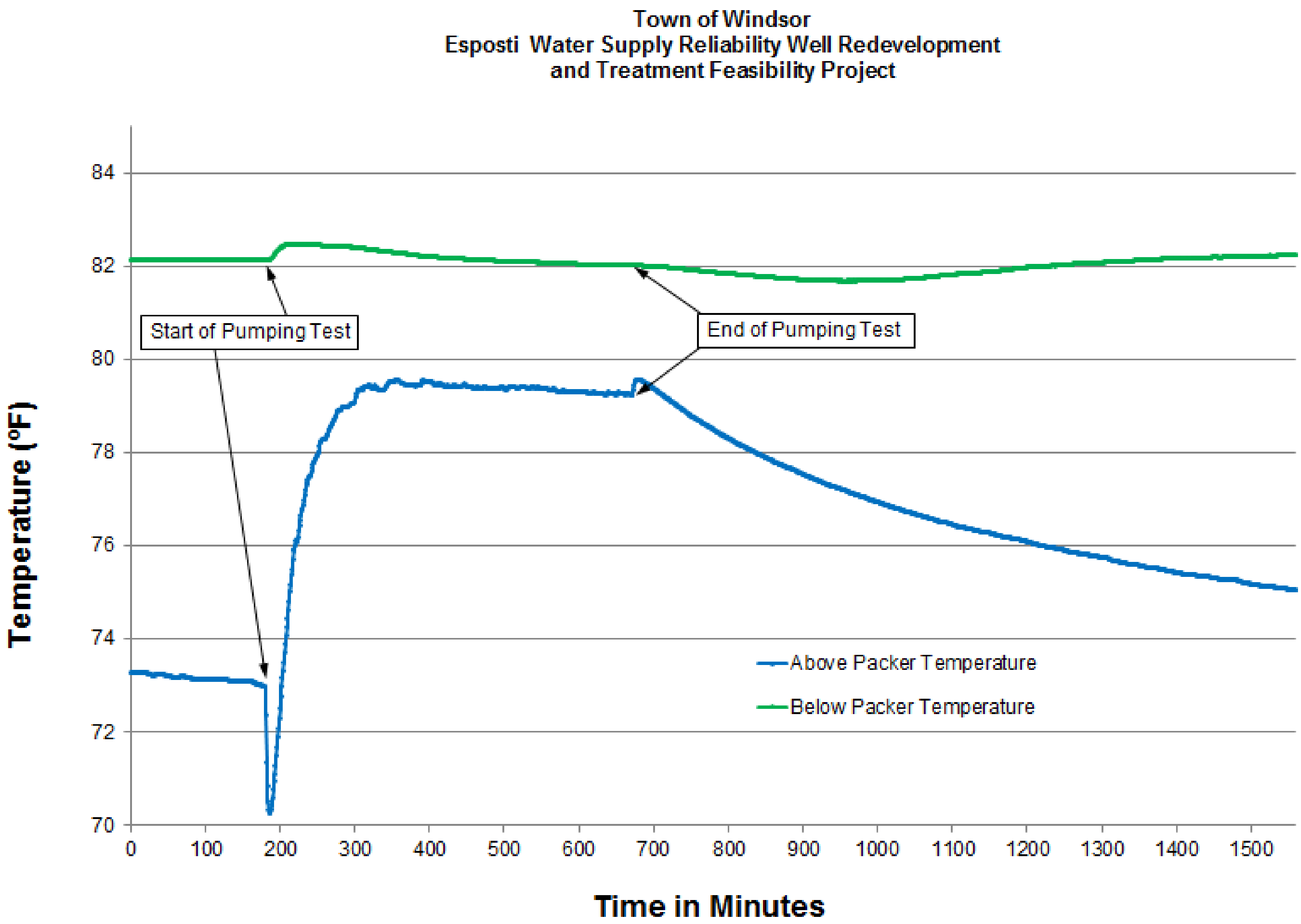



Figure 9 8-Hour First Screen Zone Test Temperature Above and Below Packer Groundwater Drawdown

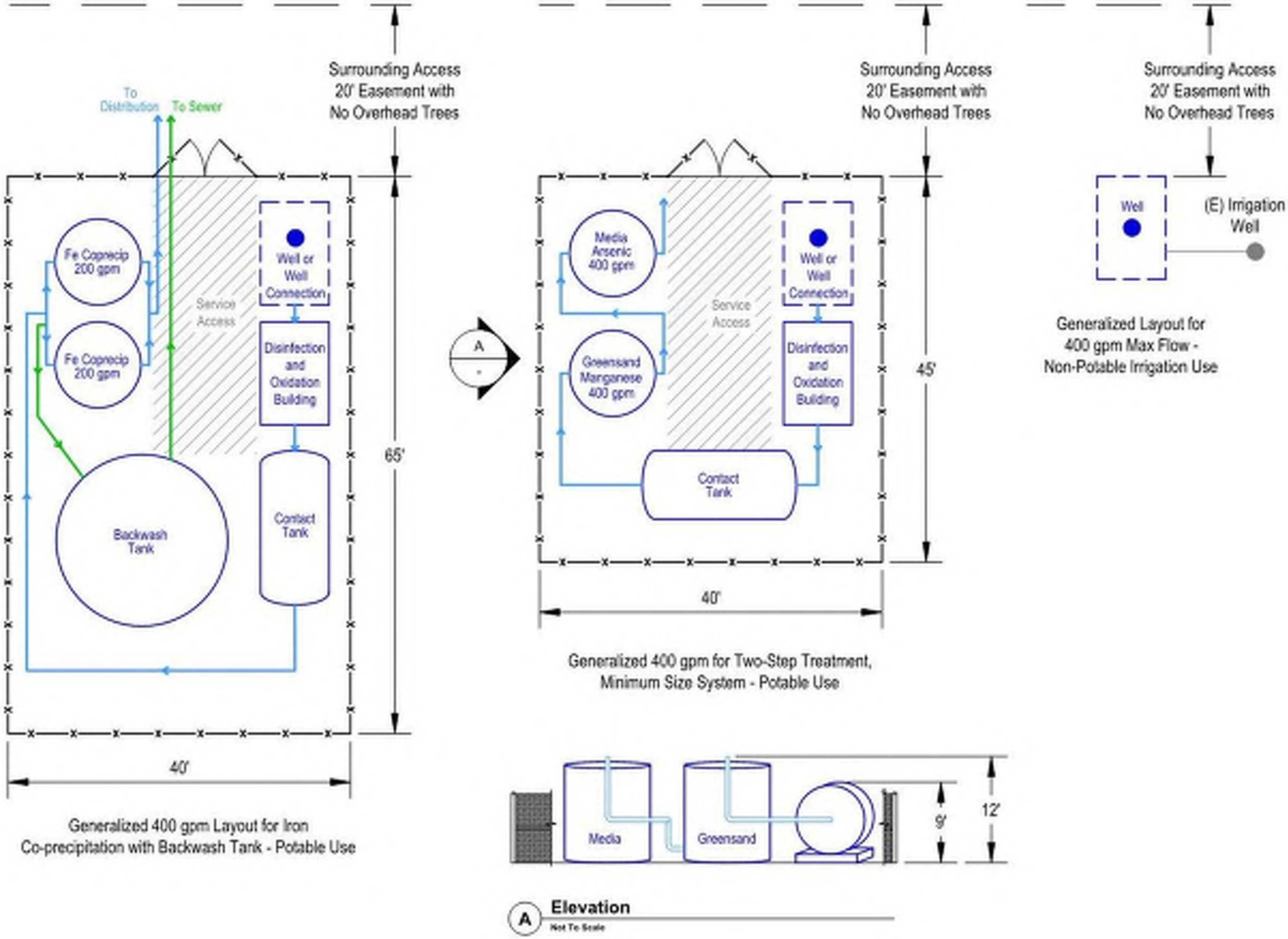



Figure 10 Compound Options


Figure 11 System Location, Northwest Option

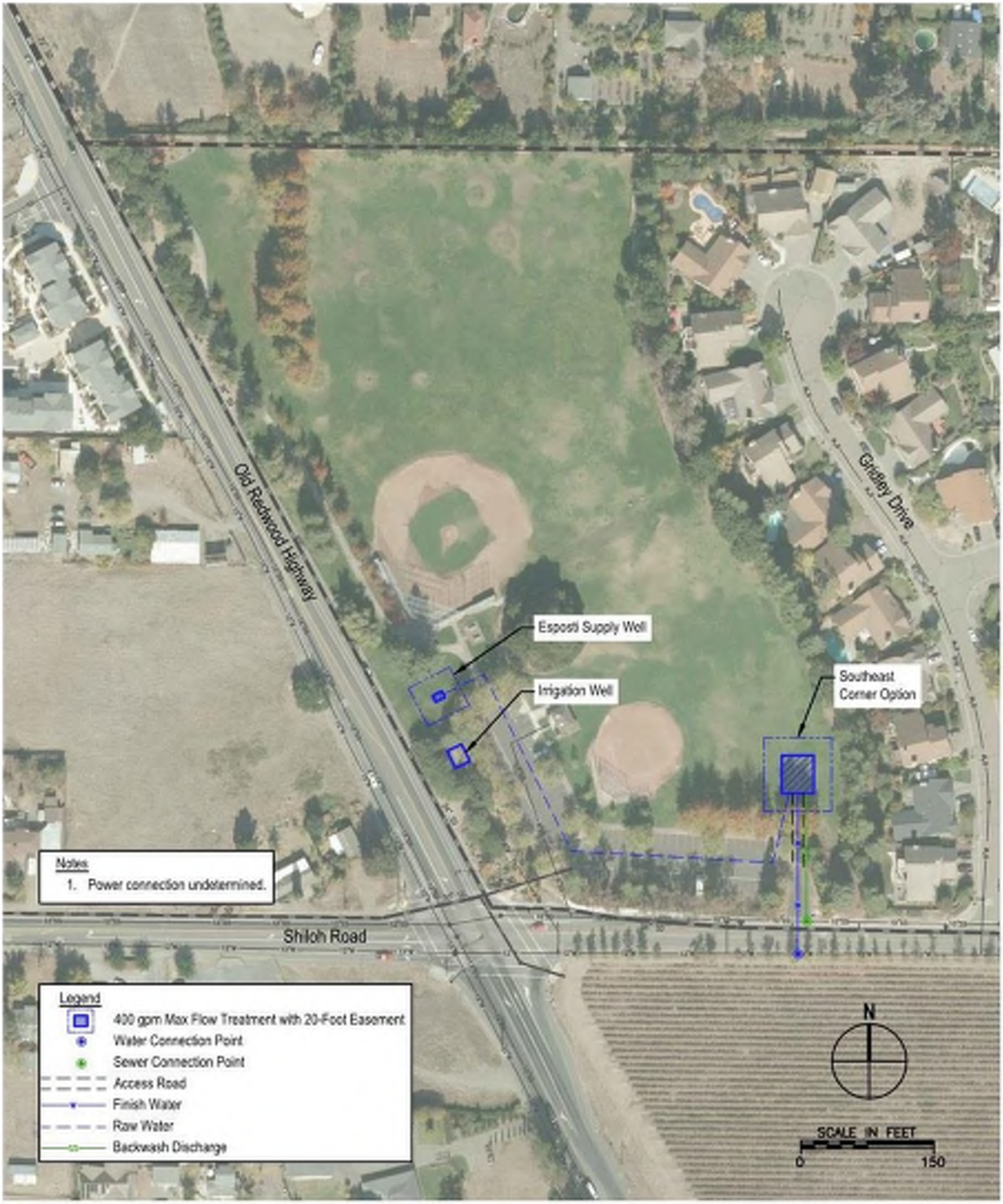



Figure 12 System Location, Southeast Option


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

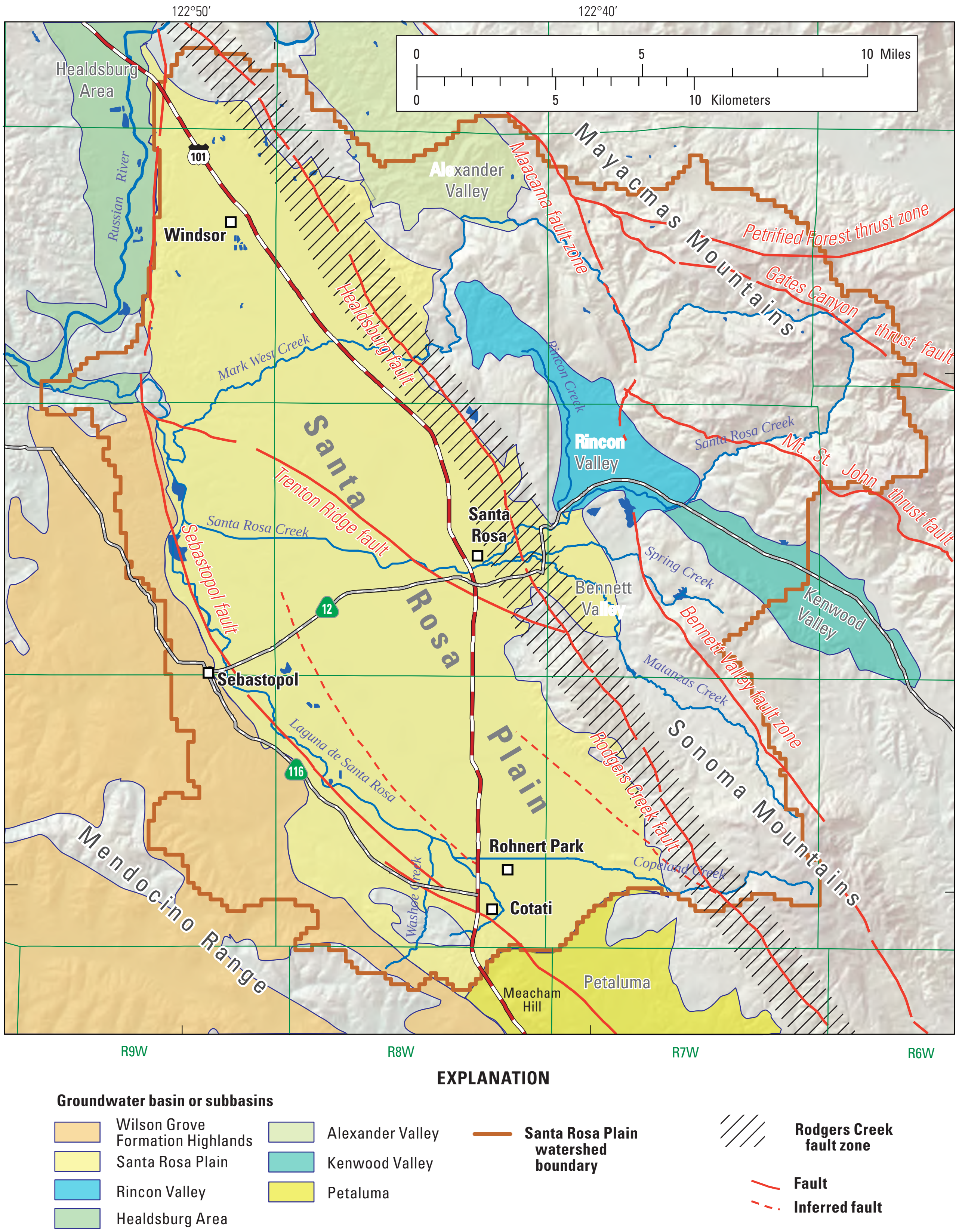



**Figure 3.** Santa Rosa Plain watershed boundary with groundwater subbasins, Sonoma County, California.

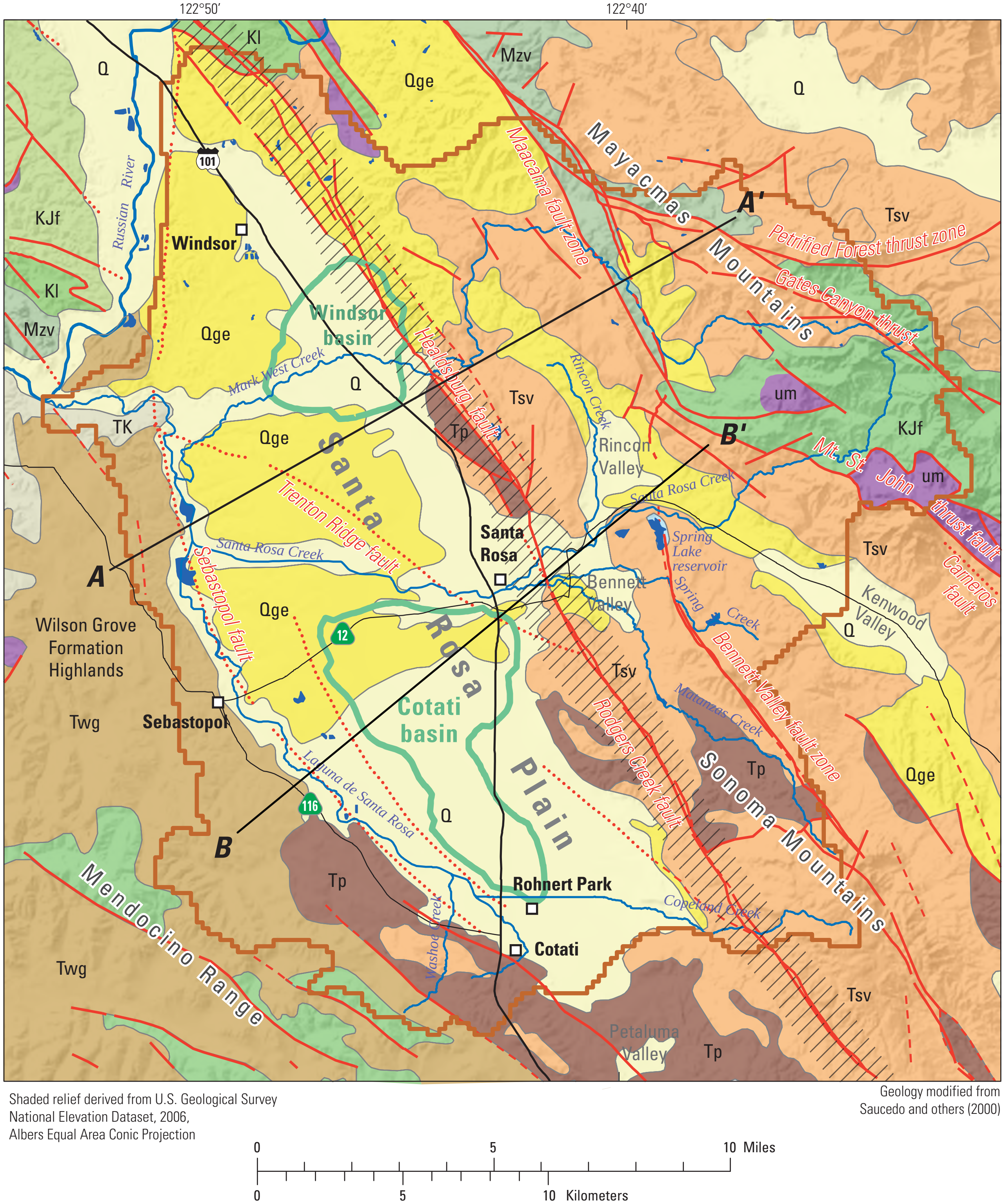



**Figure 1.** Santa Rosa Plain watershed, Sonoma County, California.

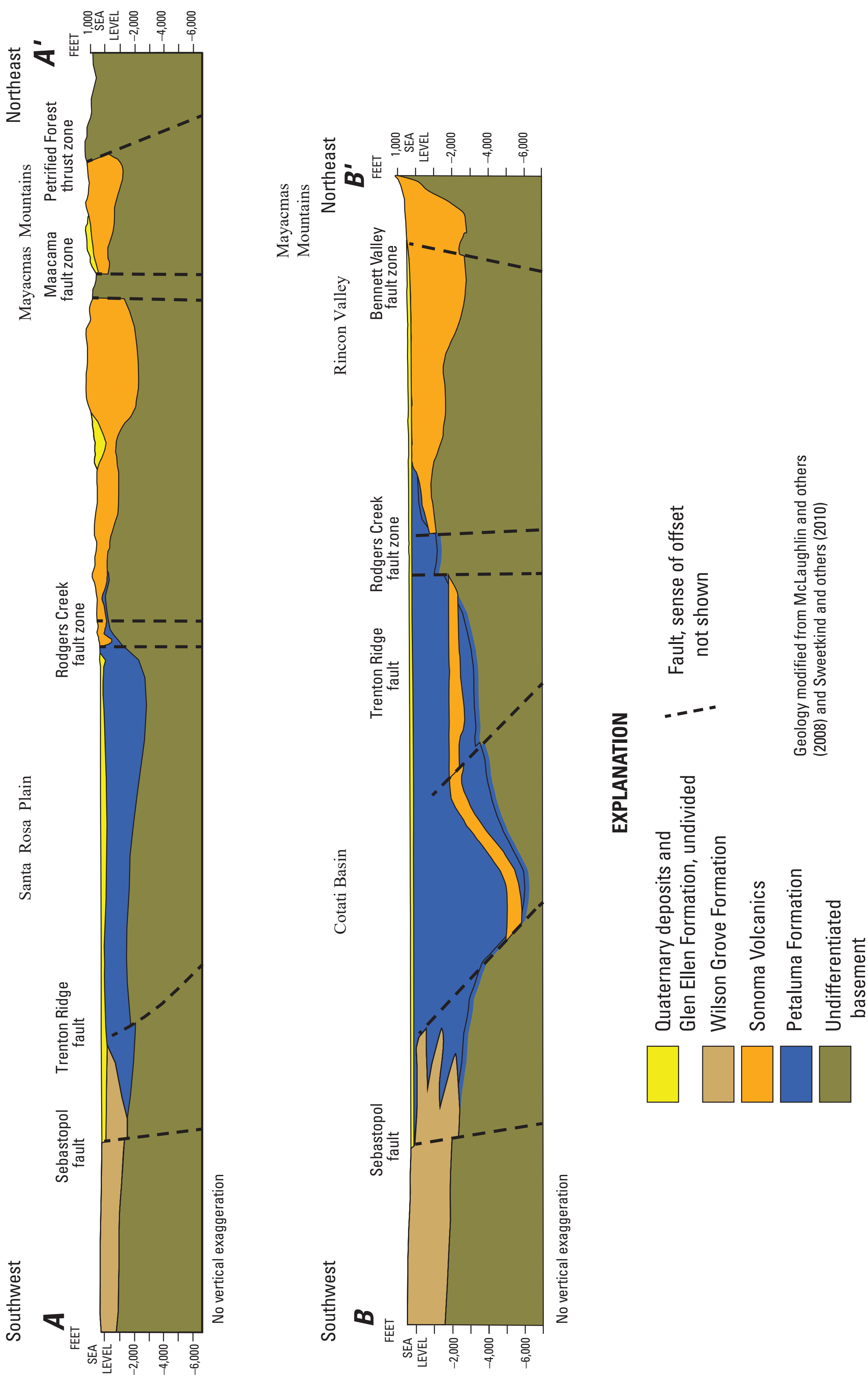



**Figure 2.** Interpretive geologic cross sections of the Santa Rosa Plain watershed, Sonoma County, California.

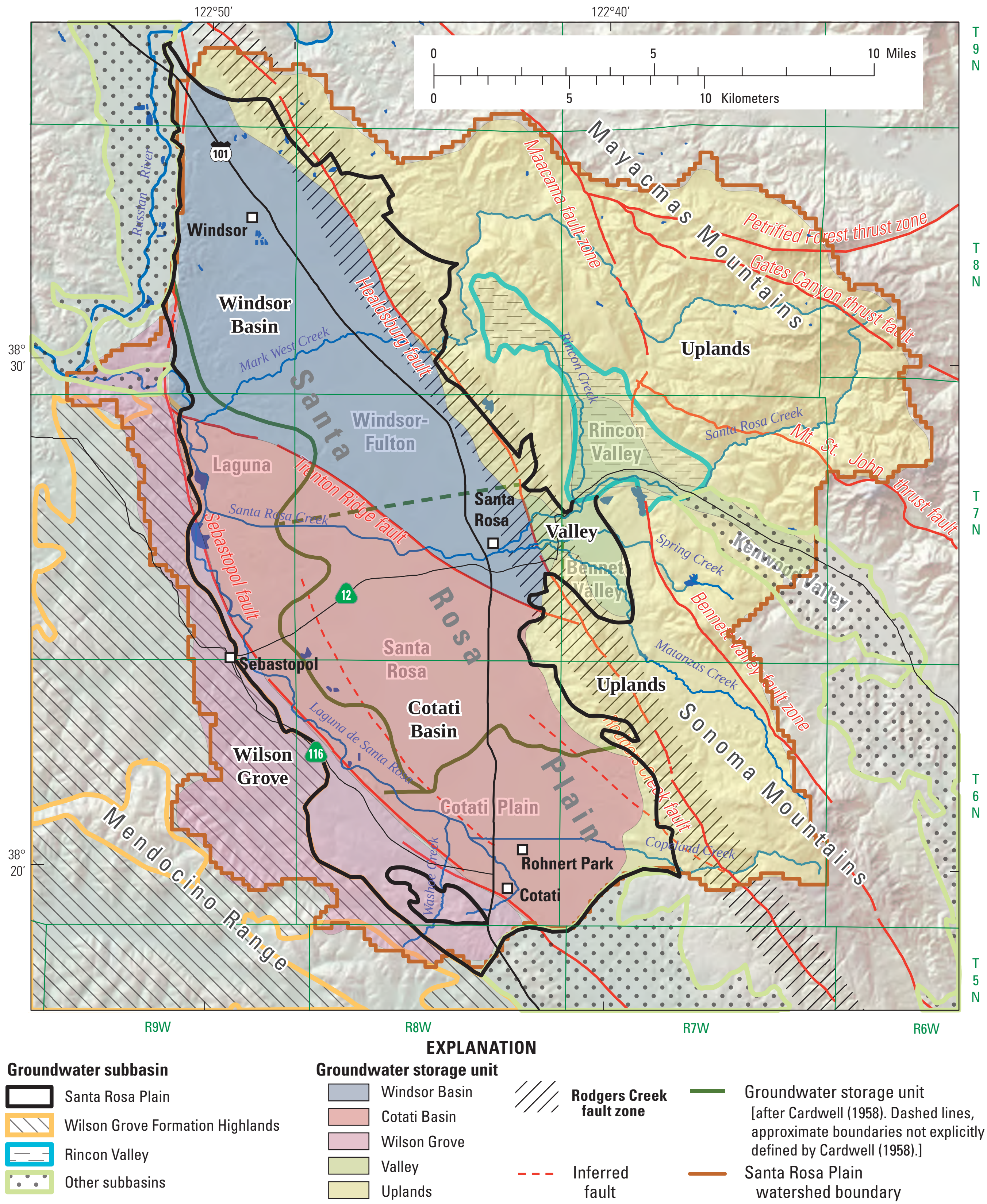



**Figure 24.** Groundwater basins, subbasins, and storage units in the Santa Rosa Plain watershed, Sonoma County, California.

# 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

State of California

# Well Completion Report

Refer to Instruction Pamphlet

No. e0113306



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

DWR Use Only – Do Not Fill In

State Well Number/Site Number

Latitude N Longitude W

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 (Address) Zamora (City) CA (State) 95695 (Zip)

Signed [signature] C-57 Licensed Water Well Contractor

Date Signed 7-23-10 C-57 License Number 283326

DWR 188 REV. 1/2006

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

| | | | |
|---|---|---|---|
| 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 | Start Date: | 2/24/2010 |
| Sampler Type: | Grab from Cyclone | End Date: | 3/27/2010 |
| | | Latitude: | N 38° 31' 35.4" |
| | | Longitude: | W 122° 46' 46.5" |

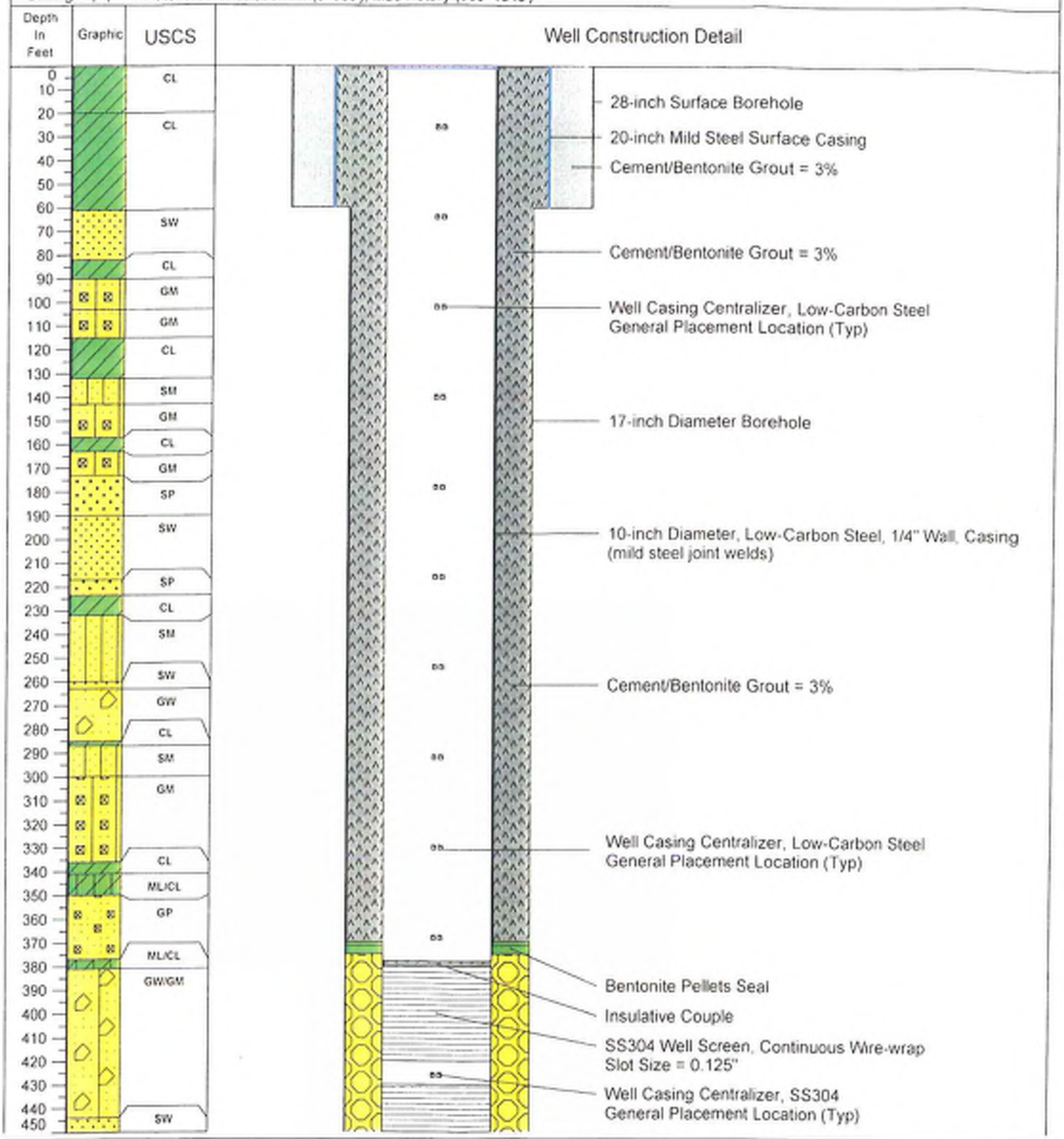
# WELL CONSTRUCTION DIAGRAM

## Esposti Park Test Hole

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

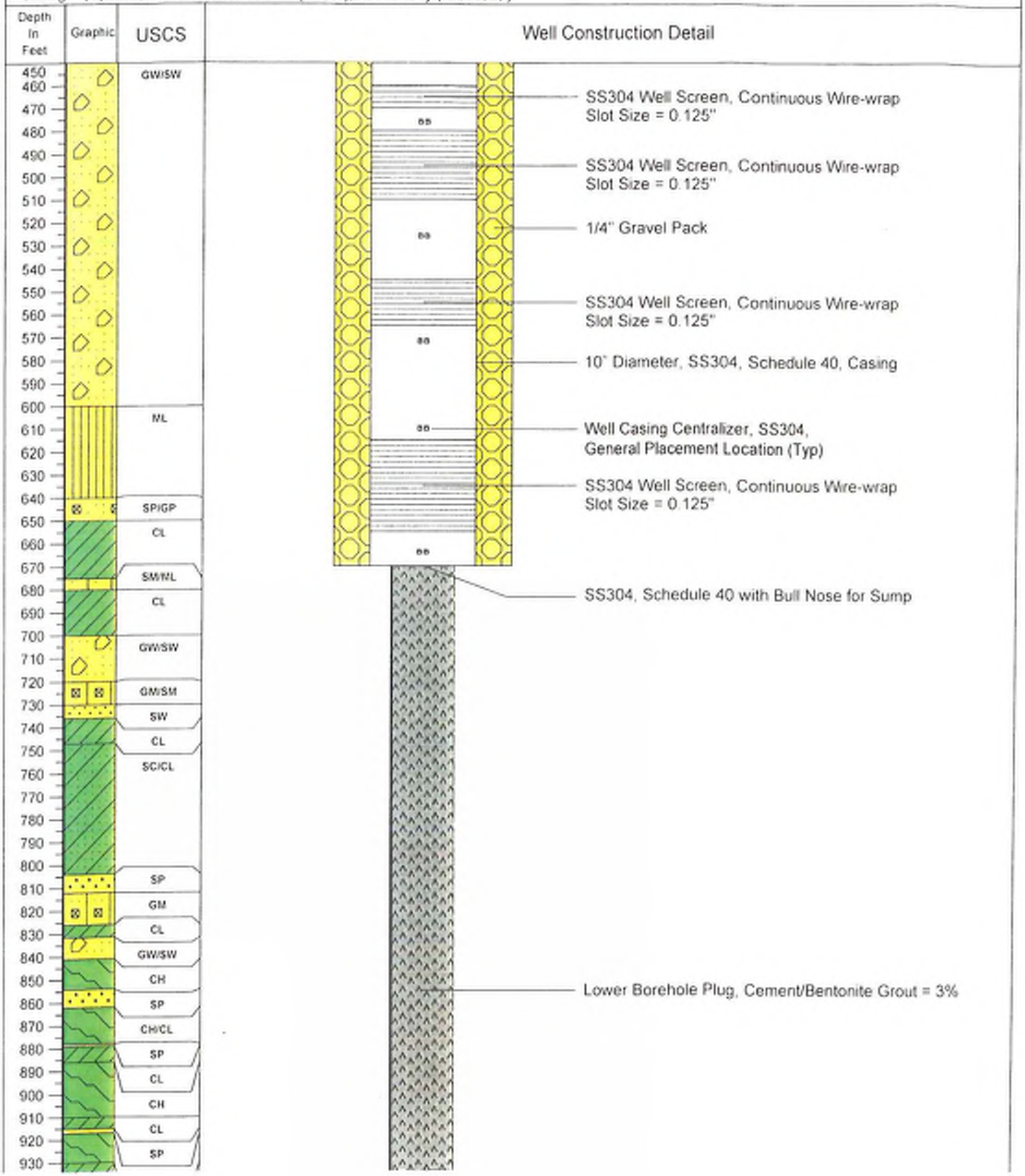
E-PUR, llc

# 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')



# WELL CONSTRUCTION DIAGRAM

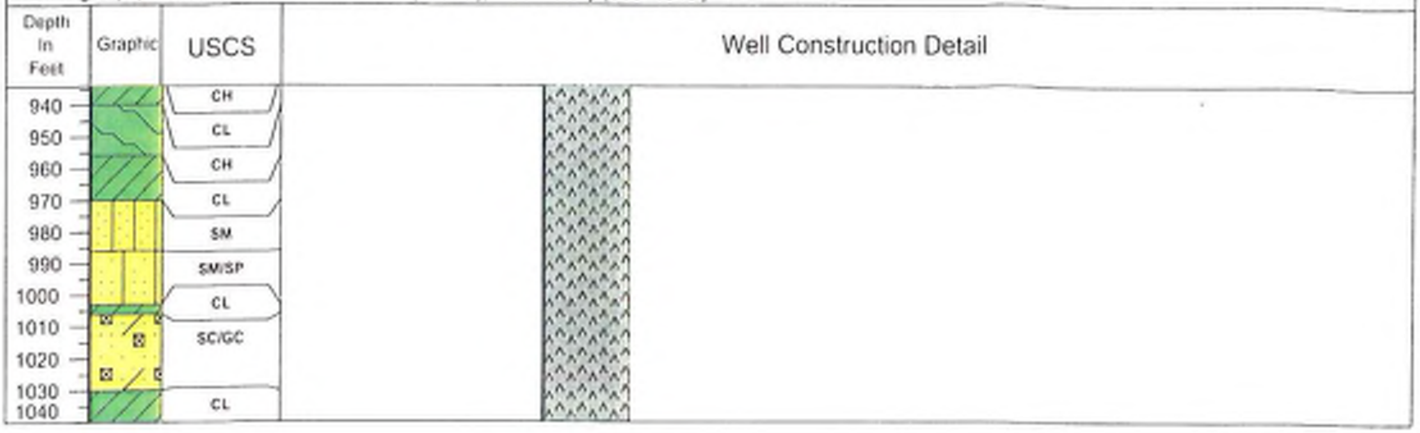
## Esposti Park Test Hole

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')



E-PUR.llc

Drilling Company: WDC Exploration and Wells
Driller: Gary Eldred, Greg Gallo, John Chaves
Drilling Equipment: Reverse Circulation
Air (0-790), Mud Rotary (791-867)

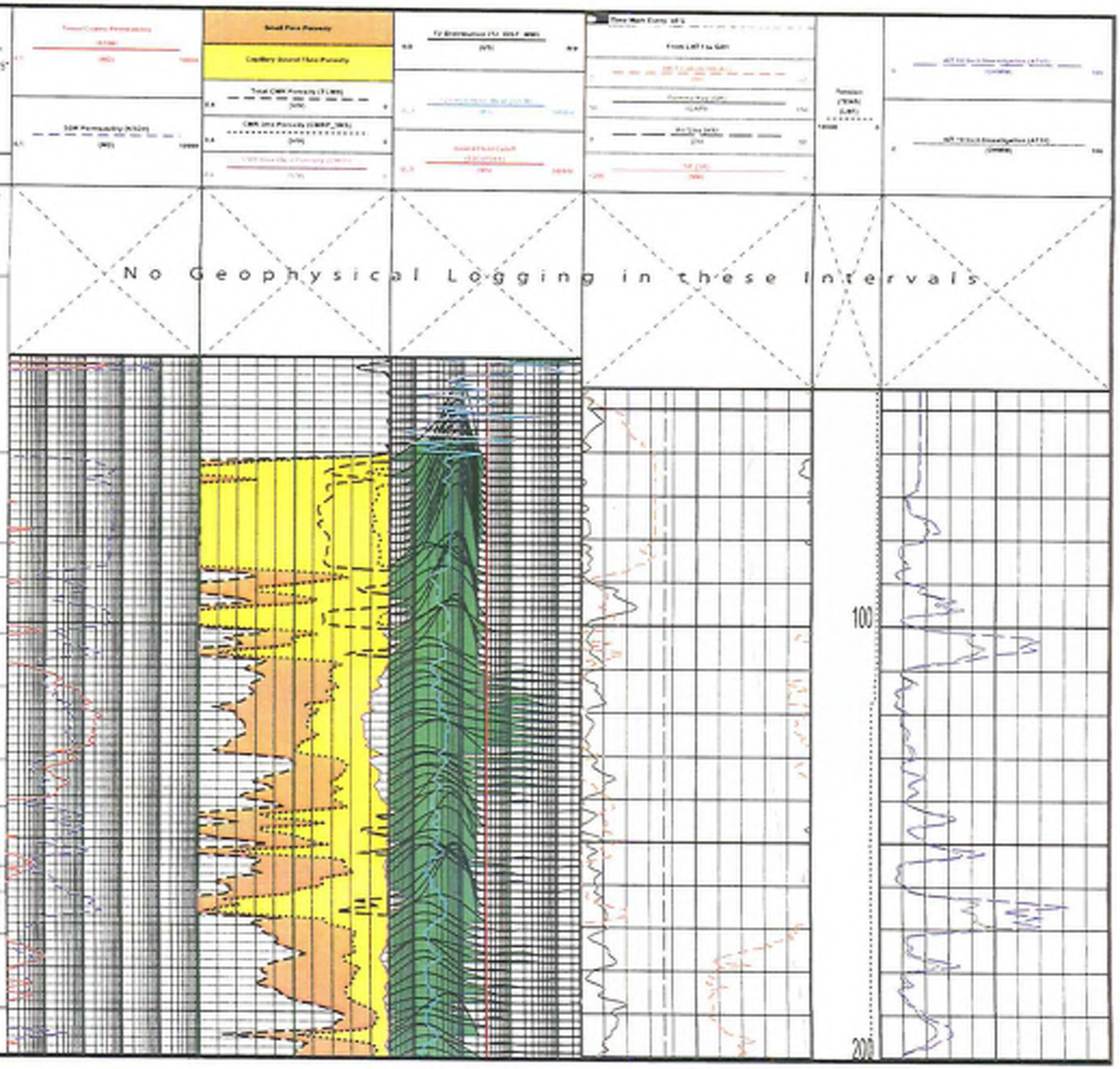
# BORING LOG: Esposti Park

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

| USCS | Description |
|---|---|
| CL | Sandy CLAY (CL) - medium to light brown, stiff, plastic clay; varicolored, poorly sorted, fine to coarse, subangular to angular sand; poorly sorted, rounded fine to coarse gravel |
| 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 |
| 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 |
| 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 |
| 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 |
| CL | Silty CLAY (CL) - dark gray/green, plastic clay; with silt and fine sand |
| SM | Silty SAND (SM) - gray/green, poorly sorted, rounded to subrounded, fine sand; fine, subangular to subrounded gravel, with rare cobble |
| GM | Silty GRAVEL (GM) - as above with fine gravel to coarse sand, varicolored |
| CL | Sandy CLAY (CL) - light brown, clay; sand |
| 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 |
| SP | SAND (SP) - varicolored, subrounded to rounded, fine to medium sand, abundant well rounded and frosted quartz |
| 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: Cory Eldred, Greg Gallo, John Chavez
Drilling Equipment: Reverse Circulation Air (0-795'), Mud Rotary (795-867')

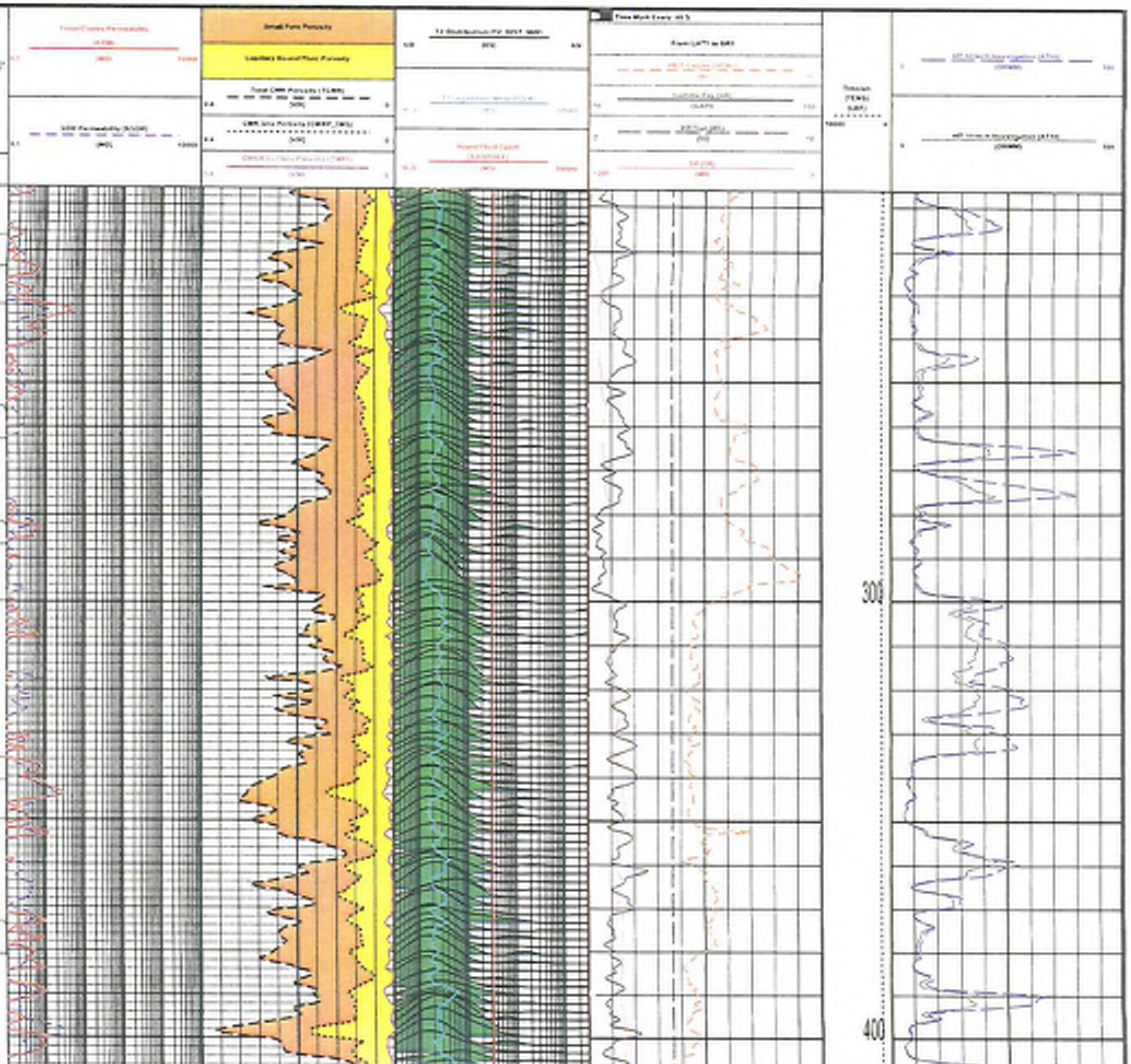
# BORING LOG: Esposti Park

Esposti Park Well Test Hole

Start Date: 3/24/2010
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

| Depth (feet) | Graphic | 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<br>Abundant volcanics at 400 feet |



E-PUR.llc

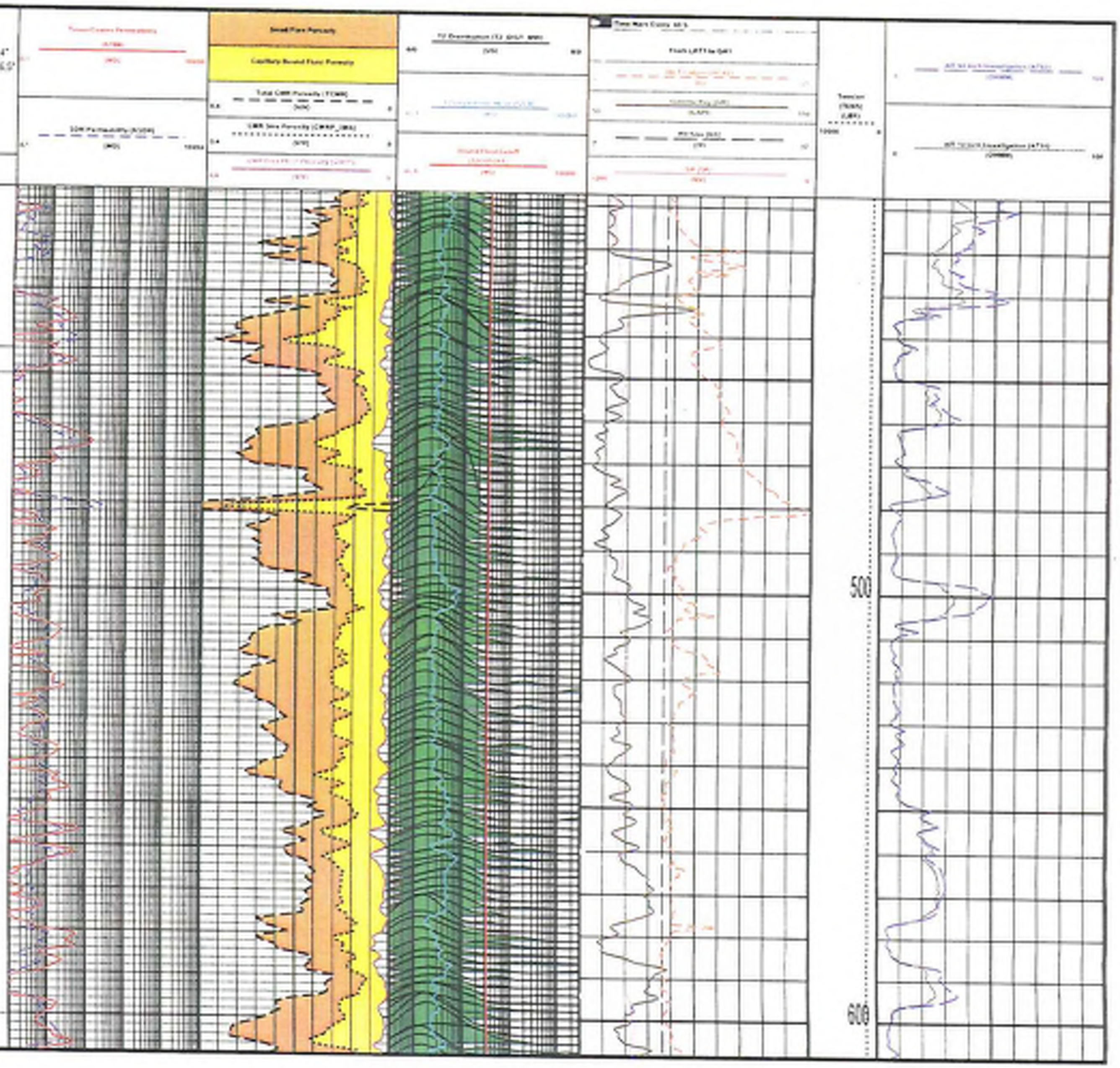
Drilling Company: WDC Exploration and Wells
Driller: Gary Eldred, Greg Gallo, John Chaves
Drilling Equipment: Reverse Circulation Air (0'-795'), Mud Rotary (795'-867')

# BORING LOG: Esposti Park

Esposti Park Well Test Hole

| | |
|---|---|
| Start Date: | 2/4/2010 |
| 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) | Graphic | USCS | Description |
|---|---|---|---|
| 410–445 | | | |
| 445–450 | | SW | SAND (SW) - well graded sand, with little ash; stringer of clay at 450 feet |
| 450–600 | | GW/SW | Sandy GRAVEL (GW) to Gravelly SAND (SW) - variecolored, fine to coarse grained sand and gravel<br>Stringer of clay at 465 feet<br>Trace of clay at 480 feet<br>Interbedded clay unit with sand and gravel at 510 to 513 feet<br>Trace alkalinity at 520 feet<br>Lost circulation at 545 feet<br>Trace of clay at 580 feet; |
| 600– | | ML | Sandy SILT (ML) - gray, friable, silt (asm); light gray, angular to subrounded, medium sand |



# BORING LOG: Esposti Park

Esposti Park Well Test Hole

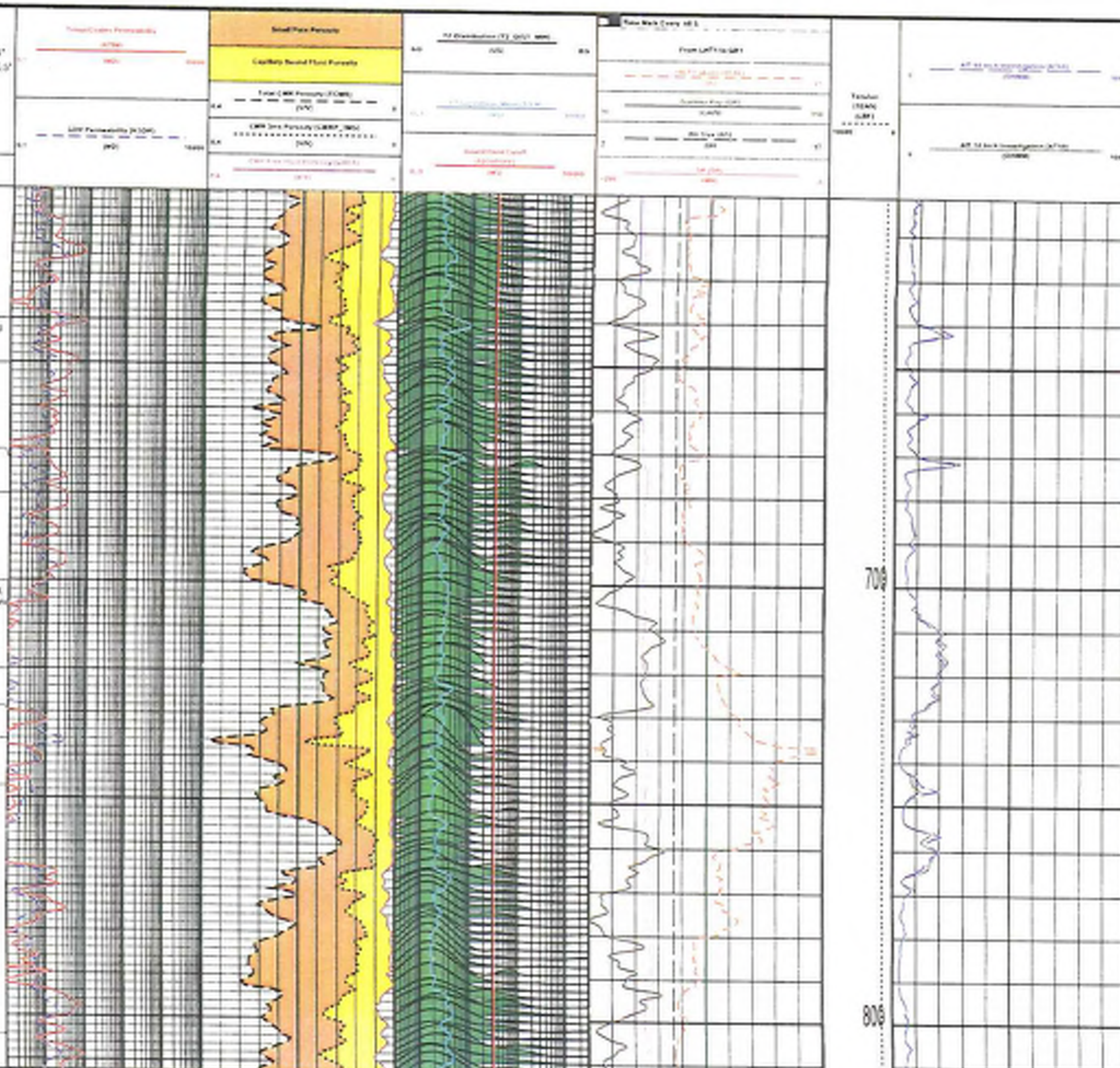
E-PUR.llc

Drilling Company: WDC Exploration and Wells
Driller: Gary Eldred, Greg Gallo, John Chaves
Drilling Equipment: Reverse Circulation
Air (0'-795'), Mud Rotary (795'-867')

| | |
|---|---|
| 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 |

Start Date: 2/24/2010
End Date: 3/3/2010
Latitude: N 38° 31' 35.4"
Longitude: W 122° 40' 46.5"

| Depth (feet) | USCS | Description |
|---|---|---|
| 640–650 | 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 |
| 650–675 | CL | Silty CLAY (CL) - light gray clay and silt (ash) with interbedded gray, soft clay; some fine sand |
| 675–680 | 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 |
| 680–700 | CL | CLAY (CL) - light tan, soft, occasionally stiff clay; abundant fine sand |
| 700–722 | 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 |
| 722–730 | GM/SM | Silty GRAVEL (GM) to Silty SAND (SM) - color and texture as above |
| 730–735 | SW | SAND (SW) - dark green gray, very fine to medium grained sand, rounded to subrounded; poorly sorted; few gravel |
| 735–745 | CL | Silty CLAY (CL) - dark gray, soft clay; with micaceous silt |
| 745–805 | 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 |
| 805–810 | 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

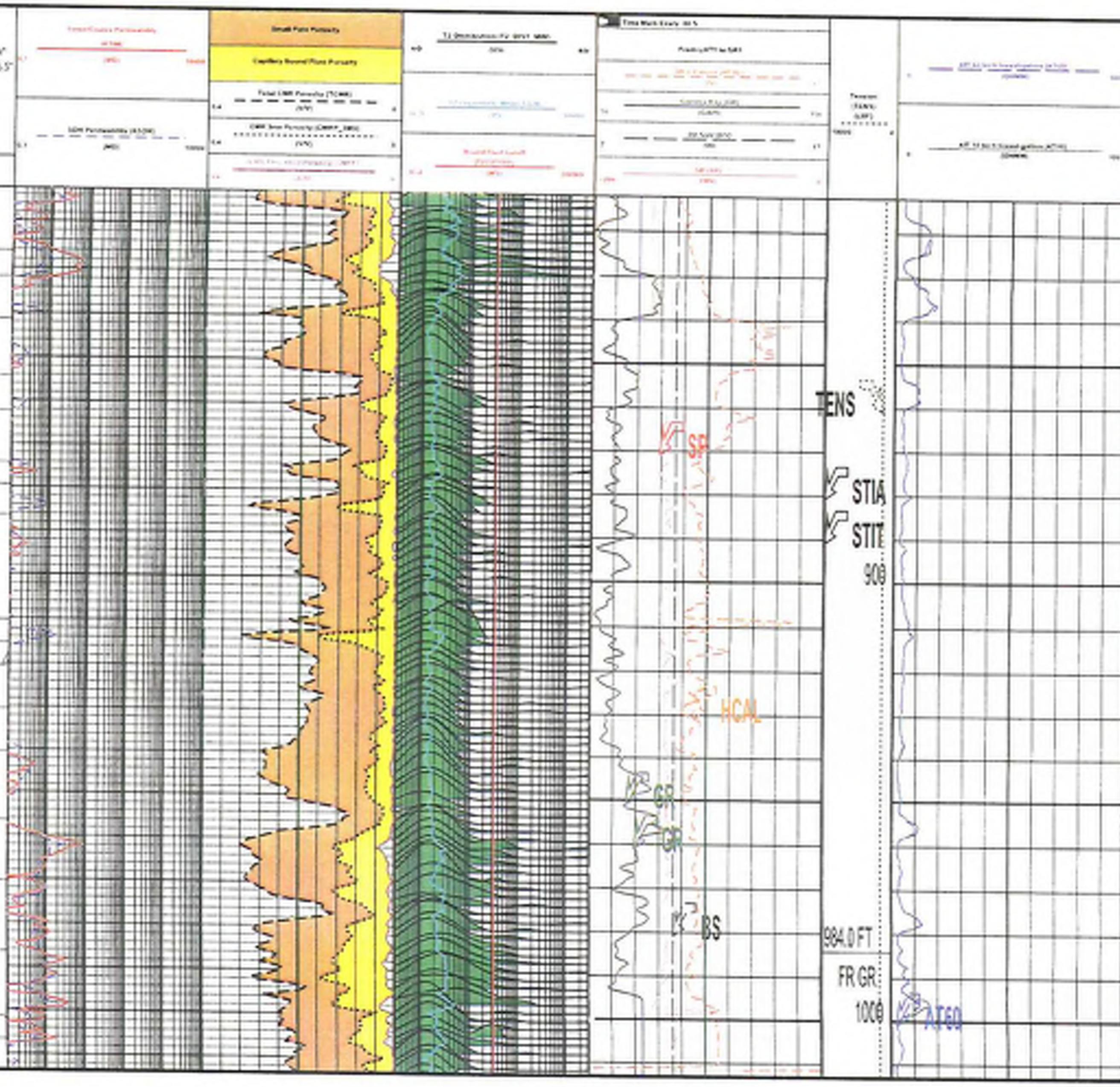
Esposti Park Well Test Hole

| | |
|---|---|
| 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')

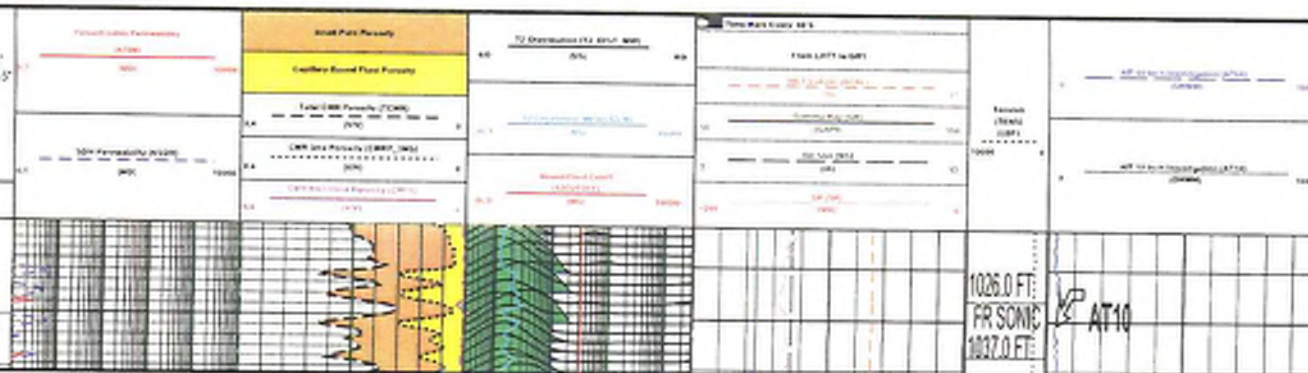
# BORING LOG: Esposti Park

Esposti Park Well Test Hole

| | |
|---|---|
| Start Date: | 2/4/2010 |
| 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 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 |

**Lithologic Log Notes:**
UCS Unified Soil Classification System (Visual-Manual Method)

**Geophysical Log Notes:**
Geophysical logging by Schlumberger (Bakersfield, CA)
CMR - Combinable Magnetic Resonance Tool
SP - Spontaneous Potential


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

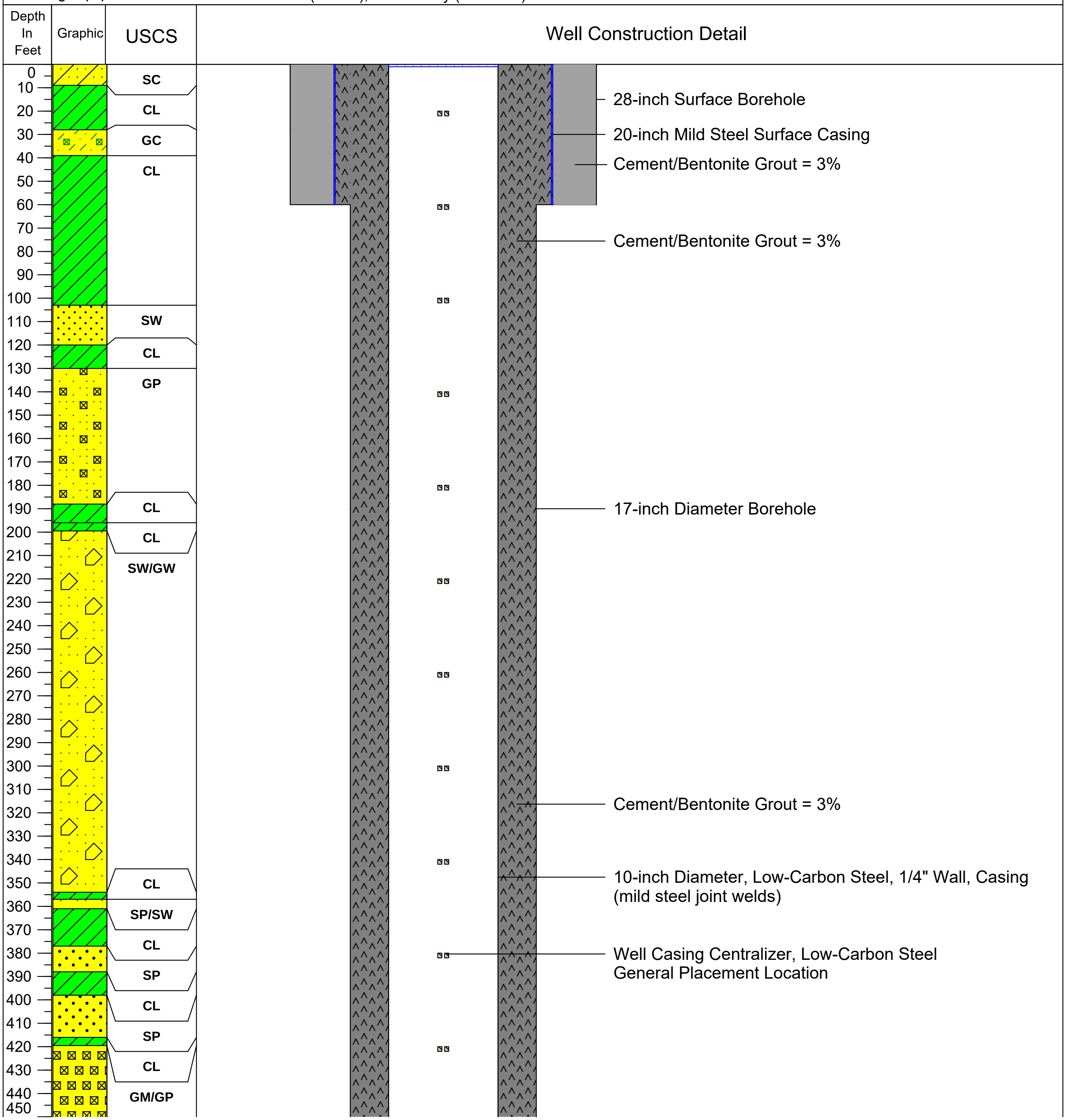
## Bluebird Replacement Well Test Hole

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: | 2/6/2010 |
| 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 |
| Annular Seal: | Cement/Bentonite Grout | 0 to 665 | 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 | | |

| | |
|---|---|
| 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 |

# **FIGURE 3**: WELL CONSTRUCTION DIAGRAM

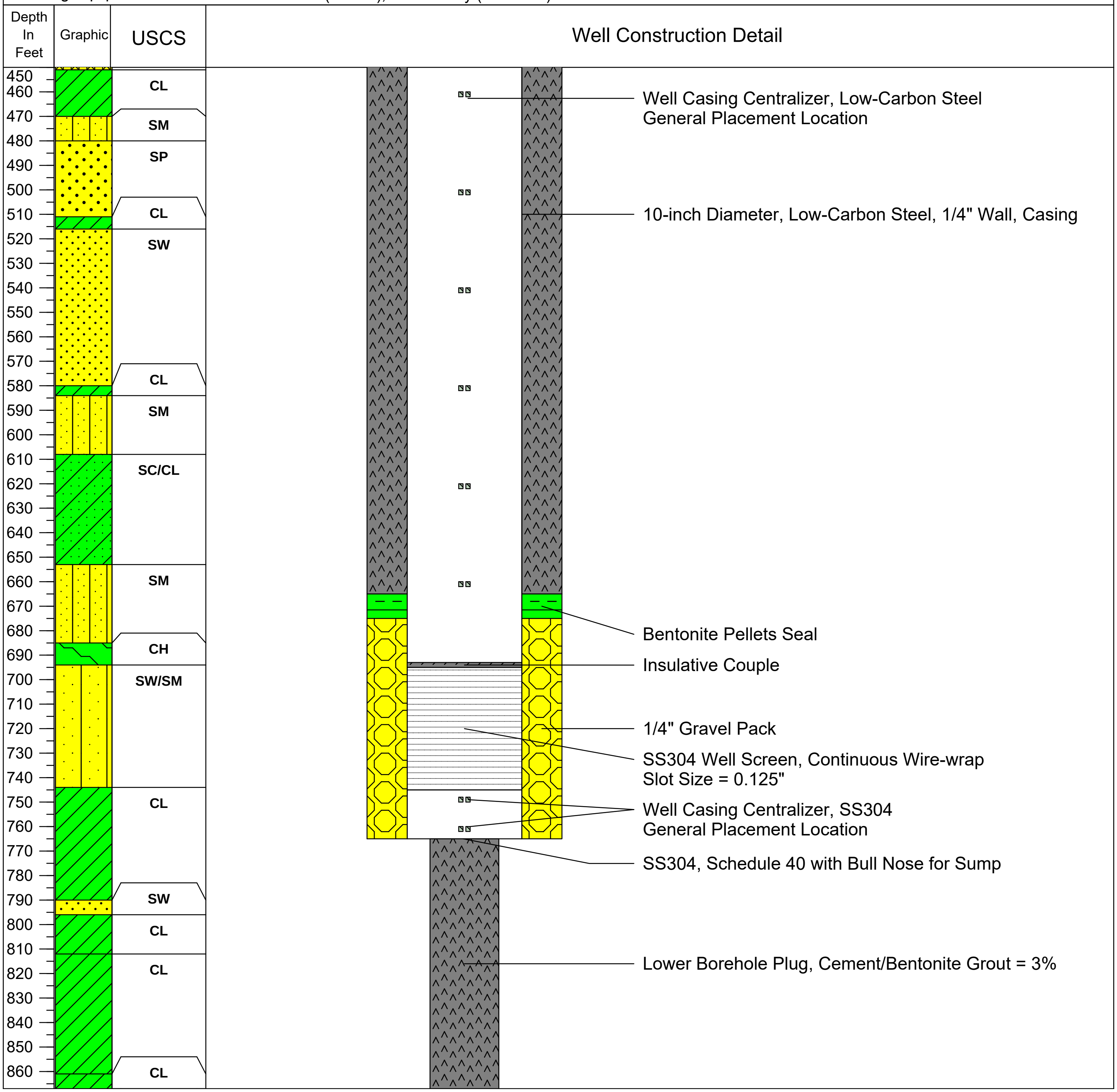
## Bluebird Replacement Well Test Hole

| | |
|---|---|
| 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')



ESPOSTI PARK

ORIGINAL
File with DWR

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

# WATER WELL DRILLERS REPORT

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

| From ft. | To ft. | Slot size |
|---|---|---|
| | | .032 Screen |
| 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 XX Bailer ☐ Air lift ☐
Depth to water at start of test XX ft. At end of test 135 ft.
Discharge 230 gal/min after 25 4 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

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

Project

Subject

Job Number

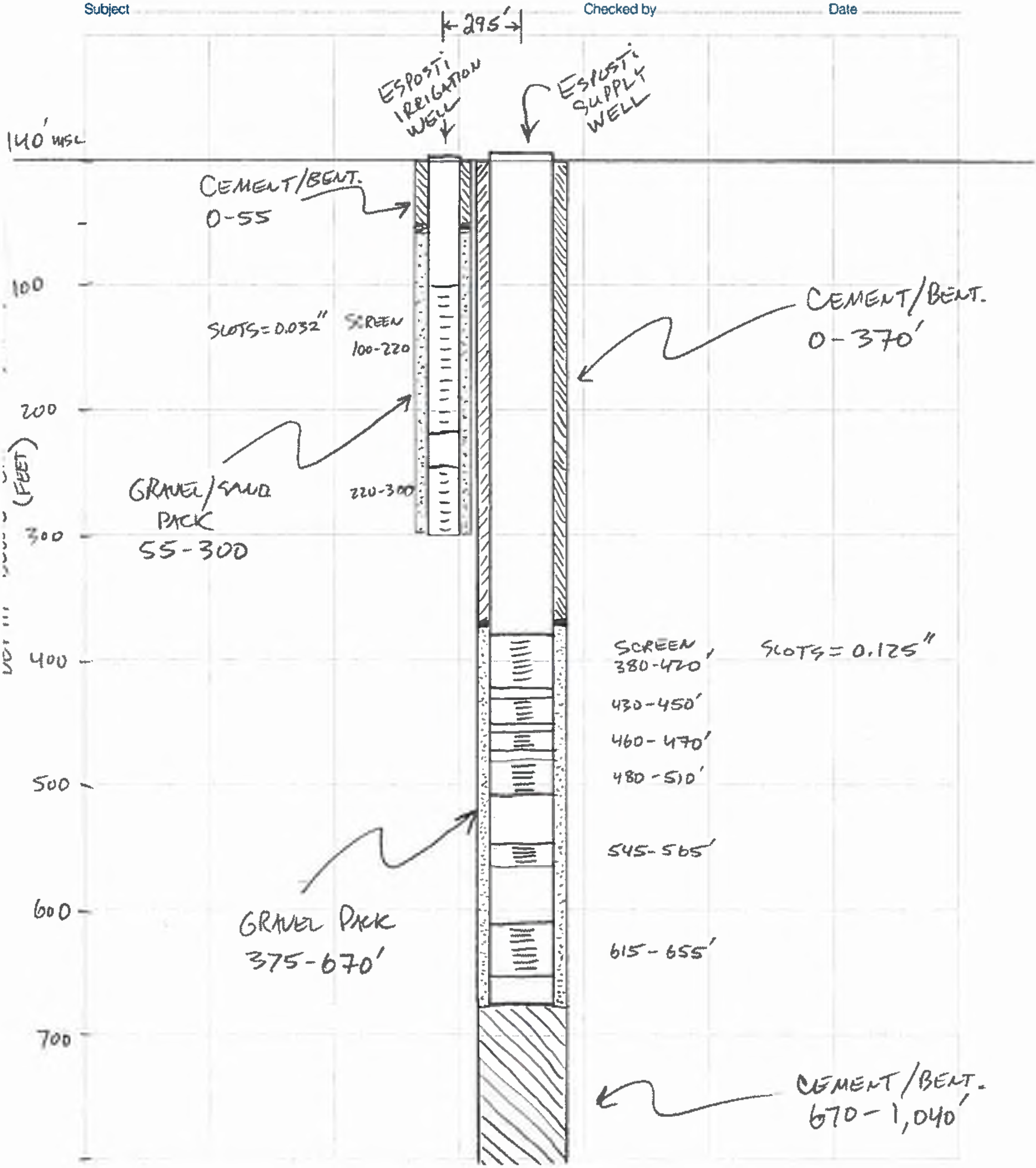
Sheets by

Checked by

Sheet of

Date

Date



# BORING LOG: Esposti Park

Esposti Park Well Test Hole

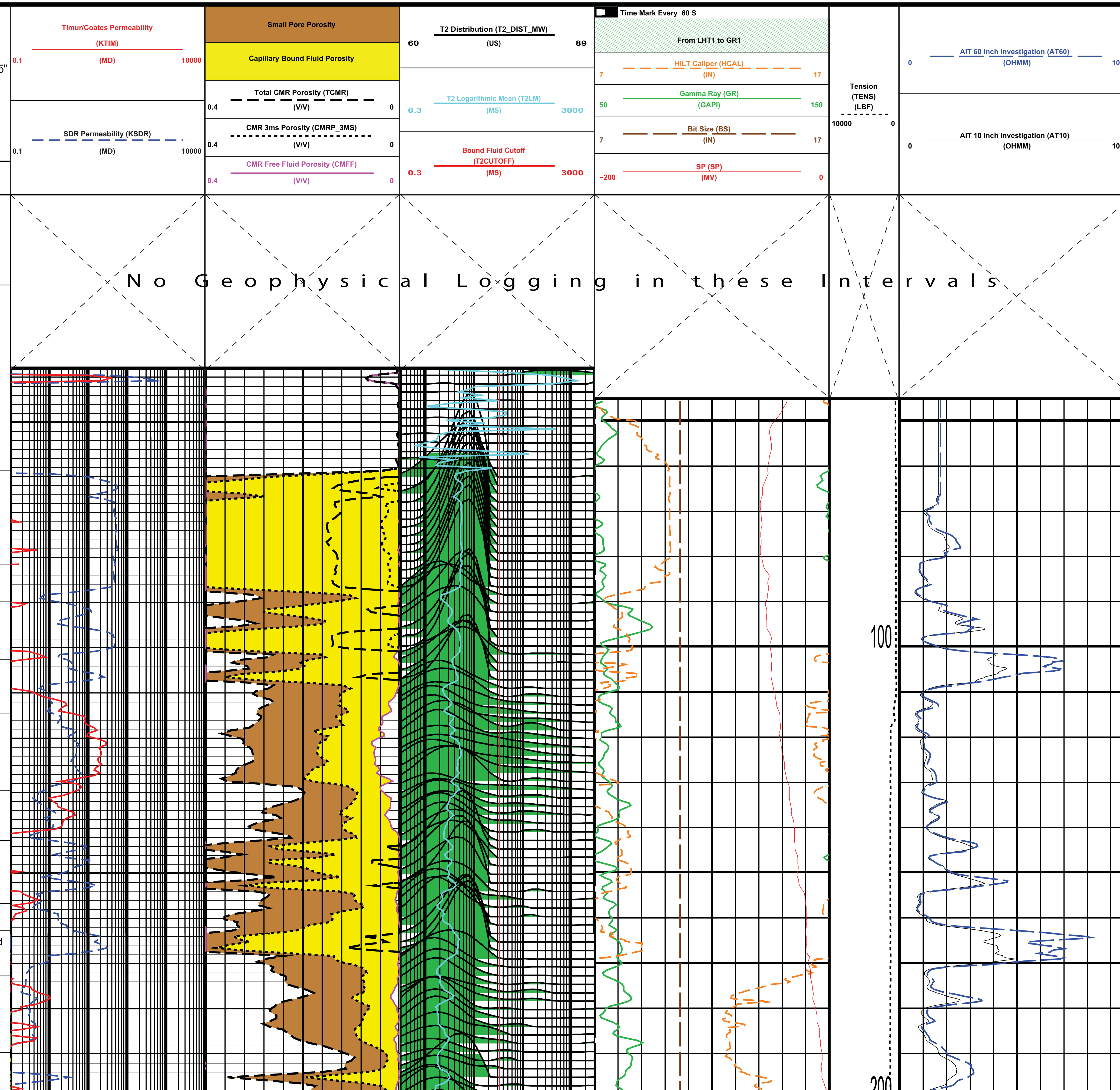
Start Date: 2/24/2010
End Date: 3/3/2010
Latitude: N 38° 31' 35.4"
Longitude: W 122° 46' 46.5"

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 |

| Depth (feet) | Graphic | USCS | Description |
|---|---|---|---|
| 0–20 | | 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 |
| 20–61 | | 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. |
| 61–82 | | 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. |
| 82–90 | | CL | Sandy CLAY (CL) - light gray clay with sand |
| 90–103 | | 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 |
| 103–116 | | 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 |
| 116–133 | | CL | Silty CLAY (CL) - dark gray/green, plastic clay; with silt and fine sand |
| 133–144 | | SM | Silty SAND (SM) - gray/green, poorly sorted, rounded to subrounded, fine sand; fine, subangular to subrounded gravel; with rare cobble |
| 144–158 | | GM | Silty GRAVEL (GM) - as above with fine gravel to coarse sand, varicolored |
| 158–164 | | CL | Sandy CLAY (CL) - light brown, clay; sand |
| 164–174 | | 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. |
| 174–191 | | SP | SAND (SP) - varicolored, subrounded to rounded, fine to medium sand; abundant well rounded and frosted quartz |
| 191–200 | | SW | Sand (SW) - fine to coarse sand, well graded, similar in angularity and color to above. |



E-PUR,llc

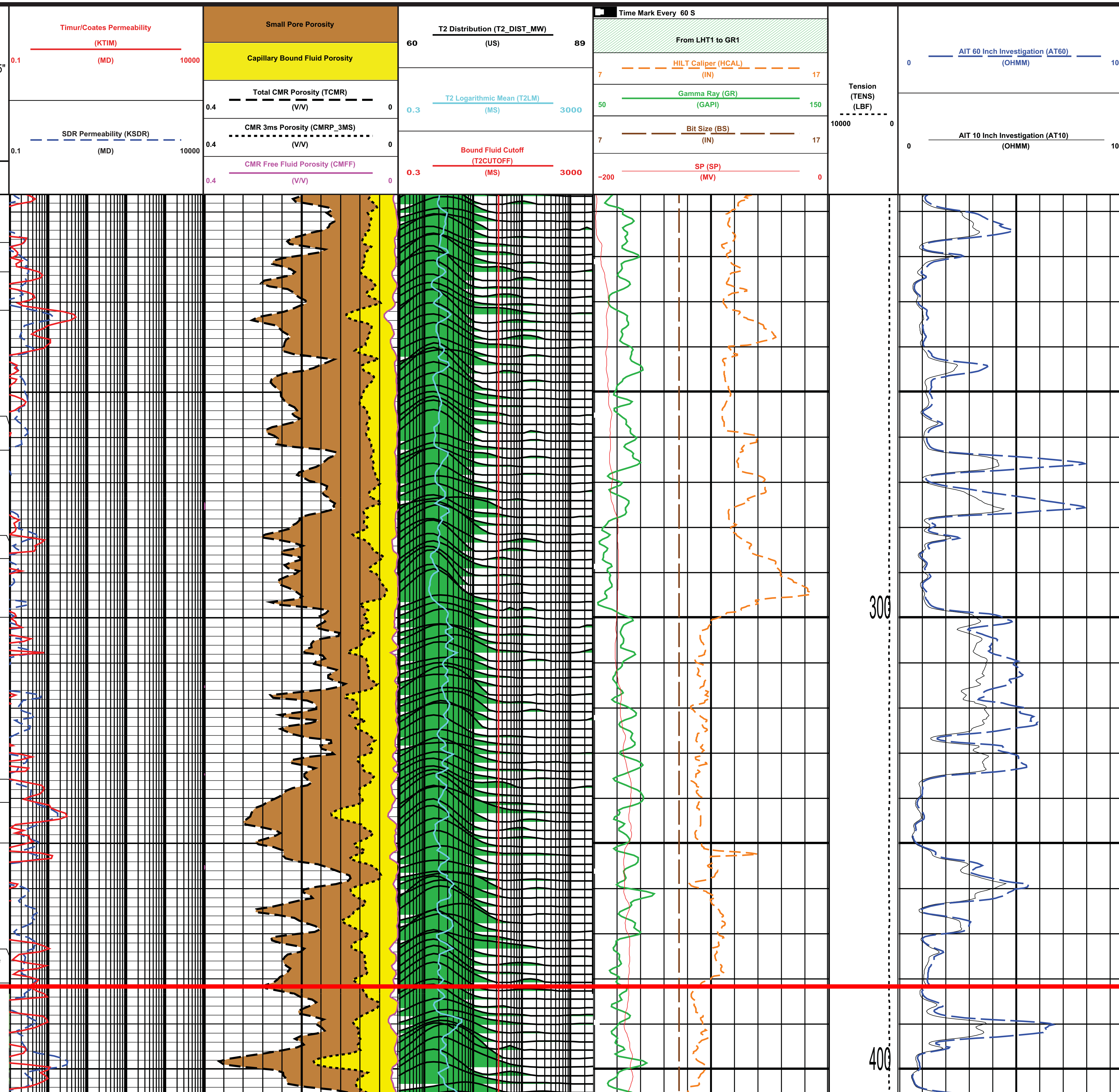
Drilling Company: WDC Exploration and Wells
Driller: Gary Eldred, Greg Gallio, John Chaves
Drilling Equipment: Reverse Circulation
Air (0'-795'), Mud Rotary (795'-867')

# BORING LOG: Esposti Park
Esposti Park Well Test Hole

| | |
|---|---|
| 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" |

| Depth (feet) | Graphic | USCS | Description |
|---|---|---|---|
| 210 | | | |
| 220 | | SP | Sand (SP) - varicolored, fine to medium, poorly graded sand |
| | | CL | Silty CLAY (CL) - light gray clay; with silt |
| 230 | | SM | Silty SAND (SM) - varicolored, poorly sorted, rounded to subrounded to subangular sand; few to little silt (ash); some gravel units |
| 240 | | | |
| 250 | | | |
| 260 | | 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 |
| 270 | | | |
| 280 | | 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 | | GM | Silty GRAVEL (GM) - as above with fine gravel and some sand |
| 310 | | | |
| 320 | | | |
| 330 | | | |
| 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 | | 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 |
| 360 | | | |
| 370 | | | |
| 380 | | 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 |
| 390 | | | |
| 400 | | | Abundant volcanics at 400 feet |



# BORING LOG: Esposti Park
Esposti Park Well Test Hole

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End Date: 3/3/2010
Latitude: N 38° 31' 35.4"
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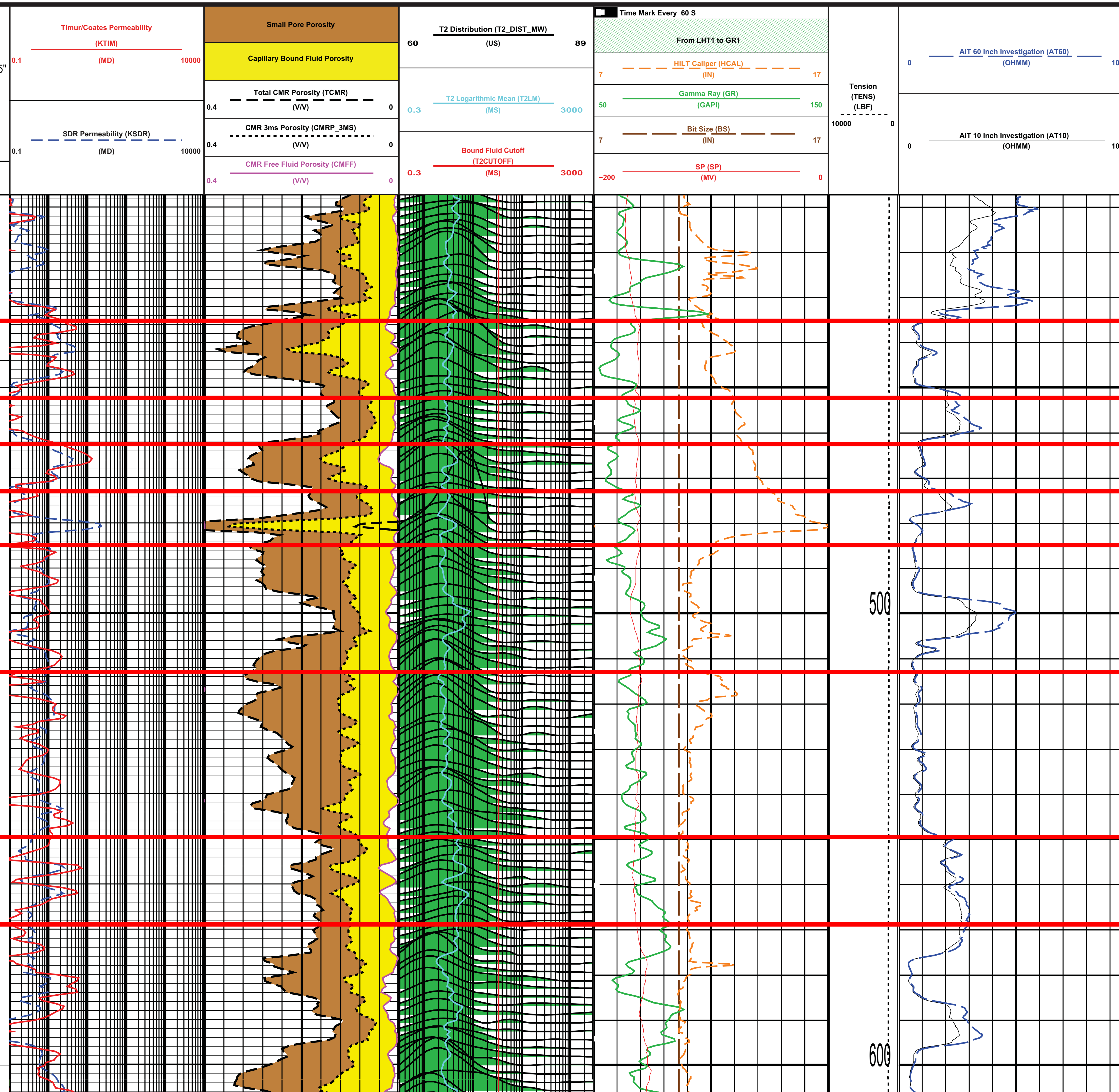
E-PUR, llc

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 |

| Depth (feet) | Graphic | USCS | Description |
|---|---|---|---|
| 410 | | | |
| 420 | | | |
| 430 | | | |
| 440 | | | |
| | | 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 |
| 460 | | | Stringer of clay at 465 feet |
| 470 | | | |
| 480 | | | Trace of clay at 480 feet |
| 490 | | | |
| 500 | | | |
| 510 | | | Interbedded clay unit with sand and gravel at 510 to 513 feet |
| 520 | | | Trace obsidian at 520 feet |
| 530 | | | |
| 540 | | | Lost circulation at 545 feet |
| 550 | | | |
| 560 | | | |
| 570 | | | |
| 580 | | | Trace of clay at 580 feet; |
| 590 | | | |
| 600 | | 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
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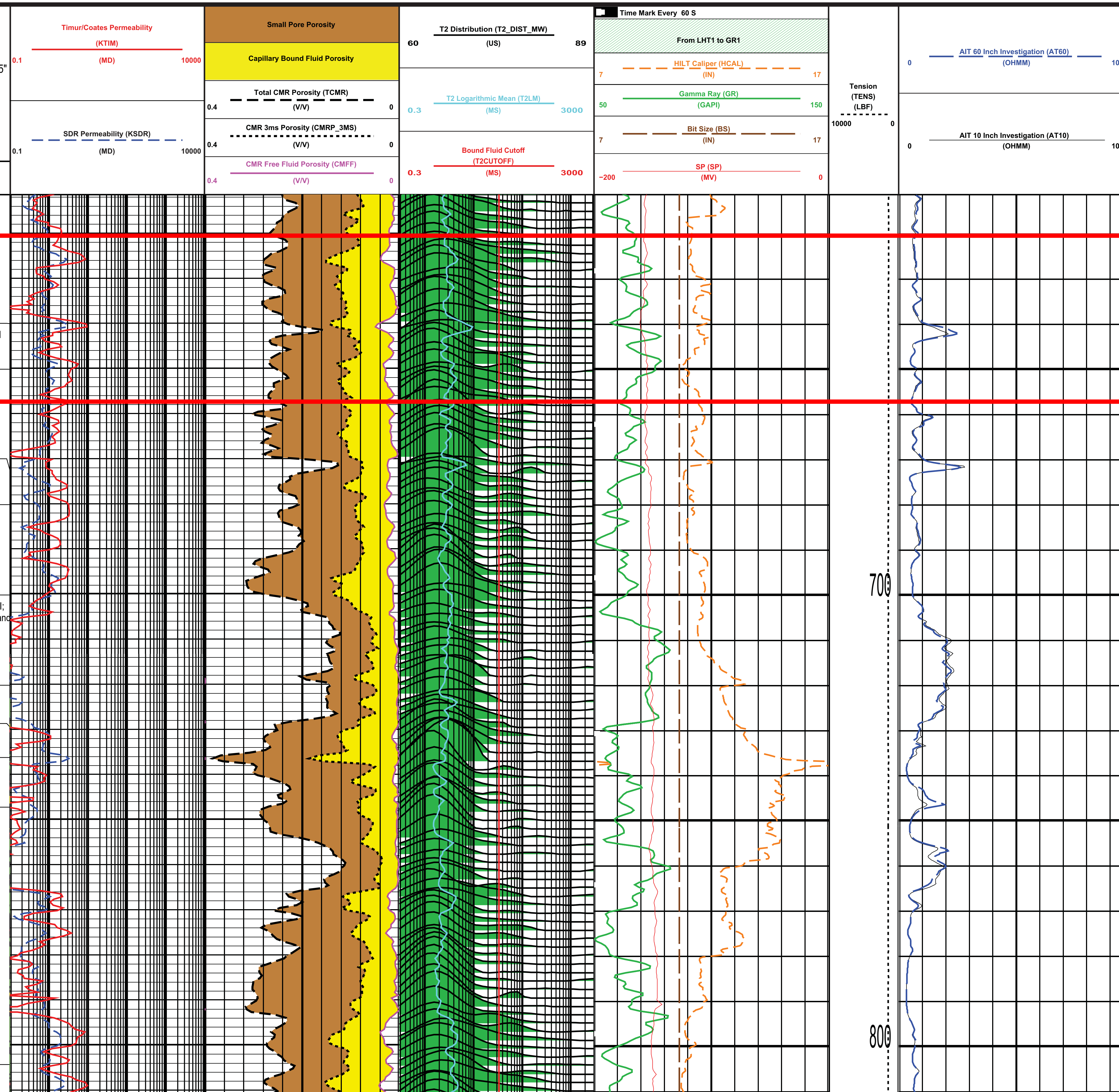
| Project | Well Installation |
| Location: | Windsor, CA |
| E-PUR PN: | E102-001-01, Task 200 |
| Logged by: | B. Gulbranson, J. Buchowski, G. Moore |
| Surface Conditions: | Grass Covered |
| Sampler Type: | Grab |

| Depth (feet) | Graphic | USCS | Description |
|---|---|---|---|
| 620 | | | |
| 630 | | | |
| 640 | | SP/GP | SAND and GRAVEL (SP/GP) - varicolored, moderately sorted, fine to medium, subround to subangular sand; some varicolored, subrounded, fine to medium gravel; interbedded gray, soft clay |
| 650 | | CL | Silty CLAY (CL) - light gray clay and silt (ash) with interbedded gray, soft clay; some fine sand |
| 660 | | | |
| 670 | | 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 |
| 680 | | CL | CLAY (CL) - light tan, soft, occasionally stiff clay; abundant fine sand |
| 690 | | | |
| 700 | | 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 |
| 710 | | | |
| 720 | | GM/SM | Silty GRAVEL (GM) to Silty SAND (SM) - color and texture as above |
| 730 | | SW | SAND (SW) - dark green gray, very fine to medium grained sand, rounded to subrounded, poorly sorted; few gravel |
| 740 | | CL | Silty CLAY (CL) - dark gray, soft clay; with micaceous silt |
| 750 | | 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 |
| 760 | | | |
| 770 | | | |
| 780 | | | |
| 790 | | | |
| 800 | | | |
| 810 | | SP | SAND (SP) - gray green, rounded to subrounded, moderately sorted sand; abundant silt (ash) |



E PUR, llc

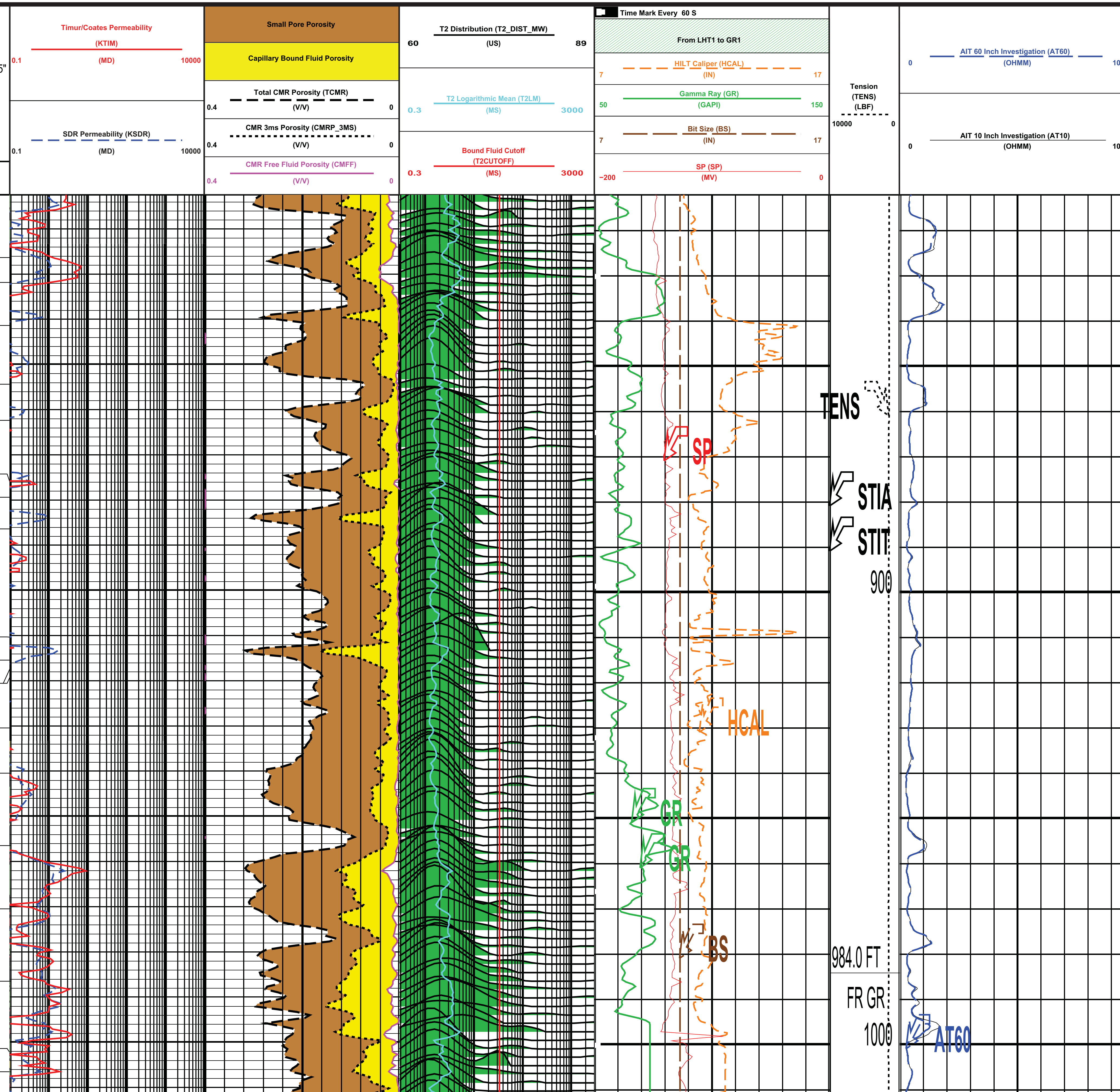
Drilling Company: WDC Exploration and Wells
Driller: Gary Eldred, Greg Gallio, John Chaves
Drilling Equipment: Reverse Circulation Air (0'-795'), Mud Rotary (795'-867')

# 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" |

| Depth (feet) | Graphic | USCS | Description |
|---|---|---|---|
| 820 | | GM | Silty GRAVEL (GM) with Sand - gray green, rounded to subrounded, medium to coarse gravel; predominantly volcanics, intermediate to felsic rhyolite clasts |
| 830 | | CL | Sandy CLAY (CL) - light gray clay with sand |
| 840 | | GW/SW | Silty GRAVEL (GW) to SAND (SW) - varicolored, fine to medium, subrounded to rounded sand; angular to subrounded, medium to coarse gravel |
| 850 | | CH | CLAY (CH) - dark gray to brown, plastic clay |
| 860 | | SP | SAND (SP) - gray green to varicolored, moderately sorted, subrounded to angular sand; little gray green to varicolored gravel |
| 870 | | 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 |
| 880 | | CL | CLAY (CL) - light gray, plastic clay with occasional interbedded sand stringers |
| 890 | | CH | CLAY (CH) - dark gray to brown, dense plastic clay |
| 900 | | | |
| 910 | | CL | Sandy CLAY (CL) - brown clay, with sand |
| | | SP | SAND (SP) - light gray, fine sand with silt |
| 920 | | CH | CLAY (CH) - gray brown to green gray, highly plastic clay; minor fine sand/silt, obsidian; hard slow drilling |
| 930 | | CL | Sandy CLAY (CL) - gray green |
| 940 | | CH | CLAY (CH) - green gray, fat clay, some silt, plastic clay with small obsidian |
| 950 | | | |
| 960 | | CL | Sandy CLAY (CL) - tan brown clay, sand |
| 970 | | SM | Silty SAND (SM) - green gray, fine sand with silt (ash) |
| 980 | | | |
| 990 | | SM/SP | SAND (SM/SP) - moderately sorted, rounded sand with silt (ash); minor clay layer; trace coarse sand at 980 feet; flowing sand |
| 1000 | | CL | Sandy CLAY (CL) - light gray, soft clay, minor fine sand; becoming very dense with depth |
| 1010 | | 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')

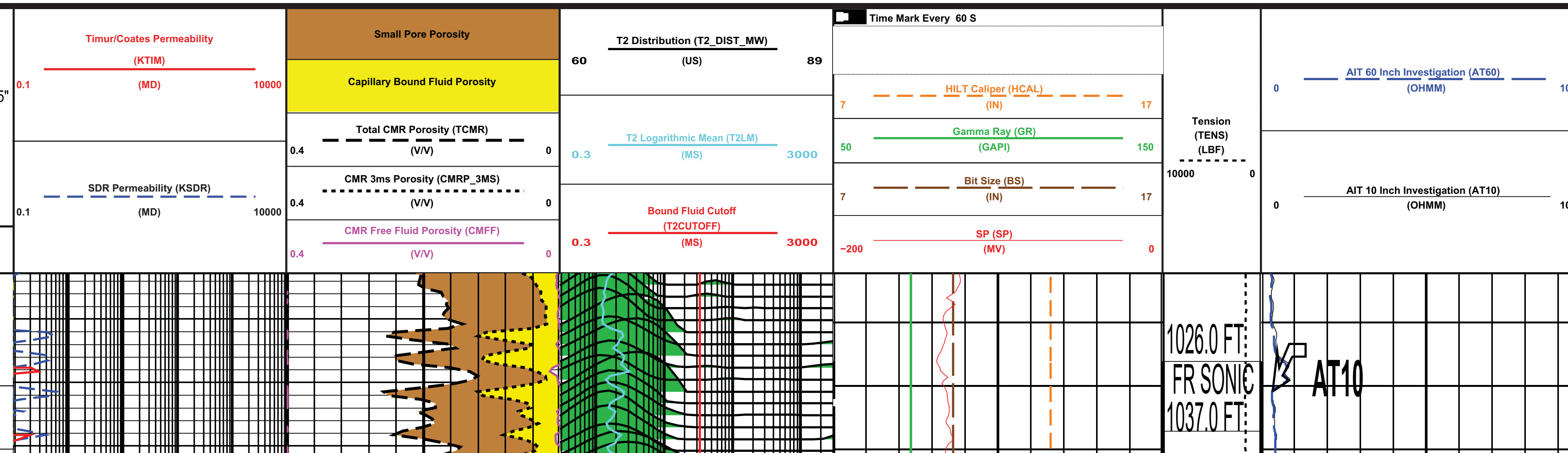
# BORING LOG: Esposti Park

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 | | | |




Page 6/6

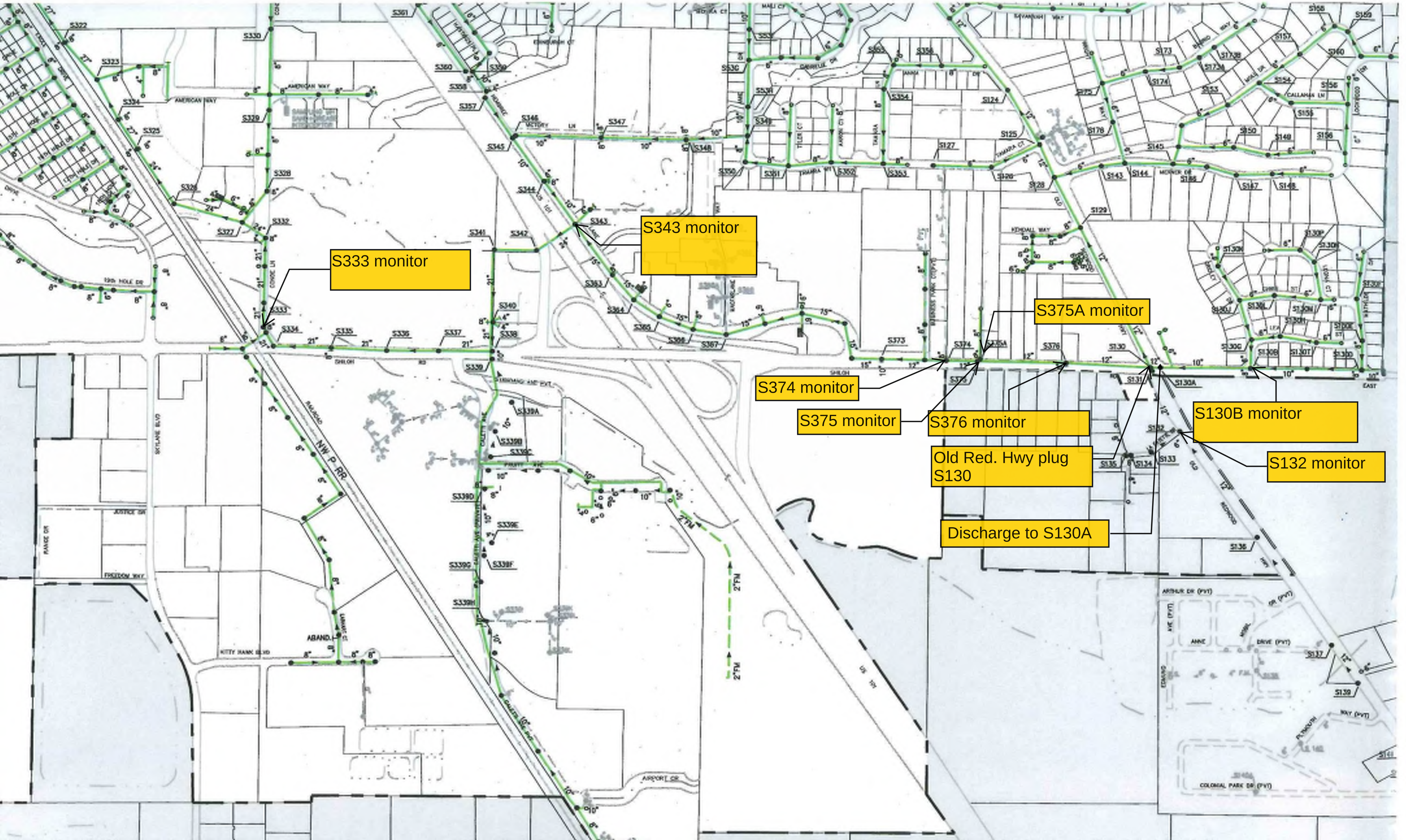
| | | | |
|---|---|---|---|
| Surface Seal: | Sanitary Seal (Grout) | 0 to 60 | feet bgs |
| Annulous Seal: | Grout | 0 to 370 | feet bgs |
| Filter Pack: | SRI 1/4 inch Gravel | 375 to 670 | feet bgs |
| Monument Type: | Temporary well cap | to | feet bgs |

| | |
|---|---|
| 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 (Bakersfielc
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

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: ESPOSTI 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 100 GPM!
CLEAN OUT BAGS-FILTERS ✓ GOOD FOR HIGHER FLOW

1105 - START DISCHARGING @ 200 GPM TO S130
DTW @ 1235 = 104.22 HEAD = 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
~~48.40 - 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<br>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 | S375 | 15% | Initail |
| 1000 | S375 | 20% | 5% increase w/100 gpm |
| 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% | |

Jose
Jorda

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 Overcast 60° / ° at pm |
| 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 |

# 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<br>° 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 ~~Get~~ Grease 100 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% incrae in flow |
| 1259 AM | " " | 25% same | 10% increasein flow |
| 12:49 PM | " " | 30% | 5% increaeinflow 300 GPM |
| 1310 PM | " " | 30% same | Same increase inflow |
| 1325 PM | " " | Same | " " " |
| 1339 PM | " | 30% Same | 0% increase flow 400 GPM |
| 1423 PM | " " | 35% | 5% increase inflow |
| 1440 PM | " " | 35% Same | " " " |
| 1155 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 S376 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 |
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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<br>° 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 GPM |
| 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 600 GPM |
| 1359 | S376 | Same 40% | Same " " |
| 1414 | S376 | Same 40% | Same " " " |
| 1424 | S376 | 45% | 5% increase in flow 700 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 flow |
| 1450 | S376 | 50% | 5% increase in flow to 800 GPM |
| 1458 | S376 | 55% | 5% increase in flow to [illegible] |
| 1506 | S376 | 60% | 5% increase flow to 900 GPM |
| 1521 | S376 | Same 60% | Same " |
| 1535 | S376 | Same 60% | Same " " 900 GPM |
| 1550 | S376 | Same 60% | Same " " " |
| 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% |
| | | | |
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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<br>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% | Initial 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 | ~~S34~~ 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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GHD

# FIELD REPORT

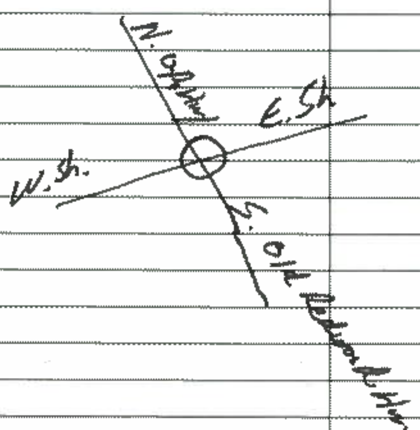
| | |
|---|---|
| DATE: 8/23/2016 | LOCATION: Esposti Well, Old Redwood Hwy at Shiloh Road, Windsor, CA |
| PROJECT NAME: Town of Windsor, Esposti Well | JOB NO: 11110001.20 |
| EVENT: Sewer Flow Test and Observations | WEATHER/TEMP: ° at am<br>° at pm |
| PRESENT AT SITE: Kent O'Brien | |

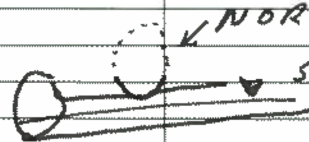
DATE: ~~dd/mm/yr~~ Aug /23/2016

| 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

# 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 S130A. Monitoring flow will be at S130A, CT4, CT5.
Attachment 2 – Site Map – Groundwater containment and discharge location Map.

TOWN OF WINDSOR

WASTEWATER DISCHARGE PERMIT APPLICATION
**TEMPORARY DISCHARGE**

## 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

TOWN OF WINDSOR

WASTEWATER DISCHARGE PERMIT APPLICATION
**TEMPORARY DISCHARGE**

## 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: [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



GHD Inc.
2235 Mercury Way Suite 150 Santa Rosa CA 95407 USA
T 1 707 523 1010 F 1 707 527 8679 E santarosa@ghd.com W www.ghd.com

- SCADA Interface — Yes
- Notes

**Summary of Water Quality Assumptions***

| | |
|---|---|
| o pH** | 6.67 |
| o Temperature** | 66 °F |
| o ORP (EMF)** | 4 mV |
| o Conductivity** | 458 µS/cm |
| o TDS** | 300 mg/L |
| o Turbidity** | 354 NTU |
| Cations | |
| o Hardness | 120 mg/L $CaCO_3$ |
| o Ammonia*** | 0.3 mg/L $NH_3$ |
| o Calcium | 22 mg/L |
| o Magnesium | 15 mg/L |
| o Sodium | 54 mg/L |
| Anions | |
| o Alkalinity | 230 mg/L $CaCO_3$ |
| o Bicarbonate | 280 mg/L $CaCO_3$ |
| o Carbonate | <1.0 mg/L $CaCO_3$ |
| o Chloride | 17 mg/L |
| o Fluoride | 0.37 mg/L |
| o Nitrate | <2.0 mg/L $NO_3$ |
| o Phosphate | (Unknown) |
| o Silica*** | 87 mg/L $SiO_2$ |
| o Sulfate | 12 mg/L $SO_4$ |
| Metals | |
| o Antimony | <6.0 µg/L |
| o Total Arsenic | 56 µg/L |
| o Copper | <50 µg/L |
| o Iron | <100 µg/L |
| o Lead | <5.0 µg/L |
| o Manganese | 750 µg/L |
| o Mercury | <1.0 µg/L |
| o Selenium | <5.0 µg/L |
| o 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 [signature] Title Project Manager Date 4/18/2016

Inspected by: V. [signature] Title Env. Program Manager Date 4/18/16

Approved by: [signature] 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
- ☐ PG&E, ATT, Comcast
- ☐ Sidewalk / Curb / Gutter / Pavement
- ☒ Maintenance
- ☐ Driveway: New / Replace / Repair
- ☐ Debris Box
- ☐ Equipment: Crane, scaffold
- ☐ Outside Water
- ☐ Other: _____
- ☐ 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:** [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)*



I:\80 - Public Works\Admin\Eng Div\Policies & Procedures\LD Procedures\gDraft Packet handouts\Handouts for Encroachment Permits\Public Encroachment Permit Handout Packet\Form A - Encr Permit AppR2

## A COPY OF THIS ENCROACHMENT PERMIT SHALL BE ON THE JOB SITE



**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 | Project Manager to check off which are approved | The following checked items have been approved by Project Manager | 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

Nina [signature]
*Print Engineering Tech Name processing the Encroachment Permit Application*

Elizabeth H Cargay
*Project Manager's Signature*

Elizabeth Cargay
*Print Project Manager's Name*

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*

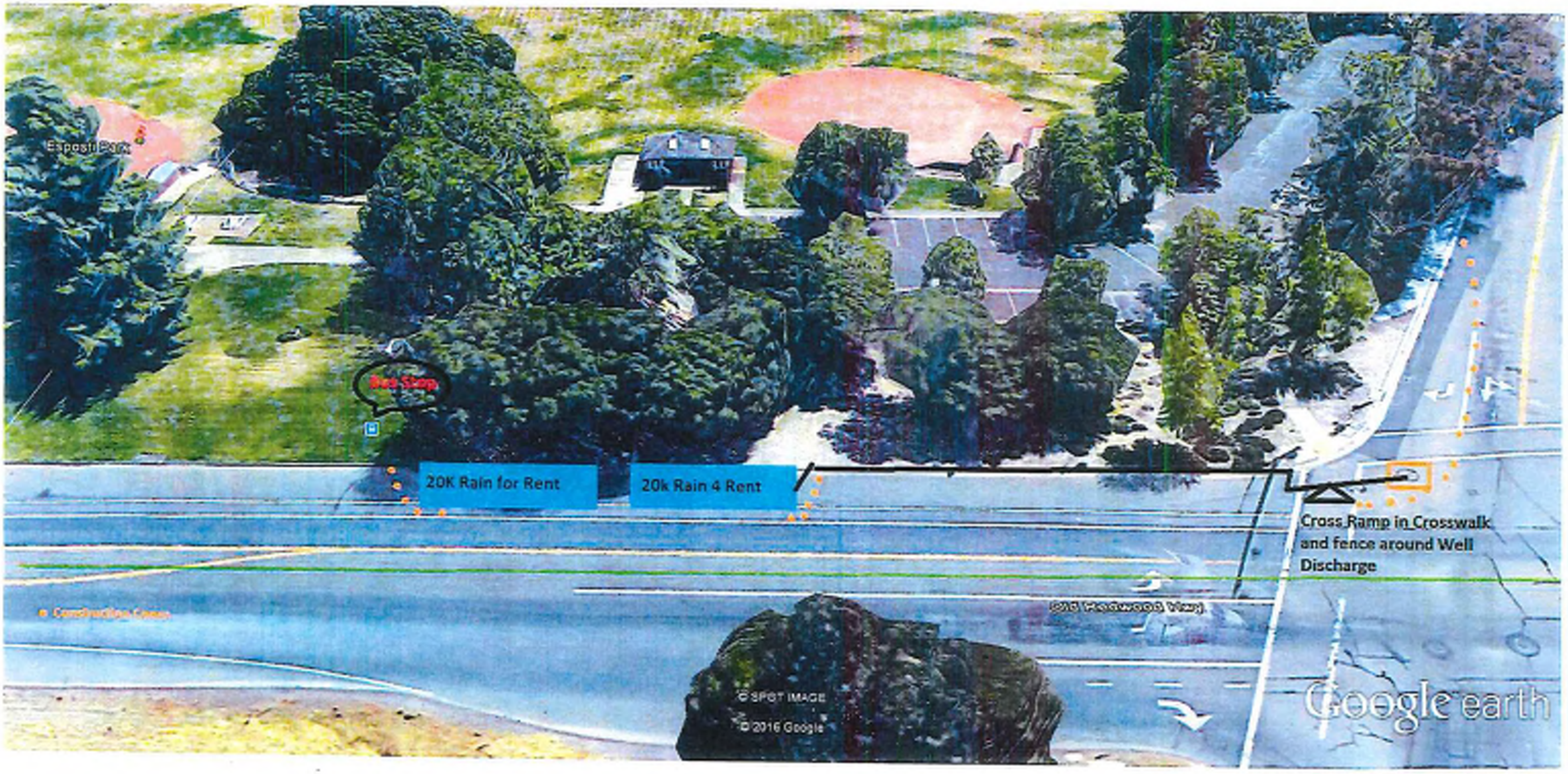
MONA IBRAHIM, ENG. TECH

*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
Construction Cones
Old Redwood Hwy
© 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. | Survey Date: | April 18, 2016 |
| Address: | P.O.Box 176 | Invoice No.: | 1287 Run: One |
| City: | Sebastopol, CA 95473 | P.O.: | Van: WC-1 |
| County: | Sonoma | Operator: | Mark F. Sharpless |
| Requested By: | Josh | Type Camera: | CCV Color Flip Camera - Short L.H. |
| Copy To: | | Latitude: | 38.52654° Longitude: 122.77948° |
| Reason For Survey: | General Inspection | Section: | 19 TWP: 8N Range: 8W |
| Location: | Shilo & Old Redwood Hwy. | | |
| Field: | Windsor | | |
| Other Information: | | | |

| CASING INFORMATION | | DEPTHS (SideScan) | VIDEO OBSERVATIONS |
|---|---|---|---|
| **Stainless Steel Screen** | **Well Depth** | 0.0 Ft. | Recording Starts - Zeroed on SideScan Lens |
| 384-423 Ft. | 656 Ft. | 39.5 Ft. | Static Water Level (SWL) |
| 434-453 Ft. | | 160.8 Ft. | Visible cement leakage at casing joint |
| 464-473 Ft. | **S.W.L** | 382-383 Ft. | Dielectric Joint |
| 484-513 Ft. | 39.5 Ft. | 383.5 Ft. | Perforations, Top Of Screen (384-423) |
| 549-569 Ft. | | 433.7 Ft. | Perforations, Top Of Screen (434-453) |
| 620-656 Ft. | | 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 |
| | **10" I.D. Casing** | | |
| | 0-656 Ft. | | |
| **Zero Datum** | Type: Steel | | |
| Top Of Casing | | | |
| **Dia. Reference** | | | |
| Measured | | | |
| **Casing Buildup** | | | |
| Moderate | | | |


0'


39.5'


160.8'


382.4'


383.2'


383.5'


423'


433.7'


453.1'


463.8'


473.2'

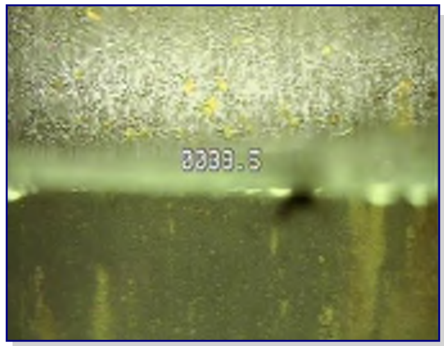

483.9'

Notes:

# WELLBORE SNAPSHOT(S)

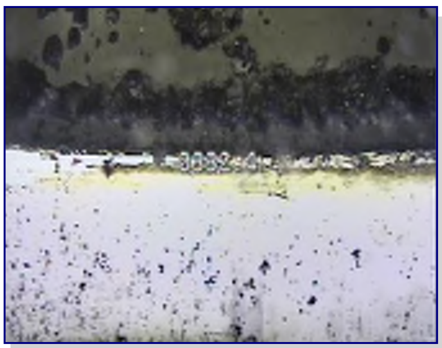
Depth: 0 Feet

Depth: 39.5 Feet



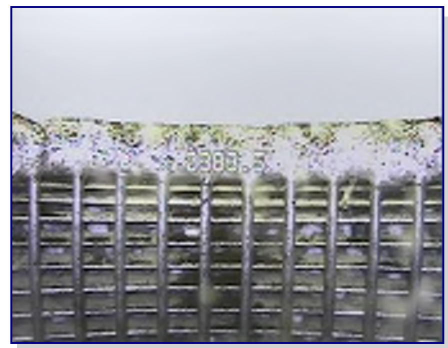
Depth: 160.8 Feet

Depth: 382.4 Feet

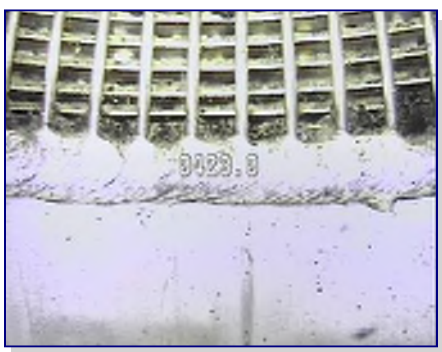


Depth: 383.2 Feet

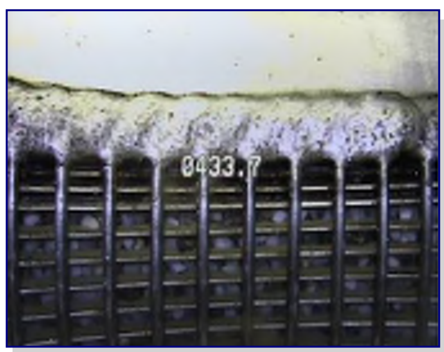
Depth: 383.5 Feet



Depth: 423 Feet



Depth: 433.7 Feet



Depth: 453.1 Feet

Depth: 463.8 Feet

Depth: 473.2 Feet

Depth: 483.9 Feet

# WATER WELL VIDEO REPORT

## Espoti Supply Well

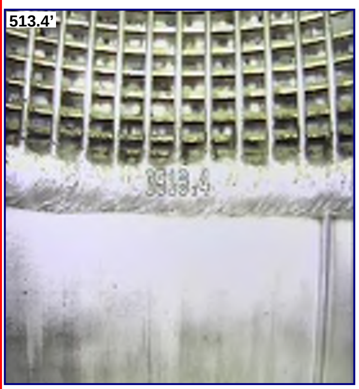
City of Windsor

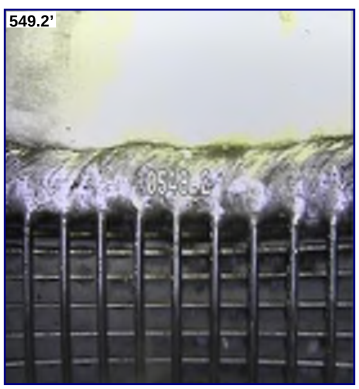

**West Coast Well Logging Services**

P.O.Box 2797 Rancho Cordova, CA. 95741

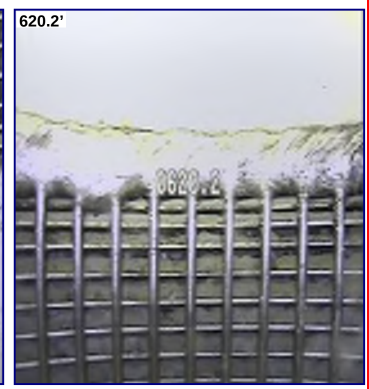
Phone: 916-224-3810 Fax: 916-858-8174 Web: www.wcwls.com

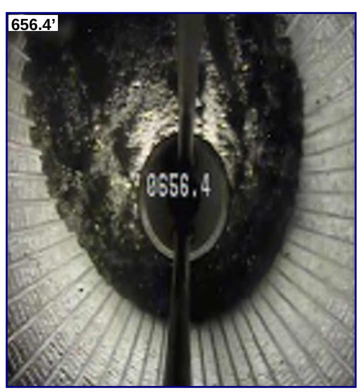

| CASING INFORMATION | | DEPTHS (SideScan) | VIDEO OBSERVATIONS |
|---|---|---|---|
| **Stainless Steel Screen** | **Well Depth** | | Additional snapshots |
| 384-423 Ft. | 656 Ft. | | |
| 434-453 Ft. | | | |
| 464-473 Ft. | **S.W.L** | | |
| 484-513 Ft. | 39.5 Ft. | | |
| 549-569 Ft. | | | |
| 620-656 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'

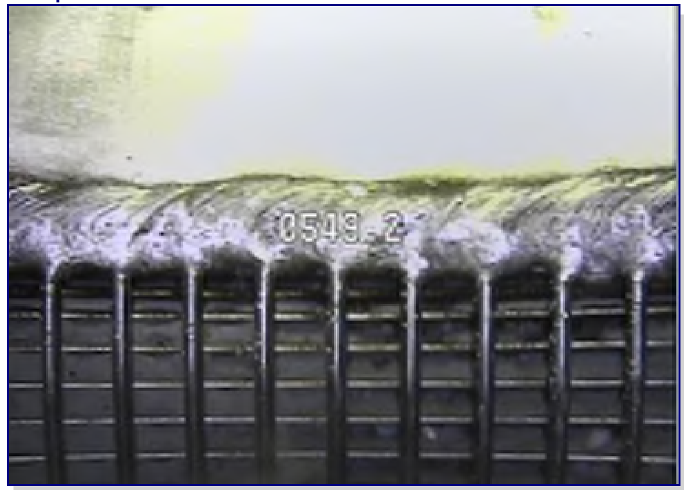

656.4'

Notes:

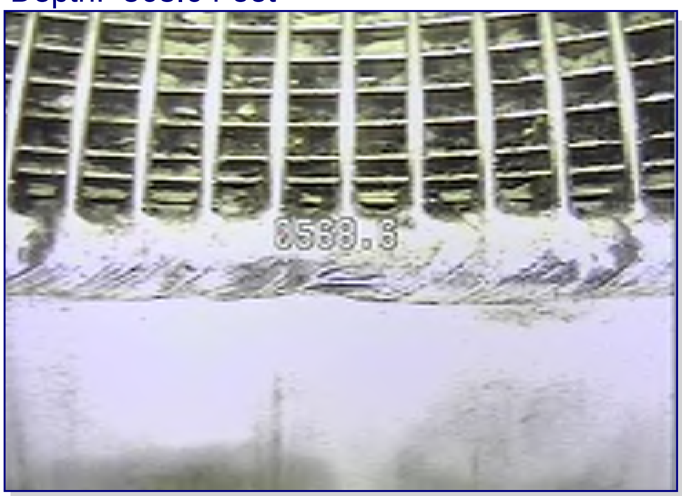
# WELLBORE SNAPSHOT(S)

Depth:  513.4 Feet

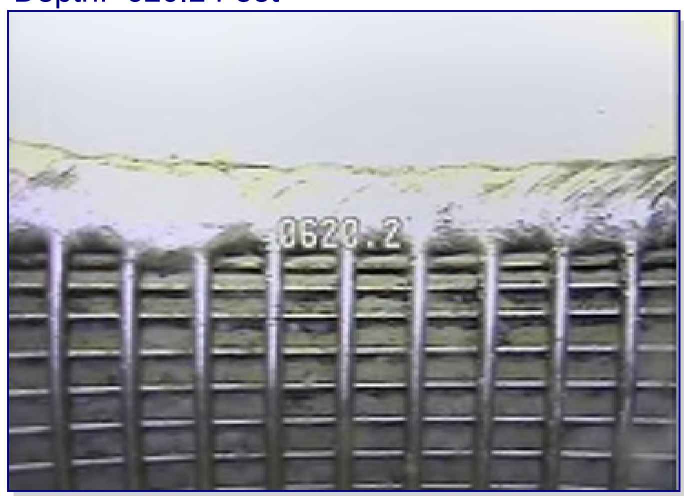

Depth:  549.2 Feet



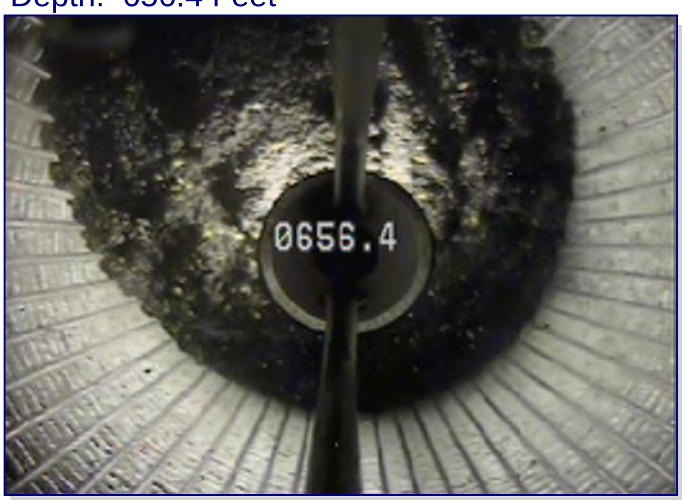

Depth:  568.6 Feet




Depth:  620.2 Feet




Depth:  656.4 Feet



# STATIC SPINNER LOGS

WEST COAST WELL LOGGING SERVICES
GEOPHYSICAL & VIDEO LOGGING

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.

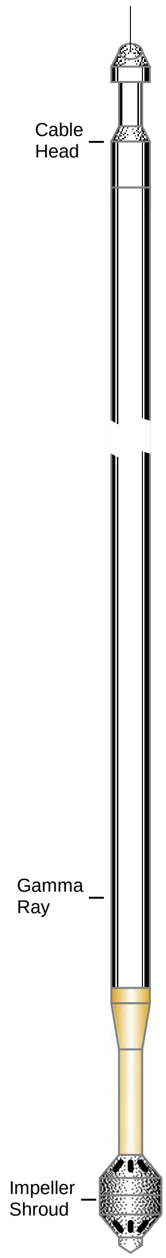
Log Measured From: **Top of Casing** , **0** Ft. Above Perm. Datum D.F. ____ Ft.

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

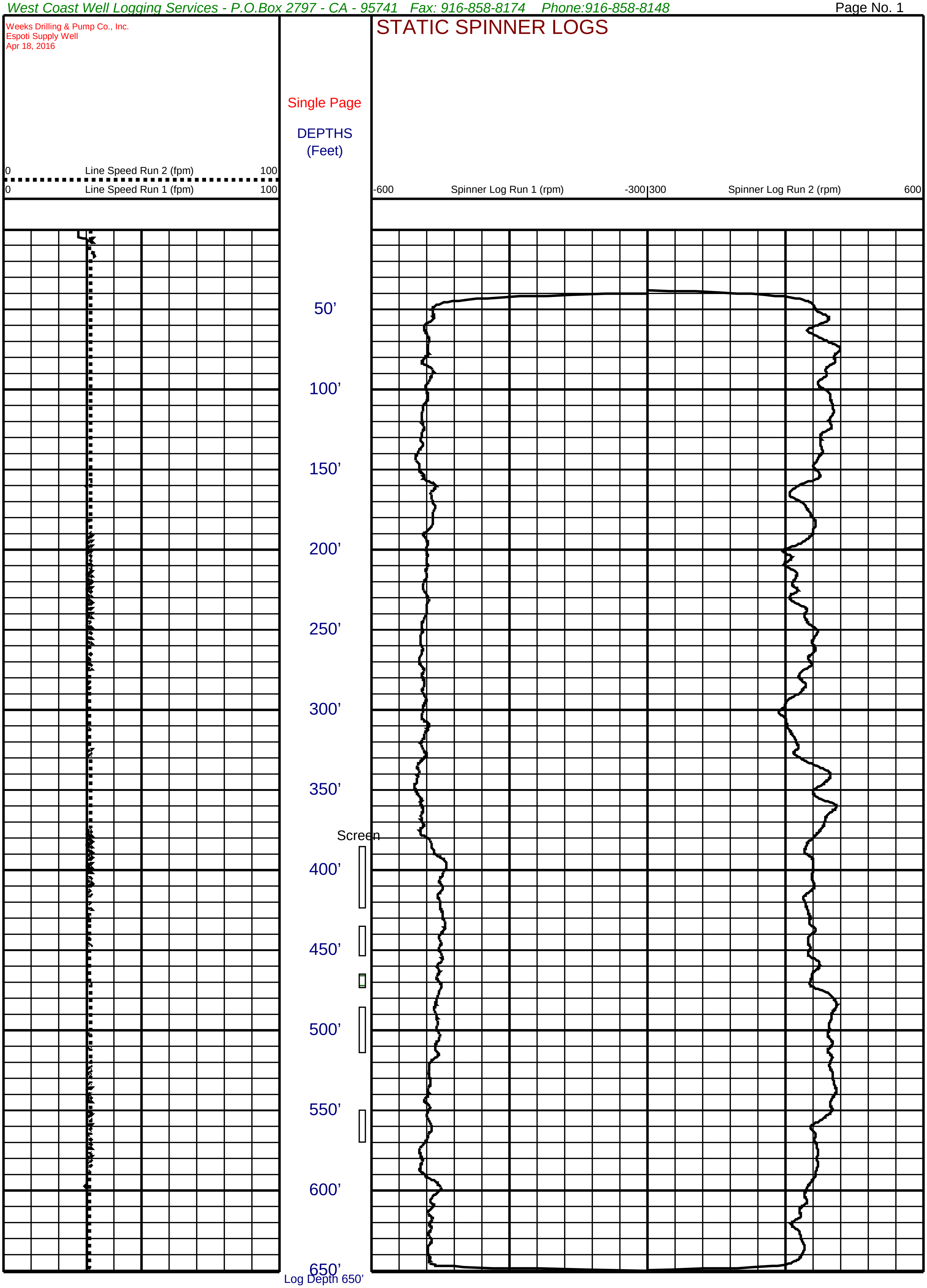
*All interpretations are opinions based on inferences from electrical and other measurements and we do not guarantee the accuracy or correctness of any verbal or written interpretation, and we shall not, except in the case of gross or willful negligence on our part, be liable or responsible for any loss, 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

*West Coast Well Logging Services - P.O.Box 2797 - CA - 95741   Fax: 916-858-8174   Phone:916-858-8148*


Weeks Drilling & Pump Co., Inc.
Espoti Supply Well
Apr 18, 2016

# STATIC SPINNER LOGS



GHD Job 1110001

# 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%

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<br>Location: Esposti Park | Well ID: Esposti Supply Well<br>Name/Site: | |
| Pumped Well | Owner: Town of Windsor<br>Location: | Well ID: Esposti Supply Well<br>Name/Site: | |
| Test Details | Date pumping commenced:<br>Date pumping ceased: | Time:<br>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~~ 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 | | Sampling Information | | Well Information | |
|---|---|---|---|---|---|
| Client: | Town of Windsor | Sample Method: | direct from pump | SWL: 56.5 ft | Check: |
| Project: | | WQ Meter Type: | | Date: 8/23/216 | Time: 11:20 |
| | | Flow Cell: | Pump Depth: 220 ft intake | Ref.datum: TOC | Stick Up: |
| Proj. No.: | 11110001 | WLevel Meter Type: | No packer | Well Depth: NM ft | Well Diam.: 10 ft |
| Sampler: | Kent O'Brien | | | Screen From: ft | To: ft |

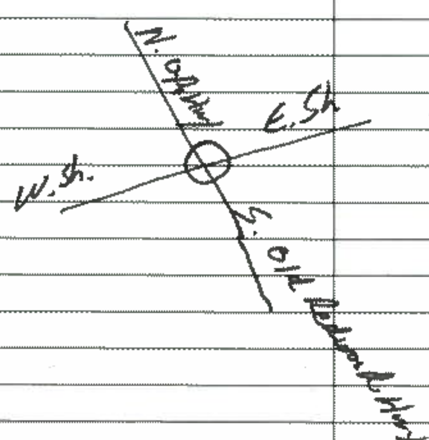
| Time (.........) | Temp (°C) | pH (pH units) | Elec.Cond (µS) | TDS (ppm) | Dis.Oxygen (.........) | Ox-Red Pt. (± mV) | Note | Note | Comment: Colour, turbidity, sediment load, sheen, odour |
|---|---|---|---|---|---|---|---|---|---|
| Stable When: | | +/- 0.2 C | +/- 0.05 pH | +/- 3% | +/- 10% | +/- 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 | 26.5 27.7 | 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 |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |

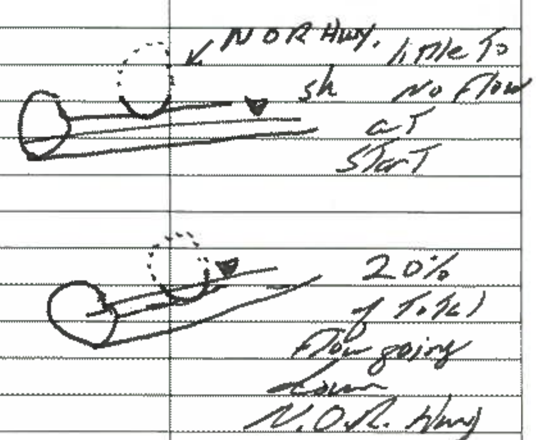
# FIELD REPORT

| | |
|---|---|
| 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<br>° 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! | | | |



## 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.: 38.52549 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 |

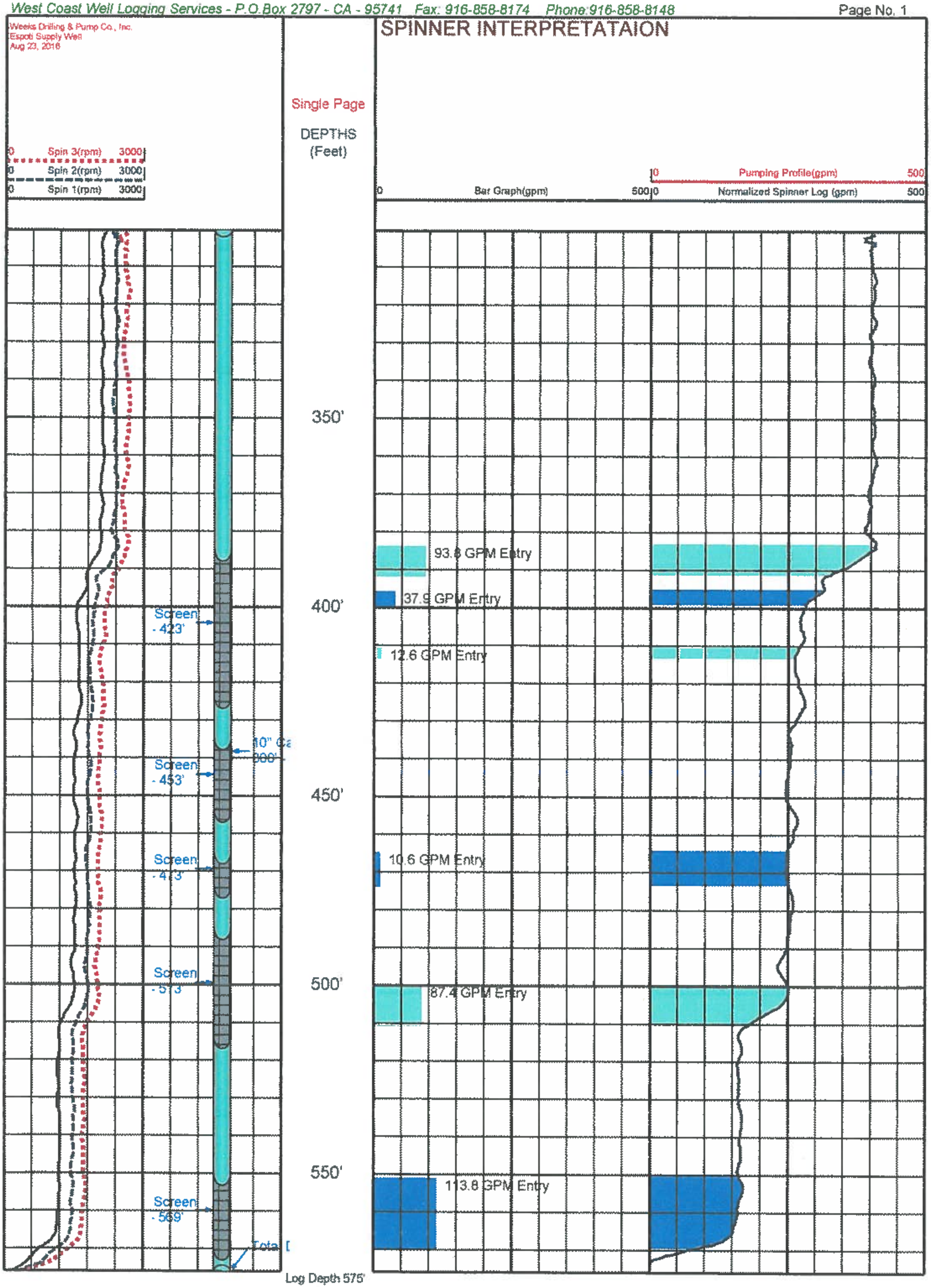
# NOTICE

*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

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


Weeks Drilling & Pump Co., Inc.
Espoti Supply Well
Aug 23, 2016
SPINNER INTERPRETATAION
Single Page
DEPTHS
(Feet)
0 Spin 3(rpm) 3000
0 Spin 2(rpm) 3000
0 Spin 1(rpm) 3000
0 Bar Graph(gpm) 500
0 Pumping Profile(gpm) 500
0 Normalized Spinner Log (gpm) 500
350'
400'
450'
500'
550'
Screen - 423'
Screen - 453'
Screen - 473'
Screen - 513'
Screen - 569'
93.8 GPM Entry
37.9 GPM Entry
12.6 GPM Entry
10.6 GPM Entry
87.4 GPM Entry
113.8 GPM Entry
Log Depth 575'

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 ____

send results to:
ecargay@townofwindsor.com
~~kom~~ 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

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 | 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 | 11:21 | | 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~~ ESW-8-23-15:21 | 8/23 | ~~13:21~~ 15:21 | | X | | | | X | | | | X | | X | X | X | 48 hr. |

| Relinquished by: | Received by: | Date | Time |
|---|---|---|---|
| [signature] | | | |
| | | | |
| | | | |
| | | | |
| | | | |

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:

# 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. | Survey Date: | May 4, 2016 |
| Address: | P.O.Box 176 | Invoice No.: | 1308 |
| | | Run: | Two |
| City: | Sebastopol, CA 95473 | P.O.: | |
| | | Van: | WC-1 |
| County: | Sonoma | Operator: | Mark F. Sharpless |
| Requested By: | Josh | Type Camera: | CCV Color Flip Camera - Short L.H. |
| Copy To: | | Latitude: | 38.52654° |
| | | Longitude: | 122.77948° |
| Reason For Survey: | Possible damage | Section: | 19 |
| | | TWP: | 8N |
| | | Range: | 8W |
| Location: | Espoti Park, Old Redwood Hwy. & Shilo | | |
| Field: | Windsor | | |
| Other Information: | | | |

### CASING INFORMATION

| Stainless Steel Screen | Well Depth |
|---|---|
| 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 | |

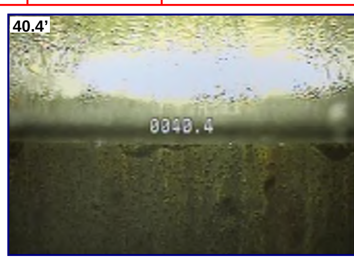
**Casing Buildup**

Very Heavy

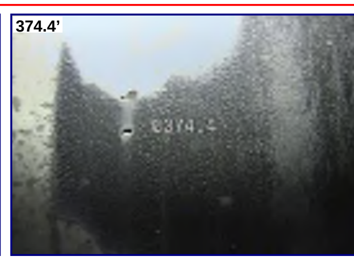
| DEPTHS (SideScan) | VIDEO OBSERVATIONS |
|---|---|
| 0.0 Ft. | Recording Starts - Zeroed on SideScan Lens |
| 40.4 Ft. | Static Water Level (SWL) |
| 374.7 Ft. | Small hole in the scale, not the casing |
| 382-384 Ft. | Dielectric Joint |
| 383.0 Ft. | Top of Stainless steel |
| 384.2 Ft. | Perforations, Top Of Screen (384-424) |
| 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 |
| 599.4 Ft. | Shipping label on casing wall |
| 620.9 Ft. | Perforations, Top Of Screen |
| 654.1 Ft. | Well plugged screen, camera is stopped on the top of the bailer |
| | End of in hole survwy |

0'

40.4'



374.4'

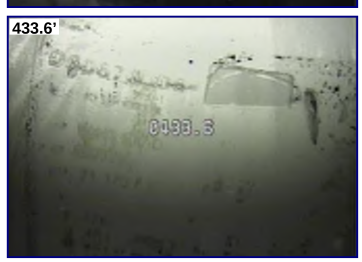


383'

384.2'

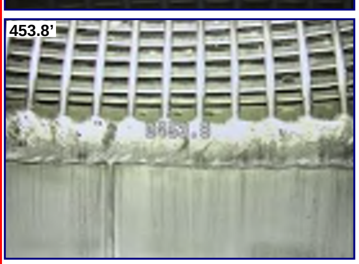
423.7'

433.6'



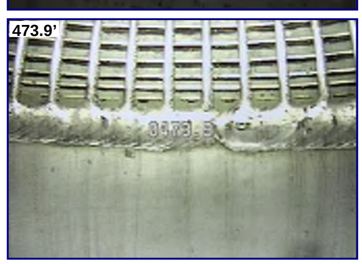
434.4'

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

# WATER WELL VIDEO REPORT

## Espoti Supply Well

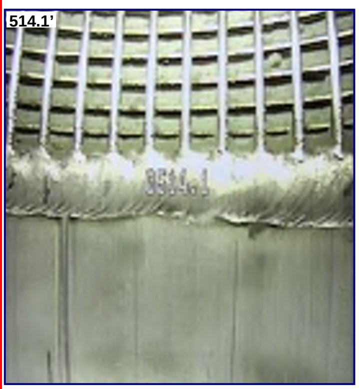
City of Windsor

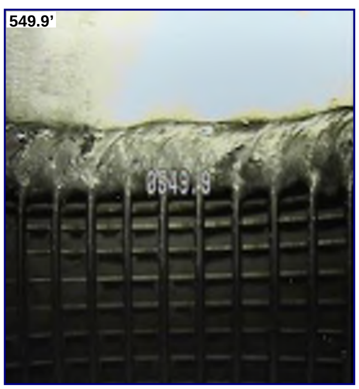
**West Coast Well Logging Services**

P.O.Box 2797 Rancho Cordova, CA. 95741

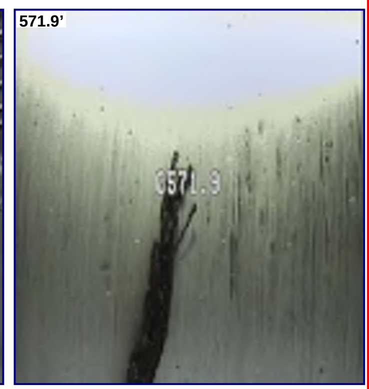
Phone: 916-224-3810 Fax: 916-858-8174 Web: www.wcwls.com

| 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'

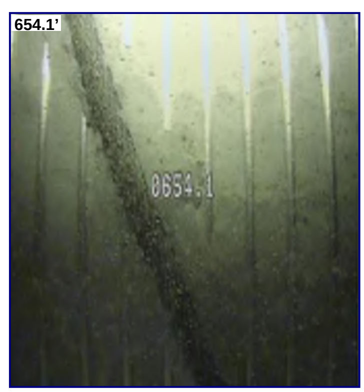

549.9'


569.3'


571.9'


599.4'


620.9'


654.1'

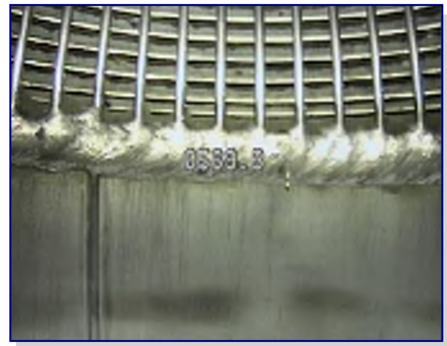
Notes:

# WELLBORE SNAPSHOT(S)

Depth: 514.1 Feet


Depth: 549.9 Feet


Depth: 569.3 Feet

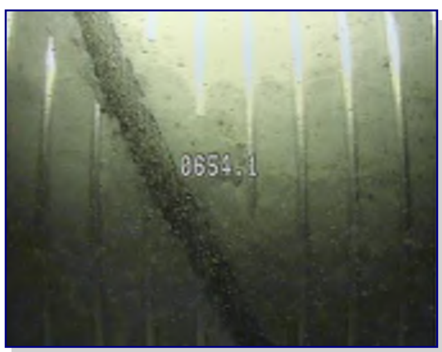


Depth: 571.9 Feet


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

4/22/16 DV INSTALLED EGS IN ESP. IRR WELL @ 75' BGS
STILL NEED BARO IN

Client
Project
Subject ESPOSOTI TRANSDUCER SET-UP

Job Number
Sheets by
Checked by

Sheet of
Date
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<br>° 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

Page____of____

# 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

GHD

# 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 TRANSD.

1315 - MOBILE HOME ESTATES WELL
DTW = 19.78 ✓
UNIT SAYS HEAD = 25.22 SO 19.78 + 25.22 = 45' DEPTH OF TRANSD.

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 - 4~~3~~2 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

$$\begin{array}{r} 270.0 \\ -\ 237.3 \\ \hline 42.7 \end{array} = \text{DTW} ✓$$

ESPOSTI IRRIGATION WELL

SOLINST "LEVEL" (DIRECT READ) = 42.37'

SET @ 75' TOC, DTW = 34.60 (FROM PORT)

$$\begin{array}{r} 34.60 \\ +\ 42.37 \\ \hline 76.97' \end{array} = \text{TOTAL DIRECT READ CABLE LENGTH}$$

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 = 270 - 104
LOST COMMUNICATION w/ IN-SITU 700 @ 1235

1255 - DISCHARGING @ 300 GPM FROM FILTER PUMP

1330 - ESW DTW = 106.68, ~~XX~~ 1340 DTW = 106.69

1345 - ESW PUMP OFF - NO CAPACITY. 400 GPM 0910-1345

1425 - START DISCHARGE @ 400 GPM

1515 - STOP MONITORING & ~~X~~ NOW DISCHARGING @ 200 GPM
48.40 ~~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<br>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 | S375 | ~~[illegible]~~ 15% | Initail |
| 1000 | S375 | 20% | 5% increase w/ 100 gpm |
| 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% | |
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GHD

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 |
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## 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<br>° 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~~ 100 GPM |
| 09:53 AM | S376 | 25% | 10% increase |
| 1000 AM | " " | Same | at 100 GPM |
| 1100 AM | " " | 15% | open flow 200 |
| 1115 1115 AM | " " | 20% | 5% increase GPM |
| 1122 AM | " " | Same | |
| 1145 AM | " " | 25% | 5% increae in flow |
| 1259 AM | " " | 25% Same | 10% increase in flow |
| 12:49 PM | " " | 30% | 5% increase in flow 300 |
| 1310 PM | " " | 30% Same | Same increase in flow GPM |
| 1325 PM | " " | Same | " " " |
| 1339 PM | " | 30% Same | 0% increase flow 400 |
| 1423 PM | " " | 35% | 5% increase in flow GPM |
| 1440 PM | " " | 35% Same | " " " |
| 1455 PM | " " | 35% Same | " " " |
| 1510 PM | " " | 30% | 5% Decrease in flow |

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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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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 |

Field Sampler - Print Name & Signature

Signature below authorizes work under terms stated on reverse side.

## Analysis Request

| Sample Identification | 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) | 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 |

Sample Collection: Date, Time. Container / Preservative / Matrix.

TAT: 24 hr (X) / 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 |
|---|---|---|---|
| [signature] | [signature] | 5/10 | 1400 |
| 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 (X)

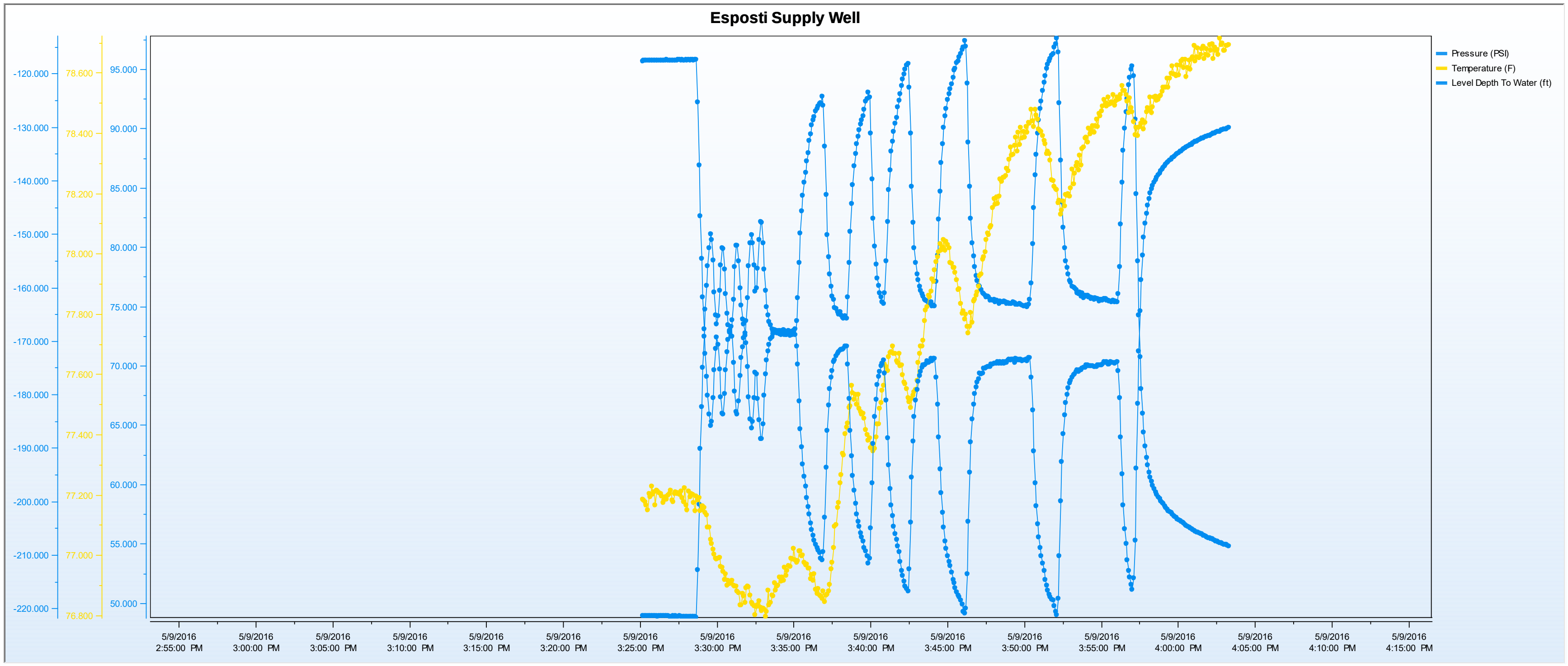
State System Number: ______

CA Geotracker EDF Report Yes ◯ No (X)

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
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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<br>° at pm |
| PRESENT AT SITE: Kent O'Brien GHD; | |

THE FOLLOWING WAS NOTED:

7:57 - set up generator, test 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 - static 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: 1110001.2 — 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 | ~~GALLONS PURGED~~ Flow | 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.sand |
| 8:32 | 400 To 1,000 surge | | 7.02 | 23.3 | 824 | -10 | musty/mod/F.S |
| 8:41 | " | " | 7.44 | 22.9 | 560.2 | -17 | L.musty/mod/F.S |
| | | | | | 100 | | |
| 9:09 | 800 gpm | | 7.51 | 23.3 | 554.2/368 | -40 | L.musty/mod/F.sand |
| 9:15 | 800 gpm | | 7.55 | 24.0 | 553/369 | -52 | VL.musty/Light/F.sand |
| 9:49 | 800 gpm | measurement drift check: | 7.61 | 22.7 | 551/369 | -59 | VL musty/light/F.sand |
| | repeat meas | Same pos. in 1 min | 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/VL light/F.sand |
| 10:09 | 800 gpm | Lab sample | 7.63 | 24.3 | 550/367 | -65 | VL musty/VL light/F.sand |
| | | | | | | | |

RECHARGE RATE (qualitative): ____

SAMPLER TYPE: TEFLON BAILER ____ ACRYLIC BAILER ____ DISPOSABLE BAILER ____

SAMPLES COLLECTED:

PRESERVED VOA'S ____ UNPRESERVED VOA'S ____
PRESERVED LITERS ____ UNPRESERVED LITERS ____
500 ml PLASTIC OR GLASS BOTTLE: ____ OTHER: ____

FIELD FILTERED: ____ UNFILTERED: ____

COMMENTS: ____

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# 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

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 | 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) | 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 (marked), 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 |
|---|---|---|---|
| [signature] | [signature] | 5/10 | 1400 |
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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<br>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<br>Flow @800 Sewer Test | WEATHER/TEMP: ° at am<br>° at pm |
| PRESENT AT SITE: Kent O'Brien GHD; | |

THE FOLLOWING WAS NOTED:

9:00 - meet E. Casey, Jim 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 A
16:08 irrigation well turned on for short period of time - need to irrigate field

Page____of____

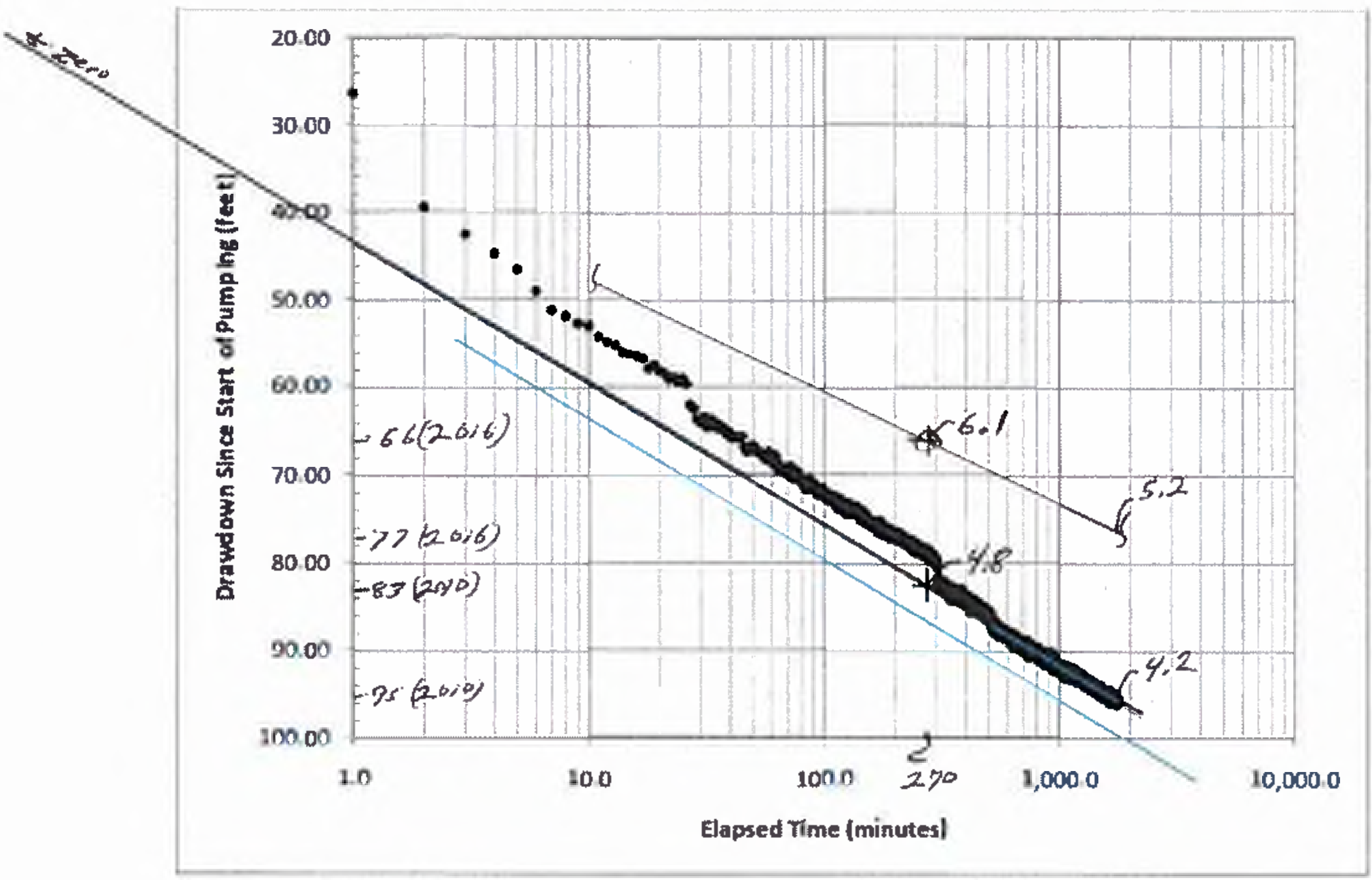
← Zero

5/11/2016

Drawdown Estimations

1.0

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




@270 minutes (4.5 hr) pumping @400 gpm

2010 - 400 gpm / 83 ft = 4.8 gpm/ft  DATA

2016 - 400 gpm / 66 ft = 6.1 gpm/ft  DATA

$\frac{(6.1-4.8)}{4.8} = 27\%$ improvement

@1440 minutes (24 hr) pumping at 400 gpm

2010 - 400 gpm / 95 ft = 4.2 gpm/ft  DATA

2016 - 400 gpm / 77 ft = 5.2 gpm/ft  projected

1.65 ft/sec velocity

@1440 minutes (24 hr) pumping at 800 gpm

2016 ~~DD~~ 77 × (800/400) = 154 FT  Estimate

3.3 ft/sec velocity

@1440 minutes (24 hr) 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<br>° at pm |
| PRESENT AT SITE: | |

DATE: dd/mm/yr ___/___/___

| Time<br>Time: use 24 ~~hour~~ time record ~~at 15~~ min ~~intervals or~~ more freq. | Flow<br>Man~~hole~~ ~~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 | |
| 13:49 | 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 → | 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 | 214.41 | @ well head flow meter |
| 16:00 | 900 | 215.0 | 29808500 gallons |
| 16:05 | ~~900~~ 880 | 215.41 | |
| 16:10 | ~~900~~ 880 | 215.92 | change in pump rate |
| 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 Pump Max | 223.0 | |
| 16:50 | 890 | 223.3 | off |
| | | | |
| | | | |
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| | | | |

Page____of____

# WELL SAMPLING DATA SHEET

PROJECT NAME: Esposti well
PROJECT DATE: 5/11/2016
PROJECT NUMBER: 1111/0001
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 less clear |
| 11:10 | " | | 7.50 | 25.1 | 549/365 | -25 | no sand |
| | | | | | | | |
| 14:14 | 600 | | 7.31 | 27 | 553/365 | -30 | |
| 14:18 | 660 | | 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 ____ UNPRESERVED VOA'S ____
PRESERVED LITERS ____ UNPRESERVED LITERS ____
500 ml PLASTIC OR GLASS BOTTLE: ____ OTHER: ______

FIELD FILTERED: ____ UNFILTERED: ____

COMMENTS: ______

# WELL SAMPLING DATA SHEET

PROJECT NAME: Espanti Supply well
PROJECT DATE: 5/11/2016
PROJECT NUMBER: 1111 0001
SAMPLER: Ken T O'Boler
WELL DESIGNATION: Espanti 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 | 9~~1~~0 | increase flow | 7.52 | 25.0 | 542µs/360ppm | -27 mv | |
| 16:23 | 910 | | 7.46 | 26.2 | 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 | |
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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: ______

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<br>° 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 GPM |
| 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 600 GPM |
| 1359 | S376 | Same 40% | Same " " |
| 1414 | S376 | Same 40% | Same " " " |
| 1424 | S376 | 45% | 5% increase in flow 700 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 800 GPM |
| 1458 | S376 | 55% | 5% increase in flow to 8[illegible] |
| 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% |
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5/11/2016

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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<br>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 | ~~S374~~ 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 | ~~S31~~ 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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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.

## Analysis Request

| Sample Identification | 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) | TAT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ESW-5-11-10:44 | 5/11 | 10:44 | | X | | | | | | | X | X | | X | X | X | | | | | | | | | | | | | | | | Filter+fix |

Field Sampler - Print Name & Signature

Container / Preservative / Matrix / Sample Collection

TAT: 24hr ☑ / 48hr ◯ (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 |
|---|---|---|---|
| [signature] | David Roma | 5/11/16 | 11:57 |
| 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:

# Work Order
# Chain of Custody Record

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916-686-5190 F) 916-686-5192

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 |

Field Sampler - Print Name & Signature:

Signature below authorizes work under terms stated on reverse side.

## Analysis Request

| Sample Identification | 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) | 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) |

Container / Preservative / Matrix

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 |
|---|---|---|---|
| [signature] | 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:

GHD

Client ............ Job Number ............ Sheet ..... of .....

Project ............ Sheets by ............ Date ............

Subject ESW Pump Test TD Downloads / Checked by In-Situ ............ 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

-1330 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

## 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<br>° 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 IOT

distance between Esposti Supply + irrigation 29.5 ft.

Elizabeth - 217 - 8365

Rich Ramos - 696-5794 pgr - 838 5389

9:00 - KENT LEFT - CONTINUED WELL 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 SHOWED 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 | 141.74 | 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 | | | 209.02 | | |
| 1330 | | | 210.18 | | |
| 1400 | | | 210.89 | | |
| 1430 | | | 211.40 | | |
| 1500 | | | 211.80 | | |
| 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 | | |
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GHD MANAGEMENT ENGINEERING ENVIRONMENT

# Parameter Record

**Well ID:** ..........................

| *Job Information* | | *Sampling Information* | | *Well Information* | | | |
|---|---|---|---|---|---|---|---|
| **Client:** | Town of Windsor | **Sample Method:** | direct from pump | **SWL:** | 42.35 ft | **Check:** | .............. |
| **Project:** | .............................................. | **WQ Meter Type:** | Ultrameter II | **Date:** | 5/16/2016 | **Time:** | 6:05 |
| | .............................................. | **Flow Cell:** | **Pump Depth:**.............m | **Ref.datum:** | TOC | **Stick Up:** | |
| **Proj. No.:** | 11110001 | **WLevel Meter Type:** | meter calibrated by KOA 5/13/2016 | **Well Depth:** | .............. ft | **Well Diam.:** | ft |
| **Sampler:** | .............................................. | | | **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 | 7.65 | 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 after 2min | Note | Comment: Colour, turbidity, sediment load, sheen, odour |
|---|---|---|---|---|---|---|---|---|---|---|
| | Stable When: | | +/- 0.2 C | +/- 0.05 pH | +/- 3% | +/- 10% | +/- 10 mV | | | |
| | 1330 | 27.5 | 7.63 | 534 | 350 | | 28 | | | |
| | 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 | | |
| | 0100 | 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 | 0600 | 25.5 | 7.57 | 534 | 353 | | -22 | -30 | | |
| | 0700 | 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 

| 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 | 7.04 | 534 | 353 | -7 | | | | |
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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 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 | Time | Container: 40ml VOA | Poly | Amber | Glass | Preservative: HCL | HNO3 | H2SO4 | Other | None | Matrix: Water | Soil | ~~As III & IV~~ As III & As IV | Ammonia | Sulfide | Cr6 DW | Cyanide DW | Radium 228 | 525.2 DDW Reg 3 | 547 Glyphosate | 1613 Dioxin DW | TAT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ~~Esposti~~ 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 | 2 wk (standard) |

TAT: 24 hr / 48hr (Lab Approval Required) / 1 wk / 2 wk (standard) — Lab Approval Required For Rush

| Relinquished by: | Received by: | Date | Time |
|---|---|---|---|
| [signature] | [signature] | 5/17/16 | 1305 |
| | | | |
| | | | |
| | | | |
| | | | |

CDPH Write On EDT Report? Yes x 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 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

Signature below authorizes work under terms stated on reverse side.

## Analysis Request

**TAT:** see note — 24 hr (circled), 48 hr, Lab Approval Required; 1 wk; 2 wk (standard) (marked). Lab Approval Required For Rush

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 | 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 | | | | | | | | | | | | | | | | Preserve in lab |
| ESW-5-16-18:00 | 5/16 | 18:00 | | X | | | | | | | X | X | | X | X | X | | | | | | | | | | | | | | | | |
| ESW-5-16-24:00 | 5/16 | 24:00 | | X | | | | | | | X | X | | X | X | X | | | | | | | | | | | | | | | | |
| 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 |
|---|---|---|---|
| [signature] | [signature] | 5/17/14 | 1315 |
| | | | |
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| | | | |

CDPH Write On EDT Report? Yes (X) 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:

# Work Order
# Chain of Custody Record

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916-686-5190 F) 916-686-5192

Lab No.____________



| | |
|---|---|
| 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 | 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: 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 |
|---|---|---|---|
| Relinquished by: [signature] | Received by: [signature] | 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 (x) 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*

| | Parameter | Value | Unit |
|---|---|---|---|
| ** | 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

| | Parameter | Value | Unit |
|---|---|---|---|
| | 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

| Parameter | Value | Unit |
|---|---|---|
| Alkalinity | 230 | mg/L $CaCO_3$ |
| Bicarbonate | 280 | mg/L $CaCO_3$ |
| 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

| Parameter | Value | Unit |
|---|---|---|
| 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 ____ |

*Raw Water Analysis are critical for basic design estimates

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%

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 OBrien 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 | |
| ~~13:43~~ 13:13 | | | 124.50 | 400 | |
| 14:15 | | | 127.40 | 400 | |
| 15:18 | | | 129.20 | 400 | |
| | | | | | 4 hour specific |
| | | | | | capacite = |
| | | | | | 5.5 gpm/ft |
| | | | | | |
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# Parameter Record

GHD Management Engineering Environment

Well ID: ~~Supply well~~ Esparto Supply well

| Job Information | | Sampling Information | | Well Information | |
|---|---|---|---|---|---|
| Client: | Town of Windsor | Sample Method: | direct from pump | SWL: 56.5 ft | Check: |
| Project: | | WQ Meter Type: | | Date: 8/23/2016 | Time: 11:20 |
| | | Flow Cell: | Pump Depth: 220 ft intake | Ref.datum: TOC | Stick Up: |
| Proj. No.: | 11110001 | WLevel Meter Type: | No packer | Well Depth: NM ft | Well Diam.: 10 ft |
| Sampler: | Kent O'Brien | | | Screen From: 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 | 26.5 | 7.38 | 515.6 | 352.7 | | ~~+[illegible]~~ -2 | | | 2nd opinion on odor - yes slight sulfer |
| 14:40 | 26.9 | 7.41 | 517.6 | 355.6 | | ~~[illegible]~~ +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

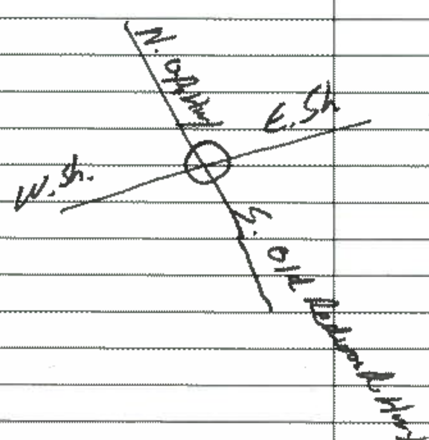
| | |
|---|---|
| DATE: 8/23/2016 | LOCATION: Esposti Well, Old Redwood Hwy at Shiloh Road, Windsor, CA |
| PROJECT NAME: Town of Windsor, Esposti Well | JOB NO: 11110001.20 |
| EVENT: Sewer Flow Test and Observations | WEATHER/TEMP: ° at am<br>° at pm |
| PRESENT AT SITE: Kent O'Brien | |

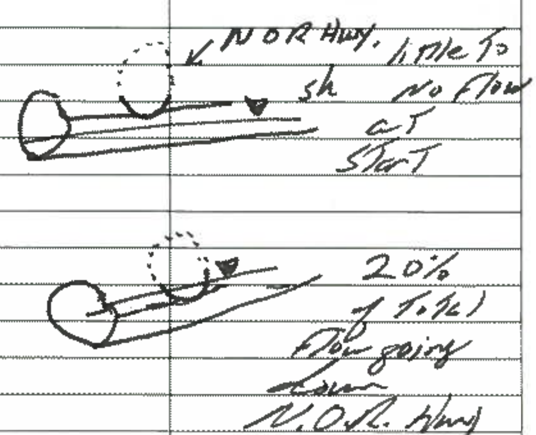
DATE: ~~dd/mm/yy~~ Aug/23/2016

| 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!



## 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

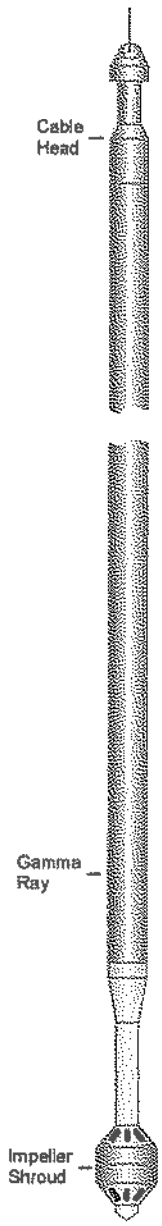
SEC: 19 TWP: 8N RGE: 8W LAT.: 38.52549 LONG.: 122.77953

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 |

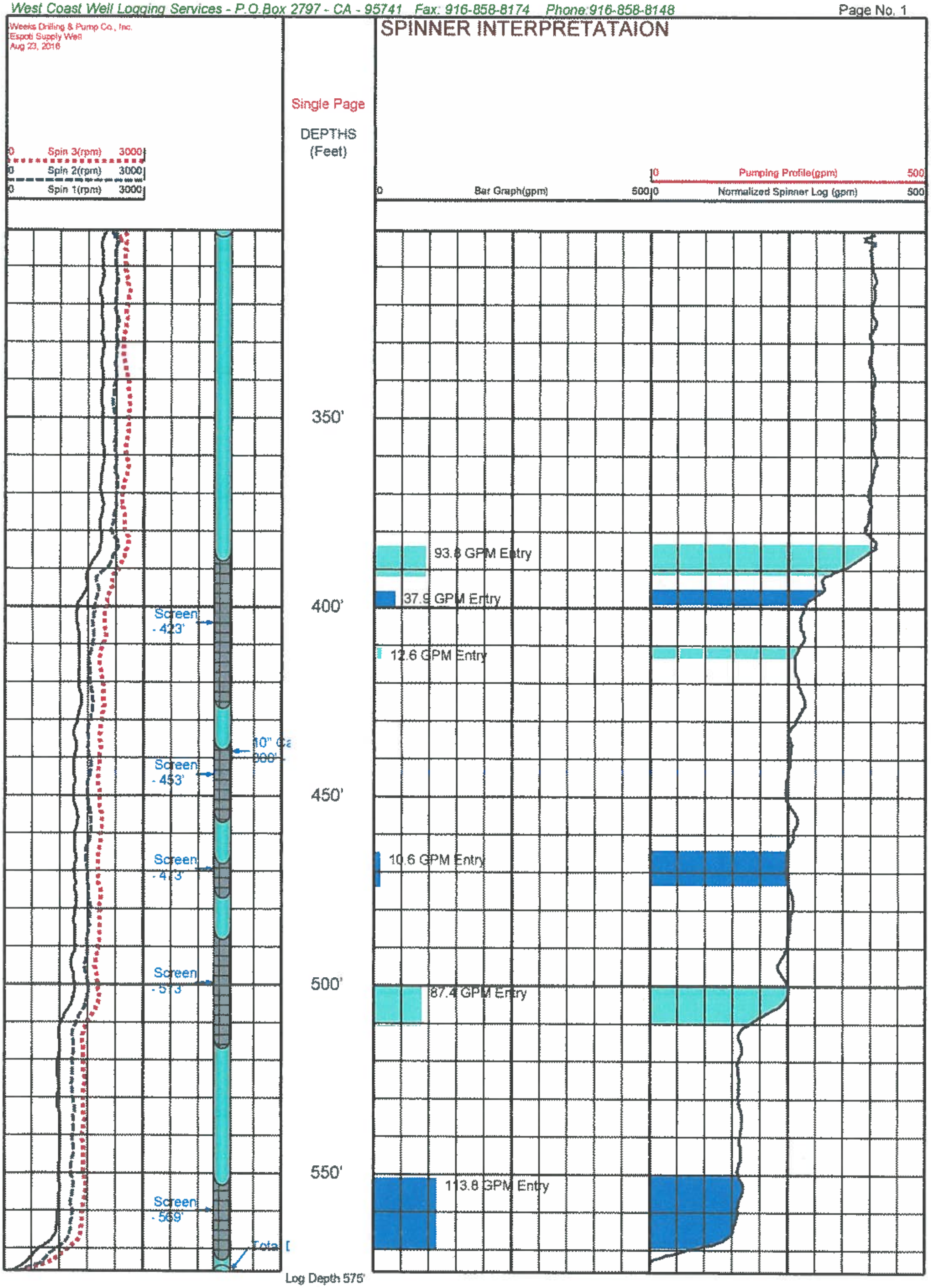
# NOTICE

*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

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


Weeks Drilling & Pump Co., Inc.
Espoti Supply Well
Aug 23, 2016
SPINNER INTERPRETATAION
Single Page
DEPTHS
(Feet)
0 Spin 3(rpm) 3000
0 Spin 2(rpm) 3000
0 Spin 1(rpm) 3000
0 Bar Graph(gpm) 500
0 Pumping Profile(gpm) 500
0 Normalized Spinner Log (gpm) 500
350'
400'
450'
500'
550'
Screen - 423'
Screen - 453'
Screen - 473'
Screen - 513'
Screen - 569'
93.8 GPM Entry
37.9 GPM Entry
12.6 GPM Entry
10.6 GPM Entry
87.4 GPM Entry
113.8 GPM Entry
Log Depth 575'

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clientservices@alpha-labs.com

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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 | 11:21 | | 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~~ ESW-8-23-15:21 | 8/23 | ~~13:21~~ 15:21 | | X | | | | X | | | | X | | x | x | X | 48 hr. |

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: [signature] | 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

GHD

# 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<br>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 | COND. (uS) | pH | TEMP (C°) |
|---|---|---|---|---|---|
| 1525 | 57.3 | — | | | |
| 1526 | 104.3 | ON | | | |
| 1531 | 119.5 | | | | |
| 1536 | 124.0 | | | | |
| 1541 | 129.8 | | | | |
| 1556 | 132.0 | | | | |
| 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

GHD

# 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<br>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

| | |
|---|---|
| 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

| | | | | |
|---|---|---|---|---|
| Measured Well | Owner: WINDSOR | | Well ID: ESW | |
| | 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? 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 | — | 57.55 | — | 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 610237C

GHD MANAGEMENT ENGINEERING ENVIRONMENT

# Parameter Record

8/26/16

**Well ID:** ESW

| Job Information | | Sampling Information | | Well Information | | | |
|---|---|---|---|---|---|---|---|
| Client: | Town of Windsor | Sample Method: | direct from pump | SWL: | 57.55 ft | Check: | |
| Project: | ESPOSTI SUPPLY WELL | WQ Meter Type: | | Date: | 8/26/16 | Time: | 0710 |
| | | Flow Cell: | Pump Depth: 428' ~~ft~~ | Ref.datum: | TOC | Stick Up: | |
| Proj. No.: | 11110001 | WLevel Meter Type: | | Well Depth: | NM ft | Well Diam.: | 10 ~~ft~~ " |
| Sampler: | RC/MATT | | | 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 | | | |
| 0716 | 24.9 | 7.52 | 543 | 376 | | -65 | | | PUMP ON @ 715AM @400GPM |
| 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 | 26.0 | 7.33 | 523 | 359 | | -28 | | | |
| 1200 | 26.0 | 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 | 26.0 | 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 |
| | | | | | | | | | |

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*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.________ 

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

| 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 |

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 | | 8/29/16 | 0630 |
| | [signature] | 8/30/16 | 1 &CD |
| | | | |
| | | | |
| | | | |

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:

GHD

## FIELD REPORT

| | |
|---|---|
| DATE: 9/6/16 | LOCATION: ESPOSTI PARK WINDSOR |
| PROJECT NAME: ESPOSTI WELL | JOB NO: WEEKS, SEBASTOPOL |
| 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 ARSEMIC 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

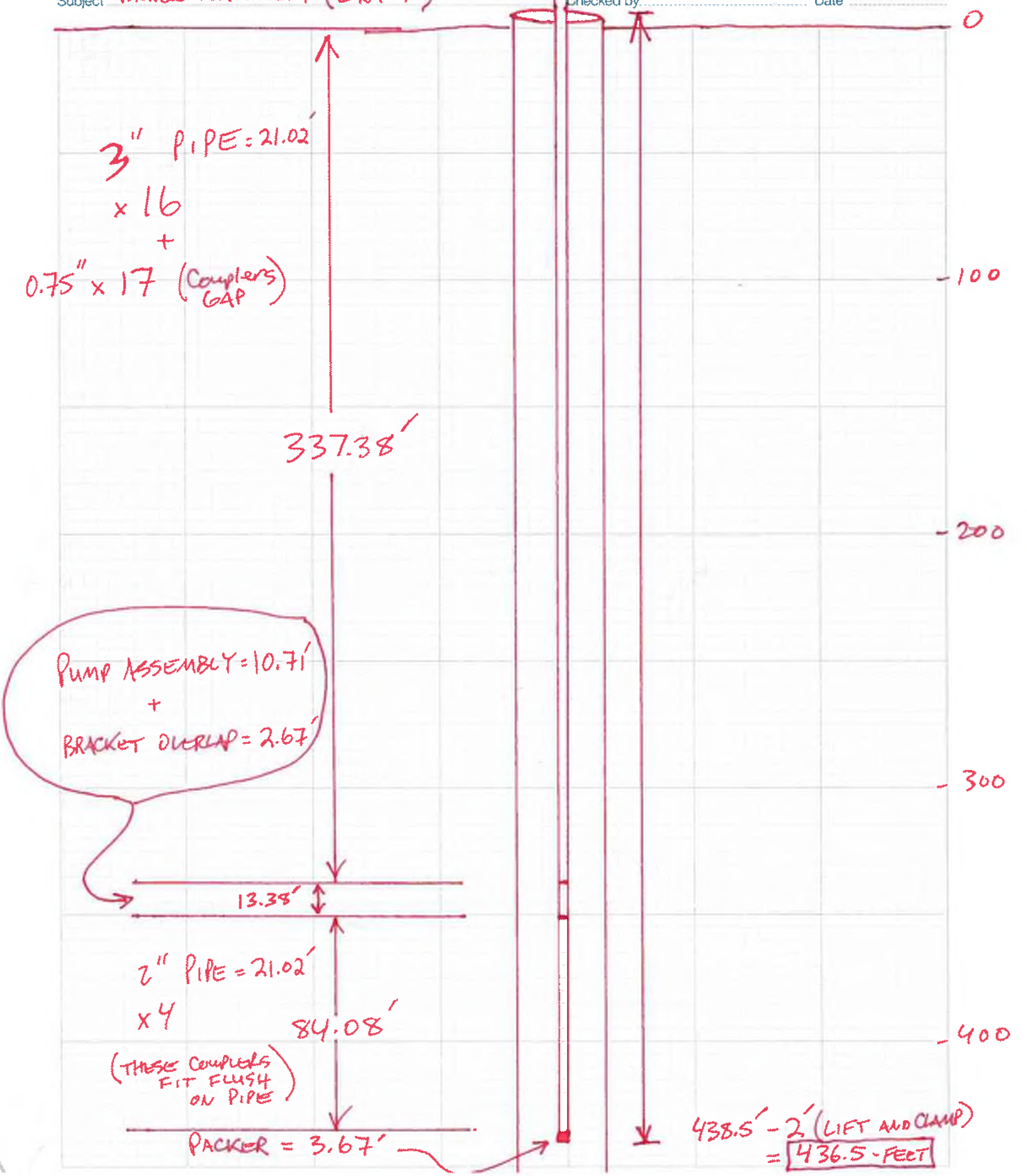
- 1300 RC ONSITE @ WEEKS. MEET W/ JOSH AND GO OVER YARD AND MEASURE ALL ZONE TEST PIPING, PUMP ASSEMBLY, PACKER, BRACKET, COUPLERS

- 1415 RC OFFSITE

GHD

Client: TOWN OF WINDSOR
Project: ESPOSITI 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

**Project ID:** #25-1310

**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 AND KOBRIEN@HAZENANDSAWYER.COM

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 | 2 wk (standard) |

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: | Travel and Site Time: | Mileage: | EDF to (Email Address): Misc. Supplies: |
|---|---|---|---|---|---|---|---|
| Ryan Crawford | [illegible signature] | 9/6/16 | 1430 | | | | |

DATE: 9/12/16 | LOCATION: ESPOSTI PARK, WINDSOR
PROJECT NAME: | EVENT: HI-DEF CAMERA VIDEO ESW

-1258 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' SCREEN STILL GOOD NOTE: ~10%-30% FINE IN SCREENS

403' SREEN/BLANK WELD GOOD

403-424.1 SCREEN GOOD

424.1 - SREEN/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 ___

GHD

# 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<br>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

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

| 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 = 13 ppb

1540 - CLEAN-UP, RC/WEEKS OFFSITE

GHD

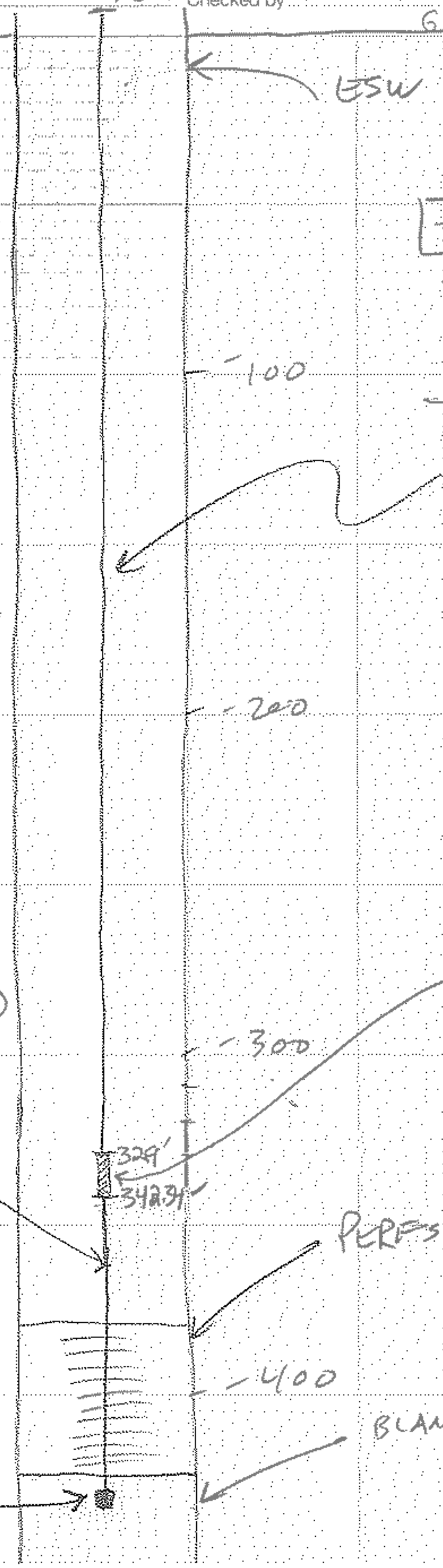
WEEKS WCK G100 CODE

Client ............ Job Number ............ Sheet ...... of ......

Project ............ Sheets by RC ............ Date 9/19

Subject PACKER/TD/PUMP INSTALL SCHEMATIC ............ Checked by ............ Date ............

GROUND




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 | | Sampling Information | | Well Information | | | |
|---|---|---|---|---|---|---|---|
| Client: | Town of Windsor | Sample Method: | direct from pump | SWL: | 58.4 ft | Check: | |
| Project: | | WQ Meter Type: | | Date: | | Time: | |
| | | Flow Cell: | Pump Depth: ...m | Ref.datum: | | Stick Up: | |
| Proj. No.: | 11118001 | WLevel Meter Type: | | Well Depth: | ft | Well Diam.: | ft |
| Sampler: | | | | 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

GHD MANAGEMENT ENGINEERING ENVIRONMENT

| Measured Well | Owner: TOWN OF WINDSOR | Well ID: |
|---|---|---|
| | Location: EPOSTI PARK | Name/Site: |

| Pumped Well | Owner: Town of Windsor | Well ID: Esposti Supply Well |
|---|---|---|
| | Location: | Name/Site: |

| Test Details | Date pumping commenced: 21SEPT16 | Time: 0700 | Test No. |
|---|---|---|---|
| | Date pumping ceased: 21SEPT16 | Time: | |

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

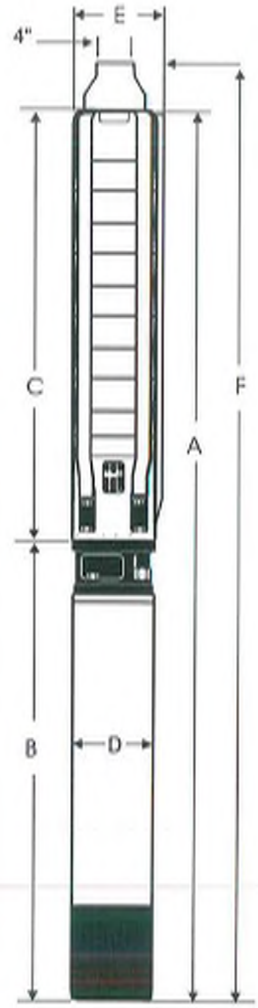
| Watch Time | Elapsed Time (min) | Calculated drawdown (ft) (DTW - Static) | Measured DTW (feet) below measuring point | Discharge (gpm) Only if pumped well | Comments or pressure measurements from transducer |
|---|---|---|---|---|---|
| 0700 | 0 | — | 58.40 | 300 | Pump START - METER 69051 |
| 0705 | 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 | Pump 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 | | | | | | APPROX. SHIP WT. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | A | B | C | D | E | F | |
| 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 | |

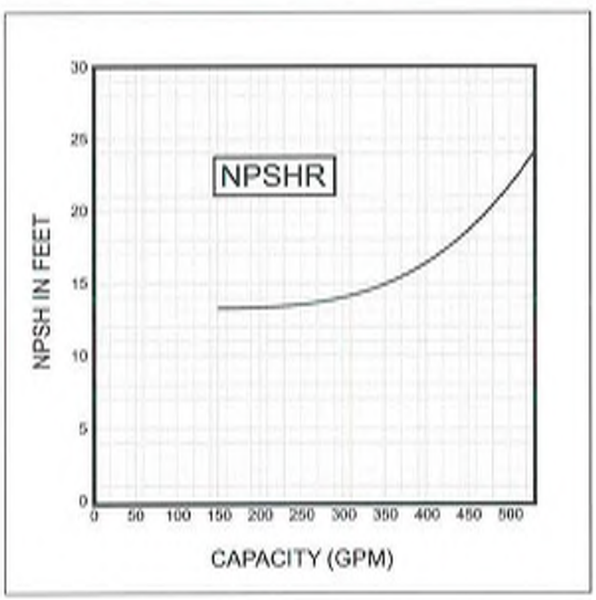
NOTES: All models suitable for use in 8" wells, unless otherwise noted.
Weights include pump end with motor in lbs.
*Alternate motor sizes available.
All models come with a standard 5"-4" Pipe Adapter. Refer to chart for dimensions.



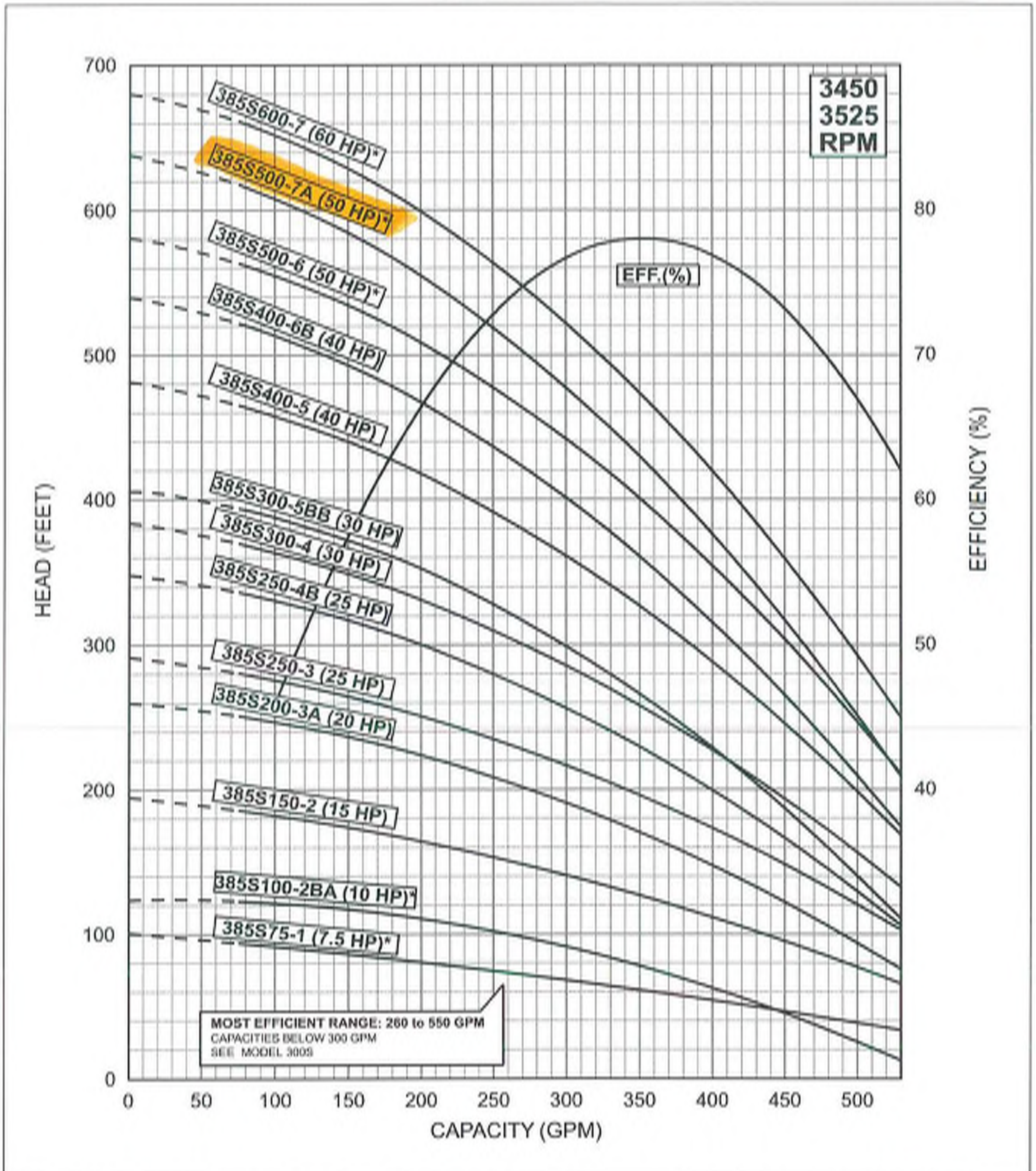
## MATERIALS OF CONSTRUCTION

| 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.



**FLOW RANGE: 75 - 550 GPM** **OUTLET SIZE: 4" NPT** **NOMINAL DIA. 8"**




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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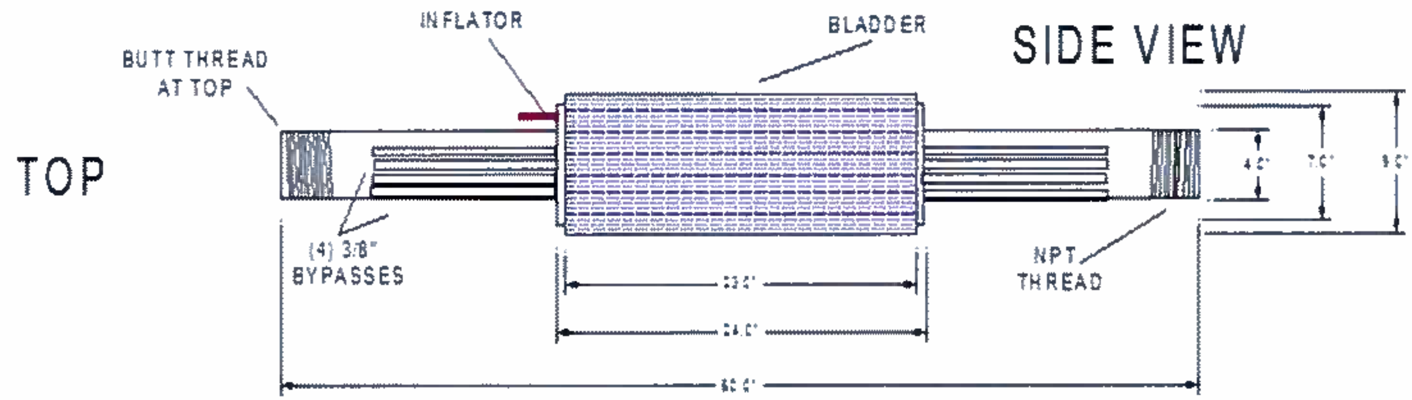
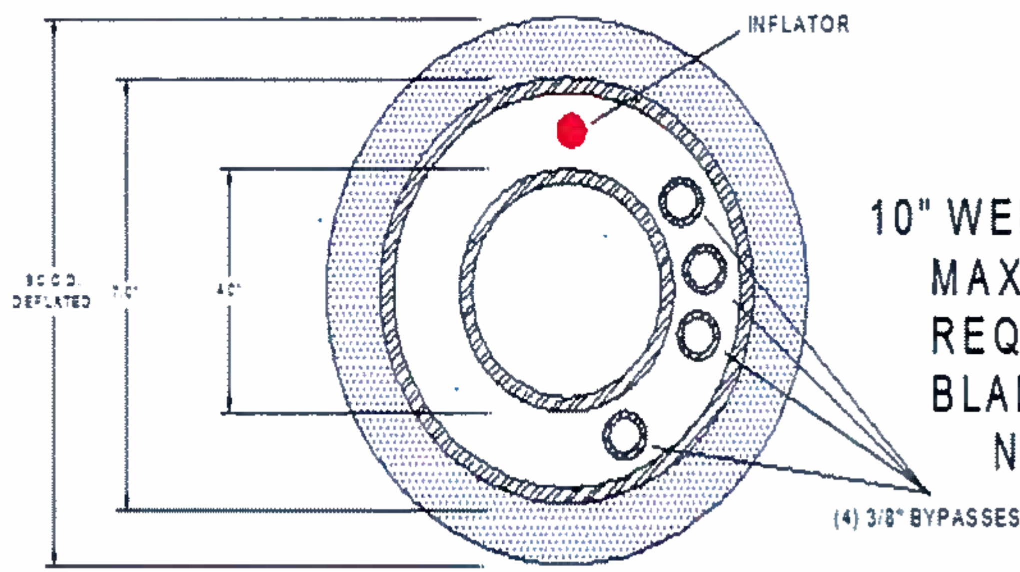
SIDE VIEW




TOP VIEW




10" WELL PACKER:

MAXIMUM BACK PRESSURE: 200 PSI
REQUIRED INFLATION: 275 PSI
BLADDER: FABRIC REINFORCED NATURAL RUBBER.

GRUNDFOS

**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<br>EN 1.4301<br>AISI ASTM 304 |
| Impeller: | Stainless steel<br>EN 1.4301<br>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 |

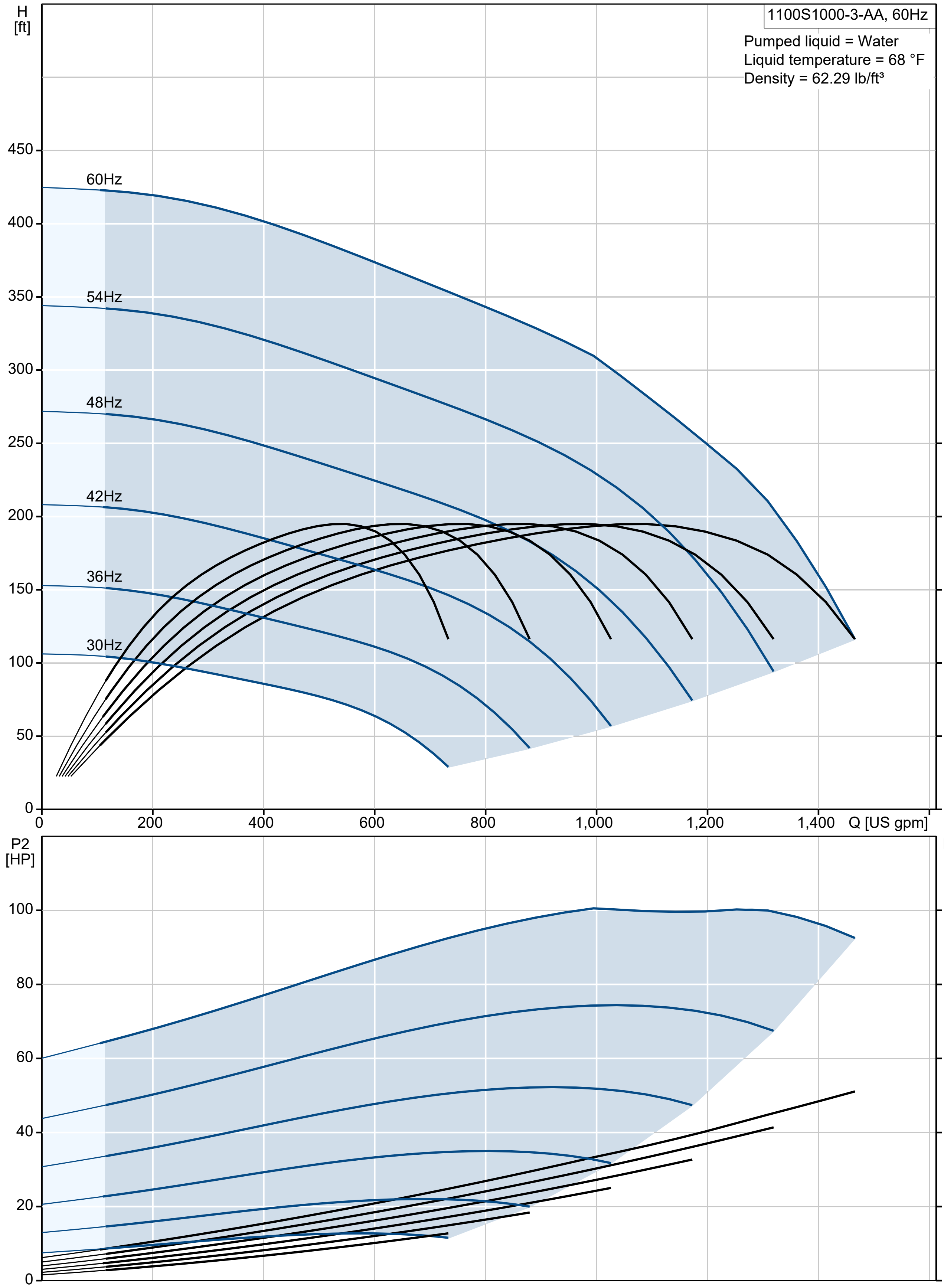
**r**

| | |
|---|---|
| ErP status: | EuP Standalone/Prod. |
| Net weight: | 138 lb |
| Gross weight: | 198 lb |
| Shipping volume: | 8.58 ft³ |

**P** **r** **d**

**D** 1/4/2016

# S AA



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 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

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

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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| | | |
|---|---|---|
| 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 |

## 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 |

*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.*

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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| | | |
|---|---|---|
| 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 | |

Alpha Analytical Laboratories Inc.
e-mail: clientservices@alpha-labs.com
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| | | |
|---|---|---|
| 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 |

## 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 |

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| | | |
|---|---|---|
| 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 |

## 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] | 04/26/16 15:39 |

**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 |

alpha
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# Work Order
# Chain of Custody Record

.4

Lab No. 16D1995    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 | 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-4.20-08:23 | 4/20/16 | 08:23 | | X | | | | | | | X | X | | X | X | X | | | | | | | | | | | | | | | | Filter & Fix In Lab. |

**TAT:** 24 hr (filled) / 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 |
|---|---|---|---|
| [illegible] | [illegible] | 4/22/16 (4/20/16) | 11:10 |
| [illegible] | [illegible] | 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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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

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| | | |
|---|---|---|
| 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 |

## 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 |

*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.*

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| | | |
|---|---|---|
| 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 |

| | Result | | Reporting Limit | Dilution | Batch | Prepared | Analyzed | Method | Note |
|---|---|---|---|---|---|---|---|---|---|
| **ESW-4-26-11:50 (16D2256-01)** | | | **Sample Type: Water** | | | **Sampled: 04/26/16 11:50** | | | |
| **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 | |

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| | | |
|---|---|---|
| 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 |

## 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 |

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| | | |
|---|---|---|
| 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 |

## 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 | |

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| | | |
|---|---|---|
| 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 |

**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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# Work Order
# Chain of Custody Record

Lab No. 1602256 Page____of____

0.4

| | |
|---|---|
| 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

| Sample Identification | 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-4-26-11:50 | 4/26/16 | 1150 | | X | | | | | | | X | X | | X | X | X | | | | | | | | | | | | | | | | FILTER ? FIX IN LAB |

TAT: 24 hr (marked) / 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 |
|---|---|---|---|
| [signature] | [signature] | 4/26/16 | 1220 |
| [signature] | [signature] | " | 1540 |
| | | | |
| | | | |
| | | | |

CDPH Write On EDT Report? Yes ◯ No (marked)

State System Number: ______

CA Geotracker EDF Report Yes ◯ No (marked)

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

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| | | |
|---|---|---|
| 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 |

## 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 |

*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.*

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Central Valley: 9090 Union Park Way, Suite 113, Elk Grove, CA 95624 • Phone: (916) 686-5190 • Fax: (916) 686-5192

| | | |
|---|---|---|
| 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 |

| | 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 | |

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| | | |
|---|---|---|
| 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 |

## 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 |

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Central Valley: 9090 Union Park Way, Suite 113, Elk Grove, CA 95624 • Phone: (916) 686-5190 • Fax: (916) 686-5192

| | | |
|---|---|---|
| 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 |

## 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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# 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; Kent O'Brien, kent.obrien@ghd.com

**PO#**

**Bill to:** month end billing

**Field Sampler - Print Name & Signature:** RYAN CRAWFORD [signature]

Signature below authorizes work under terms stated on reverse side.

## Analysis Request

| Sample Identification | 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) | TAT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EWS-4-28-11:40 | 4/28/16 | 1140 | | X | | | | | | | X | X | | X | X | X | | | | | | | | | | | | | | | | FILTER? FIX IN LAB |

TAT: 24 hr (selected) / 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 | [signature] | 〃 | 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

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| | | |
|---|---|---|
| Town Of Windsor - Drinking Water | Project Manager: Elizabeth Cargay | |
| 8400 Windsor Rd. | Project: Esposti Potable Well | Reported: |
| Windsor, CA 95492-0100 | Project Number: [none] | 05/02/16 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 |

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| | | |
|---|---|---|
| Town Of Windsor - Drinking Water | Project Manager: Elizabeth Cargay | |
| 8400 Windsor Rd. | Project: Esposti Potable Well | Reported: |
| Windsor, CA 95492-0100 | Project Number: [none] | 05/02/16 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 | |

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| | | |
|---|---|---|
| Town Of Windsor - Drinking Water | Project Manager: Elizabeth Cargay | |
| 8400 Windsor Rd. | Project: Esposti Potable Well | Reported: |
| Windsor, CA 95492-0100 | Project Number: [none] | 05/02/16 16:46 |

## 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 |

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| | | |
|---|---|---|
| Town Of Windsor - Drinking Water | Project Manager: Elizabeth Cargay | |
| 8400 Windsor Rd. | Project: Esposti Potable Well | Reported: |
| Windsor, CA 95492-0100 | Project Number: [none] | 05/02/16 16:46 |

## 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 | |

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| | | |
|---|---|---|
| Town Of Windsor - Drinking Water | Project Manager: Elizabeth Cargay | |
| 8400 Windsor Rd. | Project: Esposti Potable Well | Reported: |
| Windsor, CA 95492-0100 | Project Number: [none] | 05/02/16 16:46 |

**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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# 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 | Invoice to (if different) | Project Information |
|---|---|---|
| Company: TOWN OF WINDSOR - DRINKING WATER | Contact: | Project ID: ESPOSTI POTABLE WELL |
| Attn: ELIZABETH CARGAY | Email address: | Project No: |
| Address: 9291 OLD REDWOOD HWY BUILDING 400, WINDSOR CA | Address: | PO Number: |
| Phone/Fax: | Phone/Fax: | |

Email Address: ecargay@TOWNOFWINDSOR.com / KENT.OBRIEN@GHD.com

Field Sampler - Printed Name & Signature: RYAN CRAWFORD Ryan Crawford

| Sample Identification | Sampling Date | Sampling Time | Container: 40ml Vial | Container: Poly | Container: Glass | Container: Sleeve | Container: Other | Preservative: HCl | Preservative: HNO3 | Preservative: H2SO4 | Preservative: Other | Preservative: None | Matrix: Water | Matrix: Soil | Matrix: Other | Total Number of Containers per Sample ID | Analysis Request: 200.8 As (Diss) | Analysis Request: 200.7 Fe (Diss) | Analysis Request: 200.7 Mn (Diss) | Sample Notes or DDW Source Numbers: |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ESW-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 Poma | 4·29·16 | 1304 |
| David Poma | [signature] | 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

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| | | |
|---|---|---|
| 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 |

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| | | |
|---|---|---|
| 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-5-9-10:50 (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 | |

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| | | |
|---|---|---|
| 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 |

## 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 | |

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| | | |
|---|---|---|
| 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 |

## 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 | |

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| | | |
|---|---|---|
| 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 |

**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____

1-6

| Name: | Project ID: |
|---|---|
| Town of Windsor - Drinking Water | 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

| 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 |

TAT: 24 hr (X) / 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 |
|---|---|---|---|
| [signature] | [signature] | 5/10 | 1400 |
| [signature] | [signature] | 〃 | 1550 |
| | | | |
| | | | |
| | | | |

CDPH Write On EDT Report? Yes ◯ No (X)

State System Number: ____________

CA Geotracker EDF Report Yes ◯ No (X)

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

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| | | |
|---|---|---|
| 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-5-10-10:09 | 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 |

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| | | |
|---|---|---|
| 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 | |

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| | | |
|---|---|---|
| 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 |

## 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 | Project Manager: Elizabeth Cargay | |
| 8400 Windsor Rd. | Project: Esposti Potable Well | Reported: |
| Windsor, CA 95492-0100 | Project Number: [none] | 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 | |

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## 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 | |

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| | | |
|---|---|---|
| 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 |

## 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 | |

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**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 | 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

TAT: 24 hr (X) / 48 hr / Lab Approval Required / 1 wk / 2 wk (standard) — Lab Approval Required For Rush

1.6

Field Sampler - Print Name & Signature:

| Sample Identification | 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) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ESW-5-10-10:09 | 5/10 | 10:09 | | X | | | | | | | X | X | | X | X | X | | | | | | | | | | | | | | | | Filter and fix |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | NO Filter then fix |
| ESW-5-10-10:09 Total | 5/10 | 10:09 | | X | | | | | | | X | X | | X | X | X | total metals per Kent. | | | | | | | | | | | | | | | |

## **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 |
|---|---|---|---|
| [signature] | [signature] | 5/10 | 1400 |
| [signature] | [signature] | " | 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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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

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

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

| | | |
|---|---|---|
| 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 |

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| | | |
|---|---|---|
| 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 |

| | 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 | |

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| | | |
|---|---|---|
| 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 |

## 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 | |

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| | | |
|---|---|---|
| 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 |

## 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 | |

| | | |
|---|---|---|
| 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 |

**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

Lab No. 16E1054 Page____of____ 4

| | |
|---|---|
| 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

| Sample Identification | 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) | TAT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ESW-5-11-10:44 | 5/11 | 10:44 | | X | | | | | | | | X | X | | X | X | X | | | | | | | | | | | | | | | | Filter & fix |

Container / Preservative / Matrix

TAT: 24 hr (checked) / 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 |
|---|---|---|---|
| [signature] | David Poma | 5/11/16 | 11:57 |
| David Poma | [signature] | 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

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| | | |
|---|---|---|
| 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 |

## 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 |

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| | | |
|---|---|---|
| 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 |

| | 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 | |

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| | | |
|---|---|---|
| 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 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 | |

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| | | |
|---|---|---|
| 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 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 | |

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| | | |
|---|---|---|
| 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 | |

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| | | |
|---|---|---|
| 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 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 | |

| | | |
|---|---|---|
| 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 |

**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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916-686-5190 F) 916-686-5192

# 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.

## Analysis Request

**Field Sampler - Print Name & Signature**

| Sample Identification | 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) | 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 Fe (dissolved) |

Container / Preservative / Matrix

**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 |
|---|---|---|---|
| [signature] | Dot Gialdini | 5/12/16 | 11:00 |
| Dot Gialdini | [signature] | 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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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

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| | | |
|---|---|---|
| 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 |

## 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 |

*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.*

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| | | |
|---|---|---|
| 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 | |

*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.*

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| | | |
|---|---|---|
| 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 | |

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| | | |
|---|---|---|
| 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 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 | |

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**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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# Work Order
# Chain of Custody Record

Lab No. 16E1515 Page 1 of 1

2,↑

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

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 | 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) (Yes) | 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 | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | * | 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 |
|---|---|---|---|
| [signature] | [signature] | 5/17/16 | 1315 |
| [signature] | [signature] | 5/17/16 | 1515 |
| | | | |
| | | | |
| | | | |

CDPH Write On EDT Report? Yes (x) 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 C. Edens For Robbie C. Phillips
Project Manager

Alpha Analytical Laboratories Inc.
e-mail: clientservices@alpha-labs.com
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| | | |
|---|---|---|
| Town Of Windsor - Drinking Water | Project Manager: Elizabeth Cargay | |
| 8400 Windsor Rd. | Project: Esposti Potable Well | Reported: |
| Windsor, CA 95492-0100 | Project Number: [none] | 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 |

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Central Valley: 9090 Union Park Way, Suite 113, Elk Grove, CA 95624 • Phone: (916) 686-5190 • Fax: (916) 686-5192

| | | |
|---|---|---|
| Town Of Windsor - Drinking Water<br>8400 Windsor Rd.<br>Windsor, CA 95492-0100 | Project Manager: Elizabeth Cargay<br>Project: Esposti Potable Well<br>Project Number: [none] | Reported:<br>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 | |

| | | |
|---|---|---|
| Town Of Windsor - Drinking Water | Project Manager: Elizabeth Cargay | |
| 8400 Windsor Rd. | Project: Esposti Potable Well | Reported: |
| Windsor, CA 95492-0100 | Project Number: [none] | 06/01/16 10:45 |

## 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 | |

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| | | |
|---|---|---|
| Town Of Windsor - Drinking Water | Project Manager: Elizabeth Cargay | |
| 8400 Windsor Rd. | Project: Esposti Potable Well | Reported: |
| Windsor, CA 95492-0100 | Project Number: [none] | 06/01/16 10:45 |

## 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 |

| | | |
|---|---|---|
| Town Of Windsor - Drinking Water | Project Manager: Elizabeth Cargay | |
| 8400 Windsor Rd. | Project: Esposti Potable Well | Reported: |
| Windsor, CA 95492-0100 | Project Number: [none] | 06/01/16 10:45 |

**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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916-686-5190 F) 916-686-5192

# Work Order
# Chain of Custody Record

Lab No. 16E1580

Page 1 of 1

2.1

| | |
|---|---|
| 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 |

Field Sampler - Print Name & Signature:

Signature below authorizes work under terms stated on reverse side.

## Analysis Request

TAT: see note — 24 hr (circled), 48 hr, Lab Approval Required, 1 wk, 2 wk (standard) (marked). 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)~~ (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 |
|---|---|---|---|
| [signature] | [signature] | 5/17/16 | 1315 |
| [signature] | [signature] | 5/17/16 | 1515 |
| | | | |
| | | | |
| | | | |

CDPH Write On EDT Report? Yes (x) 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

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| | | |
|---|---|---|
| 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 |

## 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 |

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| | | |
|---|---|---|
| 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 | |

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| | | |
|---|---|---|
| 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** | | | |
| **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 | |

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| | | |
|---|---|---|
| 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** | | | |
| **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* | |

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| | | |
|---|---|---|
| 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** | | | |
| **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 | |

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| | | |
|---|---|---|
| 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** | | | |
| **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* | |

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| | | |
|---|---|---|
| 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 |

## 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 | | | |

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| | | |
|---|---|---|
| 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 |

## 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 | |

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| | | |
|---|---|---|
| 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 |

## 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 | |

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## 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** | | | | | | | | | | |
| **Blank (AE64054-BLK1)** | | | | Prepared: 05/25/16 Analyzed: 05/26/16 | | | | | | |
| 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 | | | | | | |
| 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 | | | |

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| | | |
|---|---|---|
| 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 |

## 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 | |

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| | | |
|---|---|---|
| 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 |

## 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 | |

| | | |
|---|---|---|
| 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 |

## 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 | |

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| | | |
|---|---|---|
| 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 |

## 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 | | | |

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| | | |
|---|---|---|
| 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 |

## 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 | | | |

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| | | |
|---|---|---|
| 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 |

## 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 | |

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|---|---|---|
| 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 | |

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| | | |
|---|---|---|
| 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 |

## 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 | | | |

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## 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 | |

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| | | |
|---|---|---|
| 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 |

## 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* | | | |

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| | | |
|---|---|---|
| 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 |

## 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* | | | |

| | | |
|---|---|---|
| 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 |

## 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* | | | |

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Central Valley: 9090 Union Park Way, Suite 113, Elk Grove, CA 95624 • Phone: (916) 686-5190 • Fax: (916) 686-5192

| | | |
|---|---|---|
| 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 |

## 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

| Analyte(s) | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Flag |
|---|---|---|---|---|---|---|---|---|---|---|
| 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* | | | |

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Central Valley: 9090 Union Park Way, Suite 113, Elk Grove, CA 95624 • Phone: (916) 686-5190 • Fax: (916) 686-5192

| | | |
|---|---|---|
| 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 |

## 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* | | | |

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Central Valley: 9090 Union Park Way, Suite 113, Elk Grove, CA 95624 • Phone: (916) 686-5190 • Fax: (916) 686-5192

| | | |
|---|---|---|
| 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 |

## 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 | | | |

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| | | |
|---|---|---|
| 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 |

## 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* | | | |

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| | | |
|---|---|---|
| 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 |

## 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* | | | |

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

| | | |
|---|---|---|
| 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 |

## 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 | |

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Central Valley: 9090 Union Park Way, Suite 113, Elk Grove, CA 95624 • Phone: (916) 686-5190 • Fax: (916) 686-5192



## 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 | | | |

Alpha Analytical Laboratories Inc.
e-mail: clientservices@alpha-labs.com
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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

| 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 |

## 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* | | | |

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e-mail: clientservices@alpha-labs.com
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| | | |
|---|---|---|
| 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 |

**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<br>ESW-5-17-10:00 | 5/19/2016 | 5/17/2016 10:00 |

# Section II: Data Summary

CERES Analytical Laboratory, Inc.
4919 Windplay Dr Suite 1, El Dorado Hills, CA 95762

# EPA Method 1613B

| | | |
|---|---|---|
| **Quality Assurance Sample**<br>**Method Blank**<br><br>**Project ID:** 16E1535 | **QC Batch #:** 1451<br>**Matrix:** Drinking Water<br>**Sample Size:** 1.000 L | **Date Received:** NA<br>**Date Extracted:** 5/20/2016<br>**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**

CERES Analytical Laboratory, Inc.
4919 Windplay Dr Suite 1, El Dorado Hills, CA 95762

# EPA Method 1613B

| | | |
|---|---|---|
| **Quality Assurance Sample**<br>**Ongoing Precision and Recovery** | **QC Batch #:** 1451 | **Date Received:** NA |
| | **Matrix:** Drinking Water | **Date Extracted:** 5/20/2016 |
| **Project ID:** 16E1535 | **Sample Size:** 1.000 L | **ZB-5MS Analysis:** 5/21/2016 |

| 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

| | | | |
|---|---|---|---|
| [signature] | 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

ASBESTOS TEM LABORATORIES, INC. 600 BANCROFT WAY, STE. A, BERKELEY, CA 94710 (510) 704-8930
www.asbestostemlabs.com
*With Offices in Reno, NV (775) 359-3377*

# SUBCONTRACT ORDER

Alpha Analytical Laboratories, Inc.

16E1535

341142

| SENDING LABORATORY: | RECEIVING LABORATORY: |
|---|---|
| Alpha Analytical Laboratories, Inc. | Asbestos TEM Laboratories, Inc. |
| 208 Mason St. | 630 Bancroft Way |
| Ukiah, CA 95482 | Berkeley, CA 94710 |
| Phone: (707)468-0401 | Phone :(510) 704-8930 |
| Fax: (707)468-5267 | Fax: (510) 704-8429 |
| 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** | | | |
| 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 | Received By | Date |
|---|---|---|---|
| [signature] | 5/18/16 | [signature] ATEM | 11:00am 5/19 |
| Released By | Date | Received By | Date |

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:<br>The following note applies to Hexachlorocyclopentadiene:<br>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:<br>The following note applies to Tetrachloro-m-xylene:<br>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:<br>The following note applies to Aldicarb Sulfone/Sulfoxide, Oxamyl:<br>435 Sample matrix may be affecting this analyte. Data was accepted based on the LCS or CCV recovery. |



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June 3, 2016
**Alpha Analytical Laboratories, Inc.**

Lab ID : SP 1605717
Customer : 2-20626

## 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

**Alpha Analytical Laboratories, Inc.**
208 Mason St.
Ukiah, CA 95482

Description : ESW-5-17-10:00
Project : 16E1535

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

## Sample Result - Organic

| Constituent | Result | PQL | Units | Note | Sample Preparation Method | Sample Preparation Date/ID | Sample Analysis Method | Sample Analysis 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.



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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.



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June 3, 2016
**Alpha Analytical Laboratories, Inc.**

Lab ID : SP 1605717
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 | |



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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** | | | | | | | | |
| 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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# Work Order Chain of Custody Record

Lab No. 16E1535 Page 1 of 3

| | |
|---|---|
| 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

TAT: 24 hr / 48 hr (Lab Approval Required) / 1 wk / 2 wk (standard) — Lab Approval Required For Rush

2.4

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 | 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 | 2 wk |

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 |
|---|---|---|---|
| [signature] | [signature] | 5/17/16 | 1315 |
| [signature] | [signature] | " | 1515 |
| | | | |
| | | | |
| | | | |

CDPH Write On EDT Report? Yes (x) 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

| | |
|---|---|
| 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

| Sample Identification | Date | Time | 40ml VOA | Poly | Amber | Glass | HCL | HNO3 | H2SO4 | Other | None | Water | Soil | ~~As III & IV~~ As III & As IV | Ammonia | Sulfide | Cr6 DW | Cyanide DW | Radium 228 | 525.2 DDW Reg 3 | 547 Glyphosate | 1613 Dioxin DW | TAT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ~~Esposti~~ 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 | 2 wk (standard) |

Field Sampler - Print Name & Signature

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 |
|---|---|---|---|
| [signature] | [signature] | 5/17/16 | 1305 |
| [signature] | [signature] | " | 1515 |
| | | | |
| | | | |
| | | | |

CDPH Write On EDT Report? Yes (x) 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 |

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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

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| | | |
|---|---|---|
| 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 |

**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 |

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| | | |
|---|---|---|
| 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 |

**Esposti Irrigation Well (16I0423-01)** — **Sample Type: Water** — **Sampled: 09/06/16 10:45**

| | Result | | Reporting Limit | Dilution | Batch | Prepared | Analyzed | Method | Note |
|---|---|---|---|---|---|---|---|---|---|
| **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 | |

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| | | |
|---|---|---|
| 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 | | | |

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## 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** | | | | | | | | | | |
| **Matrix Spike (AI63409-MS2)** | **Source: 16I0318-01** | | | Prepared & Analyzed: 09/20/16 | | | | | | |
| 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 | | | | | | |
| 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 | |

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| | | |
|---|---|---|
| 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 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 | 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 |

## 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 | |

| | | |
|---|---|---|
| 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 |

## 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 | |

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| | | |
|---|---|---|
| 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 | | | |

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| | | |
|---|---|---|
| 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** | | | | | | | | | | |
| **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 | |

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**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 |
| **Attn:** | Robbie Phillips | **P.O. #:** | |
| **Client:** | Alpha Analytical Laboratories - Ukiah<br>208 Mason St<br>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 — Sampled: 09/06/16 10:45 by Client

6I09025-01 (Water)

**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 | |



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## 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 | |



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## 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 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.*



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# 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.

## Analysis Request

Field Sampler - Print Name & Signature: RYAN CRAWFORD / Ryan Crawford

| 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 090616 | 9/6/16 | 1045 | | x | | | | x | x | x | x | x | | X | X | x | x | x | x | x | x | x | x | x | x | x | 2 wk (standard) |

Container / Preservative / Matrix

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

| Relinquished by: | Received by: | Date | Time | Global ID: | EDF to (Email Address): |
|---|---|---|---|---|---|
| Ryan Crawford | [signature] | 9/6/16 | 1430 | Travel and Site Time: | Mileage: / Misc. Supplies: |
| [signature] | [signature] | | 1600 | | |

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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

Alpha Analytical Laboratories Inc.
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| | | |
|---|---|---|
| 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 |

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| | | |
|---|---|---|
| Town Of Windsor - Drinking Water<br>8400 Windsor Rd.<br>Windsor, CA 95492-0100 | Project Manager: Elizabeth Cargay<br>Project: Esposti Feasibility Study - Weeks<br>Project Number: 25-1310 | Reported:<br>09/30/16 14:14 |

| | 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 | |

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| | | |
|---|---|---|
| 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 |

| | 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 | |

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| | | |
|---|---|---|
| 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 |

| | Result | | Reporting Limit | Dilution | Batch | Prepared | Analyzed | Method | Note |
|---|---|---|---|---|---|---|---|---|---|
| **ESW-9-21-15:00 (16I2059-05)** | | | **Sample Type: Water** | | | **Sampled: 09/21/16 15:00** | | | |
| **Anions by EPA Method 300.0** | | | | | | | | | |
| **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 | |

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## 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 |

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| | | |
|---|---|---|
| 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 |

## 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 | |

| | | |
|---|---|---|
| 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 |

## 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 | |

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## 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 | |

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| | | |
|---|---|---|
| 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 |

## 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 | |

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Central Valley: 9090 Union Park Way, Suite 113, Elk Grove, CA 95624 • Phone: (916) 686-5190 • Fax: (916) 686-5192

| | | |
|---|---|---|
| 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 |

## 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 | |

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## 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** | | | | | | | | | | |
| **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 | | | |

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## 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 | |

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| | | |
|---|---|---|
| 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 |

**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 | **Report Date:** | 10/10/2016 |
| | | **Received Date:** | 9/27/2016 |
| **Project:** | 16I2059 | **Turnaround Time:** | Normal |
| | | **Phones:** | (925) 828-6226 |
| | | **Fax:** | (925) 828-6309 |
| **Attn:** | Robbie Phillips | **P.O. #:** | |
| **Client:** | Alpha Analytical Laboratories - Ukiah<br>208 Mason St<br>Ukiah, CA 95482 | | |

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)

| Analyte | Result | MDL | MRL | Units | Dil | Analyzed | Qualifier |
|---|---|---|---|---|---|---|---|
| **Method:** IC-ICP/MS **Batch ID:** W6J0393 **Instr:** Inst **Prepared:** 10/09/16 09:07 **Analyst:** apa | | | | | | | |
| **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 | |



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## 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 | |



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## 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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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: SEE NOTE: WEEKS & TOWN OF WINDSOR

Field Sampler - Print Name & Signature: 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 |

GHD SUPPLIED BOTTLES

TSS, TOC, GA, Tannins only w/o ...

TSS/TOC/GROSS ALPHA/TANNINS BILL TO TOWN OF WINDSOR, REMAINING ANALYTES BILL TO WEEKS

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 | [signature] | 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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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 client 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

Signature below authorizes work under terms stated on reverse side.

**Field Sampler - Print Name & Signature:** RYAN CRAWFORD

## 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+ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ~~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: | Received by: | Date | Time |
|---|---|---|---|
| Ryan Crawford | | 9/22/16 | 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:

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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

Alpha Analytical Laboratories Inc. e-mail: clientservices@alpha-labs.com
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| | | |
|---|---|---|
| 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 |

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| | | |
|---|---|---|
| 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 |

| | 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 | |

| | | |
|---|---|---|
| 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 |

## 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 | |

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| | | |
|---|---|---|
| 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 |

## 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 | |

| | | |
|---|---|---|
| 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 |

**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:<br>The following note applies to Gross Alpha:<br>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



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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.



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October 12, 2016 Lab ID : SP 1611469
**Alpha Analytical Laboratories, Inc.** 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. |



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alpha
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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 | Project ID: Esposti Well |
| Mailing Address: 9291 Old Redwood Highway Building 400, Windsor, CA 95492 | Phase: Project ID: 25-1310 |
| Project Contact (Hardcopy or PDF to): Elizabeth Cargay ecargay@townofwindsor.com; Kent O'Brien kobrien@hazenandsawyer.com | PO# 200336 |
| | Bill to: SEE NOTE: WEEKS ? TOWN OF WINDSOR |

Signature below authorizes work under terms stated on reverse side.

## Analysis Request

Field Sampler - Print Name & Signature: RYAN CRAWFORD [signature]

| 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+ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 |

TAT: 24 hr ○ 48 hr ⊗ (Lab Approval Required) 1 wk ○ 2 wk (standard) ⊗

Lab Approval Required For Rush

GHO SUPPLIED BOTTLES

TSS/TOC/GROSS ALPHA/TANNINS BILL TO TOWN OF WINDSOR, REMAINING ANALYTES BILL TO WEEKS

weeks billing analyses on sep w/o ©

| Relinquished by | Received by | Date | Time |
|---|---|---|---|
| Ryan Crawford | David Poma | 9/22/16 | 0815 |
| David Poma | [signature] | 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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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

Alpha Analytical Laboratories Inc.
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| | | |
|---|---|---|
| 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 |

**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 |

Alpha Analytical Laboratories Inc.
e-mail: clientservices@alpha-labs.com
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| | | |
|---|---|---|
| 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 | |

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| | | |
|---|---|---|
| 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 | | | |

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Central Valley: 9090 Union Park Way, Suite 113, Elk Grove, CA 95624 • Phone: (916) 686-5190 • Fax: (916) 686-5192

| | | |
|---|---|---|
| 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** | | | | | | | | | | |
| **Matrix Spike (AI63409-MS2)** | **Source: 16I0318-01** | | | Prepared & Analyzed: 09/20/16 | | | | | | |
| 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 | | | | | | |
| 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 | |

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| | | |
|---|---|---|
| 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 | |

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| | | |
|---|---|---|
| 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 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 | |

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## 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 | |

| | | |
|---|---|---|
| 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 |

## 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 | |

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| | | |
|---|---|---|
| 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 | | | |

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| | | |
|---|---|---|
| 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** | | | | | | | | | | |
| **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 | |

| | | |
|---|---|---|
| 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 |

**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 |
| **Attn:** | Robbie Phillips | **P.O. #:** | |

**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 — Sampled: 09/06/16 10:45 by Client
6I09025-01 (Water)

| Analyte | Result | MRL | Units | Dil | Analyzed | Qualifier |
|---|---|---|---|---|---|---|
| **Method:** IC-ICP/MS **Batch ID:** W6I0467 **Instr:** Inst **Prepared:** 09/11/16 08:36 **Analyst:** apa | | | | | | |
| **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 | |



14859 East Clark Avenue,City of Industry CA, 91745 | Phone: (626) 336-2139 | Fax: (626) 336-2634
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## 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 | |



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## 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 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.*



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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. 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 090616 | 9/6/16 | 1045 | | x | | | | x | x | x | x | x | | X | X | x | x | x | x | x | x | x | x | x | x | x | 2 wk (standard) |

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

| Relinquished by: | Received by: | Date | Time | Travel and Site Time: | Mileage: | Misc. Supplies: |
|---|---|---|---|---|---|---|
| Ryan Crawford | [illegible signature] | 9/6/16 | 1430 | | | |
| [illegible signature] | [illegible] | [illegible] | 1600 | | | |

Global ID:

EDF to (Email Address):

# 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™

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23785 Cabot Blvd., Suite 321 | Hayward | CA 94545
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# 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

CERTIFIED ENGINEERING GEOLOGIST
KEVIN P. LOEB
No. 2763
STATE OF CALIFORNIA

Date: 26 July 2022

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**

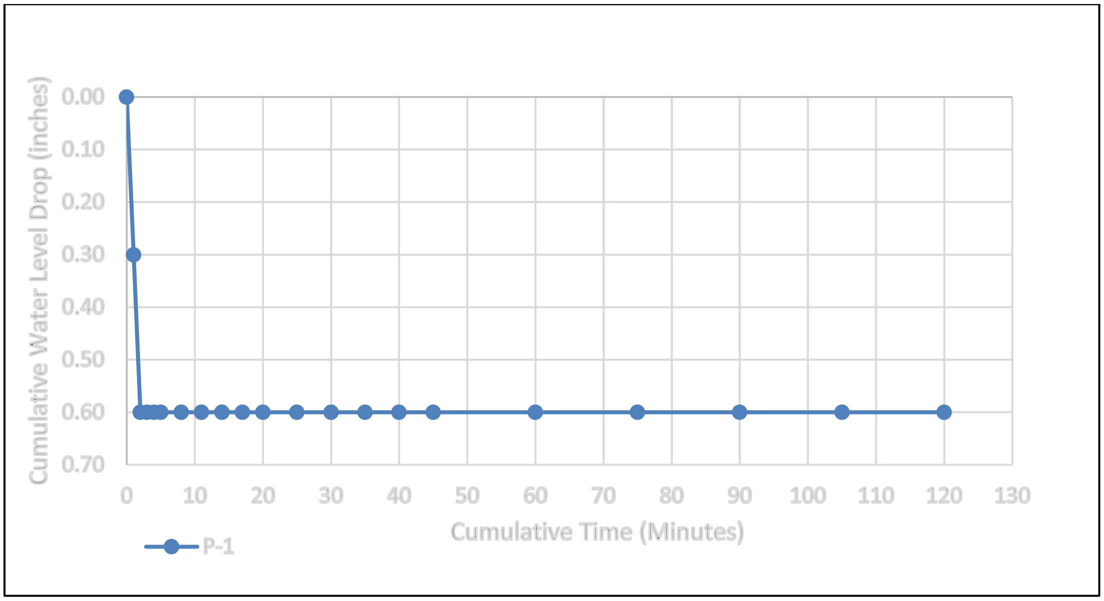


**Chart 2 – Percolation Testing Measurements for P-2**

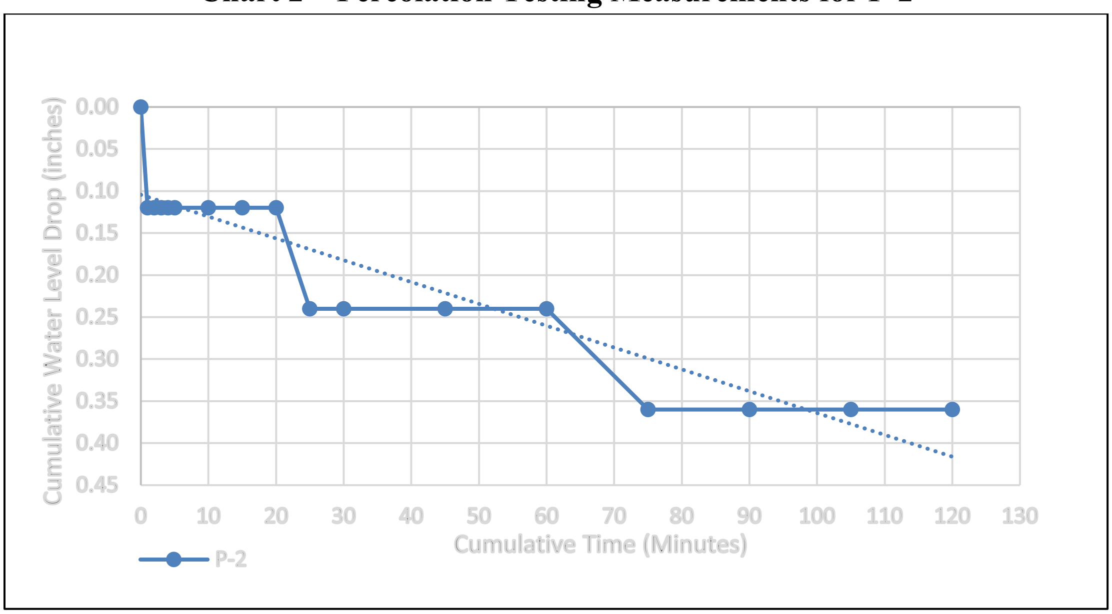

**Chart 3 – Percolation Testing Measurements for P-3**

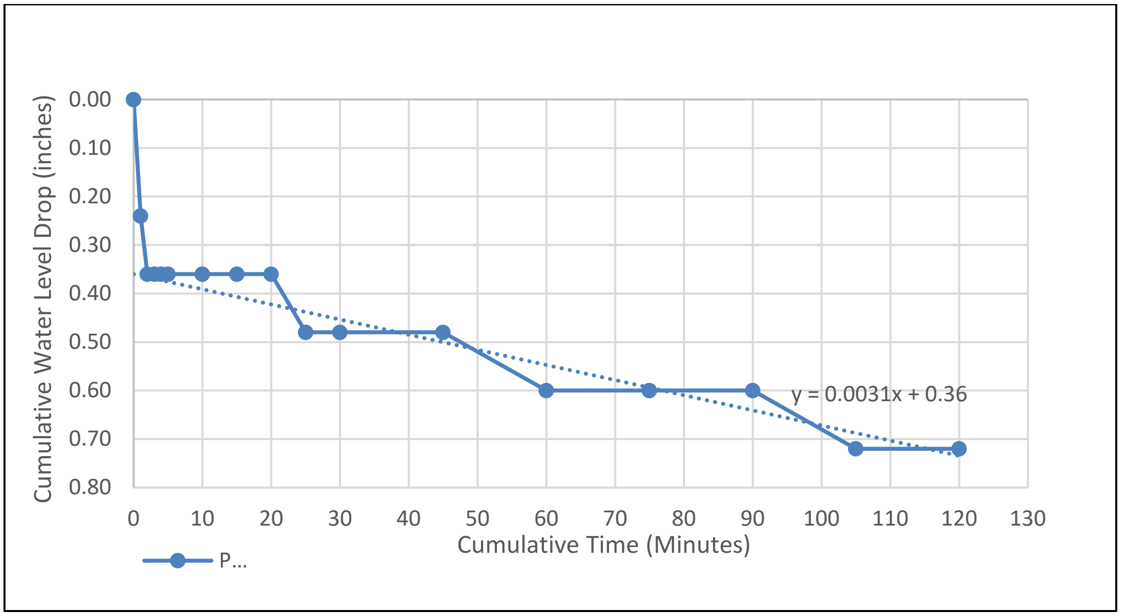


**Table 1 – Percolation Rate Data**

| 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.

0 0.25 0.5 1
MILES

N

M:\2022\220270-Hydroscience-WindsorWWTP\GIS\220270-WindsorWWTP.aprx; 5/6/2022; kdrozynska

CE&G
CAL ENGINEERING & GEOLOGY

6455 Almaden Expwy.
Suite 100
San Jose, CA 95120
Phone: (408) 440-4542

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

CE&G
CAL ENGINEERING & GEOLOGY

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San Jose, CA 95120
Phone: (408) 440-4542

WINDSOR WASTEWATER TREATMENT SYSTEM PROJECT
222 EAST SHILOH ROAD
WINDSOR, CALIFORNIA

**SITE PLAN**

| 220270 | JULY 2022 | FIGURE 2 |
|---|---|---|

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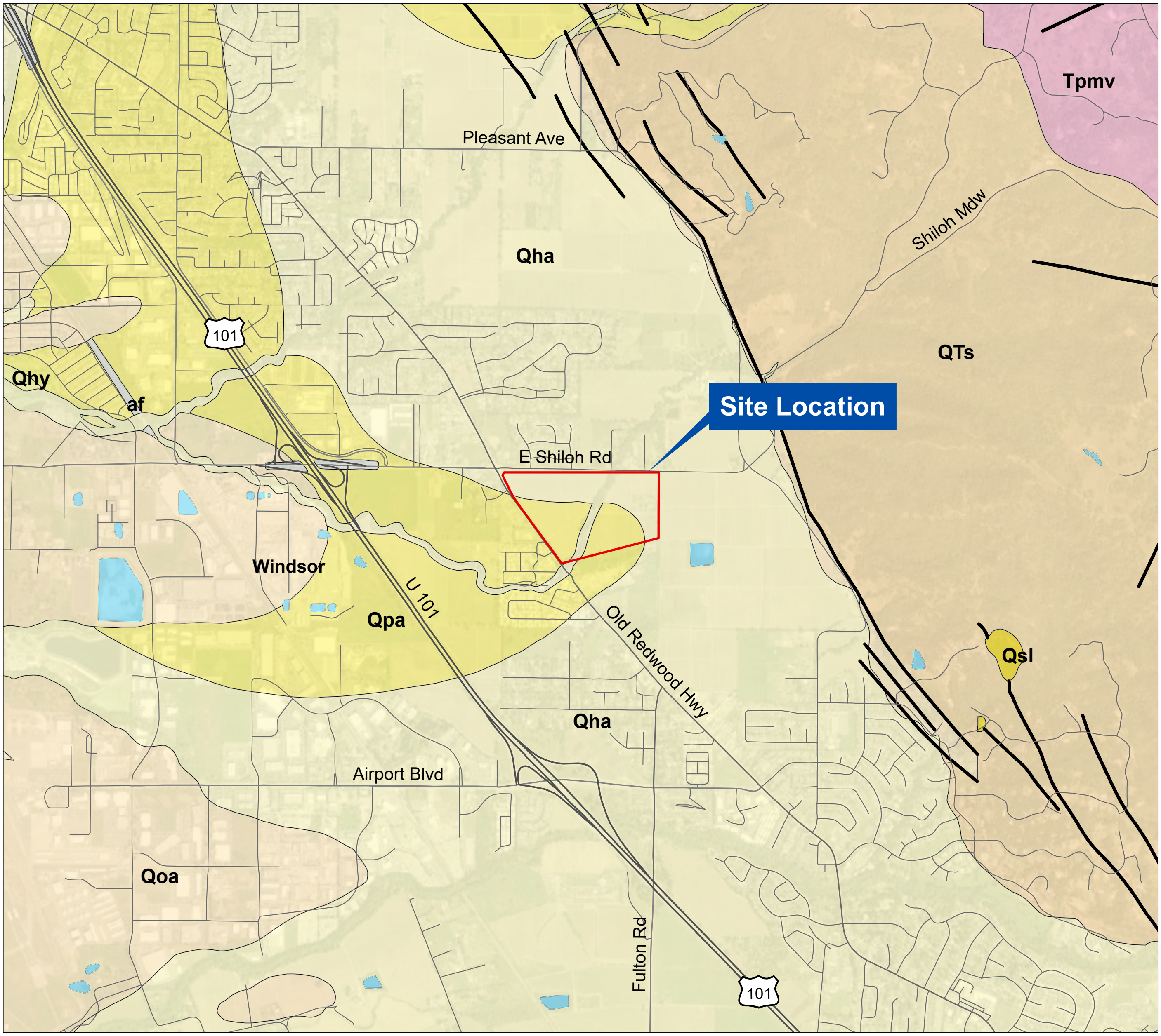


BASEMAP REFERENCE

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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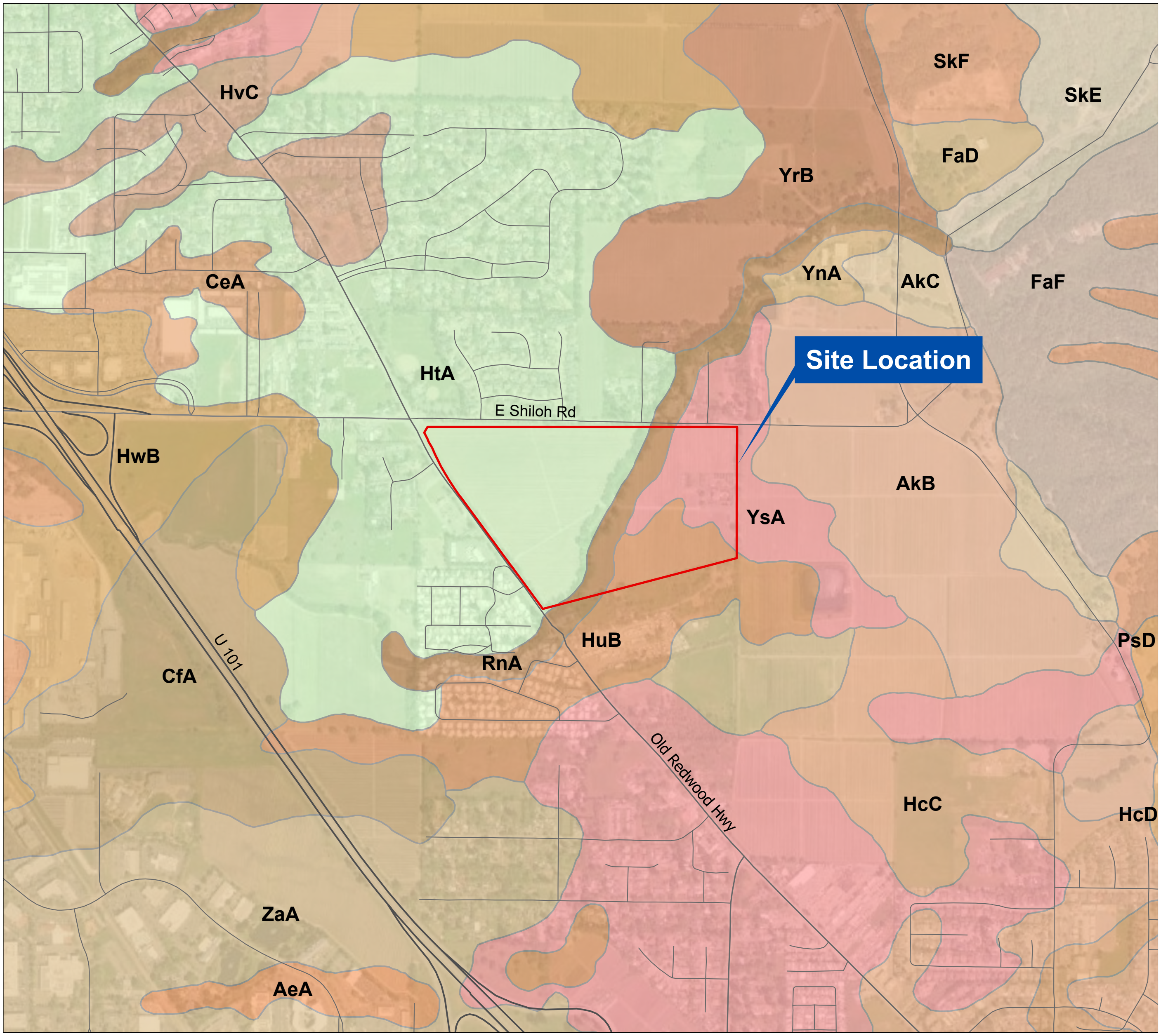
WINDSOR WASTEWATER TREATMENT SYSTEM PROJECT
222 EAST SHILOH ROAD
WINDSOR, CALIFORNIA

**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.

0 0.13 0.25 0.5
MILES

N

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

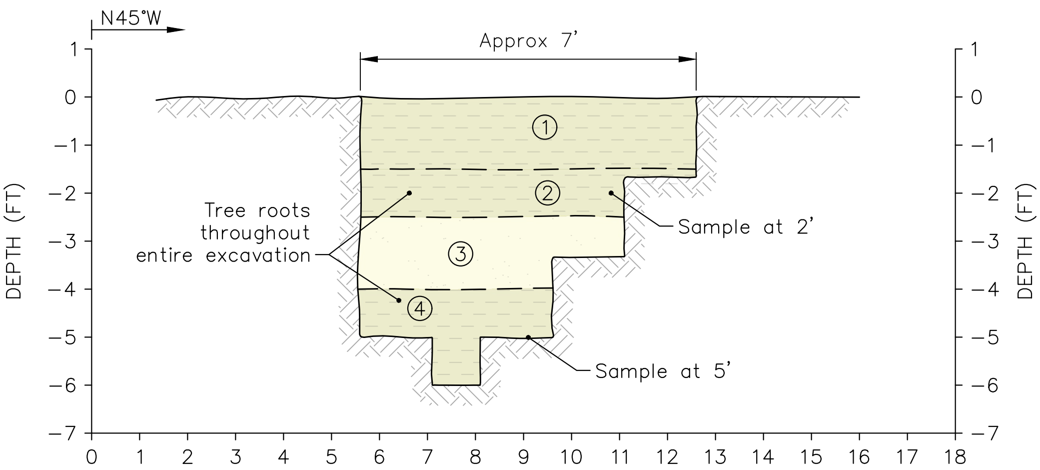
**Pajaro**

*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



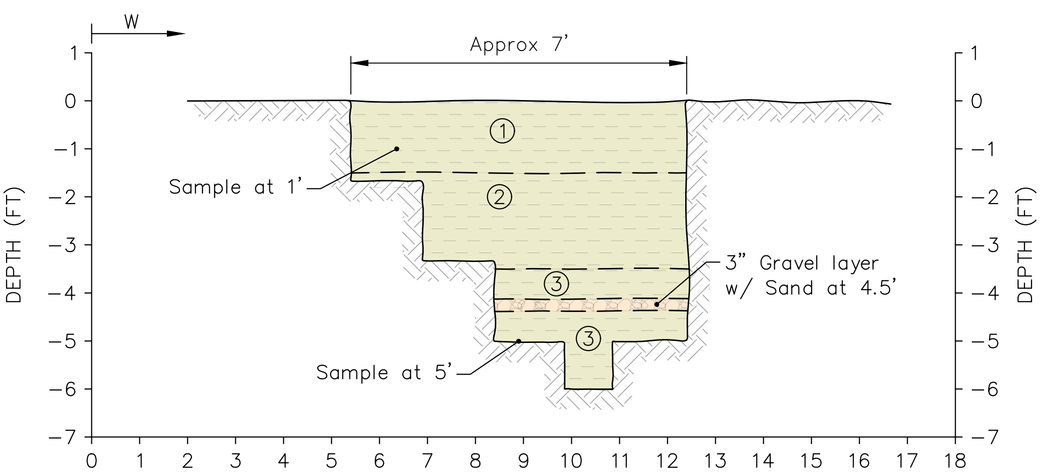

## TEST PIT P-1

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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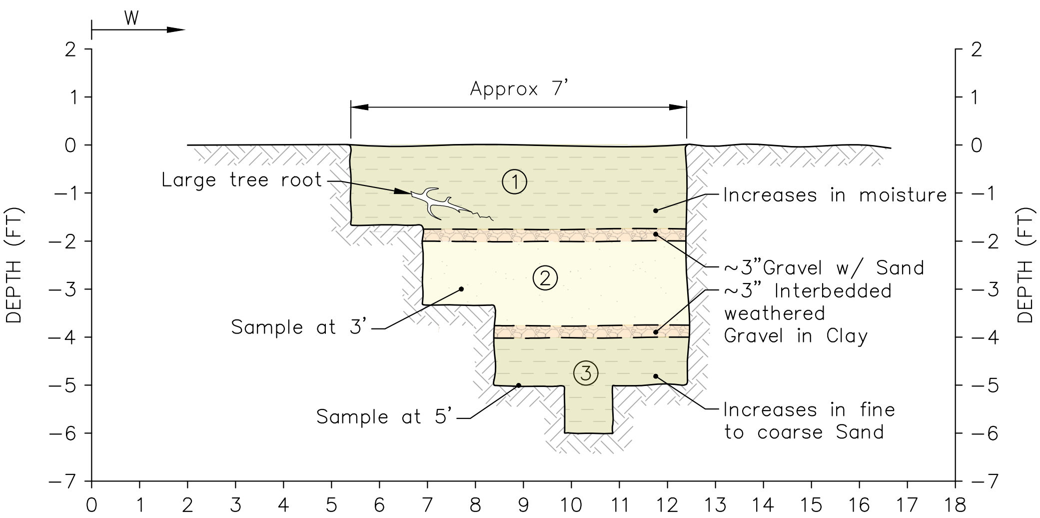
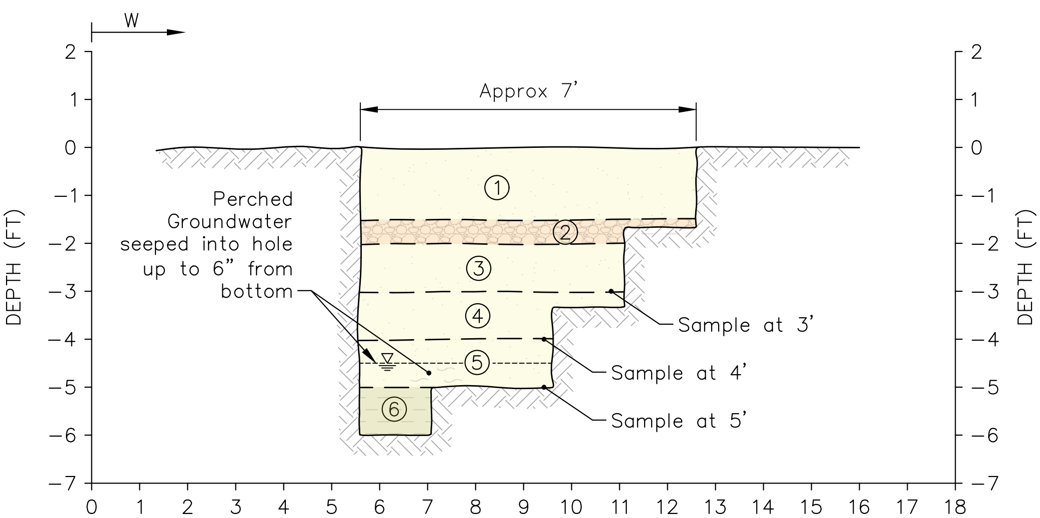
**TEST PIT LOGS FOR P-1 AND P-2**

| | | |
|---|---|---|
| 220270 | JULY 2022 | APPENDIX B (1 OF 2) |




# 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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**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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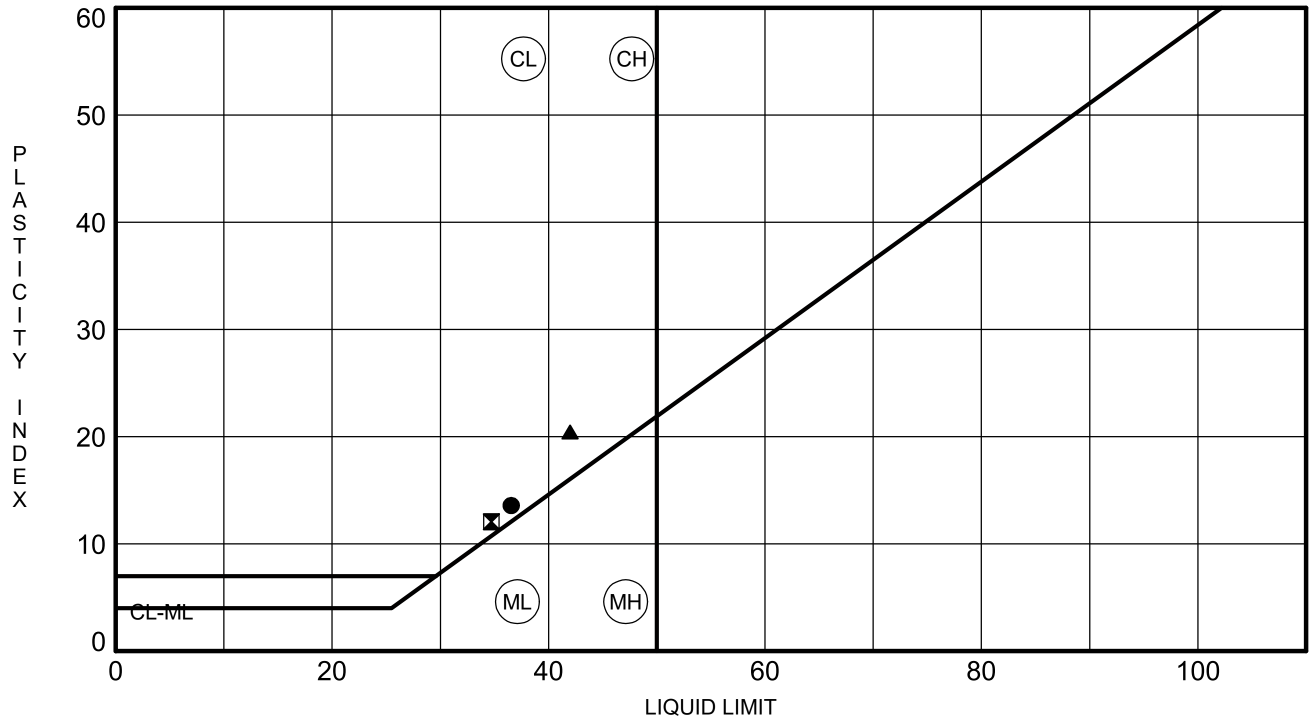
Cal Engineering & Geology

**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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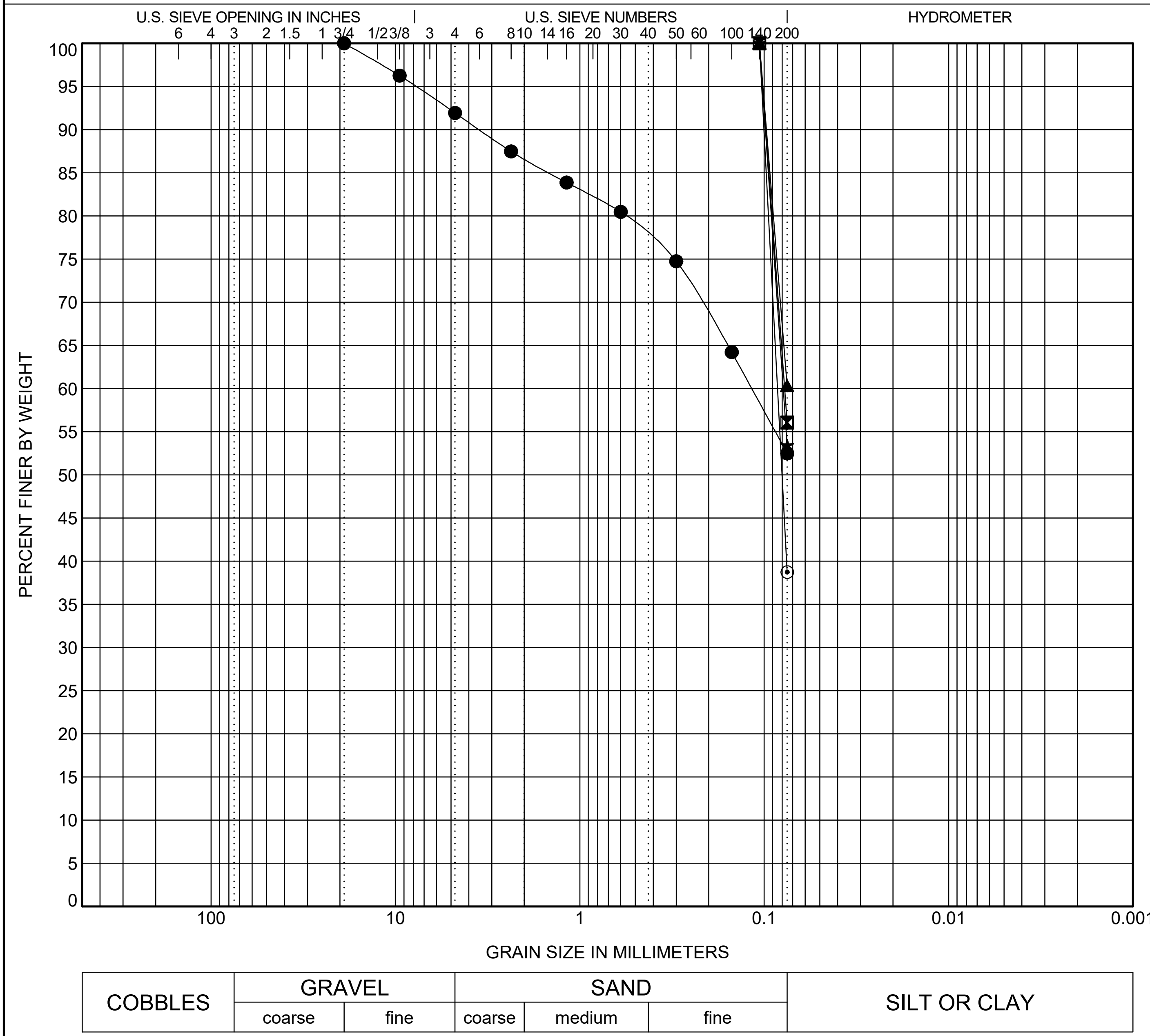
CAL ENGINEERING & GEOLOGY

**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** | |

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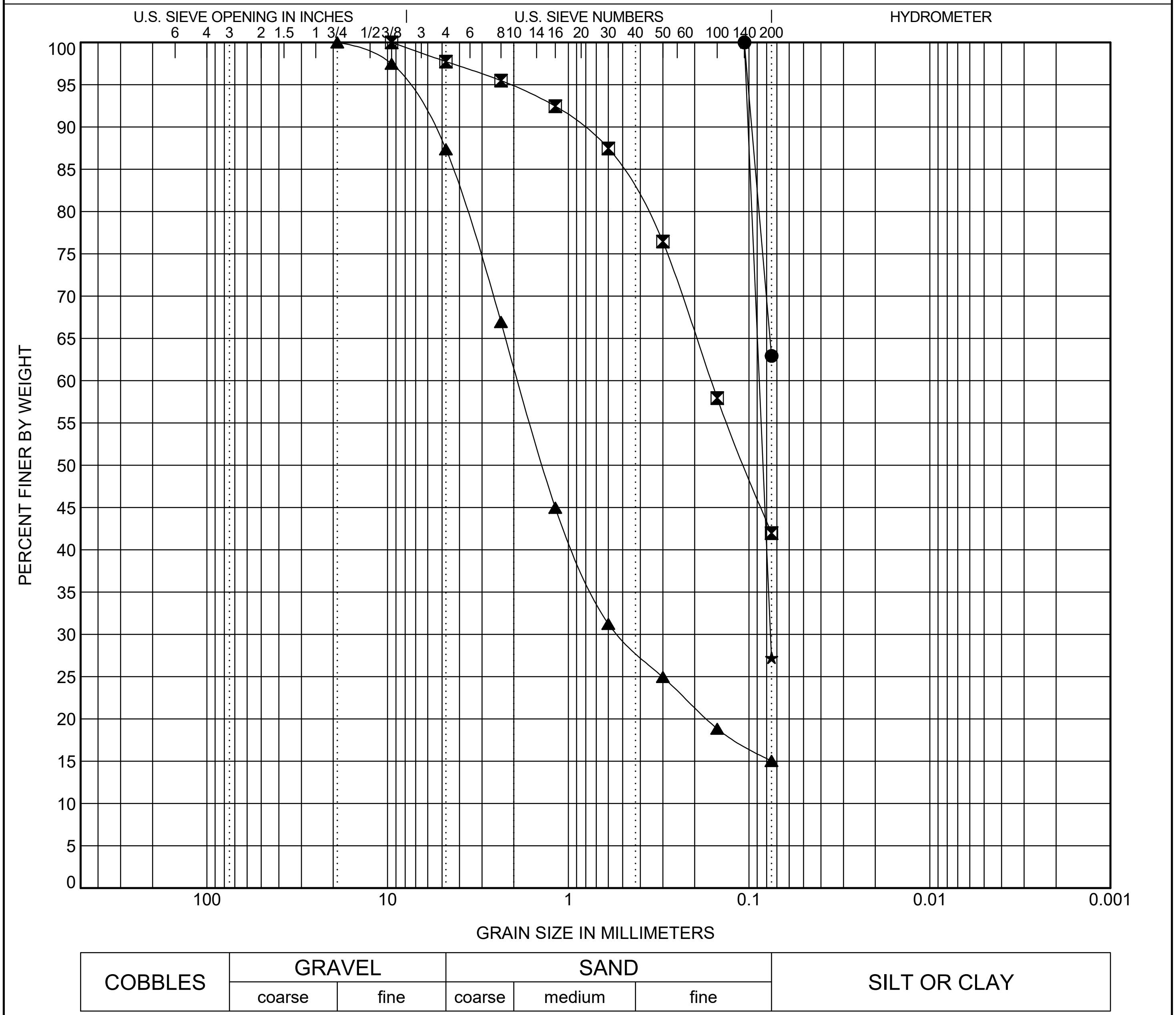
# GRAIN SIZE DISTRIBUTION

**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-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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# Appendix D-2

# Supplemental Wastewater Memorandum

# Technical Memorandum

HydroScience
Strategic Water Solutions

Sacramento • Berkeley • San Jose

**To:** Acorn Environmental

**From:** Angela Singer, PE

**Reviewed By:** Curtis Lam, PE

**Subject:** Wastewater Storage and Disposal Options for No Surface Water Discharge; Koi Nation Shiloh Resort and Casino

**Date:** March 15, 2024

HydroScience Engineers (HydroScience) was retained by Acorn Environmental (Acorn) to complete a Water and Wastewater Feasibility Study (Feasibility Study) evaluating the regulatory, technical, and engineering issues associated with supplying water and handling wastewater from the proposed Koi Resort and Casino Project (Project). Provided herein is a supplement to the Feasibility Study summarizing the offsite disposal requirements assuming that surface water discharge to Pruitt Creek is limited to 1% of the surface flows in Pruitt Creek, versus at the downstream Mark West gage. Because there is no flow data available for Pruitt Creek from which to base discharge assumptions, this memorandum conservatively assumes a "no surface water discharge" condition under the Alternative A program.

The intent is to summarize the most conservative condition to understand the upper limits of the management strategies. This technical memorandum (TM) is not intended to duplicate any analyses or data already provided in the Feasibility Study.

## Alternative A Disposal and Storage

A water balance was developed for each alternative considered in the Feasibility Study. The water balance is designed to estimate the maximum seasonal storage needs based on anticipated wastewater flows and disposal alternatives. Program Alternatives A through C were analyzed. This analysis is intended to build upon the prior analysis conducted as part of the Feasibility Study and expand upon the Alternative A storage and disposal options. **Table 1** summarizes the projections of wastewater volumes generated for Alternative A by project Buildout. These projections are based on the Buildout space program provided by Acorn.

**Table 1: Wastewater Flow Estimates for Alternative A Buildout**

| Wastewater Flow | Buildout (gpd) |
|---|---|
| Average Day | 232,000 |
| Peak Day Flow | 335,000 |
| Peaking Factor | 1.4 |

Four alternatives for treated effluent reuse/disposal were evaluated in the Feasibility Study including two onsite alternatives and two offsite. All alternatives consider recycled water use for dual-plumbed purposes (toilet and urinal flushing), cooling tower makeup, onsite landscape and vineyard irrigation, and surface water discharge. The options evaluated for Alternative A for the Feasibility Study included:

- **Option 1:** During the dry season, effluent from the on-site WWTP would be recycled and used on-site for toilet and urinal flushing, 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.

For the purposes of this supplemental analysis, it is assumed that recycled water is used for dual-plumbed purposes (toilet and urinal flushing), cooling tower makeup, and onsite landscape and vineyard irrigation are implemented. It is assumed that onsite irrigation is consistent across all alternatives and that any additional disposal would be developed offsite. The effluent disposal strategies presented include vineyard irrigation and landscape (i.e. turf) irrigation. The irrigation rates are discussed in detail in the Feasibility Study, **Section 2.3.4.1**. Storage requirements are presented for both seasonal storage ponds and enclosed storage tanks. Options analyzed include:

- **Option 5:** Year-round, 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 discharged to offsite vineyards or stored in the onsite seasonal storage pond. Additional storage needs are supplemented by storage tanks.
- **Option 6:** Similar to Option 5, except that all seasonal storage would be accomplished with a closed tank.
- **Option 7:** Similar to Option 5 except that off-site landscape/turf irrigation is assumed for effluent disposal and consequently reduced seasonal storage volume required.
- **Option 8:** Similar to Option 6, this includes an enclosed storage tank as well as off-site landscape/turf irrigation for effluent disposal.

Options 5 and 6 assume that the Project will be able to dispose of effluent both within the project site to landscape/turf and vineyard irrigation as well as to offsite vineyards. Similarly, Options 7 and 8 assume the use of onsite landscape/turf and vineyard irrigation with the balance of effluent disposed of to offsite landscape/turf irrigation. Options 5 and 7 assume storage ponds and enclosed tanks while Options 6 and 8 assume enclosed tanks will be used onsite for seasonal storage. All options assume 4.4 acres of onsite landscape irrigation. Vineyard irrigation area is affected by the storage ponds in Options 5 and 7. There are 17.4 acres of vineyard irrigation in Options 6 and 8, and the area is reduced by the pond area to 12.4 acres for Options 5 and 7.

**Table 2** summarizes conceptual estimates of the seasonal storage requirements and disposal requirements for the four effluent disposal options for Alternative A. Irrigation areas represent totals and are inclusive of both onsite and offsite storage. These estimates are preliminary and are for planning purposes only.

**Table 2: Estimated Seasonal Storage and Disposal Requirements for Alternative A**

| Seasonal Disposal Strategy | Landscape/Turf Irrigation (AF) | | Vineyard Irrigation (AF) | | Max Storage (AF) |
|---|---|---|---|---|---|
| | On-site | Off-site | On-site | Off-site | |
| Option 5– Vineyard disposal with storage pond | 13.3 | 0 | 3.9 | 128.7 | 103.7 |
| Option 6 – Vineyard disposal with tanks | 13.3 | 0 | 5.5 | 127.1 | 89.5 |
| Option 7 – Landscape/Turf disposal with storage pond | 13.3 | 133.8 | 3.9 | 0 | 101.0 |
| Option 8 – Landscape/Turf disposal with tank | 13.3 | 135.5 | 5.5 | 0 | 86.7 |

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 or tank during the wet season.
2. Onsite landscape irrigation includes 4.4 acres of irrigated area and vineyard irrigation consists of 17.4 acres for a total onsite disposal area of 21.8 acres. This is equivalent to 18.8 AF of disposal onsite.

To manage storage pond footprint, it was assumed that ponds would be constructed with taller berms up to 15 ft in height. For the Feasibility Study, a maximum height of 10 ft was assumed. The footprint of the pond remains the same as that proposed for Alternative A Option 1 in the Feasibility Study, however, increasing the height of the pond increases the storage capacity. A summary of the irrigation area and storage volume requirements are provided in **Table 3**.

**Table 3: Disposal Area and Storage Volume Requirements**

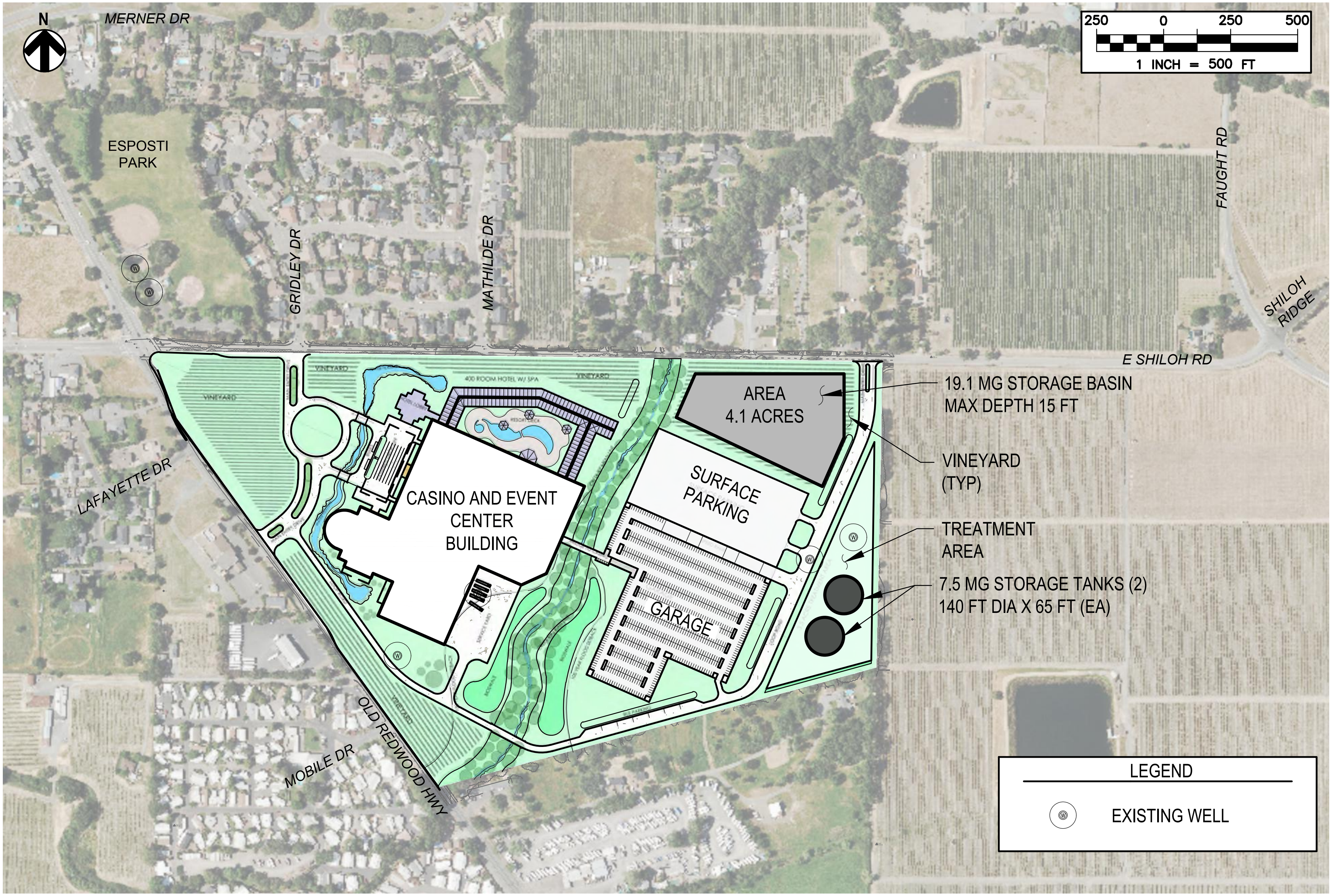
| Options | Landscape/Turf Irrigation (acres) | | Vineyard Irrigation (acres) | | Storage Requirements (MG) |
|---|---|---|---|---|---|
| | On-site | Off-site | On-site | Off-site | |
| Option 5 | 4.4 | 0 | 12.4 | 406.3 | 33.8 |
| Option 6 | 4.4 | 0 | 17.4 | 406.4 | 29.2 |
| Option 7 | 4.4 | 44.3 | 12.4 | 0 | 32.9 |
| Option 8 | 4.4 | 44.8 | 17.4 | 0 | 28.3 |

Disposal to landscape/turf grass is significantly more efficient than irrigation of vineyards and substantially reduces the disposal area required.

**Attachment A** includes figures of potential layouts for each Option. Storage tanks are assumed to be up to 64 feet tall and the number of tanks and respective diameters are adjusted according to each Option to meet the storage needs. Copies of water balances are provided as **Attachment B**.

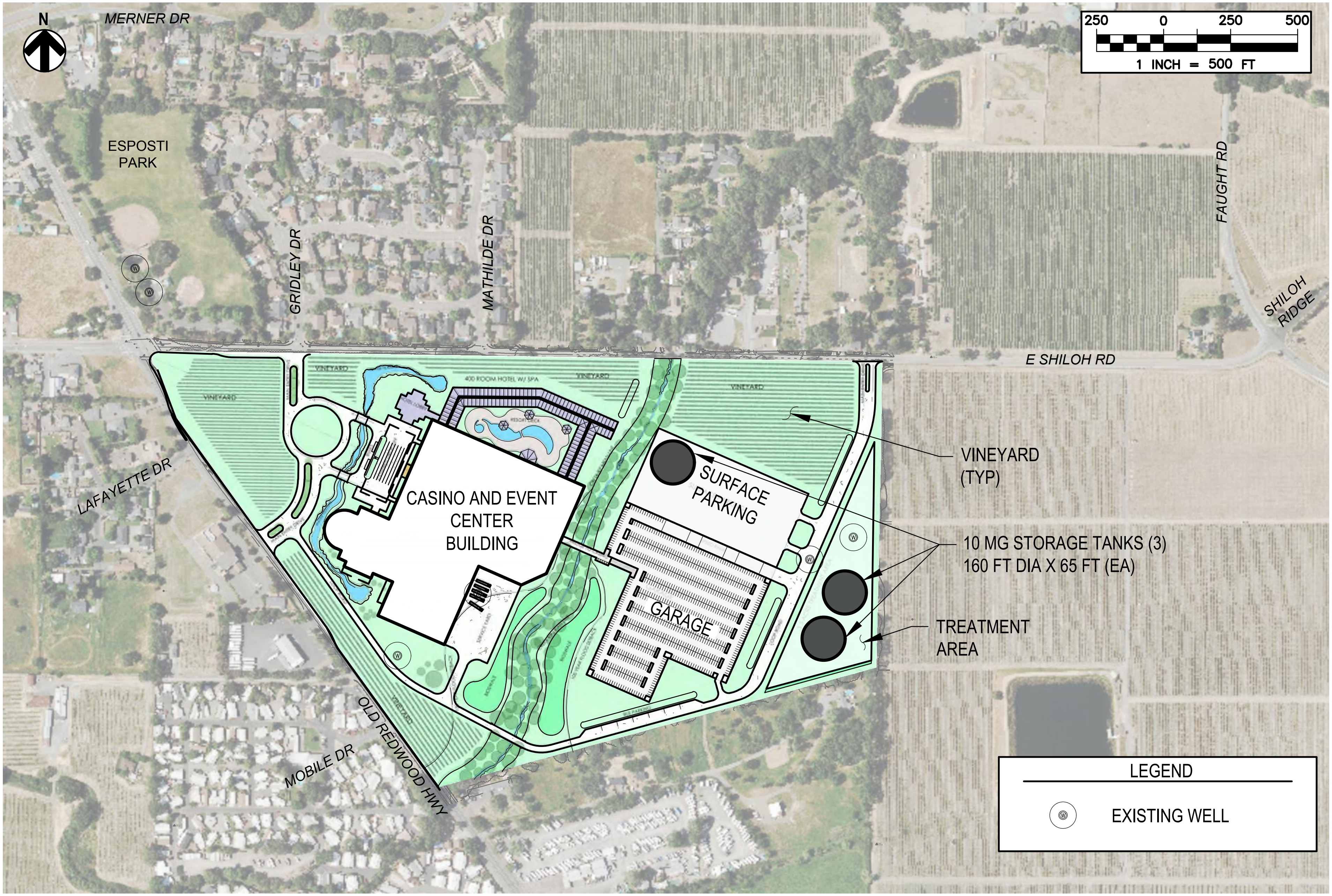
**ATTACHMENT A**

Acorn Environmental
Summary of Wastewater Storage and Disposal Options
Site Layouts for Options 5 through 8



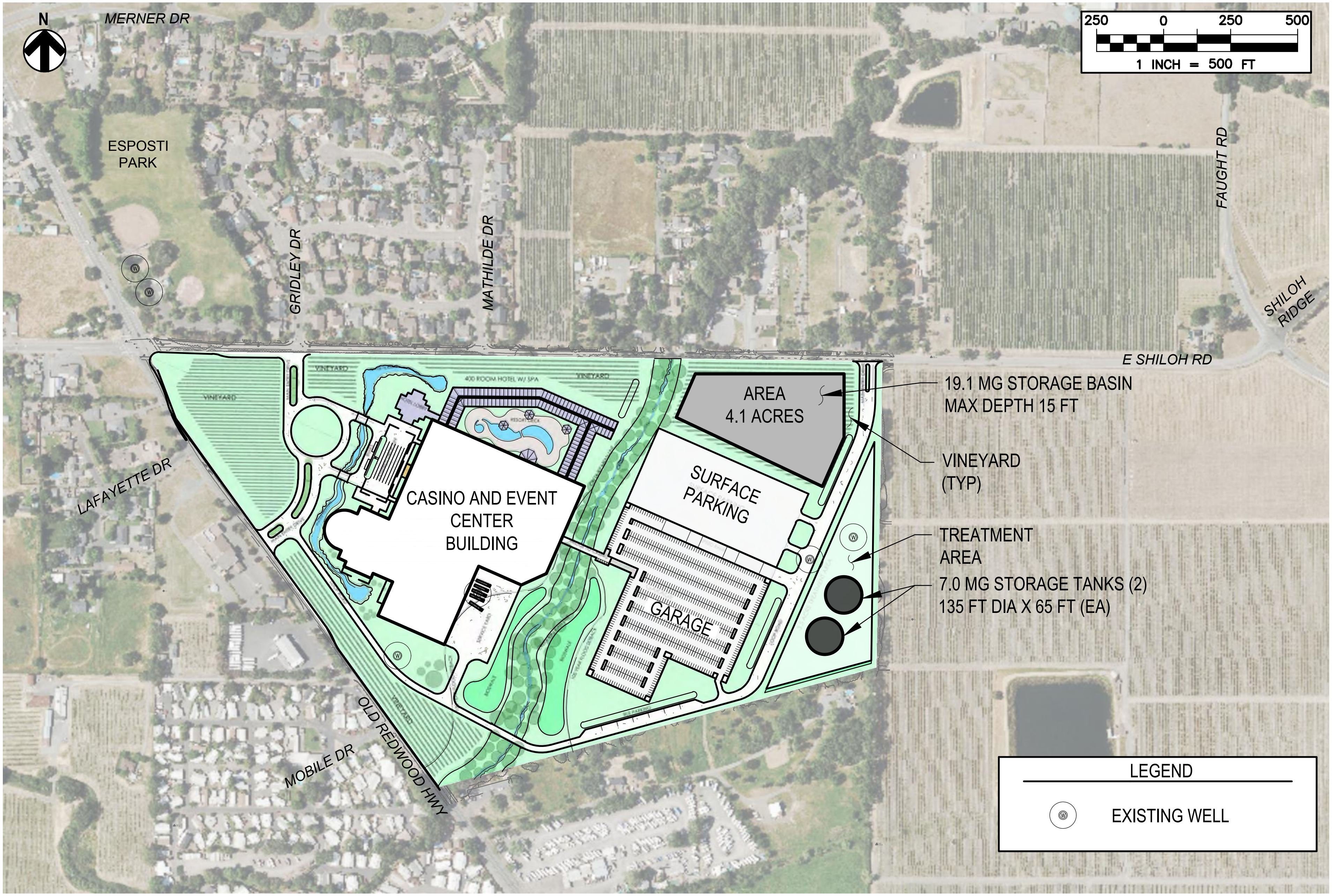

**Attachment A Figure 1**
Acorn Environmental
Koi Nation Shiloh Resort and Casino Project Wastewater Storage and Disposal
Option 5 - Alternative A

HydroScience




**Attachment A Figure 2**
Acorn Environmental
Koi Nation Shiloh Resort and Casino Project Wastewater Storage and Disposal
Option 6 and 8 - Alternative A

HydroScience




**Attachment A Figure 3**
Acorn Environmental
Koi Nation Shiloh Resort and Casino Project Wastewater Storage and Disposal
Option 7 - Alternative A

HydroScience

**ATTACHMENT B**

Acorn Environmental

Summary of Wastewater Storage and Disposal Options

No Surface Water Discharge – Water Balances

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

## Scenario: Alternative A - Option 5

**March 2024 By: Angela Singer, HydroScience**

| |
|---|
| INPUT |
| INPUT-Adjust as necessary |
| OUTPUT-Max Elevation |

| WASTEWATER INFLUENT FLOW | | | STORAGE DATA | | | OTHER INPUTS | | |
|---|---|---|---|---|---|---|---|---|
| Daily Average Wastewater Influent Flow | 231,900 | gpd | Basin Volume | 19.1 | MG | 100-YR Multiplier | 2.06 | unitless |
| I/I (PWWF-PDWF) | 250,452 | gpd | Basin Area | 4.48 | acres | Pan Evap Coefficient | 0.75 | unitless |
| | | | Tank(s) Total Volume | 14.7 | MG | | | |

| RECYCLED WATER DISTRIBUTION AND DISPOSAL ALTERNATIVES[2] | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| andscape Irrigation (Casino) | 4.4 | acres | Vineyards (Total) | 418.7 | acres | Landscpe Irrig (TBD) | 0.0 | acres | |
| Dual Plumbing | 26.4 | MG | Surface Water Discharge | 0 | MG | 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 | 4.5 | 4.4 | 4.3 | 4.2 | 4.1 | 4.0 | 3.9 | 3.8 | 3.7 | 3.6 | 3.4 | 3.3 | |
| Total Water Surface Area | acre | 4.5 | 4.4 | 4.3 | 4.2 | 4.1 | 4.0 | 3.9 | 3.8 | 3.7 | 3.6 | 3.4 | 3.3 | |
| 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 | -1.6 | -0.5 | -0.3 | -0.3 | -0.4 | -0.7 | -1.4 | -2.1 | -2.5 | -2.9 | -2.6 | -1.8 | -17.2 |
| Total Precipitation | ac-ft | 1.6 | 2.5 | 5.2 | 4.0 | 4.1 | 2.8 | 1.3 | 0.6 | 0.2 | 0.0 | 0.0 | 0.1 | 22.5 |
| 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 | -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 (Total) | ac-ft | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | -14.3 | -40.7 | -40.8 | -24.2 | -6.2 | -126.1 |
| 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 | 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 | 0.0 | 0.0 | 0.0 | |
| **MONTHLY STORAGE BALANCE** | | | | | | | | | | | | | | |
| Beginning Storage Volume | ac-ft | 0.0 | 12.0 | 26.5 | 44.7 | 61.5 | 77.2 | 92.2 | 103.7 | 98.3 | 64.1 | 29.3 | 11.8 | |
| Change in Water Volume[4] | ac-ft | 12.0 | 14.5 | 18.2 | 16.8 | 15.7 | 15.1 | 11.5 | -5.4 | -34.3 | -34.8 | -17.5 | 1.6 | |
| Final Storage Volume | ac-ft | 12.0 | 26.5 | 44.7 | 61.5 | 77.2 | 92.2 | 103.7 | 98.3 | 64.1 | 29.3 | 11.8 | 13.4 | |

Maximum Seasonal Storage (ac-ft) **103.7**
mg **33.8**

### 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 | 4.5 | 4.4 | 4.3 | 4.2 | 4.1 | 4.0 | 3.9 | 3.8 | 3.7 | 3.6 | 3.4 | 3.3 | |
| Total Water Surface Area | acre | 4.5 | 4.4 | 4.3 | 4.2 | 4.1 | 4.0 | 3.9 | 3.8 | 3.7 | 3.6 | 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 | -1.6 | -0.7 | -0.4 | -0.4 | -0.5 | -0.9 | -1.4 | -2.1 | -2.5 | -2.9 | -2.6 | -1.8 | -18.0 |
| Total Precipitation | ac-ft | 0.8 | 1.2 | 2.5 | 2.0 | 2.0 | 1.4 | 0.6 | 0.3 | 0.1 | 0.0 | 0.0 | 0.0 | 10.9 |
| 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 | -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 (Total) | ac-ft | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | -18.6 | -42.5 | -40.8 | -24.2 | -6.5 | -132.6 |
| 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 | 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 | 0.0 | 0.0 | 0.0 | |
| **MONTHLY STORAGE BALANCE** | | | | | | | | | | | | | | |
| Beginning Storage Volume | ac-ft | 13.4 | 24.4 | 36.6 | 50.9 | 64.6 | 77.0 | 89.5 | 99.3 | 88.7 | 52.4 | 17.5 | 0.0 | |
| Change in Water Volume[4] | ac-ft | 11.0 | 12.2 | 14.3 | 13.7 | 12.5 | 12.5 | 9.8 | -10.5 | -36.3 | -34.9 | -17.5 | 1.3 | |
| Final Storage Volume | ac-ft | 24.4 | 36.6 | 50.9 | 64.6 | 77.0 | 89.5 | 99.3 | 88.7 | 52.4 | 17.5 | 0.0 | 1.3 | |

Maximum Seasonal Storage (ac-ft) **99.3**
mg **32.3**

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 6**

**March 2024 By: Angela Singer, HydroScience**

| |
|---|
| INPUT |
| INPUT-Adjust as necessary |
| OUTPUT-Max Elevation |

| WASTEWATER INFLUENT FLOW | | | STORAGE DATA | | | OTHER INPUTS | | | RECYCLED WATER DISTRIBUTION AND DISPOSAL ALTERNATIVES[2] | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Daily Average Wastewater Influent Flow | 231,900 | gpd | Tank(s) Total Volume | 29.2 | MG | 100-YR Multiplier | 2.06 | unitless | andscape Irrigation (Casino) | 4.4 | acres | Vineyards (Total) | 418.8 | acres | Landscpe Irrig (TBD) | 0.0 | acres |
| I/I (PWWF-PDWF) | 250,452 | gpd | | | | Pan Evap Coefficient | 0.75 | unitless | Dual Plumbing | 26.4 | MG | Surface Water Discharge | 0 | 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 | 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 (Total) | ac-ft | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | -14.3 | -40.7 | -40.8 | -24.2 | -6.2 | -126.1 |
| 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 | 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 | 0.0 | 0.0 | 0.0 | |
| **MONTHLY STORAGE BALANCE** | | | | | | | | | | | | | | |
| Beginning Storage Volume | ac-ft | 0.0 | 12.0 | 24.5 | 37.8 | 50.9 | 62.8 | 75.8 | 87.4 | 83.5 | 51.5 | 19.7 | 4.8 | |
| Change in Water Volume[4] | ac-ft | 12.0 | 12.5 | 13.3 | 13.1 | 11.9 | 13.0 | 11.6 | -3.9 | -31.9 | -31.9 | -14.9 | 3.4 | |
| Final Storage Volume | ac-ft | 12.0 | 24.5 | 37.8 | 50.9 | 62.8 | 75.8 | 87.4 | 83.5 | 51.5 | 19.7 | 4.8 | 8.2 | |

Maximum Seasonal Storage (ac-ft) **87.4**
mg **28.5**

## 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 | 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 (Total) | ac-ft | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | -18.6 | -42.5 | -40.8 | -24.2 | -6.5 | -132.6 |
| 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 | 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 | 0.0 | 0.0 | 0.0 | |
| **MONTHLY STORAGE BALANCE** | | | | | | | | | | | | | | |
| Beginning Storage Volume | ac-ft | 8.2 | 20.0 | 31.6 | 43.8 | 55.9 | 66.9 | 79.0 | 89.5 | 80.8 | 46.9 | 14.9 | 0.0 | |
| Change in Water Volume[4] | ac-ft | 11.8 | 11.6 | 12.2 | 12.1 | 11.0 | 12.0 | 10.5 | -8.7 | -33.9 | -31.9 | -14.9 | 3.0 | |
| Final Storage Volume | ac-ft | 20.0 | 31.6 | 43.8 | 55.9 | 66.9 | 79.0 | 89.5 | 80.8 | 46.9 | 14.9 | 0.0 | 3.0 | |

Maximum Seasonal Storage (ac-ft) **89.5**
mg **29.2**

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/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 7

**March 2024 By: 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 | 19.1 | MG |
| Basin Area | 4.48 | acres |
| Tank(s) Total Volume | 13.8 | 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 (Total) | 12.4 | acres | Landscpe Irrig (TBD) | 0.0 | acres |
| Dual Plumbing | 26.4 | MG | Surface Water Discharge | 0 | MG | Additonal Turf Grass | 44.3 | 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 | 3.6 | 3.7 | 3.8 | 3.9 | 4.0 | 4.1 | 4.2 | 4.3 | 4.4 | 4.5 | |
| Total Water Surface Area | acre | 3.3 | 3.4 | 3.6 | 3.7 | 3.8 | 3.9 | 4.0 | 4.1 | 4.2 | 4.3 | 4.4 | 4.5 | |
| 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 | -2.3 | -2.9 | -3.5 | -3.3 | -2.4 | -19.0 |
| Total Precipitation | ac-ft | 1.2 | 2.0 | 4.3 | 3.5 | 3.8 | 2.7 | 1.3 | 0.7 | 0.2 | 0.0 | 0.0 | 0.1 | 19.9 |
| 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 | -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 (Total) | ac-ft | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | -0.4 | -1.2 | -1.2 | -0.7 | -0.2 | -3.7 |
| Additional Turf Grass | ac-ft | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | -0.6 | -15.8 | -26.9 | -29.2 | -25.5 | -18.5 | -116.4 |
| 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 | 0.0 | 0.0 | 0.0 | |
| **MONTHLY STORAGE BALANCE** | | | | | | | | | | | | | | |
| Beginning Storage Volume | ac-ft | 0.0 | 12.0 | 26.1 | 43.4 | 59.8 | 75.2 | 90.2 | 101.0 | 93.6 | 71.6 | 46.6 | 26.4 | |
| Change in Water Volume[4] | ac-ft | 12.0 | 14.0 | 17.3 | 16.4 | 15.4 | 15.0 | 10.9 | -7.4 | -22.0 | -25.0 | -20.2 | -11.4 | |
| Final Storage Volume | ac-ft | 12.0 | 26.1 | 43.4 | 59.8 | 75.2 | 90.2 | 101.0 | 93.6 | 71.6 | 46.6 | 26.4 | 15.0 | |

Maximum Seasonal Storage (ac-ft) **101.0**

mg **32.9**

### 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 | 4.5 | 4.4 | 4.3 | 4.2 | 4.1 | 4.0 | 3.9 | 3.8 | 3.7 | 3.6 | 3.4 | 3.3 | |
| Total Water Surface Area | acre | 4.5 | 4.4 | 4.3 | 4.2 | 4.1 | 4.0 | 3.9 | 3.8 | 3.7 | 3.6 | 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 | -1.6 | -0.7 | -0.4 | -0.4 | -0.5 | -0.9 | -1.4 | -2.1 | -2.5 | -2.9 | -2.6 | -1.8 | -18.0 |
| Total Precipitation | ac-ft | 0.8 | 1.2 | 2.5 | 2.0 | 2.0 | 1.4 | 0.6 | 0.3 | 0.1 | 0.0 | 0.0 | 0.0 | 10.9 |
| 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 | -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 (Total) | ac-ft | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | -0.6 | -1.3 | -1.2 | -0.7 | -0.2 | -3.9 |
| Additional Turf Grass | ac-ft | -1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | -10.3 | -20.5 | -28.1 | -29.2 | -25.5 | -19.2 | -133.8 |
| 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 | 0.0 | 0.0 | 2.3 | |
| **MONTHLY STORAGE BALANCE** | | | | | | | | | | | | | | |
| Beginning Storage Volume | ac-ft | 15.0 | 25.0 | 37.2 | 51.5 | 65.1 | 77.6 | 90.1 | 89.5 | 76.6 | 53.4 | 29.0 | 9.4 | |
| Change in Water Volume[4] | ac-ft | 10.0 | 12.2 | 14.3 | 13.7 | 12.5 | 12.5 | -0.5 | -13.0 | -23.2 | -24.5 | -19.6 | -9.4 | |
| Final Storage Volume | ac-ft | 25.0 | 37.2 | 51.5 | 65.1 | 77.6 | 90.1 | 89.5 | 76.6 | 53.4 | 29.0 | 9.4 | 0.0 | |

#DIV/0!

Maximum Seasonal Storage (ac-ft) **90.1**

mg **29.4**

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 8

**March 2024 By: Angela Singer, HydroScience**

INPUT
INPUT-Adjust as necessary
OUTPUT-Max Elevation

| WASTEWATER INFLUENT FLOW | | | STORAGE DATA | | | OTHER INPUTS | | | RECYCLED WATER DISTRIBUTION AND DISPOSAL ALTERNATIVES[2] | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Daily Average Wastewater Influent Flow | 231,900 | gpd | Tank(s) Total Volume | 28.3 | MG | 100-YR Multiplier | 2.06 | unitless | andscape Irrigation (Casino) | 4.4 | acres | Vineyards (Total) | 17.4 | acres | Landscpe Irrig (TBD) | 0.0 | acres | |
| I/I (PWWF-PDWF) | 250,452 | gpd | | | | Pan Evap Coefficient | 0.75 | unitless | Dual Plumbing | 26.4 | MG | Surface Water Discharge | 0 | MG | Additonal Turf Grass | 44.8 | acres | 9.9 |

**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 | 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 (Total) | ac-ft | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | -0.6 | -1.7 | -1.7 | -1.0 | -0.3 | -5.2 |
| Additional Turf Grass | ac-ft | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | -0.7 | -15.9 | -27.2 | -29.5 | -25.8 | -18.7 | -117.8 |
| 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 | 0.0 | 0.0 | 0.0 | |
| **MONTHLY STORAGE BALANCE** | | | | | | | | | | | | | | |
| Beginning Storage Volume | ac-ft | 0.0 | 12.0 | 24.5 | 37.8 | 50.9 | 62.8 | 75.8 | 86.7 | 80.6 | 60.4 | 38.1 | 20.6 | |
| Change in Water Volume[4] | ac-ft | 12.0 | 12.5 | 13.3 | 13.1 | 11.9 | 13.0 | 10.9 | -6.2 | -20.1 | -22.3 | -17.5 | -9.4 | |
| Final Storage Volume | ac-ft | 12.0 | 24.5 | 37.8 | 50.9 | 62.8 | 75.8 | 86.7 | 80.6 | 60.4 | 38.1 | 20.6 | 11.2 | |

Maximum Seasonal Storage (ac-ft) **86.7**
mg **28.3**

**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 | 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 (Total) | 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 | -1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | -10.4 | -20.7 | -28.4 | -29.6 | -25.8 | -19.5 | -135.5 |
| 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 | 0.0 | 0.0 | 2.2 | |
| **MONTHLY STORAGE BALANCE** | | | | | | | | | | | | | | |
| Beginning Storage Volume | ac-ft | 11.2 | 22.0 | 33.6 | 45.8 | 58.0 | 69.0 | 81.0 | 81.1 | 69.5 | 47.9 | 25.5 | 8.0 | |
| Change in Water Volume[4] | ac-ft | 10.8 | 11.6 | 12.2 | 12.1 | 11.0 | 12.0 | 0.1 | -11.7 | -21.6 | -22.4 | -17.6 | -8.0 | |
| Final Storage Volume | ac-ft | 22.0 | 33.6 | 45.8 | 58.0 | 69.0 | 81.0 | 81.1 | 69.5 | 47.9 | 25.5 | 8.0 | 0.0 | |

Maximum Seasonal Storage (ac-ft) **81.1**
mg **26.4**

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.

# Appendix D

# Grading and Hydrology Study

Acorn Environmental

# Site Grading and Hydrology Study

Prepared by HydroScience Engineers


February 2023

HydroScience
Strategic Water Solutions

February 2023

HydroScience

Strategic Water Solutions

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## LIST OF APPENDICES

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# SECTION 1 – INTRODUCTION AND BACKGROUND

HydroScience Engineers, Inc. (HydroScience) was retained by Acorn Environmental (Acorn) to prepare a preliminary site grading plan and hydrology study for the Shiloh Resort and Casino Project (Project) proposed by the Koi Nation of Northern California.

The project site is located at the southeastern corner of Shiloh Road and Old Redwood Highway in an unincorporated area of Sonoma County, California (see **Figure 1-1**). This report, and associated plans are intended to provide information for the environmental analysis of the Project.

## 1.1 Project Description

The study has been prepared for three development alternatives for 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 consists of a similar sized hotel and casino, but will not construct the event center or conference space. Due to this reduced intensity, a smaller parking structure will be constructed accommodate the site parking demands. The third proposed site, Alternative C – Proposed Non Gaming Site Project consists of a hotel, restaurant and winery with a visitors center. Surface parking lots will be constructed that meet the non-gaming project parking demands. All three of the site alternatives will also construct a wastewater treatment plant in the southeasterly portion of the site.

The proposed property is divided by Pruitt Creek in the north-south direction. The preliminary grading plan will incorporate an area for storm water detention to mitigate the increase in storm runoff created by the development of the proposed gaming facility and site improvements. The plan for the existing site is to elevate the proposed facilities a minimum of one foot above the floodplain to allow storm water to drain to the detention basin. The storm water detention basins will attenuate the increase in peak flow created by the development.

## 1.2 Existing Site Description and Topography

The existing site encompasses approximately 68.6 acres of agricultural land consisting of grape vineyards and a single-family residential home. The site is generally bounded by East Shiloh Road to the north, Old Redwood Highway to the west, low density residential to the south, and agricultural land to the east. The existing site is split into two areas that are divided by Pruitt Creek crossing the site in the north-south direction encompassing 5.0 acres.

The existing topography of the site is relatively flat ranging in elevation from 135 feet to 160 feet and generally slopes towards Pruitt Creek that runs through the site. With the creek flowing in the south-southwesterly direction (see **Figure 1-2**).

**Figure 1-1: Vicinity and Project Location Map**

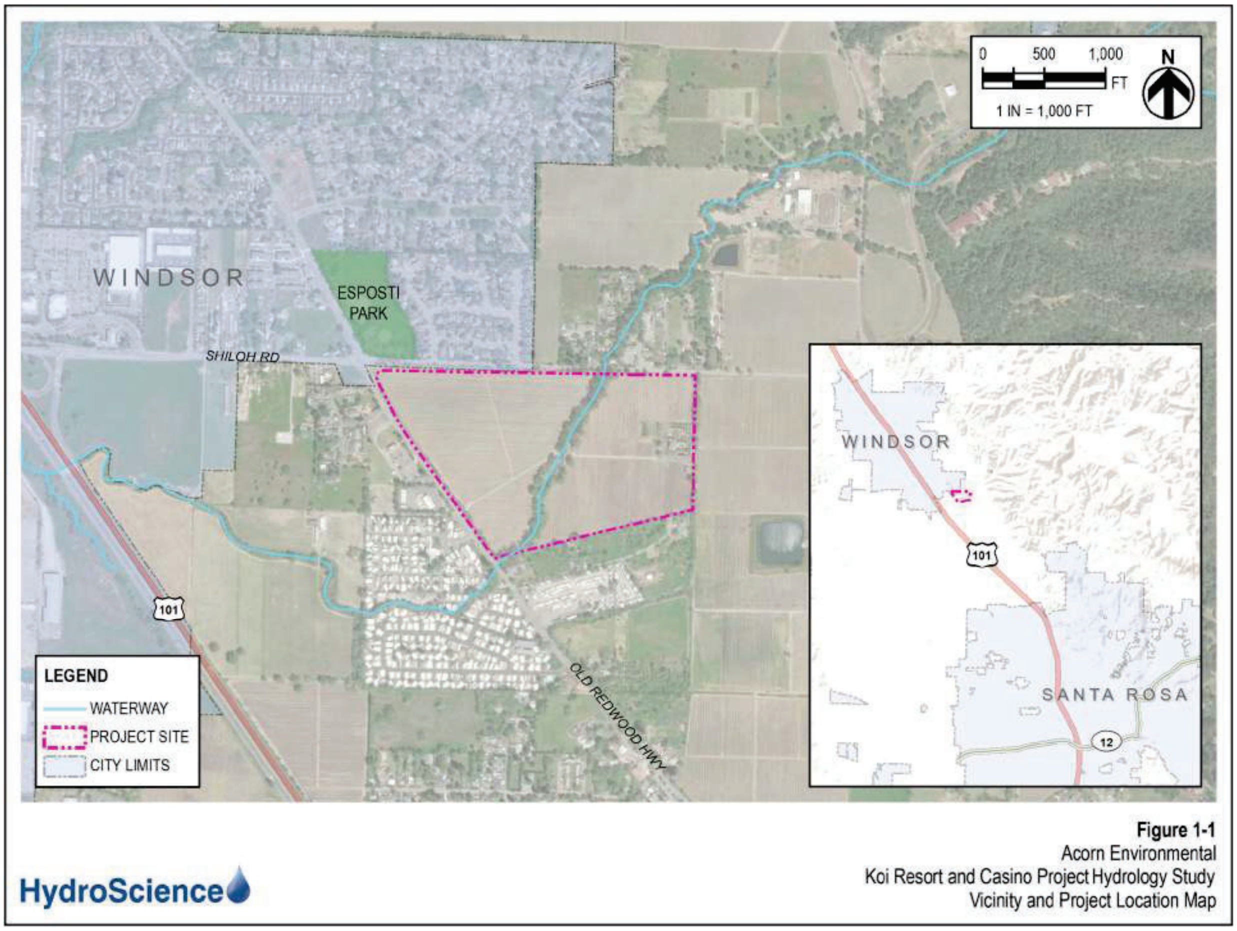
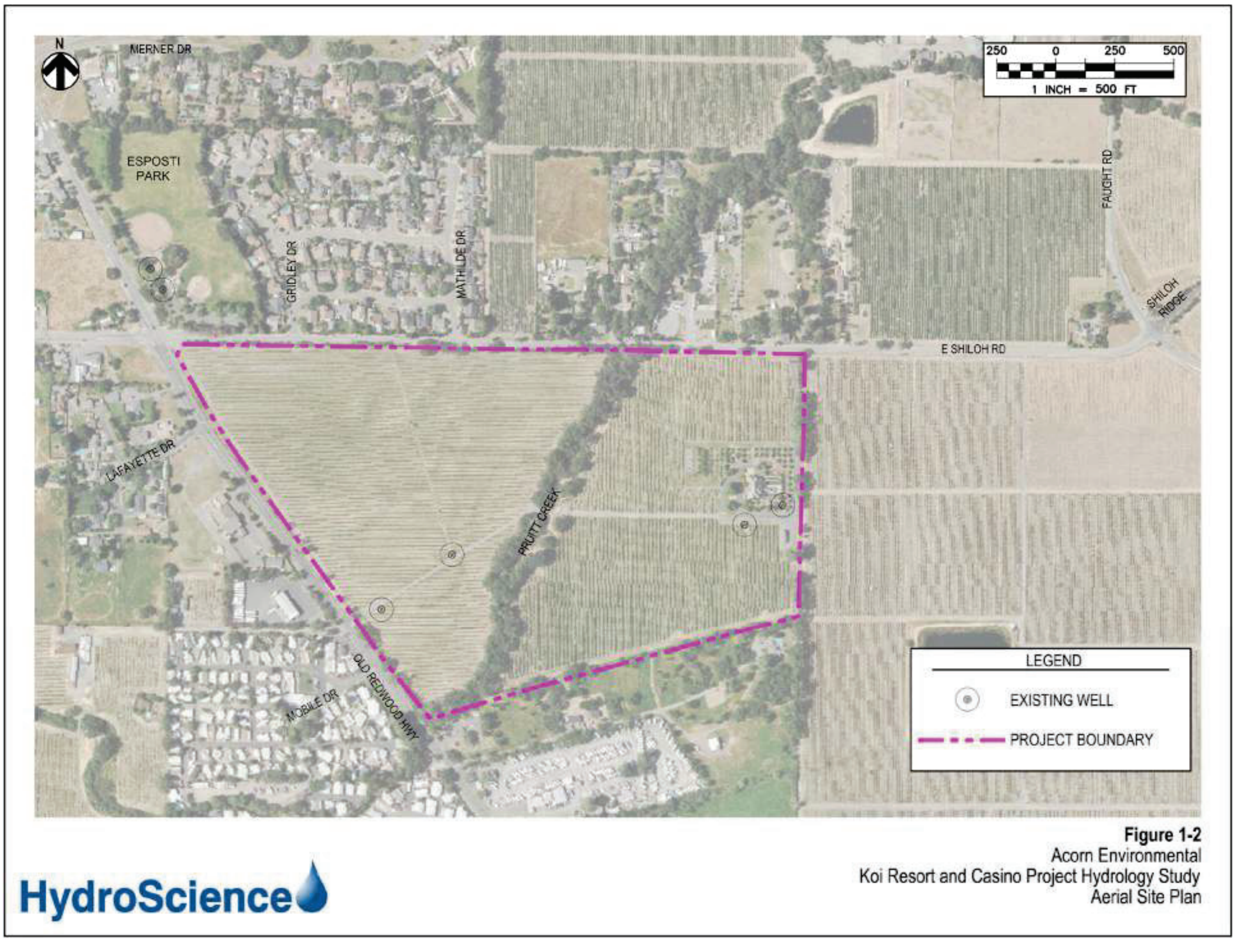


**Figure 1-2: Aerial Site Plan**



## 1.3 Flood Insurance Rate Map (FIRM) Floodplain

The property is in Flood Insurance Rate Map (FIRM) Panel 060375 entitled Sonoma County, California (Unincorporated Areas). A Firmette has been created for the project site from the FEMA Map Service Center and attached as **Appendix A**. The Firmette shows Pruitt Creek as a regulatory floodway with flood risk during any storm event and depicts the following Zones:

- Zone AE is the known base flood elevation for a 100-year storm event.
- Zone X (non-regulated) floodway is the area of a 100-year storm event with an average flood depth of less than one foot.
- Zone X are areas within a 500-year storm event.

Alternatives A, B and C have been developed to locate all structures outside of the regulatory floodplain and 100-year storm event flood limits.

## SECTION 2 – PROPOSED SITE IMPROVEMENT PLANS

With the Pruitt Creek dividing the site, Alternative A proposes to construct a resort facility that includes a casino, a food court, restaurants/ service bars, a 400-room hotel and spa, approximately 74,000 square feet of meeting space, and a 2,800-seat event center, on the west side of Pruitt Creek. On the east side of Pruitt Creek, a parking structure, parking lot, wastewater treatment facilities and other supporting infrastructure are proposed. Vehicular traffic will be able to cross the creek via a bridge and on-site roadway used for internal circulation. Pedestrian traffic will cross the creek using an aerial bridge that connects the parking structure and the casino. Various areas on both the east and west side of the site will remain as grape vineyards (see **Figure 2-1**).

Alternative B would include the development of a casino, a food court, restaurants/service bars, and a 400-room hotel and spa on the west side of Pruitt Creek. Alternative B would not include the development of the approximately 74,000 square feet of meeting space and 2,800-seat event center. On the east side of Pruitt Creek, a parking structure, wastewater treatment facilities and other supporting infrastructure are proposed. Alternative B would not include the surface parking lot proposed under Alternative A. Vehicular and pedestrian circulation elements remain the same as Alternative A. A larger portion of the site will remain as grape vineyards as well (see **Figure 2-2**).

Alternative C is a non-gaming site plan that consists of a 400-room hotel and spa, restaurant and a winery with visitors center on the west side of Pruitt Creek. Parking for the non-gaming site plan will consist of two surface parking lots on the west side of creek. The easterly side of the site will mostly remain as vineyards with only a wastewater treatment facility being constructed. (see Figure 2-3).

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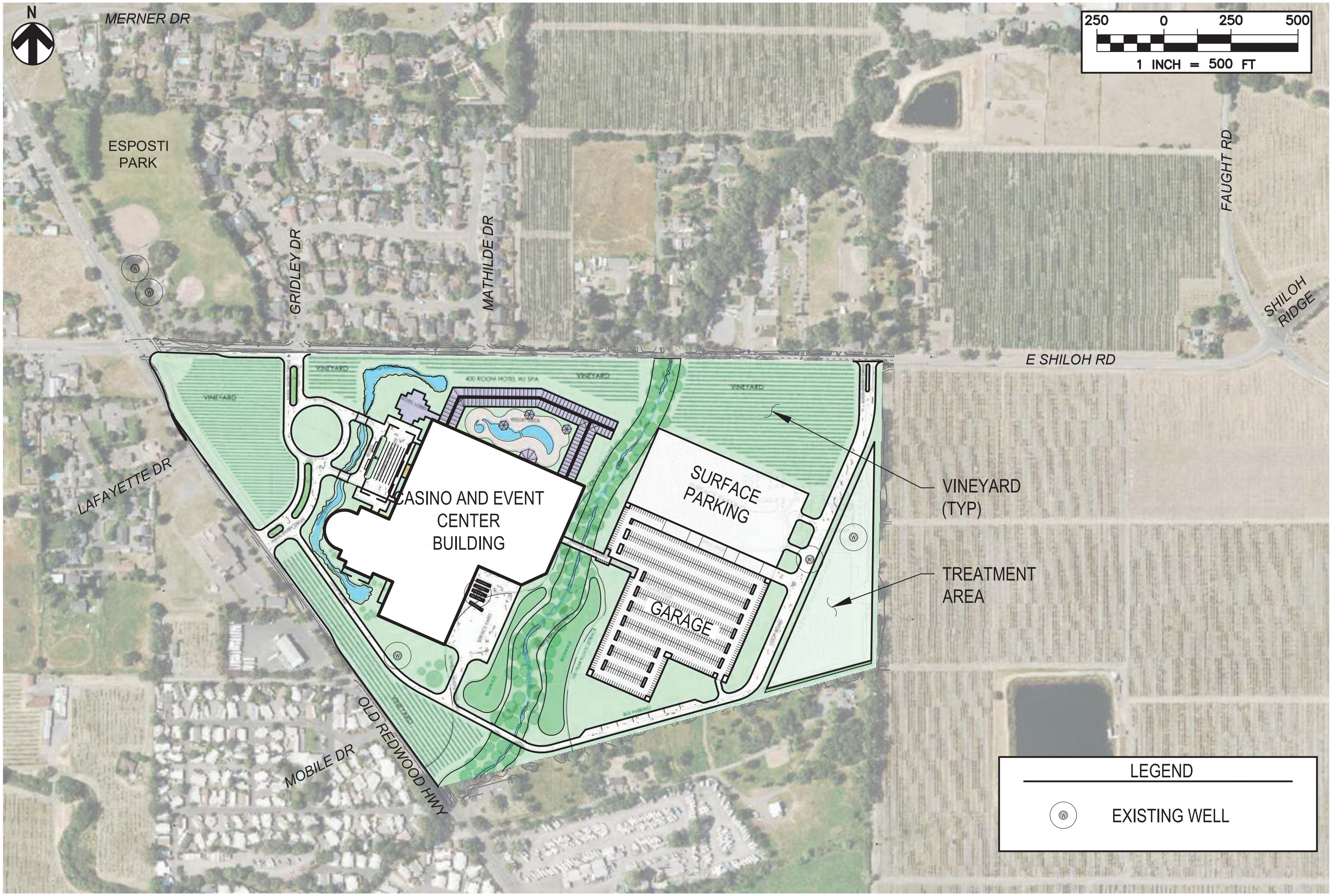


**Figure 2-1**
Acorn Environmental
Koi Resort and Casino Project Water and Wastewater Feasibility Study
Proposed Site Plan - Buildout

HydroScience

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**Figure 2-2**
Acorn Environmental
Koi Resort and Casino Site Grading and Drainage Plans
Proposed Site Plan - Reduced Intensity

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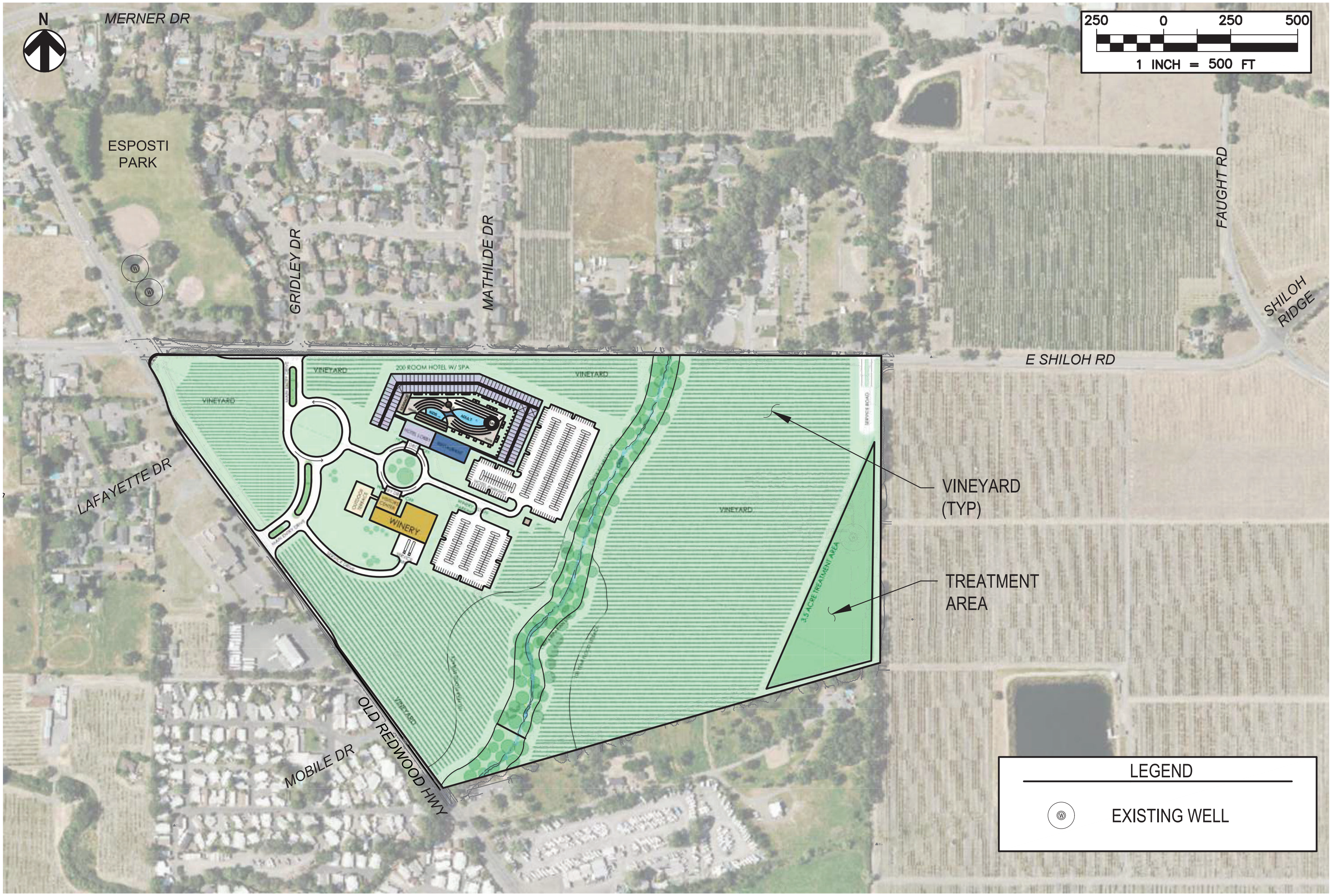


**Figure 2-3**
Acorn Environmental
Shiloh Resort and Casino Project Site Grading and Drainage Plans
Proposed Site Plan - Non Gaming Alternative

HydroScience

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## SECTION 3 – HYDROLOGY AND SITE GRADING

Although not required for tribal trust lands, local jurisdictional guidelines will be used for the site hydrology calculations. The Sonoma County Water Agency Flood Management Design Manual (FMDM) is intended to be used to guide public agencies and private entities in Sonoma County that are planning, designing, constructing, or maintaining waterways, channels, closed conduits, or culverts. It provides methods and criteria for analyzing storm drain systems and facilities that are necessary to convey rainfall run-off due to large storm events.

### 3.1 Methodology

The FMDM requires one of two hydrologic analysis methods for typical projects and facilities, depending on the size of the project/watershed area and the complexity of the situation:

- The Incremental Rational Method (IRM) – for projects less than 200 acres (ac) with no detention; or
- The Synthetic Unit Hydrograph Method (SUHM) – for all other projects

To mitigate the impacts, the stormwater drainage system for the alternatives will be designed to limit the peak flow and stormwater volume from the developed site to the undeveloped peak flows. Storm water detention basins are being proposed to attenuate the increase in peak flow and runoff volumes created by the development. Per the FMDM, SUHM shall be used as the method of hydrological analysis when using detention basins.

### 3.2 Hydrology Parameters

The FMDM describes the following parameters as needed for the hydrograph model and hydrology calculations. These parameters are described below and summarized in **Table 3-1**.

The Sonoma County FMDM SUHM methods require the 100-year probability, 24-hour duration storm event to be analyzed for calculating the peak design flows. In addition, the FMDM defaults the intensity duration of the rainfall hyetograph is assumed to be five minutes to develop the model. For these calculations, time of concentration is assumed to be 30 minutes for the existing condition due to the length of flow of the large hydrology subareas and 15 minutes for the proposed condition with smaller hydrology subareas.

The existing watershed areas of the site are divided into east and west and will be analyzed as an individual watershed. The area of each shed (Eastern and Western) is calculated from by the area outside the regulatory floodway. A hydrology map of the existing site is provided as **Appendix B**.

Rainfall intensities were determined by site specific data retrieved from NOAA Atlas 14 Precipitation frequency estimates to determine storm depth, included as **Appendix C**.

The site Hydrologic Soils Group for the site can be determined by FMDM Figure 3-8 Hydrologic Soils Group Map, included as **Appendix D.** The soils group for the site has been determined to be Group C.

Curve numbers (CNs) are used to represent the proportion of direct runoff associated with a rainfall event as a function of land cover and soil characteristics. USDA Technical Release 55 – Urban Hydrology Tables 2-2a through 2-2d using Soil Group C was used to determine the pre-development and post-development CN's, refer to **Appendix E**. A summary of the hydrologic parameters is provided in **Table 3-1**.

**Table 3-1: Hydrologic Model Parameters**

| Parameter | Value |
|---|---|
| Annual Storm Probability | 100 Year Storm (1% Probability) |
| Intensity Duration | 5 Minutes |
| Time of Concentration | 30 minutes (Existing)<br>15 minutes (Proposed) |
| Storm Duration | 24-Hour Storm Event |
| Watershed Areas | 31.76 Ac (East)<br>36.22 Ac (West)<br>3.99 (Floodway) |
| Storm Depth (NOAA Point Precipitation Frequency Data) | 0.327 inches/hour |
| Watershed Loss Curve Numbers (CN) | 85 (Existing)<br>Varies (Proposed) (Appendix E) |

## 3.3 Existing Hydrology

The hydrology model and calculations were based on Type IA rainfall distribution pursuant to FMDM standards. The hydrographs for the existing site conditions have been provided as **Appendix F**.

The hydrology results of the Eastern and Western sheds are provided in **Table 3-2** below. It should be noted that additional runoff volume for the Zone X' ponding has been added to the hydrologic volume.

**Table 3-2: Existing Hydrology**

| Drainage Shed | Peak Flow Rate (cfs) | Runoff Volume (cu. ft) |
|---|---|---|
| Western Shed | 47.18 | 754,274 |
| Western Flood Zone X' | n/a | 155,831 |
| Eastern Shed | 42.87 | 684,501 |
| Eastern Flood Zone X' | n/a | 91,701 |
| **Total** | **90.05** | **1,686,307** |

## 3.4 Conceptual Grading and Stormwater Pollution Prevention

The biggest concern to the site grading and drainage is the presence of the Pruitt Creek floodplain. To minimize cut/fill quantities and maintain a balanced earthwork site, while providing adequate protection from the floodplain, building finish floors were chosen approximately 1'-2' above existing 500-year floodplain elevations adjacent the creek. These range from 142.00' for the conference center, 144.00' for the casino and parking structure, and 146.00' for the Hotel. Although some vineyard areas will remain undisturbed, the roadway adjacent vineyards are intended as decorative landscape areas. These areas are to be graded with slopes not to exceed 4:1. Parking lot and roadways are to be designed between 1% and 5% slope. The site grading design has an overall earthwork volume estimated to be 115,000 CY. The grading concept accomplishes a near balanced site with less than 10,000 CY of fill required to be imported from off-site sources to develop the site. Cut areas include the wastewater treatment plant and foundations of the structures. Fill will primarily be placed on the southwesterly portion of the site near the floodplain.

It should be noted in this report, the wastewater treatment plant is assumed to construct an on-site storage tank for recycled water storage. In the event, an on-site reservoir is used for recycled water storage in lieu of a tank, the excavations volumes from the different sized reservoirs that would be required for Alternative A, B and C would create a fill scenario. The additional fill would be used throughout westerly side of the creek. In this scenario, the site would have balanced earthwork volumes, therefore no import and or export of soils would be required.

On the easterly side of the creek, the grading design will convey the stormwater from the vineyard areas, the parking structure and surface parking lot towards the roadway to a drainage system. The easterly drainage system will convey the runoff to a grassy bioswale prior to discharge to Pruitt Creek. The wastewater treatment plant will be graded to contain stormwater runoff within the treatment plant. Runoff in this area will be captured and used in the wastewater treatment plant processing.

On the westerly side of the creek, stormwater will be conveyed towards the decorative bioswale and then routed to a detention basin prior to discharging to the creek. Roof drains for the buildings will be connected to the storm drain system and conveyed to a bioswale adjacent to the creek. While the service area located behind the casino will drain into a bioswale within the floodplain. This particular bioswale shall be designed with an elevation at or above the floodplain elevation to allow for treatment of pollutants from the roof drains and service yard during a storm event.

Stormwater pollution will be primarily mitigated using drainage bioswales and a detention basin. The bioswales will be sized per Sonoma County LID requirements for pollutant reduction. Storm drain outfalls to the creek will be designed with rock slope protection to mitigate erosion. Additional erosion and sediment control best management practices will also be prescribed by a stormwater pollution prevention plan, that will be prepared for the project in compliance with the National Pollutant Discharge Elimination System (NPDES) Construction General Permit.

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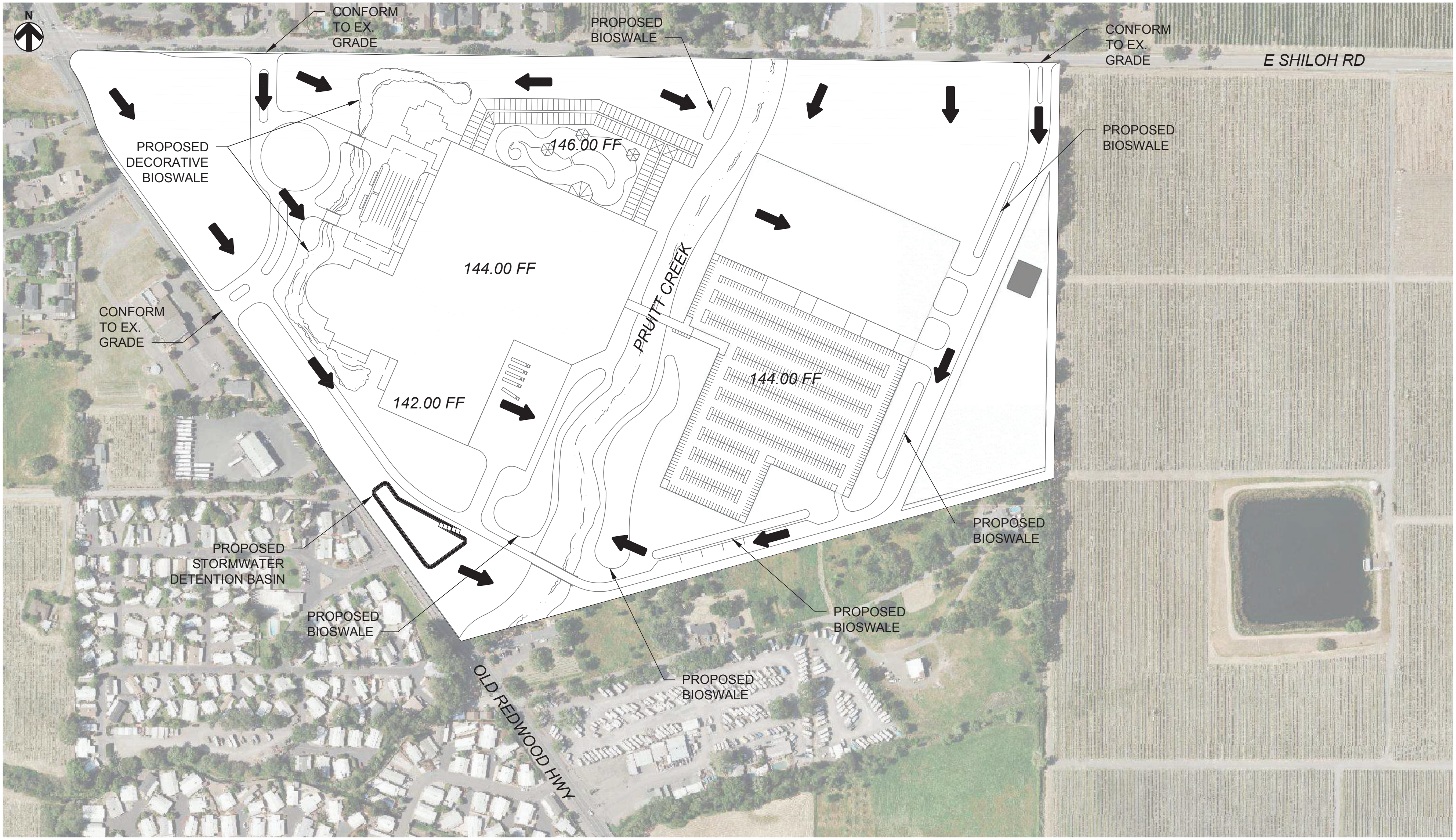


FIGURE 3-1
Acorn Environmental
Koi Resort and Casino Site Grading and Drainage Plans
Conceptual Grading & Stormwater Plan

HydroScience

## 3.5 Proposed Hydrology

The analysis below focuses on the impacts associated with Alternative A. **Table 3-3** is a comparison of impervious areas of the various site alternatives. With the largest impervious area, Alternative A will have the most significant impact to grading and hydrology. To be conservative, results of this analysis can also be applied to Alternative B and Alternative C due having less impervious area and thus generating less runoff.

**Table 3-3: Site Impervious Areas**

| Site Feature | Impervious Area (S.F.) | | |
|---|---|---|---|
| | Alternative A | Alternative B | Alternative C |
| Hotel | 134,248 | 134,248 | 151,897 |
| Casino/Entertainment | 420,675 | 310,475 | |
| Parking Structure | 308,758 | 233,573 | |
| Winery & Misc. Facilities | | | 34,940 |
| WWTP | 163,337 | 163,337 | 163,337 |
| Parking Lot | 183,090 | | 159,967 |
| Roadway | 281,337 | 287,375 | 95,345 |
| Service Area | 55,550 | 55,550 | 25,231 |
| **Total Impervious Area** | **1,546,995** | **1,175,558** | **630,717** |

The proposed grading for the Western shed will have three different sub-area watersheds with differing locations discharging stormwater to the creek. The largest shed, Sub Area A, will collect runoff from vineyards, roadways, and building roof drainage and convey the flows to the water feature in the front entrance of the casino, that will act as a decorative bioswale. For analysis, multiple subdrainage areas were routed in the model to create a single output hydrograph for the various sub areas.

Sub Area B will collect runoff from roof drainage and some landscape/vineyards into a direct discharge into the creek. Additional runoff volume from flood Zone X' will be added to Sub Area(s) A and B, respectively. Sub Area C will also collect runoff from roof drainage and the loading dock area and convey the flows through a bioswale and then discharge into the creek.

The Easterly shed will have four different sub-area watersheds. Three watersheds, Sub Area D, E, and F will convey all drainage runoff from the parking, roadways, and landscape areas into bioswales and then discharged into the creek. Sub Area E and F will also have additional runoff volume from flood Zone X'.

The Wastewater Treatment Plant (WWTP) area is the fourth sub area of the Easterly shed. Due to potential for sanitary sewer spill contamination of potential overflows, runoff in this area will be captured and conveyed to the WWTP disposal system, thus mitigating stormwater flow from the Eastern shed.

A hydrology map of the proposed site plan is provided as **Appendix G**. Proposed site hydrographs, **Appendix H**, were modeled for the sub areas as described above and results are provided in **Table 3-4: Proposed Hydrology Alternative A** below.

**Table 3-4: Proposed Hydrology Alternative A**

| Drainage Shed | Peak Flow Rate (cfs) | Runoff Volume (cu ft) |
|---|---|---|
| Western Shed Sub Area A | 40.81 | 571,089 |
| Western Shed Sub Area A (Zone X') | n/a | 32,105 |
| Western Shed Sub Area B | 13.91 | 195,223 |
| Western Shed Sub Area B (Zone X') | n/a | 123,700 |
| Western Shed Sub Area C | 5.63 | 78,974 |
| Eastern Shed Sub Area D | 43.74 | 620,202 |
| Eastern Shed Sub Area E | 3.73 | 53,863 |
| Eastern Shed Sub Area E (Zone X') | n/a | 78,800 |
| Eastern Shed Sub Area F | 0.25 | 3,544 |
| Eastern Shed Sub Area F (Zone X') | n/a | 12,901 |
| Eastern Shed Sub Area WWTP | 8.27 | 117,875 |
| **Total** | **116.34** | **1,888,274** |

## 3.6 Peak Flow Mitigation

To mitigate the impacts of the proposed improvements, storm drain improvements will be designed to limit the flow to the creek to pre-developed conditions. The pre- and post-development flow rates and volumes are summarized in **Table 3-5: Pre and Post Development Flows**

below.

**Table 3-5: Pre and Post Development Flows**

| Description | Peak Flow Rate (cfs) | Runoff Volume (cu ft) |
|---|---|---|
| Pre-Development Flows | 90.05 | 1,686,307 |
| Post Development Flows | 116.34 | 1,888,274 |
| Site Mitigation Required | 26.29 | 201,967 |

As stated above, the WWTP will provide some mitigation for the Easterly shed by capturing all runoff in the area within the WWTP site area. For the Westerly shed, Detention Basin A will need to reduce peak flow by 18.02 cfs and have a minimum storage capacity of 84,092 cu ft. This will be achieved by using an outlet pipe sized to attenuate the Sub Area A hydrograph peak flow from 40.81 cfs to 22.79 cfs.

Attenuation of the Sub Area A hydrograph with a detention basin can be analyzed in the model to reduce the peak flow rate to produce an outfall hydrograph for peak flow rate mitigation, included as **Appendix I**. Further analysis of the volume differential in hydrographs shows the basin storage volume needs to be a minimum of 103,975 cu ft, larger than what is required for the overall site mitigation. The model produces a pond depth versus outlet orifice sizing to achieve the time-lag and drawdown times required for mitigation, refer to **Appendix J**. Basin A is proposed to be five feet (5 ft) in depth, with a storage capacity of 103,975 cu ft. Based on the model, the basin will require a 21-inch outlet pipe to mitigate the peak flow.

**Table 3-6: Proposed Mitigation**

| Drainage Shed Mitigation | Reduction in Peak Flow Rate (cfs) | Mitigation Volume (cu ft) |
|---|---|---|
| Eastern Shed Sub Area WWTP (Capture) | 8.27 | 117,875 |
| Western Shed Sub Area A (Basin A) | 18.02 | 103,975 |
| **Mitigation** | **26.29** | **221,850** |

## 3.7 Summary

The proposed drainage plan for each of the alternatives includes various storm drain improvements consisting of a decorative swale, catch basins with underground storm drain pipe, building roof drains, and a detention basin (Basin A). The proposed development of the alternatives increases runoff and peak flow rates. This will be mitigated by capture of flow by the WWTP and temporary storage in the detention basin that will limit the peak flow. Detention basin sizing and outlet piping will meter the flow into the creek to pre-development levels.

**APPENDIX A**
Acorn Environmental
Grading & Hydrology Report
FEMA Firmette

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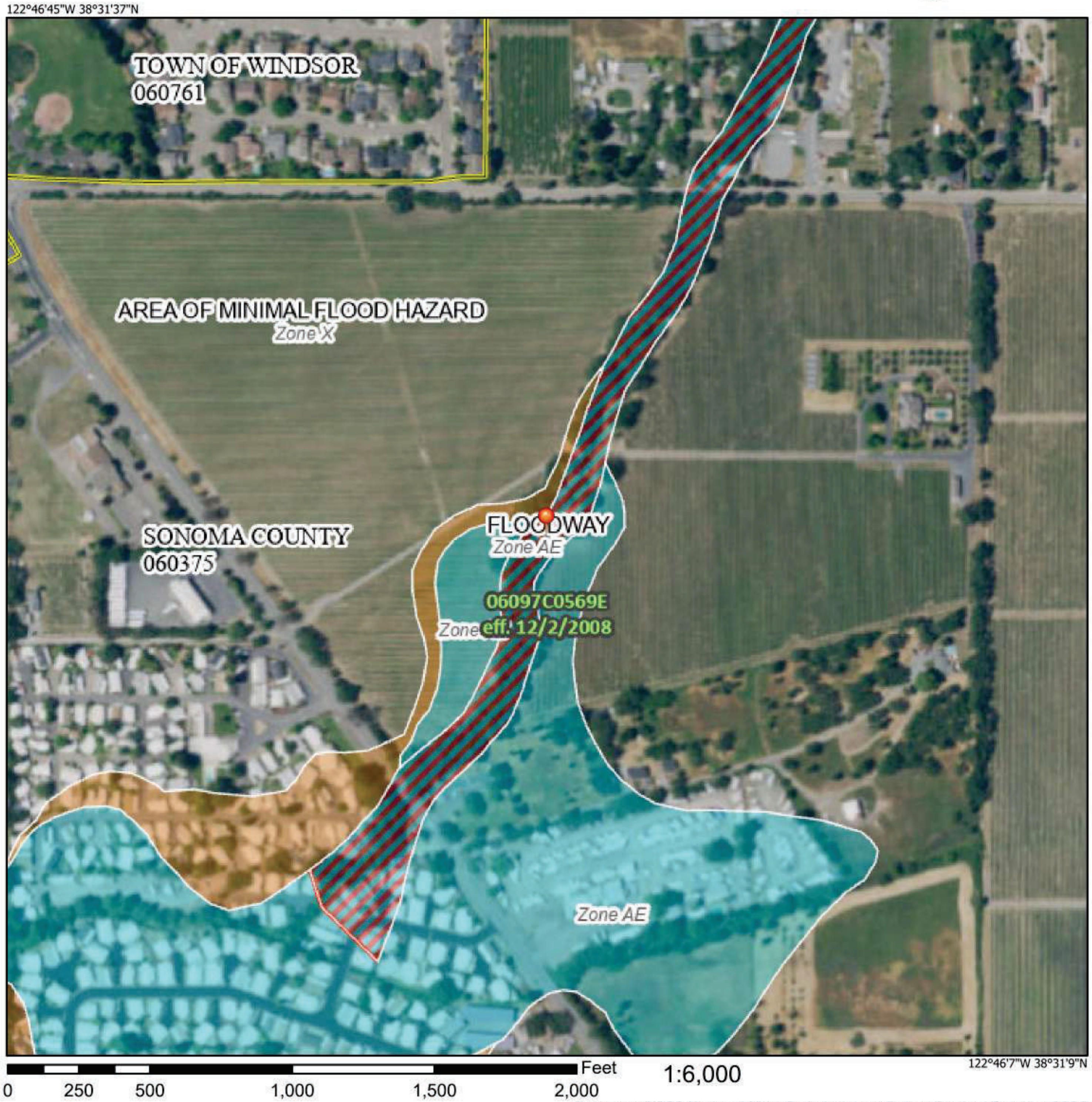
# National Flood Hazard Layer FIRMette

FEMA




Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

## Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

**SPECIAL FLOOD HAZARD AREAS**
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

**OTHER AREAS OF FLOOD HAZARD**
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

**OTHER AREAS**
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

**GENERAL STRUCTURES**
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

**OTHER FEATURES**
- B 20.2 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- 8 Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

**MAP PANELS**
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 3/23/2022 at 11:45 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

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## APPENDIX B

Acorn Environmental
Grading & Hydrology Report
Pre-Development Hydrology Map

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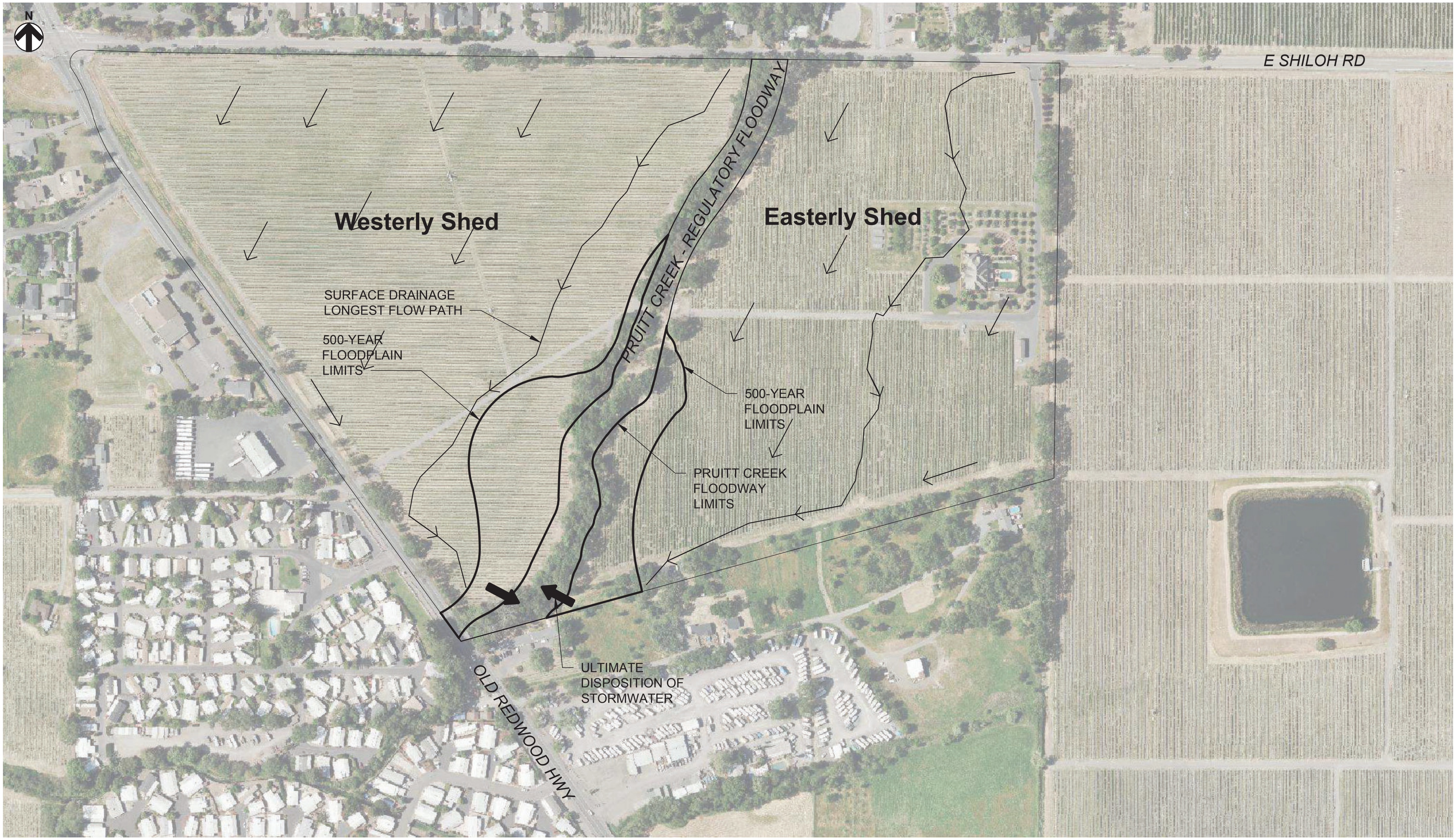


HydroScience

APPENDIX B
Acorn Environmental
Koi Resort and Casino Site Grading and Drainage Plans
Pre-Development Hydrology Map

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# APPENDIX C

Acorn Environmental
Grading & Hydrology Report
NOAA Precipitation Estimates

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NOAA Atlas 8 8lume 6 ersi n 2 8
L 8cati n name: Calif rnia USA* 8
Latitude: 3 852 83° L 8ngitude: - 22.7759° 8
Elevati n: 82.32 ft** 8
* source: ESRI Maps 8
** source: USGS 8

## POINT PRECIPITATION FREQUENCY ESTIMATES 8

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra 8
Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey 8
Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan 8

NOAA, National Weather Service, Silver Spring, Maryland 8

PF_tabular | PF_graphical | Maps_&_aerials 8

## PF tabular 8

PDS-based p 8nt precipitati n frequency estimates with 90% c 8nfidence intervals (in inches/h 8ur) 8

| Durati n 8 | Average recurrence interval (years) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 5 | 80 8 | 25 8 | 50 1 8 | 00 | 200 | 500 1 8 | 000 8 |
| 5-min 8 | .97 8 (1.75-2.24) | 2. 8 (2.14-2.74) | 2.96 8 (2.63-3.38) | 3. 8 (2.99-3.94) | .0 8 (3.38-4.81) | . 6 8 (3.67-5.48) | .92 8 (3.92-6.22) | 5.3 8 (4.15-7.02) | 5.99 8 (4.42-8.21) | 6. 6 8 (4.57-9.20) |
| 0-min 8 | . 2 8 (1.26-1.61) | .72 8 (1.53-1.96) | 2. 2 8 (1.88-2.42) | 2. 5 8 (2.14-2.82) | 2. 7 8 (2.42-3.44) | 3.20 8 (2.63-3.93) | 3.52 8 (2.81-4.45) | 3. 5 8 (2.98-5.03) | .29 8 (3.16-5.88) | .62 8 (3.28-6.59) |
| 5-min 8 | . 8 (1.01-1.30) | .39 8 (1.24-1.58) | .7 8 (1.52-1.96) | .97 8 (1.73-2.27) | 2.32 8 (1.95-2.78) | 2.5 8 (2.12-3.17) | 2. 8 (2.27-3.59) | 3. 0 8 (2.40-4.06) | 3. 6 8 (2.55-4.74) | 3.73 8 (2.64-5.32) |
| 30-min 8 | 0. 00 8 (0.712-0.908) | 0.976 8 (0.866-1.11) | .20 8 (1.06-1.37) | .3 8 (1.21-1.59) | .63 8 (1.37-1.95) | . 8 (1.49-2.22) | .99 8 (1.59-2.52) | 2. 8 (1.69-2.85) | 2. 3 8 (1.79-3.33) | 2.62 8 (1.85-3.73) |
| 60-min | 0.562 8 (0.500-0.639) | 0.6 6 8 (0.609-0.780) | 0. 85 8 (0.748-0.965) | 0.973 8 (0.853-1.12) | . 8 (0.963-1.37) | .27 8 (1.05-1.56) | . 0 8 (1.12-1.77) | .53 8 (1.19-2.00) | .7 8 (1.26-2.34) | . 8 (1.30-2.62) |
| 2-hr | 0. 25 8 (0.378-0.483) | 0.5 8 (0.457-0.586) | 0.62 8 (0.556-0.716) | 0.7 85 8 (0.628-0.825) | 0. 32 8 (0.701-0.996) | 0.9 87 8 (0.754-1.13) | .00 8 (0.800-1.26) | .0 8 (0.838-1.41) | . 9 8 (0.877-1.63) | .27 8 (0.899-1.81) |
| 3-hr | 0.36 8 (0.321-0.410) | 0. 36 8 (0.387-0.496) | 0.529 8 (0.469-0.604) | 0.602 8 (0.527-0.693) | 0.696 8 (0.586-0.833) | 0.76 8 (0.628-0.939) | 0. 3 8 (0.664-1.05) | 0. 96 8 (0.693-1.17) | 0.9 88 8 (0.722-1.34) | .0 8 (0.737-1.48) |
| 6-hr | 0.273 8 (0.243-0.310) | 0.329 8 (0.293-0.375) | 0.399 8 (0.353-0.455) | 0. 52 8 (0.397-0.521) | 0.520 8 (0.439-0.624) | 0.569 8 (0.468-0.699) | 0.6 87 8 (0.493-0.779) | 0.662 8 (0.512-0.865) | 0.720 8 (0.531-0.987) | 0.762 8 (0.540-1.09) |
| 2-hr | 0. 92 8 (0.171-0.218) | 0.235 8 (0.209-0.268) | 0.2 8 (0.255-0.329) | 0.32 8 (0.288-0.378) | 0.379 8 (0.320-0.454) | 0. 85 8 (0.341-0.510) | 0. 50 8 (0.359-0.568) | 0. 83 8 (0.374-0.631) | 0.525 8 (0.387-0.719) | 0.555 8 (0.393-0.791) |
| 2 8hr | 0. 32 8 (0.119-0.150) | 0. 66 8 (0.149-0.188) | 0.206 8 (0.184-0.234) | 0.236 8 (0.210-0.271) | 0.27 8 (0.237-0.324) | 0.30 8 (0.255-0.362) | 0.327 8 (0.271-0.402) | 0.352 8 (0.285-0.443) | 0.3 83 8 (0.299-0.500) | 0. 05 8 (0.307-0.546) |
| 2-day 8 | 0.0 87 8 (0.078-0.099) | 0. 80 8 (0.099-0.125) | 0. 3 8 (0.124-0.157) | 0. 59 8 (0.141-0.182) | 0. 85 8 (0.160-0.219) | 0.20 8 (0.173-0.245) | 0.222 8 (0.184-0.272) | 0.239 8 (0.193-0.301) | 0.260 8 (0.203-0.340) | 0.275 8 (0.208-0.371) |
| 3-day 8 | 0.067 8 (0.060-0.076) | 0.0 85 8 (0.076-0.097) | 0. 07 8 (0.096-0.122) | 0. 2 8 (0.110-0.142) | 0. 8 (0.125-0.170) | 0. 59 8 (0.135-0.191) | 0. 73 8 (0.144-0.213) | 0. 86 8 (0.151-0.235) | 0.203 8 (0.159-0.265) | 0.2 85 8 (0.163-0.290) |
| -day 8 | 0.056 8 (0.050-0.063) | 0.07 8 (0.064-0.081) | 0.090 8 (0.080-0.102) | 0. 03 8 (0.092-0.119) | 0. 2 8 (0.105-0.143) | 0. 33 8 (0.113-0.160) | 0. 85 8 (0.120-0.178) | 0. 56 8 (0.127-0.197) | 0. 7 8 (0.133-0.223) | 0. 8 (0.137-0.244) |
| 7-day 8 | 0.039 8 (0.035-0.045) | 0.050 8 (0.045-0.057) | 0.063 8 (0.057-0.072) | 0.073 8 (0.065-0.084) | 0.0 85 8 (0.074-0.101) | 0.09 8 (0.080-0.113) | 0. 03 8 (0.085-0.126) | 0. 8 (0.090-0.139) | 0. 2 8 (0.094-0.158) | 0. 2 8 (0.097-0.173) |
| 0-day 8 | 0.03 8 (0.028-0.036) | 0.0 88 8 (0.036-0.046) | 0.050 8 (0.045-0.057) | 0.05 8 (0.052-0.067) | 0.06 8 (0.059-0.080) | 0.075 8 (0.064-0.090) | 0.0 82 8 (0.068-0.100) | 0.0 8 (0.071-0.118) | 0.096 8 (0.075-0.125) | 0. 02 8 (0.077-0.137) |
| 20-day 8 | 0.02 8 (0.019-0.024) | 0.027 8 (0.024-0.030) | 0.033 8 (0.030-0.038) | 0.039 8 (0.034-0.044) | 0.0 85 8 (0.039-0.053) | 0.0 89 8 (0.042-0.059) | 0.05 8 (0.044-0.066) | 0.05 8 (0.047-0.073) | 0.063 8 (0.049-0.082) | 0.066 8 (0.050-0.089) |
| 30-day 8 | 0.0 87 8 (0.015-0.019) | 0.02 8 (0.019-0.024) | 0.027 8 (0.024-0.030) | 0.03 8 (0.027-0.035) | 0.036 8 (0.031-0.042) | 0.039 8 (0.033-0.047) | 0.0 83 8 (0.035-0.052) | 0.0 86 8 (0.037-0.058) | 0.0 89 8 (0.039-0.065) | 0.052 8 (0.039-0.070) |
| 5-day 8 | 0.0 8 (0.012-0.015) | 0.0 87 8 (0.016-0.020) | 0.022 8 (0.019-0.025) | 0.025 8 (0.022-0.029) | 0.029 8 (0.025-0.034) | 0.032 8 (0.027-0.038) | 0.03 8 (0.028-0.042) | 0.037 8 (0.030-0.046) | 0.0 88 8 (0.031-0.052) | 0.0 82 8 (0.031-0.056) |
| 60-day 8 | 0.0 82 8 (0.011-0.014) | 0.0 85 8 (0.014-0.017) | 0.0 89 8 (0.017-0.022) | 0.022 8 (0.020-0.025) | 0.025 8 (0.022-0.030) | 0.02 8 (0.024-0.033) | 0.030 8 (0.025-0.037) | 0.032 8 (0.026-0.040) | 0.03 8 (0.027-0.045) | 0.036 8 (0.027-0.049) |

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS). 8

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a 8 given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not 8 checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values. 8

Please refer to NOAA Atlas 14 document for more information. 8

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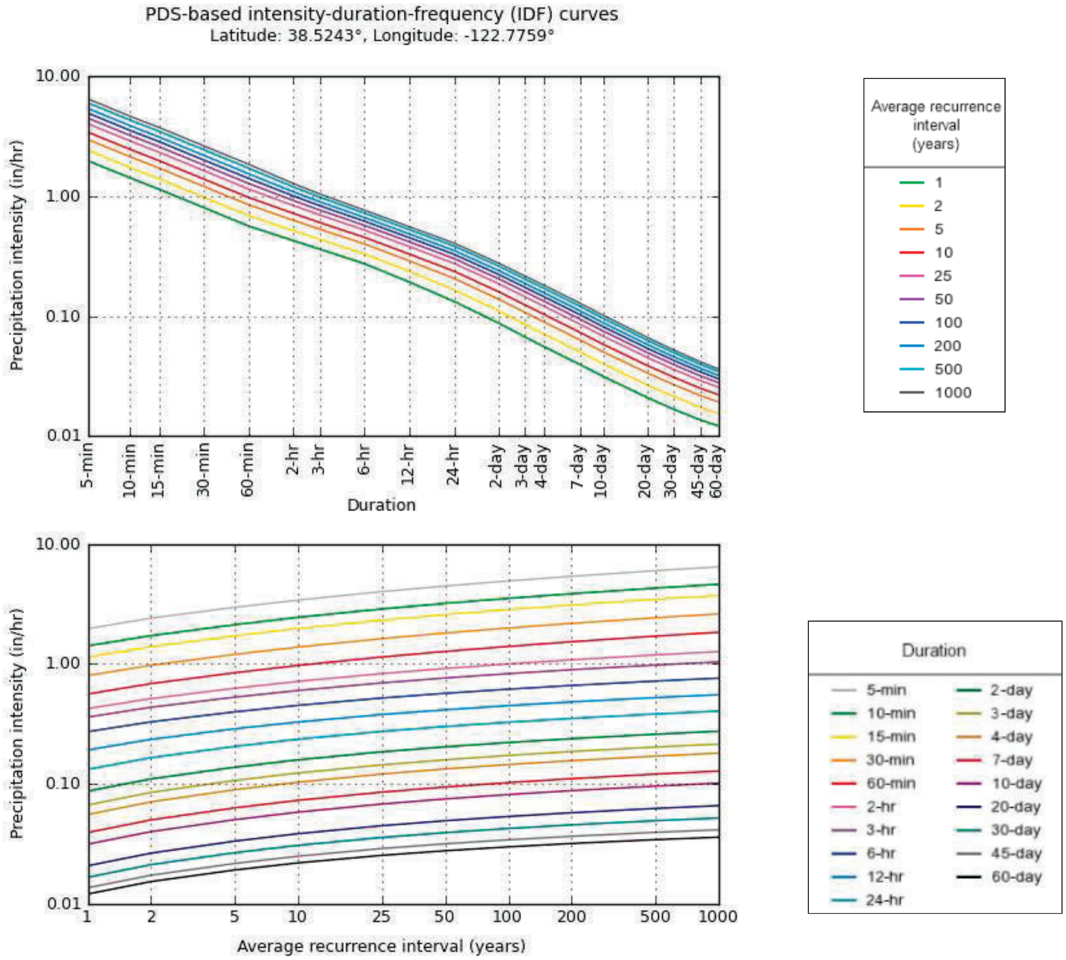
## PF graphical 8

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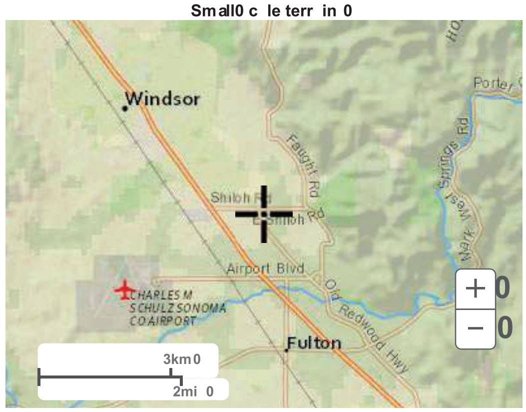


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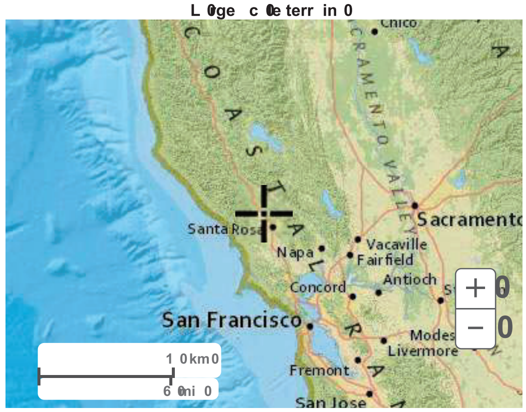

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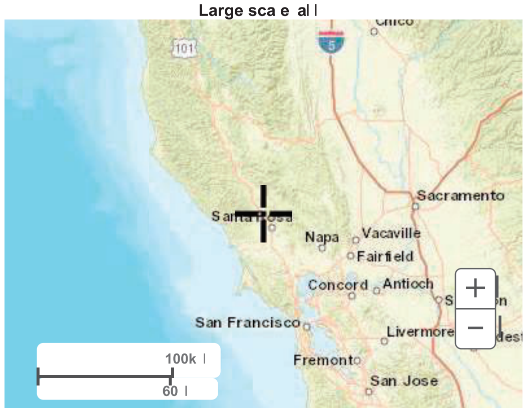


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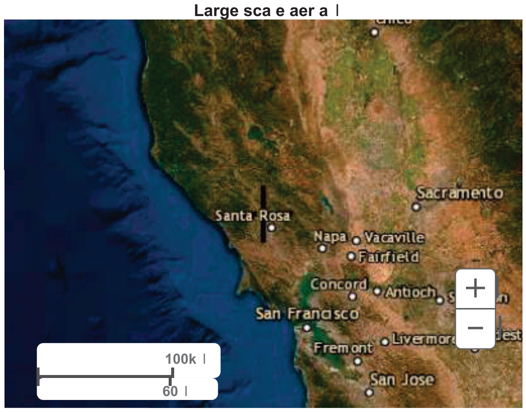


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[US Department of Commerce](#) l
[Nationa Oceanic and Atmospheric Administration](#) l
[Nationa Weather Service](#) l
[Nationa Water Center](#) l
1325 East West Highway l
Si ver Spring, MD 20910 l
Questions?: [HDSC.Questions@noaa.gov](#) l

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**APPENDIX D**
Acorn Environmental
Grading & Hydrology Report
Sonoma County Hydrologic Soils Group Map

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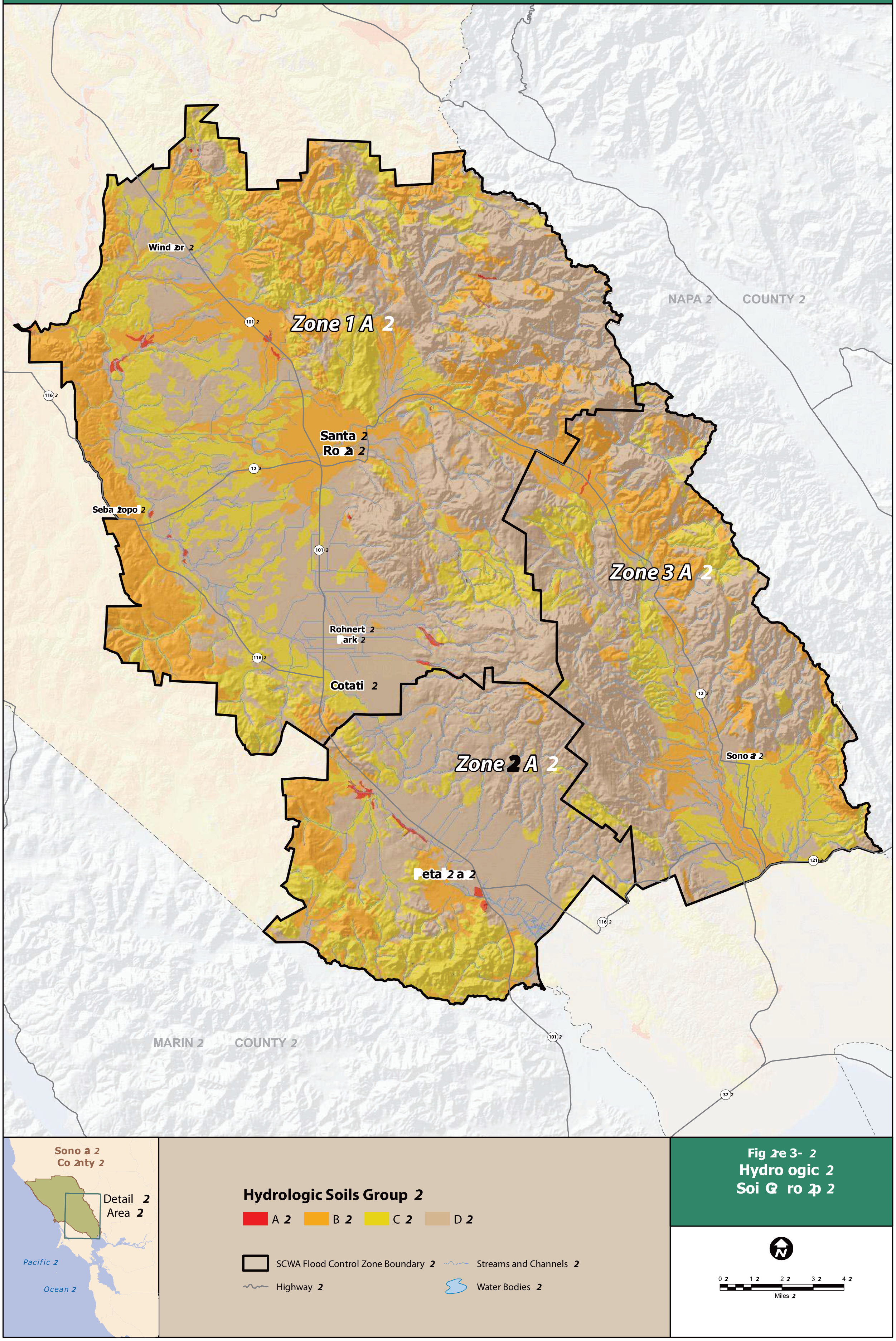


Fig re 3- 2
Hydro ogic 2
Soi G ro p 2

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**APPENDIX E**
Acorn Environmental
Grading & Hydrology Report
TR-55 Table 2-2a through 2-2d: Curve Numbers

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Table - a Runoff curve numbers for urban areas [1/]

| Cover description: Cover type and hydrologic condition | Average percent impervious area [2/] | A | B | C | D |
|---|---|---|---|---|---|
| ***Fully l p urban ar as ( g tati n stablish )*** | | | | | |
| Open spa e (lawns, parks, golf ourses, emeteries, et .) [3/]: | | | | | |
| Poor ondition (grass over < 50%) | | 68 | 79 | 86 | 89 |
| Fair ondition (grass over 50% to 75%) | | 49 | 69 | 79 | 84 |
| Good ondition (grass over > 75%) | | 39 | 61 | 74 | 80 |
| Impervious areas: | | | | | |
| Paved parking lots, roofs, driveways, et . (ex luding right-of-way) | | 98 | 98 | 98 | 98 |
| Streets and roads: | | | | | |
| Paved; urbs and storm sewers (ex luding right-of-way) | | 98 | 98 | 98 | 98 |
| Paved; open dit hes (in luding right-of-way) | | 83 | 89 | 92 | 93 |
| Gravel (in luding right-of-way) | | 76 | 85 | 89 | 91 |
| Dirt (in luding right-of-way) | | 72 | 82 | 87 | 89 |
| Western desert urban areas: | | | | | |
| Natural desert lands aping (pervious areas only) [4/] | | 63 | 77 | 85 | 88 |
| Artifi ial desert lands aping (impervious weed barrier, desert shrub with 1- to 2-in h sand or gravel mul h and basin borders) | | 96 | 96 | 96 | 96 |
| Urban distri ts: | | | | | |
| Commer ial and business | 85 | 89 | 92 | 94 | 95 |
| Industrial | 72 | 81 | 88 | 91 | 93 |
| Residential distri ts by average lot size: | | | | | |
| 1/8 a re or less (town houses) | 65 | 77 | 85 | 90 | 92 |
| 1/4 a re | 38 | 61 | 75 | 83 | 87 |
| 1/3 a re | 30 | 57 | 72 | 81 | 86 |
| 1/2 a re | 25 | 54 | 70 | 80 | 85 |
| 1 a re | 20 | 51 | 68 | 79 | 84 |
| 2 a res | 12 | 46 | 65 | 77 | 82 |
| ***D l ping urban ar as*** | | | | | |
| Newly graded areas (pervious areas only, no vegetation) [5/] | | 77 | 86 | 91 | 94 |
| Idle lands (CN's are determined using over types similar to those in table 2-2 ). | | | | | |

[1] Average runoff ondition, and $I_a = 0.2S$.
[2] The average per ent impervious area shown was used to develop the omposite CN's. Other assumptions are as follows: impervious areas are dire tly onne ted to the drainage system, impervious areas have a CN of 98, and pervious areas are onsidered equivalent to open spa e in good hydrologi ondition. CN's for other ombinations of onditions may be omputed using figure 2-3 or 2-4.
[3] CN's shown are equivalent to those of pasture. Composite CN's may be omputed for other ombinations of open spa e over type.
[4] Composite CN's for natural desert lands aping should be omputed using figures 2-3 or 2-4 based on the impervious area per entage (CN = 98) and the pervious area CN. The pervious area CN's are assumed equivalent to desert shrub in poor hydrologi ondition.
[5] Composite CN's to use for the design of temporary measures during grading and onstru tion should be omputed using figure 2-3 or 2-4 based on the degree of development (impervious area per entage) and the CN's for the newly graded pervious areas.

Table 2-2b R n unoff curve number for cultivated agricultural land n/ n

| Cover de cription n | | | Curve number for n hydrologic noil group n | | | |
|---|---|---|---|---|---|---|
| Cover type n | Treatment 2/ n n | Hydrologic n condition 3/ n | A n | B n | C n | D |
| Fallow n | Bare noil n | —n | 77 n | 86 n | 91 n | 94 n |
| | Crop re idue cover (C n) n | Poor n | 76 n 9 | 8 n | 0 n | 93 n |
| | | Good n | 74 n | 83 n | 88 | 90 n |
| S ow crop n | traight row (S n) n | Poor n | 72 n | 81 n | 88 n | 91 n |
| | | Good n | 67 n | 78 8 | 8 n | 9 n |
| | S n+ C n | oor n | 71 n | 80 n | 87 n | 90 n |
| | | Good n | 64 n 8 | 7 n | 2 | 8 n |
| | Contoured (C) n | Poor n | 70 n | 79 n | 84 n | 88 n |
| | | Good n 7 n | 6 n 8 | | 2 | 86 n |
| | C + C n | oor n | 69 n | 78 n | 83 n | 87 n |
| | | Good n | 64 n | 74 n | 81 n | 8 n |
| | Contoured & terraced (C&T) n | Poor n | 66 n | 74 n | 80 n | 82 n |
| | | Good n | 62 n | 71 n | 78 n | 81 n |
| | C&T+ C n | oor n 7 | 6 n | 3 n | 79 n | 81 n |
| | | Good n | 61 n | 70 n | 77 | 80 n |
| Small grain n | S n | oor n 7 | 6 n | 6 n | 84 n | 88 n |
| | | Good n | 63 n 8 | 7 n | 3 | 87 n |
| | S + C n | oor n | 64 n 8 | 7 n | 3 | 86 n |
| | | Good n | 60 n | 72 n | 80 n | 84 n |
| | C n | Poor n | 63 n | 74 n | 82 n | 8 n |
| | | Good n | 61 n | 73 n | 81 n | 84 n |
| | C + C n | oor n | 62 n | 73 n | 81 n | 84 n |
| | | Good n | 60 n | 72 n | 80 n | 83 n |
| | C&T n | Poor n | 61 n | 72 n | 79 n | 82 n |
| | | Good 5 n | 9 n | 70 | 78 n | 81 n |
| | C&T+ C n | oor n | 60 n | 71 n | 78 n | 81 n |
| | | Good 5 n | 8 n | 69 n | 77 | 80 n |
| Clo e- eeded n | S n | oor n | 66 n | 77 n8 | 8 n | 9 n |
| or broadca t n | | Good 5 n | 8 n | 72 n | 81 n | 8 n |
| legume or n | C n | Poor n | 64 n 8 | 7 n | 3 n | 8 n |
| rotation n | | Good 5 n 6 | | 9 n | 78 n | 83 n |
| meadow n | C&T n | Poor n | 63 n | 73 n | 80 n | 83 n |
| | | Good 5 n | 1 n | 67 | 76 n | 80 n |

1 Average runoff condition, and $I_a = 0.2S$
2 Crop re idue cover applie nonly if re idue i on at lea t % of the nurface throughout the year. n
3 Hydraulic condition i ba ed on combination factor that affect infiltration and runoff, including (a) den ity and canopy of vegetative area , n (b) amount of year-round cover, (c) amount of gra nor clo e- needed legume , (d) percent of re idue cover on the land nurface (good ≥ 20%), n and (e) degree of urface roughne n n

Poor: Factor impair infiltration and tend to increa e runoff. n

Good: Factor encourage average and better than average infiltration and tend to decrea e runoff. n

**Table - c** R noff c rve n mbers for other agric lt ral lands [1]

| Cover description: Cover type | Hydrologic condition | Curve numbers for hydrologic soil group: A | B | C | D |
|---|---|---|---|---|---|
| Past re, grassland, or range—contin o s forage for grazing. [2] | Poor | 68 7 | 9 | 86 | 89 |
| | Fair | 49 | 69 7 | 9 | 84 |
| | Good | 39 | 61 7 | 4 | 80 |
| Meadow—contin o s grass, protected from grazing and generally mowed for hay. | — | 30 | 58 7 | 1 7 | 8 |
| Br sh—br sh-weed-grass mixt re with br sh the major element. [3] | Poor | 48 | 6 8 | | 3 |
| | Fair | 35 | 56 7 | 0 7 | |
| | Good | 30 [4] | 48 | 65 7 | 3 |
| Woods—grass combination orchard or tree farm). [5] | Poor | 5 | 3 8 | 8 | 6 |
| | Fair | 43 | 65 7 | 6 | 8 |
| | Good | 2 5 3 | 8 7 | | 9 |
| Woods. [6] | Poor | 45 | 66 7 8 | | 3 |
| | Fair | 36 | 60 7 | 3 7 | 9 |
| | Good | 30 [4] | 55 7 | 0 7 | |
| Farmsteads—b ildings, lanes, driveways, and s rro nding lots. | — | 59 7 | 4 8 | 8 | 6 |

1 Average r noff condition, and $I_a = 0.$ S.
*Poor:* <50%) gro nd cover or heavily grazed with no m lch.
*Fair:* 50 to 5% gro nd cover and not heavily grazed.
*Good:* > 5% gro nd cover and lightly or only occasionally grazed.

3 *Poor:* <50% gro nd cover.
*Fair:* 50 to 5% gro nd cover.
*Good:* > 5% gro nd cover.

4 Act al c rve n mber is less than 30; se CN = 30 for r noff comp tations.

5 CN's shown were comp ted for areas with 50% woods and 50% grass past re) cover. Other combinations of conditions may be comp ted from the CN's for woods and past re.

6 *Poor:* Forest litter, small trees, and br sh are destroyed by heavy grazing or reg lar b rning.
*Fair:* Woods are grazed b t not b rned, and some forest litter covers the soil.
*Good:* Woods are protected from grazing, and litter and br sh adeq ately cover the soil.

Table 2-2d R n unoff curve number for arid and nemiarid rangeland n/[1]

| Cover de cription: Cover type n | Hydrologic n condition[2] | Curve number for hydrologic noil group: A[3] | B n | C n | D |
|---|---|---|---|---|---|
| Herbaceou —mixture of gra n weed , and n low-growing bru h, with bru h the n minor element. n | Poor n | | 80 n | 87 n | 93 n |
| | Fair n | | 71 n | 81 n | 89 n |
| | Good n | | 62 n | 74 n | 8 n |
| Oak-a pen—mountain bru h mixture of oak bru h, n a pen, mountain mahogany, bitter bru h, maple, n and other bru h. n | Poor n | | 66 n | 74 n | 79 n |
| | Fair n | | 48 5 n | 7 n | 63 n |
| | Good n | | 30 n | 41 n | 48 n |
| Pinyon-juniper—pinyon, juniper, or both; n gra nunder tory. n | Poor n | 8 n | 7 n 8 | | 9 n |
| | Fair 5 n | | 8 n | 73 n | 80 n |
| | Good n | | 41 n | 61 n | 71 n |
| Sagebru h with gra nunder tory. n | Poor n | | 67 n | 80 n | 8 n |
| | Fair 5 n | | 1 | 63 n | 70 n |
| | Good n | 4 | 3 n | 7 5 n | |
| De ert hrub—major plant include naltbu h, n grea ewood, creo otebu h, blackbru h, bur age, n palo verde, me quite, and cactu . n | Poor n | 63 n | 77 n5 8 | 8 n | 8 n |
| | Fair 5 n 7 | | 2 n | 81 n | 86 n |
| | Good n | 49 n | 68 n | 79 n | 84 n |

[1] n Average runoff condition, and $I_a$, = 0.2S. For range in humid region , u e table 2-2c. n
[2] n Poor: <30% ground cover (litter, gra n and bru h over tory). n
Fair: n30 to 70% ground cover. n
Good: > 70% ground cover. n
[3] n Curve number for group A have been developed only for de ert hrub. n

**APPENDIX F**
Acorn Environmental
Grading & Hydrology Report
Pre-Development Hydrographs

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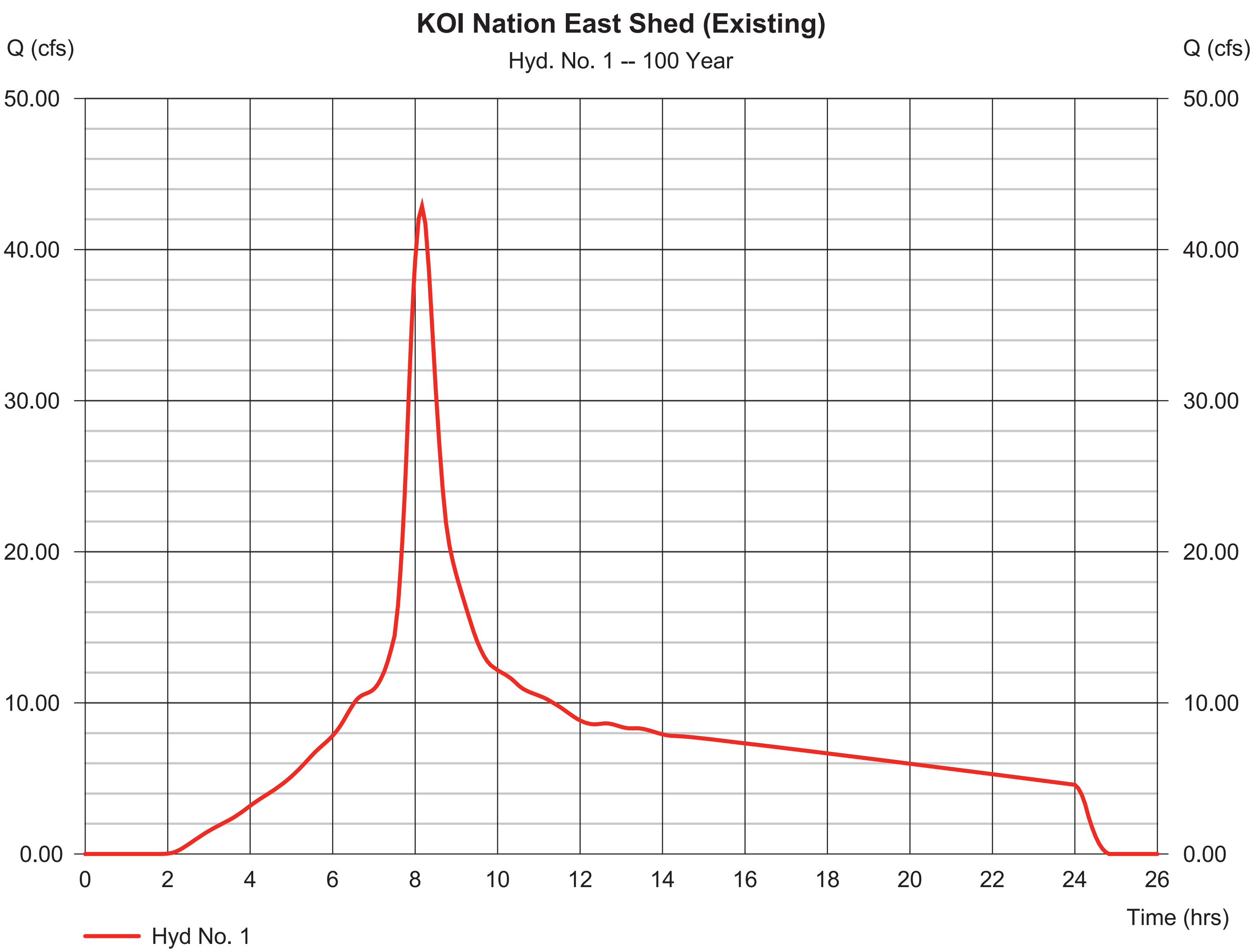
# Hydrograph Report



## Hyd. No. 1

KOI Nation East Shed (Existing)

| | | | |
|---|---|---|---|
| Hydrograph type | = SCS Runoff | Peak discharge | = 42.87 cfs |
| Storm frequency | = 100 yrs | Time to peak | = 8.17 hrs |
| Time interval | = 5 min | Hyd. volume | = 684,501 cuft |
| Drainage area | = 29.660 ac | Curve number | = 85 |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = User | Time of conc. (Tc) | = 30.00 min |
| Total precip. | = 7.95 in | Distribution | = Type IA |
| Storm duration | = 24 hrs | Shape factor | = 484 |



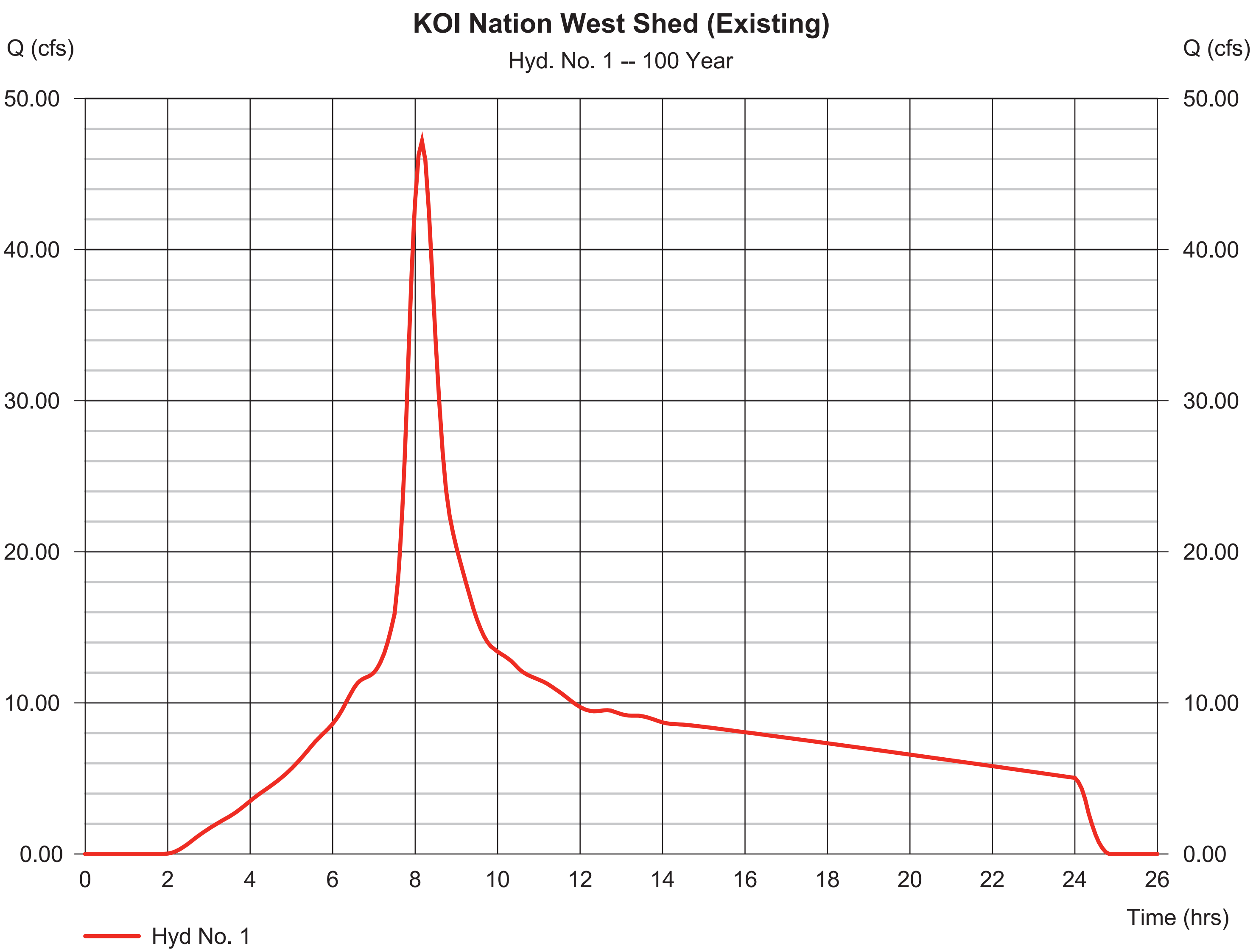
# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022 — Wednesday, 06 / 15 / 2022

## Hyd. No. 1

KOI Nation West Shed (Existing)

| | | | |
|---|---|---|---|
| Hydrograph type | = SCS Runoff | Peak discharge | = 47.18 cfs |
| Storm frequency | = 100 yrs | Time to peak | = 8.17 hrs |
| Time interval | = 5 min | Hyd. volume | = 753,274 cuft |
| Drainage area | = 32.640 ac | Curve number | = 85 |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = User | Time of conc. (Tc) | = 30.00 min |
| Total precip. | = 7.95 in | Distribution | = Type IA |
| Storm duration | = 24 hrs | Shape factor | = 484 |



**APPENDIX G**

Acorn Environmental

Grading & Hydrology Report

Post-Development Hydrology Map

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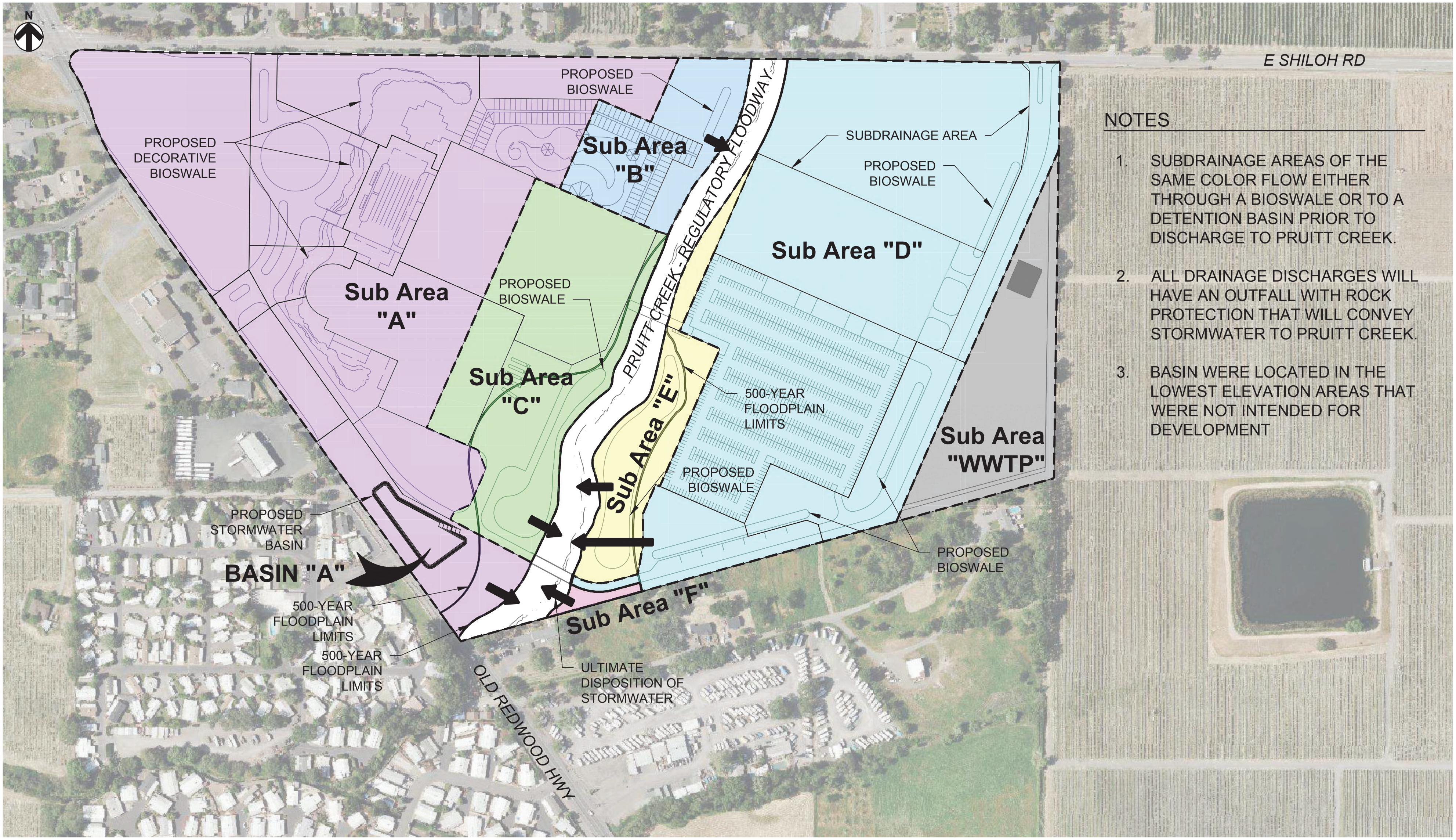


NOTES

1. SUBDRAINAGE AREAS OF THE SAME COLOR FLOW EITHER THROUGH A BIOSWALE OR TO A DETENTION BASIN PRIOR TO DISCHARGE TO PRUITT CREEK.
2. ALL DRAINAGE DISCHARGES WILL HAVE AN OUTFALL WITH ROCK PROTECTION THAT WILL CONVEY STORMWATER TO PRUITT CREEK.
3. BASIN WERE LOCATED IN THE LOWEST ELEVATION AREAS THAT WERE NOT INTENDED FOR DEVELOPMENT

HydroScience

APPENDIX G
Acorn Environmental
Koi Resort and Casino Site Grading and Drainage Plans
Post-Development Hydrology Map

**APPENDIX H**
Acorn Environmental
Grading & Hydrology Report
Post-Development Hydrographs

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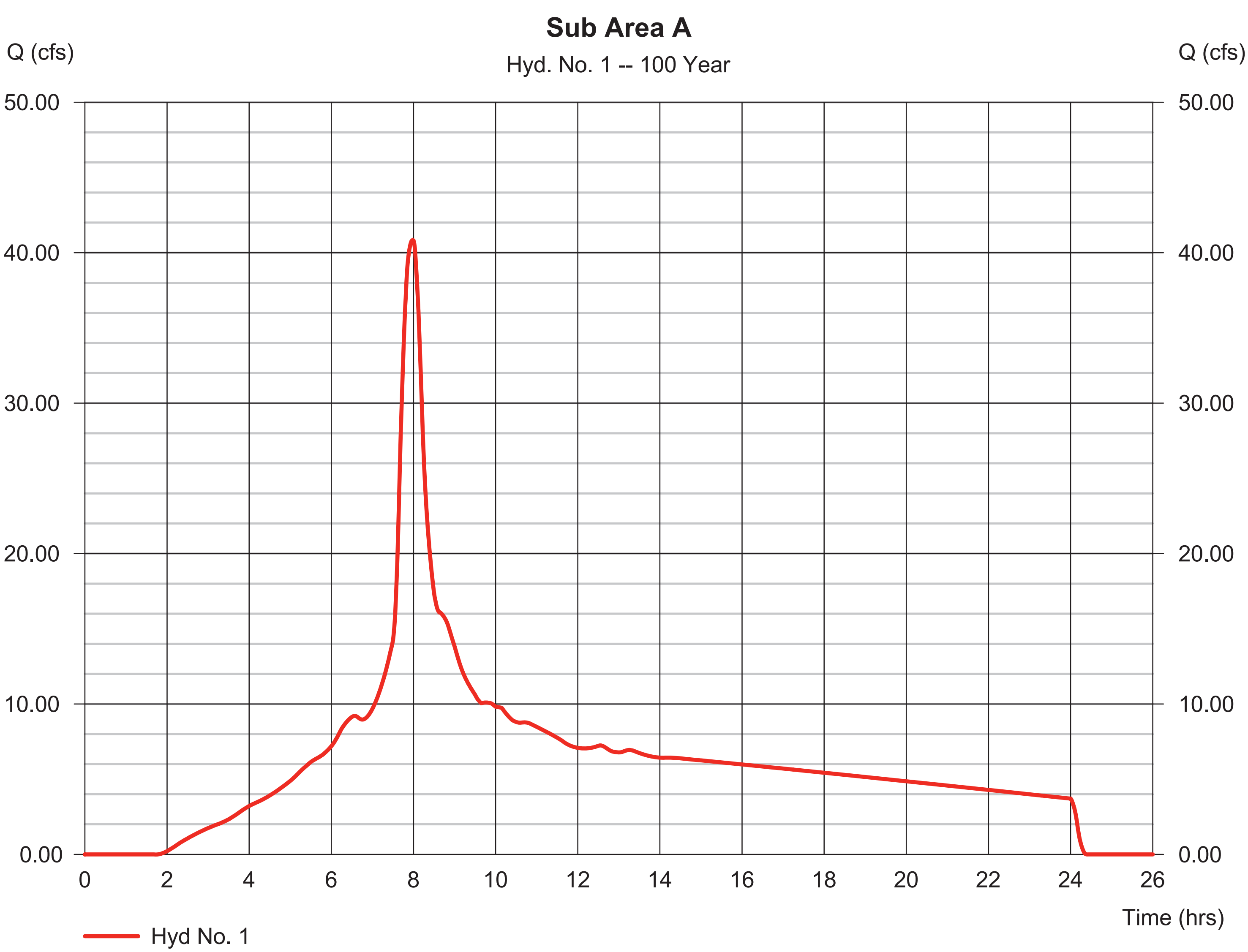
# Hydrograph Report



## Hyd. No. 1

Sub Area A

| | | | |
|---|---|---|---|
| Hydrograph type | = SCS Runoff | Peak discharge | = 40.84 cfs |
| Storm frequency | = 100 yrs | Time to peak | = 7.98 hrs |
| Time interval | = 1 min | Hyd. volume | = 571,089 cuft |
| Drainage area | = 25.040 ac | Curve number | = 86 |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = User | Time of conc. (Tc) | = 15.00 min |
| Total precip. | = 7.95 in | Distribution | = Type IA |
| Storm duration | = 24 hrs | Shape factor | = 484 |



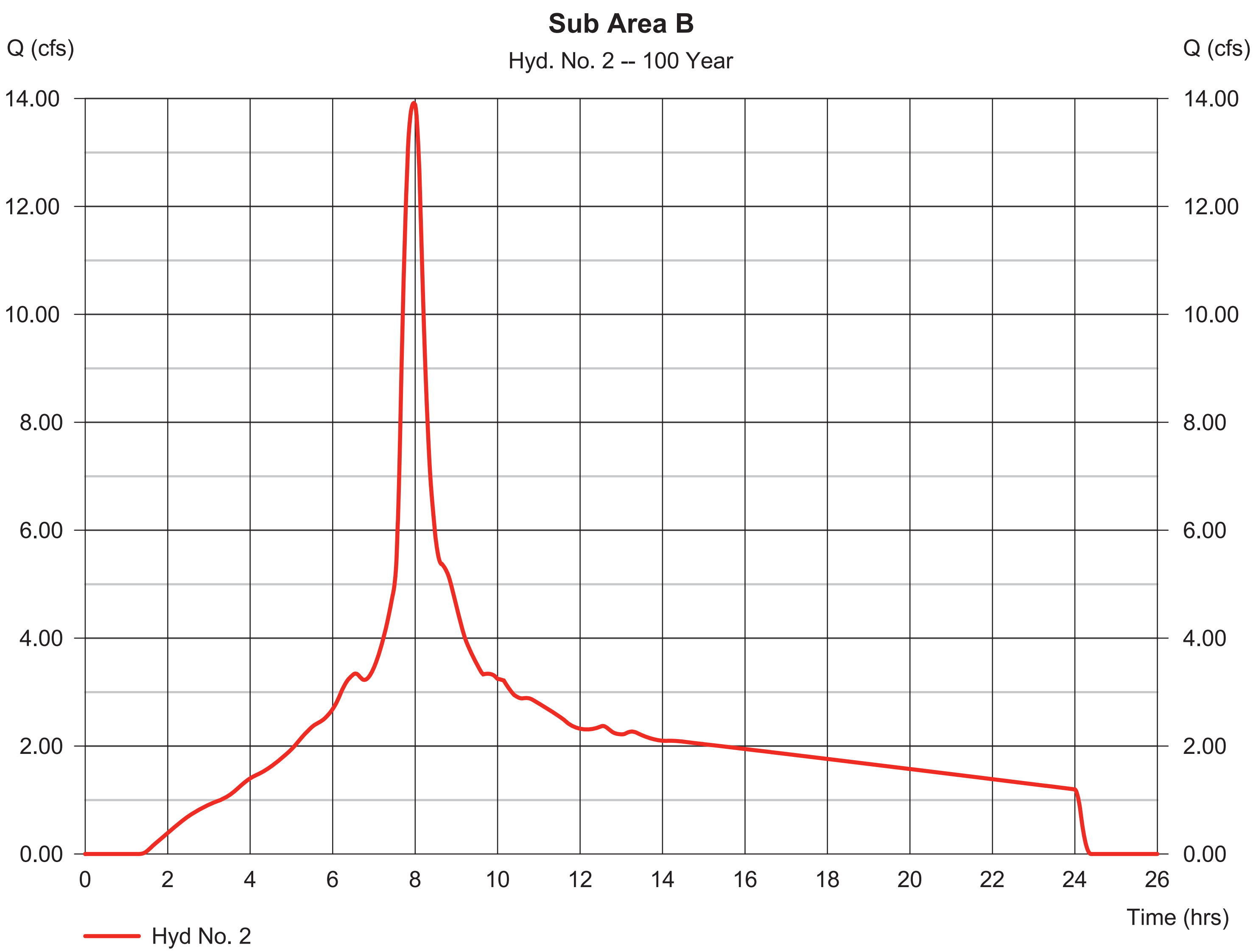
# Hydrograph Report



## Hyd. No. 2

Sub Area B

| | | | |
|---|---|---|---|
| Hydrograph type | = SCS Runoff | Peak discharge | = 13.91 cfs |
| Storm frequency | = 100 yrs | Time to peak | = 7.97 hrs |
| Time interval | = 1 min | Hyd. volume | = 195,223 cuft |
| Drainage area | = 7.960 ac | Curve number | = 90 |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = User | Time of conc. (Tc) | = 15.00 min |
| Total precip. | = 7.95 in | Distribution | = Type IA |
| Storm duration | = 24 hrs | Shape factor | = 484 |



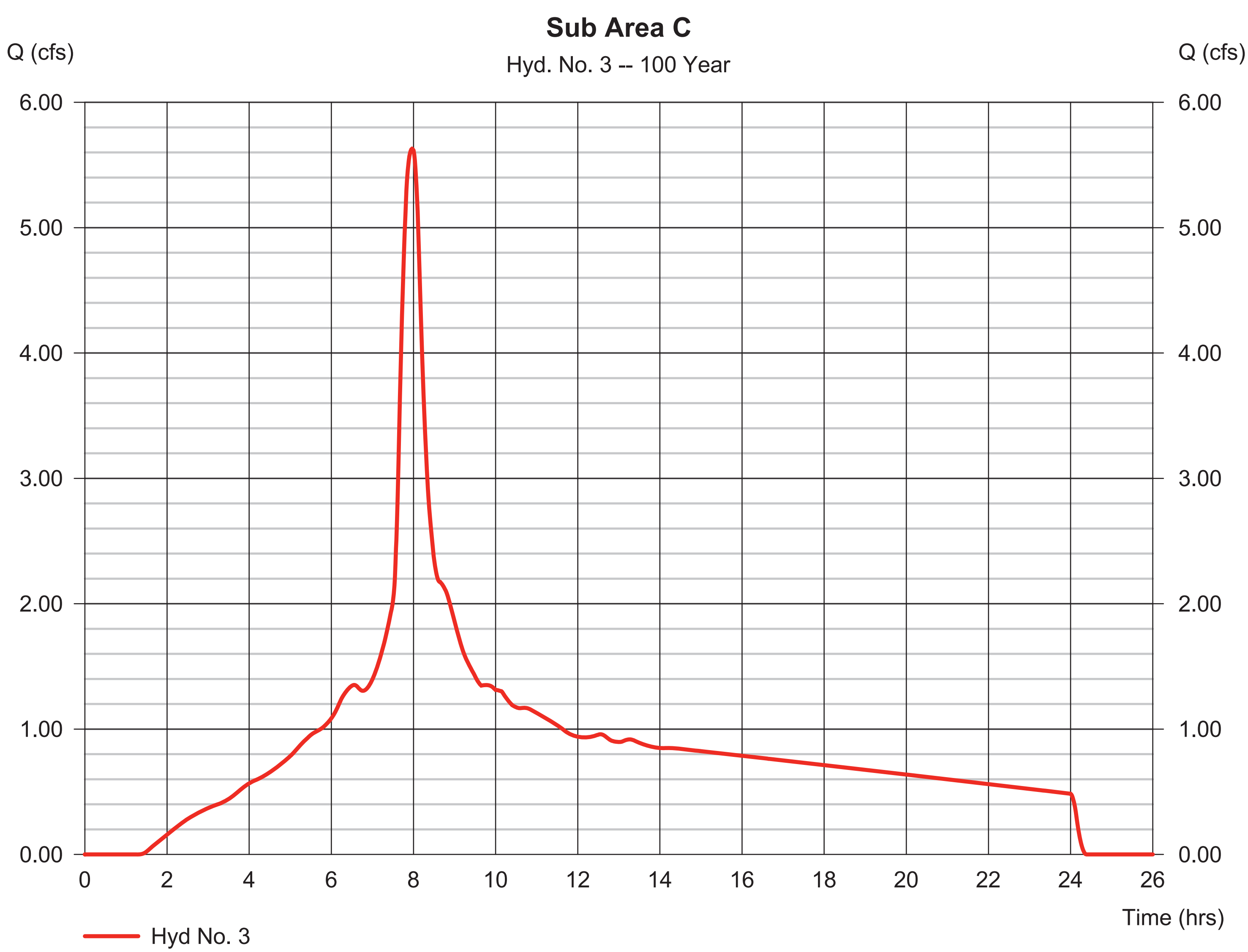
# Hydrograph Report



## Hyd. No. 3

Sub Area C

| | | | |
|---|---|---|---|
| Hydrograph type | = SCS Runoff | Peak discharge | = 5.629 cfs |
| Storm frequency | = 100 yrs | Time to peak | = 7.97 hrs |
| Time interval | = 1 min | Hyd. volume | = 78,972 cuft |
| Drainage area | = 3.220 ac | Curve number | = 90 |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = User | Time of conc. (Tc) | = 15.00 min |
| Total precip. | = 7.95 in | Distribution | = Type IA |
| Storm duration | = 24 hrs | Shape factor | = 484 |



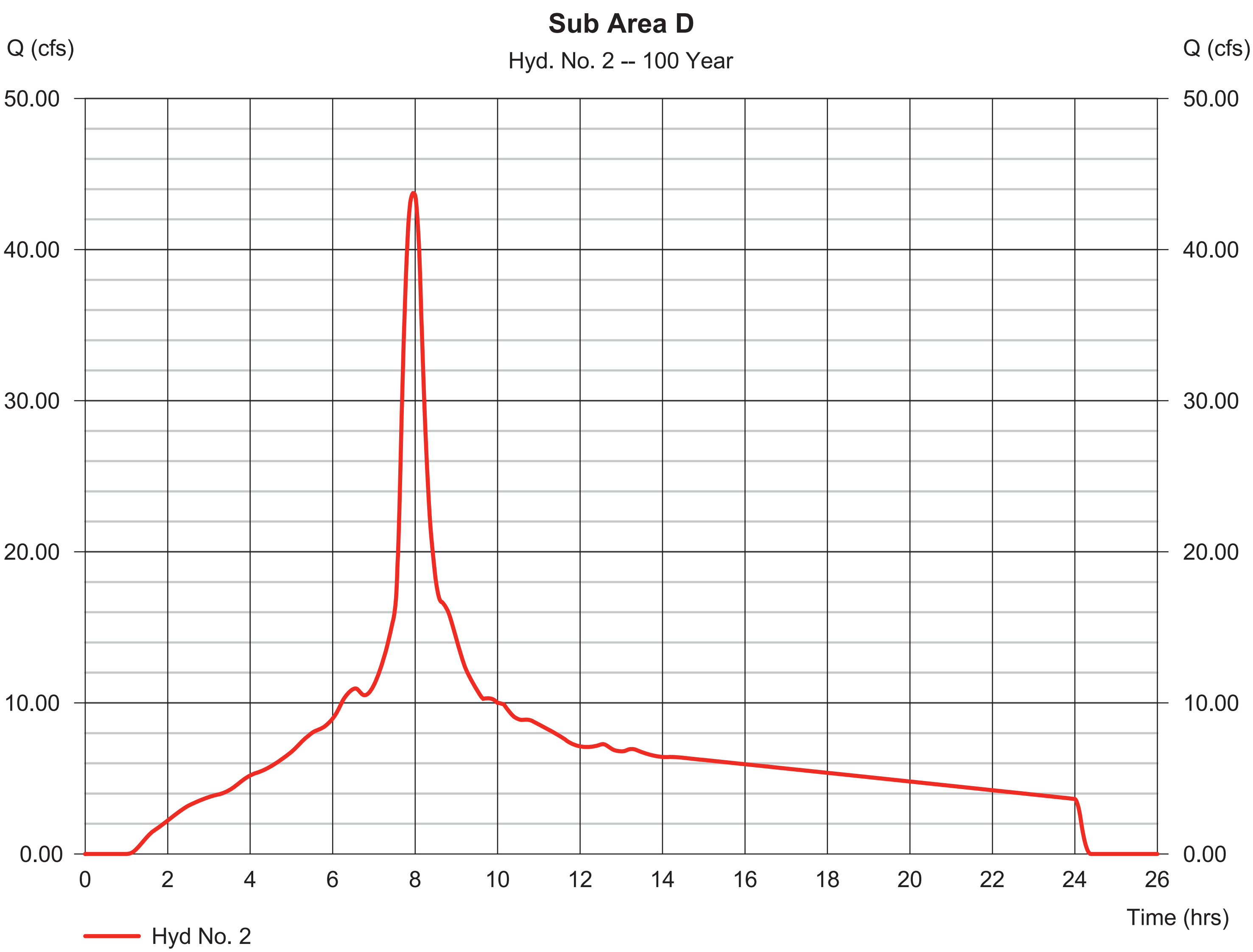
# Hydrograph Report



## Hyd. No. 2

Sub Area D

| | | | |
|---|---|---|---|
| Hydrograph type | = SCS Runoff | Peak discharge | = 43.74 cfs |
| Storm frequency | = 100 yrs | Time to peak | = 7.97 hrs |
| Time interval | = 1 min | Hyd. volume | = 620,202 cuft |
| Drainage area | = 24.020 ac | Curve number | = 93 |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = User | Time of conc. (Tc) | = 15.00 min |
| Total precip. | = 7.95 in | Distribution | = Type IA |
| Storm duration | = 24 hrs | Shape factor | = 484 |



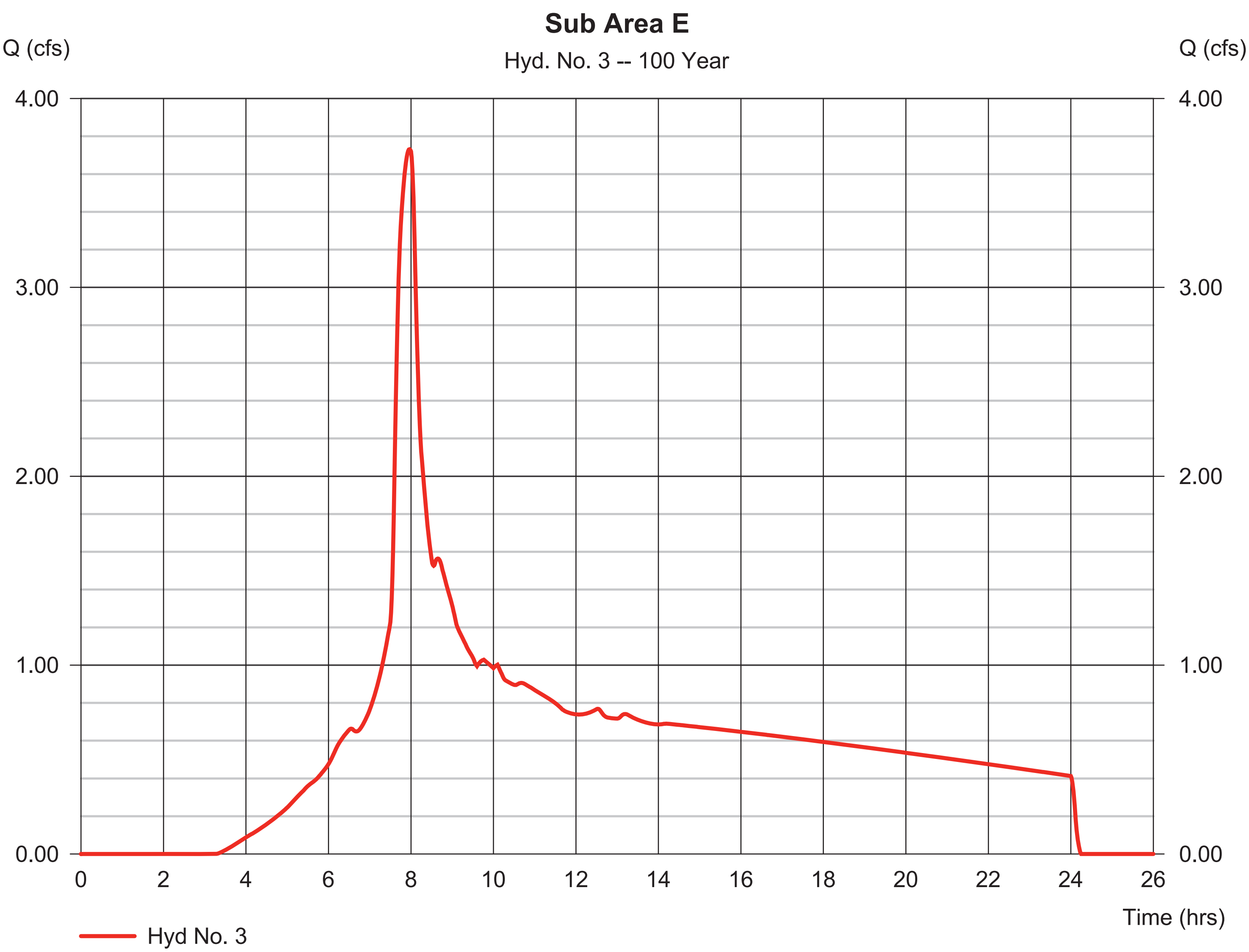
# Hydrograph Report



## Hyd. No. 3

Sub Area E

| | | | |
|---|---|---|---|
| Hydrograph type | = SCS Runoff | Peak discharge | = 3.731 cfs |
| Storm frequency | = 100 yrs | Time to peak | = 7.97 hrs |
| Time interval | = 1 min | Hyd. volume | = 53,863 cuft |
| Drainage area | = 3.040 ac | Curve number | = 74 |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = User | Time of conc. (Tc) | = 10.00 min |
| Total precip. | = 7.95 in | Distribution | = Type IA |
| Storm duration | = 24 hrs | Shape factor | = 484 |



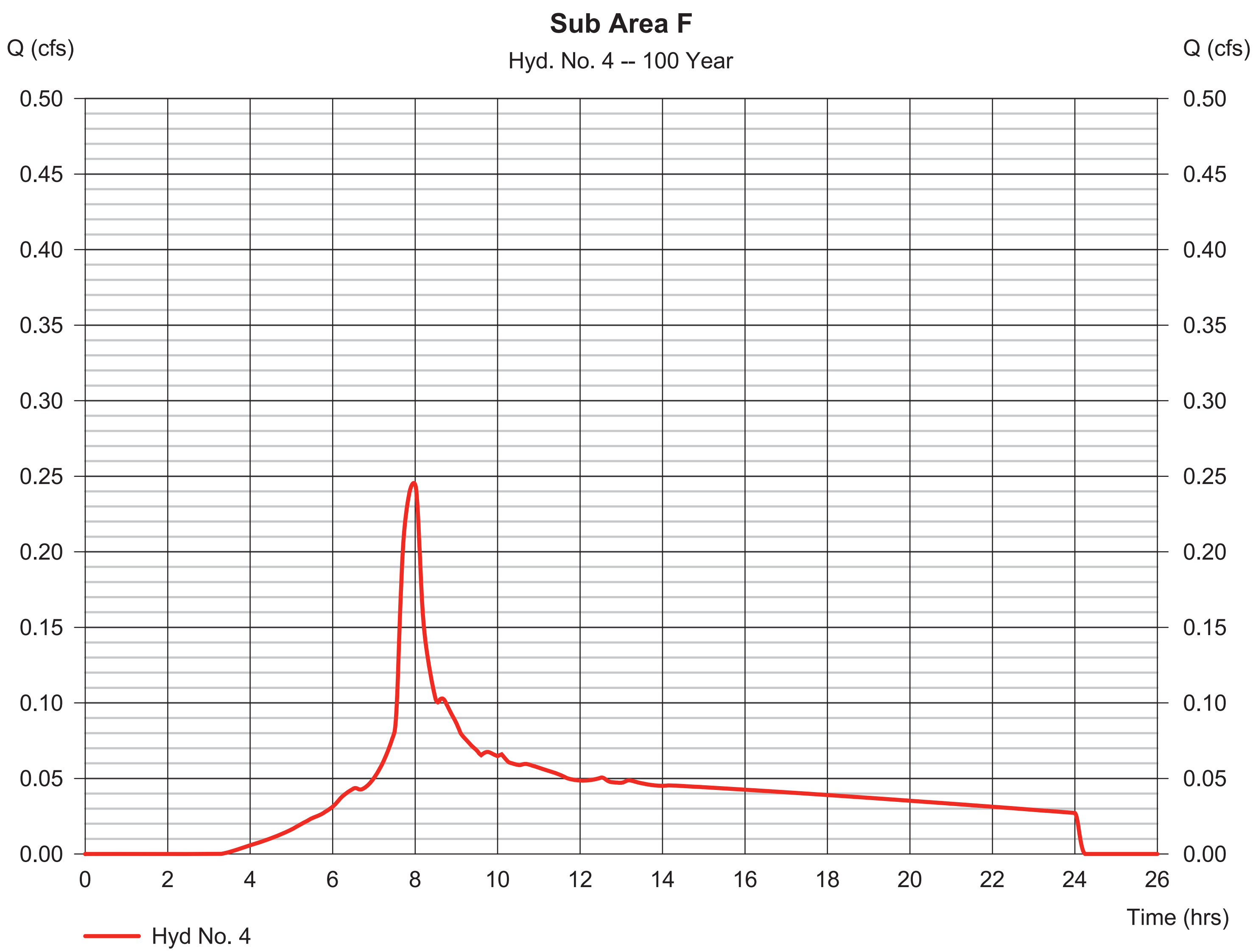
# Hydrograph Report



## Hyd. No. 4

Sub Area F

| | | | |
|---|---|---|---|
| Hydrograph type | = SCS Runoff | Peak discharge | = 0.245 cfs |
| Storm frequency | = 100 yrs | Time to peak | = 7.97 hrs |
| Time interval | = 1 min | Hyd. volume | = 3,544 cuft |
| Drainage area | = 0.200 ac | Curve number | = 74 |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = User | Time of conc. (Tc) | = 10.00 min |
| Total precip. | = 7.95 in | Distribution | = Type IA |
| Storm duration | = 24 hrs | Shape factor | = 484 |



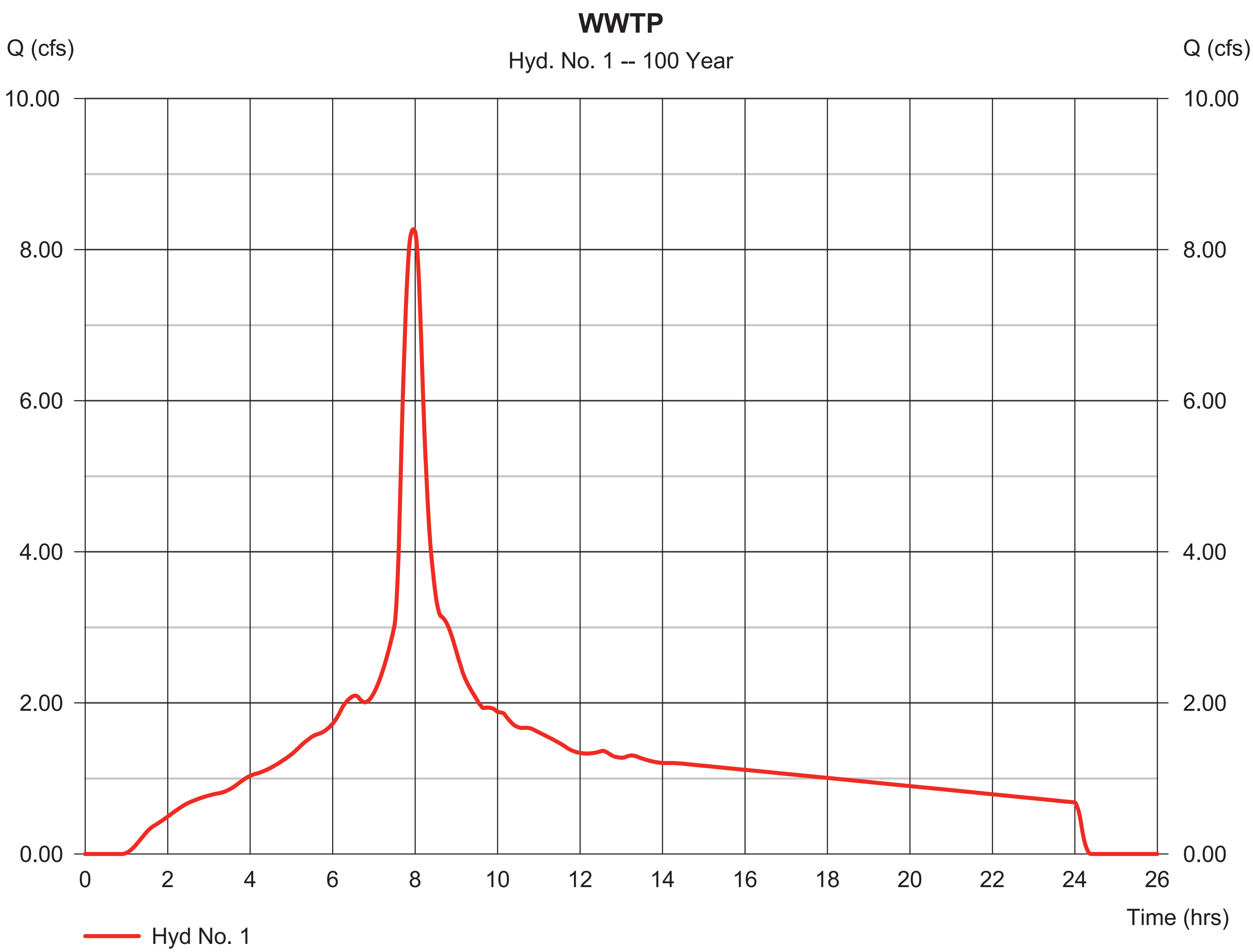
# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022 Thursday, 06 / 16 / 2022

## Hyd. No. 1

WWTP

| | | | |
|---|---|---|---|
| Hydrograph type | = SCS Runoff | Peak discharge | = 8.268 cfs |
| Storm frequency | = 100 yrs | Time to peak | = 7.95 hrs |
| Time interval | = 1 min | Hyd. volume | = 117,875 cuft |
| Drainage area | = 4.490 ac | Curve number | = 94 |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = User | Time of conc. (Tc) | = 15.00 min |
| Total precip. | = 7.95 in | Distribution | = Type IA |
| Storm duration | = 24 hrs | Shape factor | = 484 |



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**APPENDIX I**

Acorn Environmental
Grading & Hydrology Report
Peak Flow Rate Mitigation Hydrograph

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# Hydrology Report

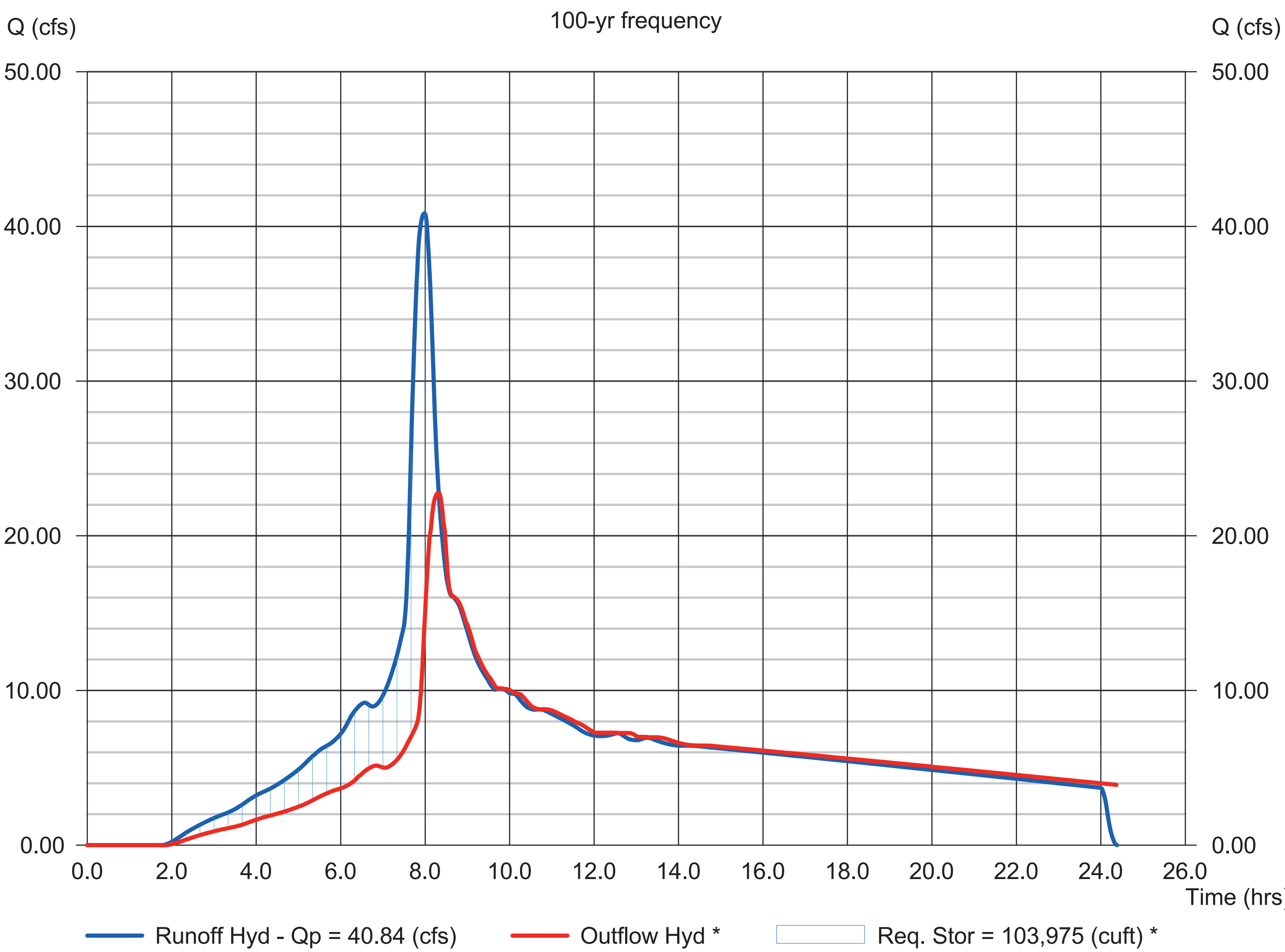
Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Jun 16 2022

## Proposed West - Peak Flow Rate Mitigation

| | | | |
|---|---|---|---|
| Hydrograph type | = SCS | Peak discharge (cfs) | = 40.84 |
| Storm frequency (yrs) | = 100 | Time interval (min) | = 1 |
| Drainage area (ac) | = 25.040 | Curve number (CN) | = 86 |
| Basin Slope (%) | = n/a | Hydraulic length (ft) | = n/a |
| Tc method | = User | Time of conc. (min) | = 15 |
| Total precip. (in) | = 7.95 | Storm Distribution | = Type IA |
| Storm duration (hrs) | = 24 | Shape factor | = 484 |

Hydrograph Volume = 571,089 (cuft); 13.110 (acft)

### Runoff Hydrograph




* *Estimated*

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# APPENDIX J
Acorn Environmental
Grading & Hydrology Report
Detention Basin and Outlet Pipe Sizing

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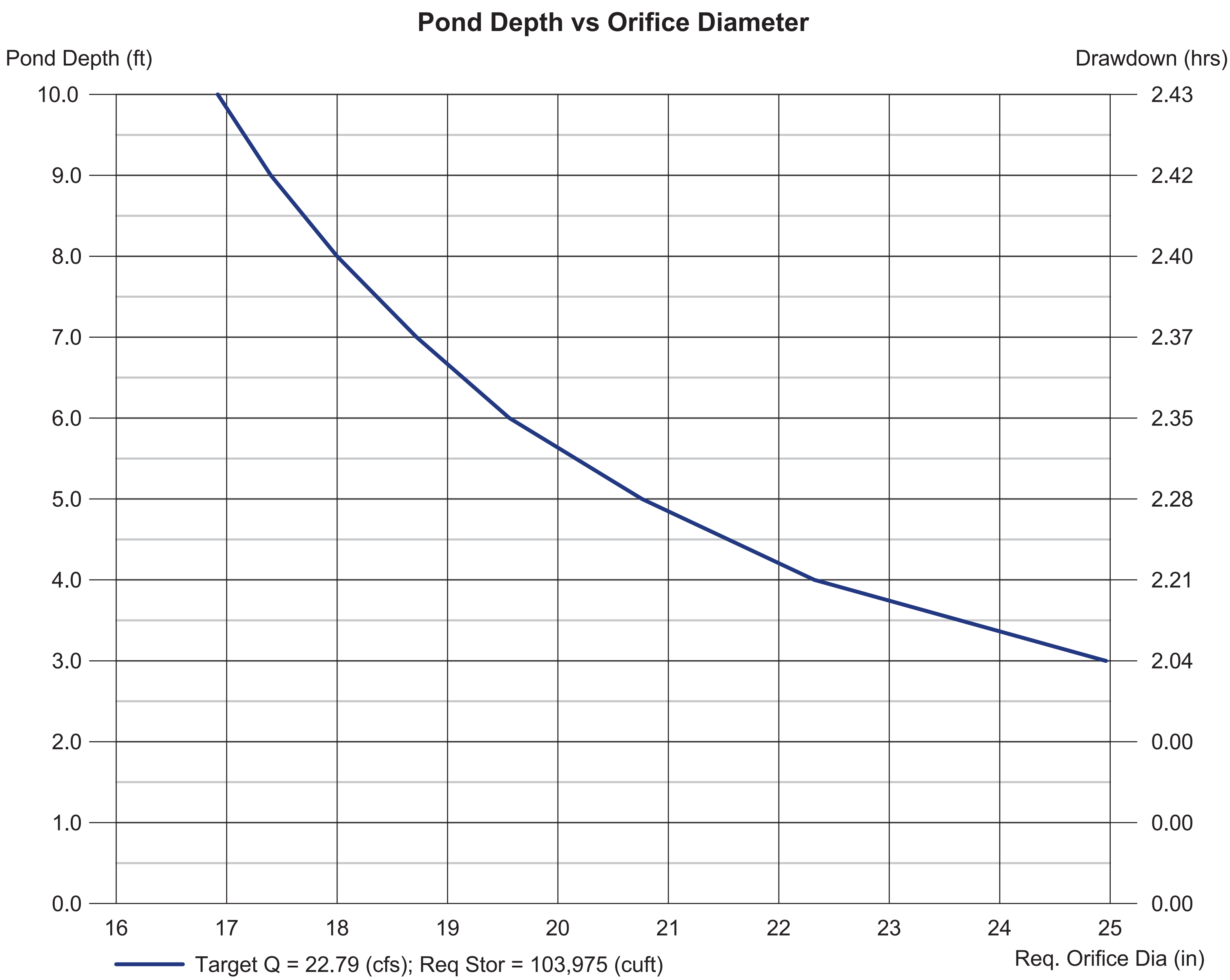
# Hydrology Report



## Proposed West - Peak Flow Rate Mitigation

| | | | |
|---|---|---|---|
| Hydrograph type | = SCS | Peak discharge (cfs) | = 40.84 |
| Storm frequency (yrs) | = 100 | Time interval (min) | = 1 |
| Drainage area (ac) | = 25.040 | Curve number (CN) | = 86 |
| Basin Slope (%) | = n/a | Hydraulic length (ft) | = n/a |
| Tc method | = User | Time of conc. (min) | = 15 |
| Total precip. (in) | = 7.95 | Storm Distribution | = Type IA |
| Storm duration (hrs) | = 24 | Shape factor | = 484 |

Hydrograph Volume = 571,089 (cuft); 13.110 (acft)



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February 2023

HydroScience

Strategic Water Solutions

# Appendix D-4

# Supplemental Groundwater Resources Impact Assessment

FORMATION ENVIRONMENTAL

# TECHNICAL MEMORANDUM

# SUPPLEMENTAL GROUNDWATER RESOURCES IMPACT ASSESSMENT, SHILOH CASINO AND RESORT, WINDSOR, CALIFORNIA


PREPARED FOR: Acorn Environmental

PREPARED BY: Mike Tietze, PG, CHG, CEG, Formation Environmental, LLC
Nat Beal, PG, Formation Environmental, LLC
Christina Johnson, Formation Environmental, LLC
Will Gnesda, Formation Environmental, LLC


DATE: April 17, 2024

This technical memorandum presents the methods and results of a supplemental Groundwater Resources Impact Assessment (GRIA) to evaluate potential groundwater-related impacts associated with the Shiloh Resort and Casino Project (Project), proposed by the Koi Nation (the Tribe) of Northern California.

In September 2023, an Environmental Assessment (EA) was prepared for the Project on behalf of the BIA to comply with the requirements of the National Environmental Policy Act (NEPA) (BIA 2023). The U.S. Environmental Protection Agency (EPA), the Town of Windsor, the Santa Rosa Plain Groundwater Sustainability Agency (SRPGSA), Sonoma County, Federated Indians of Graton Rancheria, and private individuals provided comments on the EA in November 2023. This supplemental GRIA has been prepared to further evaluate the potential for groundwater resource impacts associated with the proposed water demand for the Project and will be used as a basis to address concerns related to potential groundwater resource impacts identified in the comments on the EA.

## 1 PROJECT OVERVIEW AND SETTING

The Project is proposed to be constructed on a 68.6-acre property (the Site) located in unincorporated Sonoma County southeast of the Town of Winsor, California (Figure 1). The Site is currently developed as a vineyard with a single-family residence that is currently used as an office. The Tribe has submitted an application to the U.S. Bureau of Indian Affairs (BIA) to take the land into federal trust status for the benefit of the Tribe. Following acquisition into federal trust, the Tribe proposes to develop a gaming resort facility that includes a casino, hotel, ballroom/meeting space, event center, spa, and associated parking and infrastructure on the property.

Based on a review of historical aerial photographs available on Google Earth, it appears the residence and vineyard were developed in 2003 and 2004. Prior to 2003, it appears that a small orchard was present in the northwest portion of the Site and the remaining area of the Site was undeveloped grassland and trees.

Pruitt Creek, an ephemeral stream that runs northeast to southwest from the Mayacamas Mountains to the Site, generally bisects the property. Stream discharge data are not available for Pruitt Creek; thus, the frequency, duration, and volume of discharge are uncertain. Additional details on Pruitt Creek are provided in Section 4.2.

The Project Site is bordered by Shiloh Road, Esposti Park, and residential properties to the north, vineyards to the east, residential properties to the south and Old Redwood Highway to the west. Residential and commercial properties, a mobile home park, and Shiloh Neighborhood Church are west of Old Redwood Highway. The surrounding area is generally developed for residential, agricultural, and commercial use.

The water demands for the Project Site have been refined from those reported by HydroScience (2023) to better support the impact analysis described herein and are described in Section 3. There are four existing groundwater supply wells located on the Project Site, with pumping capacities ranging from 120 to over 600 gallons per minute (gpm) (HydroScience 2023). In the surrounding area, the Town of Windsor provides water service to the area north of the western portion of the Site. The area north of the eastern portion of the Site, east and south of the Site is served by private domestic and irrigation wells. The area west of the Site is served by several small community water systems.

# 2 PROJECT DESCRIPTION

The EA evaluated the Proposed Project (Alternative A) and a reasonable range of alternatives including a Reduced Intensity Alternative (Alternative B), a Non-Gaming Alternative (Alternative C) and a No Action Alternative (Alternative D). The focus of this Supplemental GRIA is on evaluating the potential impacts associated with implementation of Alternative A. Groundwater-related impacts associated with Alternatives B and C will be less. Additional details regarding the project alternatives are provided in the EA (BIA 2023). This section describes Alternative A (the Proposed Project), which is further evaluated in the remaining sections of this Supplemental GRIA.

The Proposed Project consists of construction and operation of resort hotel and casino with associated parking and infrastructure southeast of the intersection of Shiloh Road and Old Redwood Highway. The resort facility would be located in the western portion of the Project Site and would include a three-story casino, a five-story, 400-room hotel with a spa and pool area, ballrooms and meeting space, and ancillary parking areas, access roads, landscaped areas and a small vineyard.

The casino and hotel would comprise approximately 538,137 square feet and 268,930 square feet of building space, respectively. Parking would be provided on the ground floor of the casino and in a four-story parking garage and paved surface lot on the east side of Pruitt Creek. An enclosed, clear-span pedestrian bridge would provide access to the hotel and casino from the parking structure and would be constructed without disturbing the bed and banks of Pruitt Creek. Under Alternative A, approximately 46 acres of existing vineyard would be removed to construct Project facilities. The remaining approximately 14 acres of vineyard would be retained.

The potable water demand for the Project would be met by pumping groundwater from up to two new on-site supply wells that would be screened from approximately 400 to 600 feet below ground surface (bgs) in the Santa Rosa Plain groundwater subbasin (HydroScience 2023). The Project non-potable water demand would be met by using recycled tertiary treated water produced by the on-site wastewater treatment facility. Recycled water would be used for toilet and urinal flushing, on-site landscape irrigation, on-site vineyard irrigation and cooling tower makeup water. Efforts are reportedly in progress to develop agreements to provide additional recycled water to vineyards in the Site vicinity.

# 3 PROJECT WATER BALANCE

The total Project water demand is estimated at 315 acre-feet/year (AFY) and includes both potable and non-potable uses (HydroScience 2023). The potable water demand (supplied by a new well or wells) would be approximately 191 AFY (170,000 gallons per day [GPD]) and the total non-potable water demand (supplied by recycled water) would be 124 AFY (108,000 GPD).

Table 1 describes the well completion details and estimated yields for the existing on-Site wells. Existing groundwater uses at the Site result in a groundwater demand of approximately 34 AFY and include the following:

- Vineyard irrigation, estimated at 0.5 acre-feet per acre based on water duty estimates used by Sonoma County and the Town of Windsor, and consistent with the lower bound of mapped irrigation rates estimated by USGS (Woolfenden and Nishikawa 2014), applied to 59.3 acres during the irrigation season (generally June to October) for a total of 29.7 acre-feet.

- Frost-protection pumping, estimated at 4 acre-feet, based on information provided by the Ranch Manager, Patin Vineyard Management, and applied to the vineyard as needed in March and/or April.

- Domestic well pumping is estimated at 0.5 acre-feet per year based a study of rural domestic water demand by the Water Research Foundation (2016).

The above uses would be discontinued if the Project is constructed, partially offsetting the Project groundwater demand.

As described in the EA, impacts from the Project on groundwater recharge due to land use changes are expected to be less than significant (BIA 2023).[1] This is because the Project will include construction of stormwater retention/detention facilities that maintain the stormwater discharge from impervious surfaces constructed for the Project at rates that are no greater than current levels (HydroScience 2023). As discussed in Section 4.2, the existing vineyard at the Site extracts a significant amount of soil moisture storage derived from local precipitation (approximately 20 inches/year). Because the amount of precipitation and runoff at the Site will remain relatively constant and the amount of consumptive use by

[1] For perspective, soils on the Project Site are classified as Hydrologic Group C, with relatively low permeabilities and slow infiltration rates; therefore, the Project Site is not a significant source of natural recharge (BIA 2023).

vegetation will decrease once the vineyard is removed, there will be an increase in the amount of soil moisture available to move downward through the soil profile and recharge groundwater. As such, it is likely the Project will actually result in an increase in groundwater recharge.

Annual water demands for the existing land uses and the Proposed Project are summarized in Table 2. Existing water demands are described above. Project water demands are taken from Appendix C of the EA (HydroScience 2023).

**TABLE 2: EXISTING AND PROPOSED SITE WATER DEMAND AND SUPPLIES**

| Alternative | Water Uses and Supply Sources | Vineyard Acreage | Estimated Average Annual Supply (AFY) | Estimated Average Annual Demand (gpd) |
|---|---|---|---|---|
| Existing Land Uses | Vineyard Irrigation, Frost Protection, Domestic Well Use (Groundwater) [1] | 59.3 | 34 | 30,500 |
| | | | | |
| Proposed Project (Alternative A) | Potable Water (Groundwater) | 13.7 | 191 | 170,000 |
| | Non-Potable Water (Recycled Water) | | 124 | 108,000 |
| **Total Project Water Demand** | | | **315** | **278,000** |

Notes:
1. Irrigation and frost protection water demands are seasonally variable.

# 4 PROJECT SETTING

## 4.1 LOCAL WATER SUPPLIES

The Town of Windsor provides water service to the area north of the western portion of the Site. The area north of the eastern portion of the Site, east and south of the Site is served by private domestic and irrigation wells. The area west of the Site is served by several small community water systems. The Town of Windsor's primary potable water supply sources include the Russian River Well Field and Sonoma Water Agency's transmission system via the Santa Rosa Aqueduct (Woodard & Curran 2021). The Russian River Well Field, operated by Sonoma Water Agency since 1984, consists of five production wells that capture Russian River underflow with capacities up to approximately 1,300 gpm. These wells are located outside of the Santa Rosa Plain subbasin boundaries, which is the groundwater basin that the Project is located within (refer to Section 4.4.1). Sonoma Water Agency sources its water from the Russian River and supplements the supply with groundwater pumped from wells within the Santa Rosa Plain Groundwater Subbasin. In addition, the Town of Windsor operates a non-potable irrigation well (the Esposti Irrigation Well) and maintains a standby potable water supply well (the Esposti Park Well), which are located across East Shiloh Road at Esposti Park, northwest of the Project Site (Figure 1). The available construction details for these wells are summarized in Table 1. Finally, Windsor has three additional inactive groundwater wells in the subbasin (Bluebird 1, Bluebird 2, and the Keiser Park Irrigation well). Additional small municipal, irrigation and domestic supply wells are located throughout the surrounding area as described in Section 4.4.3.

The Town of Windsor adopted a Water Master Plan update in 2011 proposing four phases of water system improvements through the year 2040 to address deficiencies and provide for planned future growth (RMC 2011). Included in the 2011 WMP were plans to rehabilitate or replace the Town's existing Esposti Park and Bluebird wells and use them as potable water sources for the Town's water supply system. The WMP proposed to inject water diverted from the Russian River in the winter and extract this water to meet dry season demands using these wells. A Program Environmental Impact Report (PEIR; Horizon 2011) was adopted together with the WMP on September 7, 2011.

In 2019, the Town adopted an additional update to its WMP (Woodard & Curran 2019). In that update, it was noted that since adoption of the 2011 WMP, *"… potable water demands have decreased, so the Town has not moved forward with MAR[2] exploration but has maintained the short-term well replacement projects and continues to investigate options for developing off-river municipal wells."* Thus, injection of Russian River water at the proposed well sites was no longer being considered. Instead, the town proposed moving forward with investigation of the North Windsor well to determine whether development of this supply would require arsenic treatment and considered either installing the North Windsor well or implementing arsenic treatment at the existing Esposti Park well by 2025. By 2030, both wells were proposed to be in service. The 2020 Urban Water Management Plan (UWMP) proposes the use of both the Esposti Park well and the North Windsor well to supplement the town's potable water supply during single-dry and multi-dry years at a rate of 350 AFY, each. It notes planned water quality testing for the North Windsor well to determine next steps for development (Woodard & Curran 2021).

The PEIR adopted for the Town of Windsor's 2011 WMP found that the groundwater level and aquifer sustainability effects from implementation of the proposed groundwater storage and recovery program could be addressed through operational balancing of groundwater injections and withdrawals, and recommended implementation of certain mitigation measures to ensure impacts on groundwater level fluctuations would be less than significant (Horizon 2011). Although the 2019 WMP changed the operational scheme for Esposti Park Well and the North Windsor Well to an extraction-only scheme, the potential drawdown and aquifer effects of operating the wells in this fashion do not appear to have been evaluated in any published studies or CEQA documents.

## 4.2 SURFACE HYDROLOGY

The Santa Rosa Plain watershed is divided into three drainage areas: Mark West Creek, Santa Rosa Creek, and Laguna de Santa Rosa, which are part of the middle Russian River watershed (USGS 2006; SRPBAP 2014). The Project is within the Mark West Creek subwatershed, which covers 86 square miles in the

[2] MAR refers to Managed Aquifer Recharge, or in this case the injection of Russian River Water during the wet season for later dry season recovery.

northern part of the Santa Rosa Plain watershed. The Project Site is located in the low-lying, relatively flat, area of the Mark West Creek subwatershed a short distance west of the Mayacamas Mountains.

Figure 2 shows hydrologic features in the vicinity of the Project Site. Mark West Creek, approximately 1 mile to the south, is the only perennial stream in the immediate vicinity of the Project. The Russian River is located more than 4 miles to the west. Numerous intermittent streams and ephemeral drainages are also mapped in the Site vicinity. These streams and drainages originate in the foothills of the Mayacamas Mountains to the east. In addition, a number of ponds, lakes and reservoirs are mapped in the area.

Pruitt Creek generally flows northeast to southwest from the Mayacamas Mountains across the Santa Rosa Plain to its confluence with Pool Creek approximately 1 mile west of the Project Site. The existing topography of the Project Site is relatively flat and generally slopes toward the creek, which bisects the Site from the northeast to the southwest (Figure 2). Pruitt Creek begins in the Mayacamas Mountains, where it and several unnamed tributaries are mapped as ephemeral. As described in the Aquatic Resources Delineation Report (Sequioa 2022), Pruitt Creek is considered intermittent on the valley floor because (1) pooled and flowing water in the channel appears to be a result of seasonal rains and not perennial hydrology; (2) significant ordinary high-water mark indicators indicate seasonal flow; and/or (3) background sources (National Wetlands Inventory, National Hydrography Dataset, United States Geological Survey [USGS] topographic maps) indicate seasonal flow. Information provided by Sonoma County suggests a short reach of Pruitt Creek between the Mayacamas Mountains and Faught Road may support perennial flow (Sonoma Water 2023). The available data suggest the creek may be connected to the shallow groundwater table in this area.

In the northeast portion of the Project Site and for a short distance upstream, Pruitt Creek is surrounded by an area of riparian mixed hardwoods that is likely sustained by a number of water sources, including soil moisture derived from seasonal precipitation, streamflow and shallow groundwater. Based on regional groundwater levels, it is unlikely this reach of the stream, when flowing, is groundwater connected. Within the Project Site, the wetted channel of Pruitt Creek is about 3 to 10 feet wide with an active floodplain width of approximately 10 to 30 feet or more (Sequoia 2022). Pruitt Creek enters the Project Site through a box culvert beneath Shiloh Road and leaves the Site as an open channel to the adjacent property before flowing through a box culvert beneath Old Redwood Highway.

Using information derived by the Parameter-Elevation and Regression of Independent Slopes Model, the 30-year average annual precipitation at the Site is approximately 34 inches (PRISM 2024). The average annual evapotranspiration (ET) for the Site from 2018 to 2023 was estimated using OpenET and found to be 26 inches (OpenET 2024). This ET value represents the consumptive demand of water by the vineyard at the Site. Given that the reported irrigation water duty for vineyards in this area is 6 inches, and irrigation occurs during the summer and fall when precipitation is minimal, we conclude that most of the vineyard water demand at the Site is met by soil water storage derived from precipitation. We note that in the absence of the on-Site vineyard some of the soil moisture that is currently being used by the vineyard would percolate downwards and recharge the groundwater table.

## 4.3 POTENTIAL GROUNDWATER-DEPENDENT ECOSYSTEMS

Reported potential groundwater dependent ecosystems (GDEs) and wetlands near the Project Site are shown in Figure 3. Potential GDEs were identified using the Natural Communities Commonly Associated with Groundwater dataset developed for the California Department of Water Resources (DWR) by The Nature Conservancy (TNC) in cooperation with the California Department of Fish and Wildlife (TNC 2024). Wetland areas were identified using the National Wetlands Inventory (U.S. Fish & Wildlife Service 2024).

During preparation of the EA (BIA 2023), four seasonal wetlands, covering an area of approximately 0.019 acres, were identified and delineated on the western edge of the Project Site between the perimeter fencing and the Old Redwood Highway. Topography and vegetation patterns indicate that these wetlands are hydrologically connected to the drainage ditch along Old Redwood Highway and an evaluation of the upland soils suggests the wetlands are at least partially influenced by agricultural irrigation. As explained in the EA (BIA 2023), these would likely revert to upland areas should irrigation cease, indicating they are unlikely to be groundwater connected.

As shown on Figure 3, there are a number of streams, ponds, and wetlands in the general vicinity of the Project Site, but there are no wetlands mapped within or immediately adjacent to the property. The closest mapped aquatic features are two freshwater ponds that appear to be manmade and located north and east of the Project Site. Both freshwater ponds appear to be storage basins associated with vineyards. A freshwater emergent wetland is mapped south-southwest of the Project Site west of Old Redwood Highway. Along Mark West Creek south of the Project Site, there are several freshwater forested/shrub and freshwater emergent wetlands.

The depth to the regional water table documented in shallow monitoring wells at two leaking underground storage tank sites located approximately 1 mile west and 0.8 miles south of the Project Site (see Figure 9) is reported to range from approximately 10 to 25 feet below ground surface (bgs), and to fluctuate approximately 5 to 10 feet (and sometimes up to 20 feet) seasonally (Stratus 2023a and 2023b; SWRCB 2024). This suggests it is unlikely that surface water ponds, emergent wetlands and intermittent streams such as Pruitt Creek in the vicinity of the Project Site are groundwater connected. An exception may be the reported perennial reach of Pruitt Creek extending from the foot of the Mayacamas Mountains approximately to Faught Road (Sonoma Water 2023). Monitoring over a number of years has reportedly confirmed the perennial presence of water where the stream emerges from the mountains. Groundwater would be expected to be shallower along this recharge boundary, so this perennial reach could well be a losing, groundwater connected stream reach that provides mountain front recharge to the subbasin. Additional monitoring would be required to confirm whether this is the case.

Sonoma County recently conducted a delineation study to identify Public Trust Review Areas (PTRA) to support implementation of the County's Well Ordinance (O'Conner Environmental 2023). Areas were delineated where pumping from new wells could potentially deplete surface water that supports high value aquatic habitat, so that additional review and permitting requirements could be implemented to protect Public Trust resources in these areas. The study identified the area near the Project Site, including the reported perennial reach of Pruitt Creek, as having a low habitat value and a low risk of streamflow depletion. Hence the area was not designated as a PTRA. We note that monitoring observations of this stream reach reportedly identified rainbow trout and Steelhead trout (*Oncorhynchus mykiss*) on several occasions (Sonoma Water 2023). To our knowledge, these sightings have not been confirmed by others, but may indicate a higher habitat value and level of sensitivity.

An area of riparian vegetation mapped as potential GDEs are located along Pruitt Creek in the northern portion of the Project Site and off-site to the northeast (TNC 2024; See Figure 3). These potential GDEs extend for a distance of approximately 0.7 miles from the northeast portion of the Project Site upstream to near the Mayacamas Mountains. Vegetation in this area is identified as consisting of riparian hardwoods, and is dominated by Eucalyptus, Valley oak, Oregon ash, Buckeye, California bay-laurel and Coast live oak, with native and non-native shrubs, grasses and herbs in the understory (Sequoia 2022). In a riparian setting, these species typically derive their water supply from a combination of precipitation, streamflow and, when present, shallow groundwater.

Normalized difference vegetation index (NDVI) trend imagery for 1985 through 2022 was obtained from TNC, and trend data from 2008 to 2022 is shown on Figure 3 (TNC 2024). The NDVI trend provides a metric of the change in vegetation health and leaf density over time and indicates that there has been little to no change in vegetation health and leaf density along the Pruitt Creek corridor from 2008 through 2022, indicating that the amount of water available to these potential GDEs has not changed significantly over the long term. A similar result is noted for 1985 to 2022.

## 4.4 HYDROGEOLOGY

The following describes the hydrogeologic information for the vicinity of the Project Site that forms the basis of a Conceptual Site Model (CSM) used to evaluate the potential effects of groundwater extraction for the Project.

### 4.4.1 HYDROGEOLOGIC SETTING

The Project Site is located within the Santa Rosa Plain Groundwater Subbasin (Basin No. 1-055.01), the largest subbasin in the Santa Rosa Valley Basin (DWR 2021). The Santa Rosa Valley Basin is located between the Mayacamas Mountains and the Mendocino Range and also contains the Wilson Grove Formation Highlands Subbasin (1-059), Healdsburg Area Subbasin (1-055.02), and the Lower Russian River Valley Subbasin (1-060). Figure 4 shows the hydrogeologic setting and groundwater basins surrounding the Project Site. Table 3 summarizes the subbasin details.

**TABLE 3. SUMMARY OF SANTA ROSA PLAIN GROUNDWATER SUBBASIN**

| DWR Groundwater Basin Number | Approximate Area (square miles) | SGMA Priority | Critical Overdraft |
|---|---|---|---|
| 1-055.01 | 125 | Medium | No |

Source: DWR 2021
SGMA = Sustainable Groundwater Management Act

The Santa Rosa Plain Subbasin is about 22 miles long and ranges from about 0.2 miles wide at its northern end to about 6 to 9 miles wide in the valley area of the subbasin. It has an estimated groundwater storage capacity of approximately 4,313,000 acre-feet. Groundwater-bearing sediments range in thickness from approximately 50 feet to more than 1,000 feet with an average thickness of about 400 feet (DWR 2004).

The west-northwest striking Trenton Ridge fault (Figure 4) runs diagonally across the middle of the Santa Rosa Plain and divides it into two separate groundwater storage units (Nishikawa 2013). The Project Site is located north of the Trenton Ridge fault and within the Windsor Basin storage unit, which measures approximately 5.5 miles by 7.5 miles, has an overall triangular shape, and is fault bounded to the south and east. As mentioned previously, the Trenton Ridge fault is located to the south and the Healdsburg fault zone is approximately 3,500 feet to the east of the Project Site and is represented as a horizontal flow barrier in a groundwater model developed by the USGS that is further described in Section 5.

The area of the Santa Rosa Plain Subbasin surrounding the Project Site is generally mapped as having a low groundwater recharge potential (SRPBAP 2014). Reports by the USGS indicate that vertical migration of recharge in the Santa Rosa Plain is potentially limited by the presence of low-permeability clays in the Glen Ellen and Petaluma Formations (Nishikawa 2013). Soils underlying the Project Site are generally classified as Hydrologic Group C, which have low infiltration and high runoff potential (BIA 2023).

In the northern part of the subbasin, groundwater generally flows from east to west, away from the Mayacamas Mountains and towards the Santa Rosa Plain (DWR 2004). As described above, vertical groundwater flow is somewhat impeded by the heterogeneous bedding and clays of the alluvial valley fill and Glen Ellen Formation.

Long-term groundwater monitoring in the Santa Rosa Plain Groundwater Subbasin indicates that groundwater levels are relatively stable to increasing, especially in the northern portion of the subbasin, including the area near the Project Site (SRPGSA 2022). The Project Site is not located in an area that is designated as overdrafted, critically overdrafted, or in adjudication (City of Santa Rosa 2021). According to the DWR (2018), in the northern portion of the basin, groundwater elevations fluctuated from approximately 38 to 58 feet above mean sea level (amsl) between 2011 and 2017. Available hydrographs from monitored wells near the Project Site are shown in Figure 5. These wells are completed in the shallow, shallow/intermediate, and deep groundwater zones described in Section 4.4.3, and are generally representative of the groundwater level trends across the major hydrostratigraphic units in the vicinity of the Project Site. The well construction details for these wells are summarized in Table 1. The hydrographs show that groundwater levels fluctuate on an annual basis due to seasonal effects but have remained relatively stable over the period of record. A USGS Scientific Investigation Report also describes groundwater levels in the northern portion of the subbasin as relatively stable with slight increases in some areas (Nishikawa 2013). Seasonal groundwater level fluctuations near the Project Site range from about 5 to 10 feet and can be as much as 20 feet (Figure 5 and Section 4.3).

Hydrographs for representative monitoring point (RMP) wells for which Sustainable Management Criteria have been developed under the local Groundwater Sustainability Plan (GSP) are shown in Figure 6. These hydrographs also show relatively stable groundwater elevations with some seasonal fluctuation, with groundwater levels at or just below the Measurable Objective (MO) set for each well. In general, water levels for the RPM wells were near historical low groundwater levels in 2021, which was classified as a very dry water year. This is likely due to lower recharge and a greater use of groundwater to meet water demands during this drought period. As seen on the hydrographs for SRP0375 and SRP0375, water levels rebounded to the MO after the fall of 2021. These data indicate that groundwater demands are in relative equilibrium with groundwater recharge and fluctuate over the short term but display relatively stable long-term trends. Drawdown during drought periods is offset by groundwater level recovery during normal and wetter years, which is a hallmark of sustainable groundwater management.

## 4.4.2 GEOLOGIC SETTING

As shown on the geologic map of the Santa Rosa Plain (Figure 7), the Project Site is located within the Windsor Basin structural trough, which is centered near the Town of Windsor. The Windsor Basin is bounded by the Healdsburg fault zone on the east, the Trenton Ridge Fault on the south, and poorly exposed normal faults on the west, and contains basin fill sediments to a depth of approximately 3,000 to 6,500 feet (Langenheim et al., 2008). The Healdsburg fault zone is contiguous with the Rodgers Creek fault zone to the south. These fault zones have a northwest trend and are right-lateral faults that are part of the San Andreas transform system. As noted in Section 4.4.1, a ridge formed by the Trenton Ridge Fault separates the Windsor Basin from the Cotati Basin to the south.

The USGS (Woolfenden and Nishikawa 2014) prepared a geologic cross section south of the Project Site (A to A’) (Figure 8). Geologic units that underlie the Project Site include Quaternary alluvial deposits, the Glen Ellen Formation, the Petaluma Formation, and Mesozoic Basement rocks. The Quaternary alluvial deposits generally consist of intermixed clays, silts, sand, and gravels with an estimated thickness of up to 550 feet and are younger than 12,000 years (Nishikawa 2013). The Glen Ellen Formation consists of lenses of poorly sorted alluvial gravel, sand, and clay that are partially cemented (Cardwell 1958). The formation is early Pleistocene to Pliocene in age (approximately 3 to 3.5 million years old) and up to 500 feet thick in the basin (Nishikawa 2013). The Pliocene-aged Petaluma Formation (approximately 5 million years old) was deposited in a continental to shallow marine transitional environment and consists predominantly of silt and clay-rich mudstones with local beds and lenses of poorly sorted sandstones and conglomerates (Nishikawa 2013).

To the east of the Project Site, on the other side of the Healdsburg faut zone and beneath the Mayacamas Mountains, the Sonoma Volcanics overlie the basement rocks. The Sonoma Volcanics are Miocene to Pliocene in age (approximately 2.5 to 8 million years old) and are interbedded with volcaniclastic sedimentary rocks. Estimated to be up to 3,000 feet thick, the Sonoma Volcanics are generally exposed in the Mayacamas and Sonoma Mountains and are found beneath the valley floor, where the unit is interbedded with the Petaluma and Glen Ellen formations (Nishikawa 2013). The bedrock basement of the Santa Rosa Plain Subbasin is formed of Mesozoic aged rocks of the Franciscan Complex, the Great Valley Sequence, and the Coast Range Ophiolite. The Mesozoic basement rocks are not exposed within the Wilson Basin and only found in the western portion and the northeast portion of the Santa Rosa Plain Subbasin. Further descriptions of the geology of the Sant Rosa Plain Subbasin can be found in the GSP (SRPBAP 2014) and the hydrologic properties of the geologic units are described in Section 4.4.3.

The potential for subsidence in the Santa Rosa Plain Subbasin is addressed in the GSP (SRPGSA 2022). In general, changes in the land surface elevation can be a result of tectonic forces, hydraulic isostatic loading, increases in effective stress due to groundwater withdrawals, and other forces. Excessive groundwater pumping can reduce the hydrostatic pressure, which can cause fine-grained materials such as clays to consolidate, resulting in a permanent lowering of the land surface that does not recover after groundwater levels are restored. There is only limited land subsidence data for the Santa Rosa Plain with one station in the Santa Rosa Plain. The station recorded a positive change in land surface elevation of 0.01 inches from 2005 to 2019, corresponding to an annual increase in land surface elevation of 0.003 inches (SRPGSA 2022).

Another study assessing the Rodgers Creek Fault for evidence of creep indicated evidence of potential subsidence and uplift in the southern portion of the Subbasin that may be related to groundwater pumping (Funning *et al.* 2007; Jin and Funning 2017). The area and timing of subsidence correlate with groundwater level declines and recovery. Groundwater levels declined due to an increase in municipal groundwater pumping and then recovered as municipal pumping was reduced. This data indicates that the southern portion of the Santa Rosa Plain Subbasin has experienced minor elastic subsidence that has not caused permanent consolidation of the fine-grained units in the aquifer system.

Recent spatial variance of ground surface change data collected by DWR using Interferometric Synthetic Aperture Radar (InSAR) show insignificant land surface elevation change from 2015 through 2018 in the vicinity of the Project site (SRPGSA 2022).

### 4.4.3 HYDROSTRATIGRAPHIC UNITS

The three principal water-bearing geologic units present in the vicinity of the Project Site are the Glen Ellen Formation, Petaluma Formation, and Sonoma Volcanics. They are overlain by Quaternary Alluvium, which provides some water to shallow wells. The underlying basement rocks are not considered a significant supply source in the subbasin. A USGS groundwater modeling report for the Santa Rosa Plain watershed describes the Glen Ellen Formation as heterogeneous and variable in thickness, typically hundreds of feet thick (Woolfenden and Nishikawa 2014). Similarly, the Santa Rosa Plain GMP notes that the Glen Ellen Formation is approximately 100 to 150 feet thick in the Windsor hydrogeologic subarea and is underlain by the Petaluma Formation, except at the western edge of the subbasin. Deposited in the late Tertiary Period, the Petaluma Formation is the deepest and thickest aquifer in the region, reaching depths of at least 2,000 feet in the Windsor subarea (SRPBAP 2014). On the eastern side of the Windsor subarea, the Miocene-Pliocene-age Sonoma Volcanics interfinger with the Petaluma Formation.

Local hydrostratigraphic information indicates varying interpretations regarding the depth of the Glen Ellen Formation near the Project Site. Boreholes drilled for the Esposti Park and Bluebird wells to 1,040 feet and 867 feet, respectively, did not encounter marker beds for the top of the Petaluma Formation (RMC 2010). Reports by RMC (2010) and GHD (2017) therefore concluded the Glen Ellen Formation is deeper than shown in the USGS cross-section in Figure 8. Because these wells are located relatively close to the Project Site (0.3 miles and 1.8 miles, respectively), the boring logs provide the most useful information for delineating the local groundwater-bearing zones, and the attribution of these sediments to specific formations is of little importance. For the purposes of this analysis, the following major hydrostratigraphic units in the vicinity of the Project Site were identified. These designations represent the upper 1,000 feet of the stratigraphy in the basin, are consistent with hydrogeologic reports prepared for the Town of Windsor, and are a further refinement of the groundwater zones described in the EA.

- **Shallow Zone (first water to approximately 120 feet bgs):** Comprised of sand and gravel with interbeds of sandy clay. (The Shallow Zone is referred to as the water table zone elsewhere in this GRIA, and is simulated using model Layer 1 in Section 5.)
- **Intermediate Zone (approximately 130 to 350 feet bgs):** Comprised of sand and gravel with some volcanic ash and interbeds of silty to sandy clays. This hydrostratigraphic zone is separated from the overlying shallow zone by a clay to silty clay aquitard occurring from approximately 120 to 130 feet bgs that is assumed to be laterally continuous near the Project Site based on the available well log data. (The Intermediate Zone is simulated using model Layer 3 in Section 5.)
- **Deep Zone (greater than 350 feet):** Comprised of sand and gravel with interbedded clay and sandy clay and separated by a sandy clay aquitard of variable thickness occurring from approximately 335 to 380 feet bgs that is assumed to be laterally continuous near the Project Site based on the available well log data. (The Deep Zone is simulated using model Layers 4, 5 and 6 in Section 5.)

Construction details for wells near the Project Site show water supply wells completed in the shallow, intermediate, and deep zones (Table 1). In general, domestic wells in the area tend to be screened in the shallow and intermediate zones, while municipal and irrigation wells are completed in the intermediate and deep zones. Many of the wells are screened across multiple groundwater zones (Table 1). Figure 9 shows the locations of the wells summarized in Table 1 in addition to several shallow monitoring wells not included in the table. Finally, well completion depth statistics from DWR for domestic wells in the nine PLSS sections near the Project Site are shown in Figure 10 to provide an overview of the density and depths of domestic wells and depths in the region. It should be noted that some domestic wells reportedly extend into the deep zone in this area; however, the shallow and intermediate zones are the primary domestic water source in the region, and the average domestic well depth is in the intermediate zone.

A major structural feature important to the CSM of the area is the Healdsburg Fault, which forms the eastern boundary of the Windsor subbasin (HydroScience 2023). The Healdsburg Fault is an active strike-slip fault bordering the foothills of the Mayacamas Mountains and is the northward extension of the Rogers Creek Fault Zone (RMC 2010). As is typical for similar faults in the region, offset of sedimentary beds and formation of fault gouge is reported to impede groundwater flow; the USGS groundwater model for the Santa Rosa Plain watershed simulates the fault as a horizontal flow barrier (Woolfenden and Nishikawa 2014).

### 4.4.4 AQUIFER PROPERTIES

The USGS modeling report for the Santa Rosa Plain watershed describes the aquifer properties of the water-bearing formations in the vicinity of the Project Site based on regional data and previous studies (Woolfenden and Nishikawa 2014).

To validate the aquifer parameters used in the USGS model in the area near the Project Site, the following key reports and data were reviewed and compared to the USGS data:

- GHD, 2017. Town of Windsor and Windsor Water District Esposti Supply Well Redevelopment, Pump Test, and Treatment Feasibility Study. Dated October 3.
- SRPGSA, 2022. Groundwater Sustainability Plan for the Santa Rosa Plain Subbasin.
- RMC, 2010. Windsor Groundwater Well Installation and Testing Project Summary Report. Prepared for the Town of Windsor in association with E-Pur. September.
- DWR, 2004. California's Groundwater Bulletin 118, North Cost Hydrologic Region, Santa Rosa Valley, Santa Rosa Plain Subbasin. Updated February 27.
- Well Completion Reports reporting specific capacity test results for wells near the Project Site completed in the shallow and intermediate water-bearing zones.

Aquifer parameter estimates pertinent to the geologic units and the model layers in the vicinity of the Project Site are summarized in Table 4. Hydraulic conductivity (K) estimates for the Alluvium range from 2 to 51 ft/day, which is consistent with the USGS model values assigned to Layer 1. For the Glen Ellen Formation, K was reported to range from 13 to 23 ft/day by Woolfenden and Nishikawa (2014) and a wide range of transmissivity values has been estimated from other data sources. Model Layers 3-8, which appear to represent the Glen Ellen Formation, are generally within these reported ranges, with a few high outliers. Similarly, the range of transmissivity values for the Petaluma Formation reported by Wolfenden and Nishikawa (130 -1,600 square feet per day [$ft^2$/day]) is consistent with the deeper layers of the USGS model.[3]

As a result of its pumping test at the Esposti Park well, RMC (2010) concluded that the intermediate the intermediate and deep zone in the vicinity of the well are likely isolated from the shallow zone by an aquitard. This conclusion was based on a lack of drawdown in the nearby Esposti Park non-potable irrigation well and Mobile Home Estates well after 32 hours of pumping. We note that it can be difficult to infer the competence of an aquitard to isolate an overlying aquifer from pumping in the aquifer beneath it based on a relatively short-term pumping test. To that end, we note that the modeling analysis conducted for this GRIA and discussed in Section 5 suggests that drawdown would have been observed if the test were extended for a longer period of time. As such, while several clay layers appear to exist that can be correlated across several wells in the area, their effectiveness to isolate the shallow zone from underlying pumping cannot be confirmed at this time.

[3] Data for these deeper aquifer layers are not summarized in Table 4 because they are well below the completion depths of interest to this evaluation. The reader is referred to Wolfenden and Nishikawa 2014 for additional information.

**TABLE 4: REPORTED HYDRAULIC PROPERTIES**

| Hydrostratigraphic Unit | Reference Source | Hydraulic Conductivity (ft/d) | Transmissivity ($ft^2/d$) | Transmissivity based on Sc[1] ($ft^2/d$) | Storativity | Specific Yield (%) |
|---|---|---|---|---|---|---|
| Alluvium | Woolfenden and Nishikawa 2014 | *Not Reported* | | | | |
| | Santa Rosa Plain GSP | 2 – 51 | | | 0.0013 – 0.19 | |
| | DWR 2004 | | | | | 8 – 17 |
| Shallow-Intermediate | Well Development (08N09W13A002M) | | | 27 | | |
| Shallow-Intermediate | Well Development (Esposti Irrigation) | | | 769 | | |
| Intermediate | Well Development (4820/Well #2) | | | 67 | | |
| Glen Ellen Formation | Woolfenden and Nishikawa 2014 | 13 – 23 | | | | 3 – 7 |
| | Kadir and McGuire (1987) | 5 | 785 | | | |
| | RMC 2010 | | 96 – 3,850 | | | |
| | DWR 2004 | | | <2,675 | | |
| Intermediate-Deep (Glen Ellen Formation) | Well Development (3925/Well #3) | | | 698 | | |
| Deep (Glen Ellen Formation) | Pump Test (Esposti Park) | 6.3 | 555 | | | |
| Petaluma Formation | Woolfenden and Nishikawa 2014 | | 130 – 1,600 | | | |
| | Santa Rosa Plain GSP | | | | | 3 – 7 |
| Sonoma Volcanics | Woolfenden and Nishikawa 2014 | | 0.8 – 5,300 | | | 0 – 15 |

| **USGS Santa Rosa Plain Hydrologic Model (SRPHM)[2]** | **Hydraulic Conductivity (ft/d)** | | **Transmissivity ($ft^2/d$)** | **Transmissivity based on Sc[1] ($ft^2/d$)** | **Storativity** | **Specific Yield (%)** |
|---|---|---|---|---|---|---|
| SRPHM Layer | *Mean $K_h$* | *Geomean $K_h$* | *Geomean* | *N/A* | *Mean* | *Mean* |
| Layer 1 | 9.9 | 1.9 | 171.1 | | 0.13 | 13.5 |
| Layer 2 | 0.8 | 0.25 | 12.4 | | 8.65E-05 | 9.6 |
| Layer 3 | 6.0 | 0.6 | 122.2 | | 3.57E-04 | 9.9 |
| Layer 4 | 3.5 | 0.3 | 19.3 | | 1.22E-04 | 8.5 |
| Layer 5 | 2.4 | 0.1 | 18.3 | | 2.55E-04 | 8.4 |
| Layer 6 | 1.0 | 0.05 | 6.3 | | 2.40E-04 | 8.6 |
| Layer 7 | 0.6 | 0.02 | 2.8 | | 2.04E-04 | 12.8 |
| Layer 8 | 0.4 | 0.01 | 1.35 | | 2.55E-04 | 4.5 |

Notes:

1. Sc – specific capacity. Transmissivity based on specific capacity was estimated using empirical relationships from Driscol (1986).
2. Woolfenden and Nishikawa (2014). Model parameters were extracted and summarized for the area of interest.

# 5 EFFECTS ANALYSIS

## 5.1 OVERVIEW OF MODELING APPROACH

The Santa Rosa Plain Hydrologic Model (SRPHM) developed by the USGS (Woolfenden and Nishikawa 2014) formed the underlying model architecture to assess drawdown impacts of the Project. The model grid of the SRPHM was locally refined around the area of interest. Current understandings of local hydrogeology from investigations performed for the Town of Windsor wells incorporated into the refined model. Proposed Project and Cumulative Impacts pumping scenarios were simulated using a comparative superposition-based approach to assess drawdown spatially and temporally over the model domain.

### 5.1.1 CONCEPTUAL APPROACH

To assess the effects of Project pumping, a superposition-based modeling approach was used whereby model results are compared to an initial baseline condition to estimate the drawdown induced by additional well pumping. Superposition modeling is a widely used approach when evaluating the effects of a project or action (Reilly et al.1987). When using this approach, a model is run twice, once with the action being evaluated and once without, and the two results are superimposed and subtracted. The result is a simulation of the change induced by the simulated action or actions, with the absolute values in each run. Mathematically, this approach can to some extent “subtract out” or lessen the errors that are inherent in any model by focusing on the change in water levels rather than prediction of absolute values.

The baseline condition was generated by retaining all the water budget inflows and outflows incorporated into the USGS model and adding the seasonal pumping of the three on-Site irrigation and frost-protection wells and one on-Site domestic well. These baseline conditions were simulated using the USGS historical 35-year modeling period to allow conditions to stabilize and reach a steady state. The 2010 model results were then used as a steady state condition to generate a 50-year baseline model.

To simulate Project pumping, a Project forecast scenario was run in which the existing on-Site wells were replaced by the proposed Project pumping conceptualized as a single new well at the location on the east side of the Project Site proposed by HydroScience (2023). The new well was pumped at a constant rate equal to the Alternative A groundwater demand. The simulated pumping was started at the end of the baseline simulation and carried forward for a 50-year forecast period to simulate Project effects over the planning horizon specified in SGMA (California Water Code §10721(r)).

To simulate cumulative impacts, a forecast scenario was run which added pumping two new municipal wells described in the Town of Windsor 2020 UWMP (Woodard & Curran 2021). Consistent with the operating strategy for these proposed municipal wells presented in the UWMP, they were simulated to be operated only during dry years. The number and timing of dry years during which pumping occurred followed a climate change simulation scenario included in the USGS model.

The impact assessment model used in this GRIA includes the following simplifying assumptions:

- First, the constant baseline conditions, while appropriate for a relative comparison of drawdown impacts, do not provide a representative basis for predicting actual potentiometric heads across the region of interest. Rather, the superposition approach focuses on understanding the response of the system to changes in the baseline conditions induced by additional pumping.
- Second, the hydraulic properties of the lithologic units represented in the USGS SRPHM were assumed to be generally appropriate for the local area of interest. Minimal refinements to the hydrostratigraphy were incorporated, as described in Section 5.4 (i.e., addition of a clayey aquitard layer). Available reported data within the Project vicinity was used to verify the overall hydrostratigraphic conceptual model and properties. This was considered sufficient for the purpose of evaluating the likely Project and cumulative impacts.
- Finally, the simulated dry periods represent hypothetical forecasts based on data from the GSP and climate change scenarios used in Woolfenden and Nishikawa (2014). We did not alter any groundwater inflows or outflows other than pumping. This is an acceptable simplification when using a superposition modeling approach.

### 5.1.2 MODELING CODE SELECTION

The SRPHM was developed to help manage the hydrologic resources of the Santa Rosa Plain watershed (Nishikawa 2013; Woolfenden and Nishikawa 2014). The SRPHM couples the modeling codes GSFLOW and MODFLOW to simulate interactions between surface-water and groundwater from 1975 to 2010, as well as several projected climate scenarios. The setting of the SRPHM encompasses the Project Site and provides a basis for the hydrogeologic conditions to be simulated for the Project lifetime. The Python package FloPy was used to extract inputs and outputs from the original SRPHM and refine the area of interest for the Proposed Project and Cumulative Impact forecast scenarios. FloPy is an opensource set of Python scripts to run MODFLOW and related groundwater programs, offering both flexibility and transparency within the groundwater modeling process (Hughes et al. 2023; Bakker et al. 2016)

## 5.2 MODEL DOMAIN AND DISCRETIZATION

The SRPHM domain spans the Santa Rosa Plain Watershed. For this supplemental GRIA analysis, a localized child model was subdivided into the northwestern portion of the SRPHM. The active extent of the parent model follows that of the Santa Rosa Plain Groundwater Basin to the north and is truncated to the south and east approximately 6 miles from the Project Site (Figure 11). The active extent of the child model measures 3.75 miles (west to east) by 4.25 miles (north to south) and is centered a short distance northwest of the Project Site to optimize evaluation of drawdown within the basin fill between the proposed North Windsor Well on the north and Mark West Creek on the south.

The original horizontal grid cell size of the SRPHM was retained in the parent model and is discretized spatially into a rectangular grid with uniform cell size of 660 ft by 660 ft (10 acres). Using the Local Grid Refinement (LGR) MODFLOW module, the child model area was further discretized into 132-ft by 132-ft grid cells (5x refinement). The two lowermost model layers of the 8-layer SRPHM model were removed from the parent and child models because they are substantially deeper than the aquifers of interest to this study. Evaluation of local boring logs from within the child model area indicated the consistent presence of a confining layer in the upper portion of Layer 3. Therefore, the child model grid was vertically refined, and a 20-ft thick layer (Layer 3a) was delineated to simulate this aquitard and reflect the local hydrostratigraphic conditions as illustrated in Figure 12.

## 5.3 BOUNDARY CONDITIONS

Boundary conditions at the edges of the parent model were established from the output of the 35-year SRPHM simulation by the USGS and are represented as constant head cells. The purpose of the outer boundary is to approximate far-field basin inflows, which in turn inform boundary flows into and out of the child model domain. The parent-model constant head boundary cells represent the SRPHM model-calculated heads for September 2010. The child model is bounded by a groundwater exchange boundary condition that calculates flows between the parent and child domains. The LGR module and groundwater exchange modules run the separate parent and child models concurrently to provide updated boundary conditions at the child model boundaries. The outside of the active lateral extent of the SRPHM and the bottom of Layer 6 were simulated as no-flow boundary conditions.

Recharge and evapotranspiration conformed to net recharge values calculated from the SRPHM model output for September 2010. Within the SRPHM, net recharge from the unsaturated zone is calculated from the budget components of the coupled GSFLOW-MODFLOW model. Accordingly, net recharge (net groundwater flux) incorporates fluxes from the unsaturated to saturated zones (i.e., groundwater inflows from soil moisture and stream seepage, and outflows from evapotranspiration and discharge to the soil zone or land surface; Woolfenden and Nishikawa 2014). For the purposes of this analysis, net recharge values were interpreted as either groundwater recharge or evapotranspiration varying spatially over the model domain but held constant at 2010 rates throughout the simulation.

## 5.4 HYDRAULIC PROPERTIES

Simulated hydraulic properties, including hydraulic conductivity, storage, and anisotropy ratios were consistent with the Windsor Basin Model Storage Unit of the SRPHM, with the exception of an added aquitard layer in the child model domain. Lithologic logs from the Bluebird and Esposti Park wells identify an approximately 20-foot thick sandy-clay aquitard between approximately 345 and 365 feet bgs (RMC 2010). This aquitard unit was designated Layer 3a, as noted in Section 5.2, and assigned a hydraulic conductivity of 1 ft/day and a vertical anisotropy ratio of 400. A cross-valley hydrostratigraphic section through the child model domain along the cross-section line A-A' (Figure 11) is shown in Figure 12.

The top three layers of the model were specified as convertible within the Node Flow Property MODFLOW package. Convertible layers transition from confined to unconfined aquifers if the head drops below the layer top elevation. Layers 4, 5 and 6 were simulated as confined.

A single fault, the Healdsburg Fault, was simulated east of the Project Site using the Horizontal Flow Barrier MODFLOW package. The barrier properties conformed to those used within the SRPHM; hydraulic characteristic of 1e-20 (1/day), assuming a standard fault width of 1-foot.

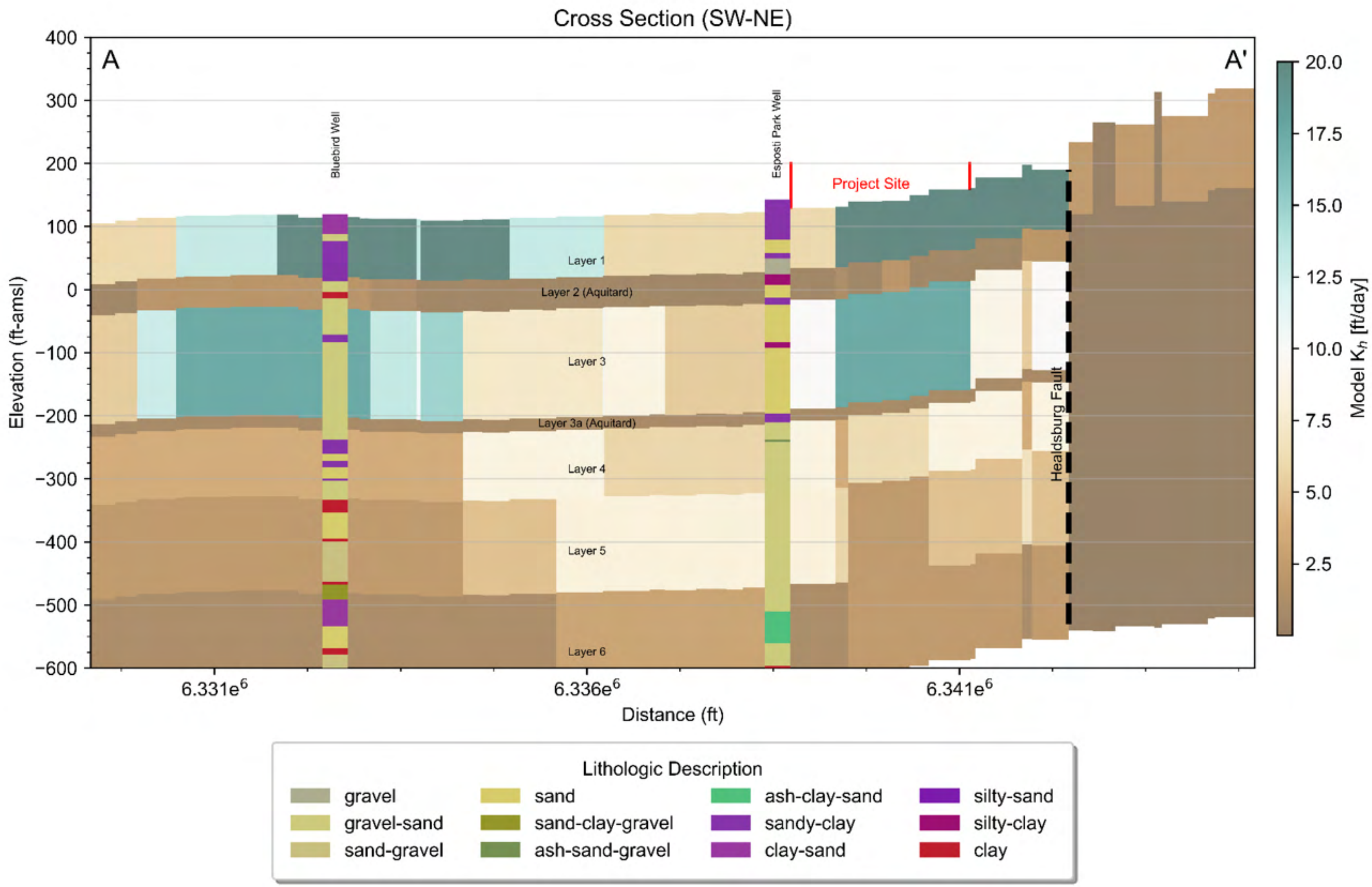


**FIGURE 12: MODEL CROSS SECTION AND LOCAL LITHOLOGIC LOGS**

## 5.5 STRESS PERIODS AND MODEL INPUTS

The baseline conditions simulation was conducted over a 50-year period and included existing on-Site pumping at the rates discussed in Section 3. All other model conditions were identical to those used to simulate the Proposed Project and Cumulative Impact forecast scenarios. Modeled pumping rates were simulated in as follows:

- Irrigation pumping was simulated from Well #1, pumping from Model Layers 3 and extracting a total of 29.7 acre-feet from June to October (5-months) each year.
- Frost-protection pumping was simulated in April each year, extracting a total of 4 acre-feet split equally between Well #1, Well #3 (pumping from Model Layers 3, 4 and 5) and Well #4 (pumping from Model Layer 3).
- Domestic pumping was simulated from Well #2, pumping from Model Layer 3 at a constant rate of 0.5 acre-feet per year.

Proposed Project and Cumulative Impact forecast scenarios were also simulated over a 50-year period. For the Proposed Project forecast scenario, only the proposed new on-Site well was simulated as pumping at a constant rate of 190 AFY within Layers 4 and 5 (refer to Figure 12 for model layers in cross-section).

The Cumulative Impact forecast scenario defined five distinct dry periods over a 50-year period to simulate the additional pumping from new municipal supply wells installed by the Town of Windsor and operated during drought years at a rate of 350 AFY each as specified in the Town's 2020 UWMP (Woodard & Curran 2021). Based on the SRPHM climate change simulations and inputs developed by the USGS, the frequency of drought periods is expected to increase with climate change; the frequency of dry periods simulated in the Cumulative Impacts forecast scenario approximately mirrors that used in the SRPHM high-emissions climate change scenario.

During the Cumulative Impact forecast scenario, the Town of Windsor's Esposti Park Well (which is expected to be brought online within the next several years) and the proposed North Windsor Well (which remains to be installed) are simulated to pump at a rate of 350 AFY during dry years. The pumping of these wells is simulated in addition to the constant pumping of the Project well at 190 AFY. The North Windsor Well was simulated within Layers 4 and 5 in the vicinity of Hiram Lewis Park. Hiram Lewis Park is one of two potential locations proposed for the North Windsor Well in the 2019 WMP update and is slightly closer to the Project Site than the alternative location off U.S. 101 south of Arata Lane. Because final design and construction of the North Windsor Well has not yet occurred, the depth of the screened interval was assumed to be the same as the existing Esposti Park Well. Figure 13 shows the pumping schedule for the Cumulative Impacts scenario.

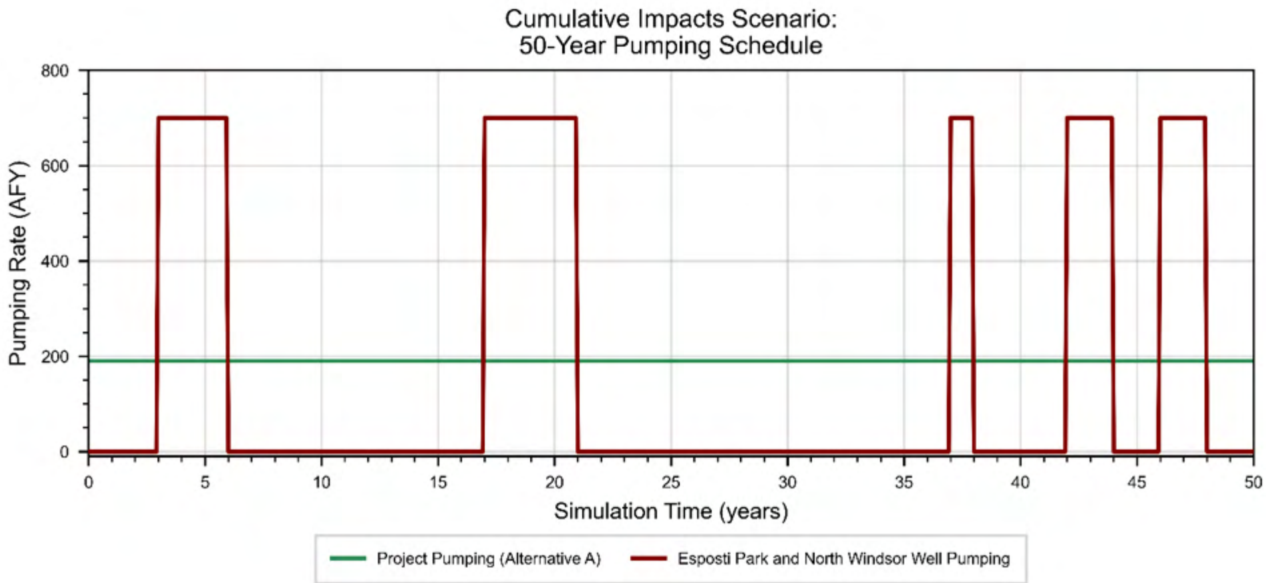


**FIGURE 13: CUMULATIVE IMPACTS SCENARIO PUMPING SCHEDULE**

## 5.6 OBSERVATION POINTS

Several observation points were simulated within the model to evaluate drawdown at locations and depths of interest. The locations of the observation points at which simulated drawdown data were extracted are shown in Figure 14 and Figure 15. Three points covering the upstream, midstream, and downstream sections of the Pruitt Creek GDE were placed in Layer 1 to evaluate pumping effects on the local water table and possible stresses to groundwater-dependent vegetation. Additional observation points were established to assess potential interference drawdown impacts to existing nearby wells, including the nearest potential location of a domestic well, the nearest existing off-Site irrigation well, the Town of Windsor Bluebird Well and Esposti Park, the closest Representative Monitoring Well established for GSP compliance (SRP0376, Well #13 on Figure 9), and the nearest supply well for the Mobile Home Estates small community water system west of the Project Site (Well #17 on Figure 9). The domestic well observation point was inferred as the nearest potential location of a domestic well serving the residential area located north of the eastern portion of the Project Site across Shiloh Road. Since details regarding the completion depths of domestic wells in this area were not available, we assessed drawdown impacts at three observation depths representing the average, minimum, and maximum well depths reported by DWR in the PLSS section containing the Project Site (DWR 2024). Simulated drawdown at these observation points is discussed in Section 5.7 below.

## 5.7 DRAWDOWN RESULTS

### 5.7.1 PROPOSED PROJECT SCENARIO

The lateral extent of predicted drawdown at the water table (Model Layer 1) at the end of the 50-year simulation under the Proposed Project forecast scenario is shown on Figure 14. The maximum predicted drawdown at the water table at the Project Site is approximately 1.6 feet. The spatial extent of drawdowns greater than 1 foot extends in a north-northwest to south-southeast oriented oblong centered on the Project Site along the western side of the Healdsburg Fault and measuring approximately 1.5 wide by 4.5 miles long.

The lateral extent of drawdown in the pumped aquifer (Model Layer 5) at the end of the 50-year simulation is shown on Figure 15. The maximum drawdown at the Project Site is predicted to be less than 10 feet. Drawdown exceeding 5 feet is predicted to occur in an approximately circular cone of depression extending radially from the simulated well and extending approximately 0.25 mile west, 0.45 mile east, and approximately 0.35 miles north and south. Predicted drawdown decreases to less than 2 feet at distances ranging from approximately 1.0 to 1.8 miles from the simulated well.

Table 5 summarizes the predicted drawdown effects over time at the observation points described in Section 5.6 and shown on Figure 15. Simulated drawdown effects initially occur rapidly: approximately 60 to 90 percent of drawdown is predicted to occur within one month, and over 99 percent of drawdown is predicted to occur after one year. As summarized in Table 5, drawdown effects for the nearest potential domestic well location were predicted to stabilize at 2.89, 1.63 and 8.01 feet for the average, minimum and maximum reported domestic well completion depths, respectively. The maximum predicted drawdowns at nearby existing municipal/small community) supply and irrigation well locations range from 2.57 to 9.23 feet (for the Mobile Home Estates small community water system well and the irrigation well located on the parcel east of the Site, respectively). The simulated maximum drawdown at the water table at the simulated GDE observation points ranges from 1.58 to 1.62 feet.

**TABLE 5: SIMULATED DRAWDOWN AT OBSERVATION POINTS - PROPOSED PROJECT SCENARIO**

| Time since Start of Pumping | Scenario: Preferred Alternative | Predicted Drawdown at Observation Point (feet) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Location** | **GDE Upstream** | **GDE Midpoint** | **GDE Down-stream** | **Esposti Park Well** | **Mobile Home Estates Well (Well #17)** | **Nearest Irrigation Well** | **Hypothetical Average Domestic Well** | **Hypothetical Shallow Domestic Well** | **Hypothetical Deep Domestic Well** | **RMP SRP0376 (Well #13)** | **Bluebird Well** |
| | **Model Layer** | **Layer 1** | **Layer 1** | **Layer 1** | **Layer 5** | **Layer 3** | **Layer 6** | **Layer 3** | **Layer 1** | **Layer 5** | **Layer 4** | **Layer 6** |
| | **Depth Range (feet-bgs)** | ***0 to 96*** | ***0 to 96*** | ***0 to 94*** | ***446 to 596*** | ***146 to 318*** | ***596 to 746*** | ***146 to 318*** | ***0 to 96*** | ***446 to 596*** | ***338 to 446*** | ***596 to 746*** |
| 1 month | | 1.01 | 1.00 | 0.98 | 2.49 | 1.76 | 8.24 | 2.05 | 1.02 | 7.06 | 1.04 | 0.73 |
| 6 months | | 1.55 | 1.56 | 1.53 | 3.31 | 2.51 | 9.15 | 2.82 | 1.58 | 7.94 | 1.74 | 1.38 |
| 1 year | | 1.58 | 1.59 | 1.56 | 3.35 | 2.54 | 9.19 | 2.86 | 1.61 | 7.98 | 1.77 | 1.41 |
| 5 years | | 1.60 | 1.60 | 1.57 | 3.37 | 2.56 | 9.21 | 2.87 | 1.62 | 8.00 | 1.78 | 1.42 |
| 25 years | | 1.61 | 1.61 | 1.58 | 3.38 | 2.57 | 9.22 | 2.89 | 1.63 | 8.01 | 1.79 | 1.43 |
| 50 years | | 1.61 | 1.62 | 1.58 | 3.38 | 2.57 | 9.23 | 2.89 | 1.63 | 8.01 | 1.80 | 1.43 |

### 5.7.2 CUMULATIVE IMPACTS SCENARIO

Figure 16 shows the results of the Cumulative Impact forecast scenario at the end of the 50-year simulation period and the maximum predicted drawdown, which occurs after multiple dry years. This scenario simulates pumping of the Town of Windsor Esposti Park and North Windsor wells at 350 AFY each during dry and critically dry years (Woodard & Curran 2021) in addition to pumping for the Project. At the end of the 50-year simulation, the drawdown at the water table and in the pumped aquifer is predicted to be similar to the drawdown predicted under the Project forecast scenario. This appears to be because the simulation ends after a period of non-drought conditions and water level recovery occurs relatively quickly in the groundwater system. However, at the end of multiple dry years, the magnitude of drawdown and the affected area increases across the model domain. At the water table, an elongate area of drawdown exceeding 5 feet measuring about 1 mile by 5 miles is predicted to predicted to extend along the west side of the Healdsburg Fault from about 1 mile southeast of the Esposti Park well to slightly under 1 mile northwest of the North Windsor Well. Drawdown exceeding 2 feet is predicted to extend for approximately another 1 to 2.5 miles outside of this area. In the pumped aquifer, drawdown cones exceeding 15 feet are predicted to form around the North Windsor Well, the Esposti Park Well and Project well, and the area of 10 feet of drawdown is predicted to extend approximately 1 by 1.5 mile around the North Windsor Well and 1.5 by 2 miles around the Esposti Park Well/Project well. An area of drawdown exceeding 5 feet measuring approximately 3 miles by 6 miles is predicted to encompass each of the above wells and most of the Town of Windsor.

Given the drawdown results observed in the Project Cumulative Impacts scenario described above, a Baseline Cumulative Impacts scenario was also simulated based on pumping of the Town of Windsor Wells only to differentiate the effects of Town of Windsor pumping from Project pumping. Figure 17 shows a comparison between the Baseline Cumulative drawdown and Project Cumulative drawdown results after multiple dry years. The simulated 4-ft drawdown contour in Layer 1 in the Baseline Cumulative scenario extends almost to the northern boundary of the Project, demonstrating the impact of Town of Windsor pumping only accounts for a large portion of the predicted drawdown shown in the Project Cumulative scenario. In Layer 5, drawdown is predicted to be less than 20 feet from either the Town of Windsor alone or the combined Town and Project pumping during dry years.

Table 6 summarizes the predicted drawdown effects for the observation points described in Section 5.6 under the following conditions:

- Cumulative drawdown effects of Project and Town of Winsor pumping after 50 years;
- Cumulative drawdown effects of Project and Town of Windsor pumping after multiple dry years; and
- Drawdown effects induced by the Town of Windsor pumping after multiple dry years.

The data presented in Table 6 show that the magnitude of drawdowns at the observation points after several dry years is significantly higher than Project drawdown alone. Cumulative drawdown at the GDE observation points is predicted to increase to approximately 6 feet, with approximately 73 percent of the drawdown attributable to pumping of the Town of Windsor wells. Drawdown at the domestic well observation points is predicted to increase to approximately 6 to 16.6 feet, with approximately 52 to 73 percent attributable to the Town of Windsor wells. Drawdown at nearby municipal and irrigation wells is predicted to increase to 8.7 to 17.5 feet, with approximately 47 to 71 percent attributable to the Town of Windsor wells.

Figure 18 shows the predicted drawdown over time at the nearest potential domestic well location. Drawdown results are plotted for the model layers representing the average, maximum and minimum screened intervals for domestic wells in the PLSS section encompassing the area directly north of the Project Site. Dry periods during which the Town of Windsor wells are simulated as being operated are delineated by the tan vertical bands. Maximum drawdown levels are predicted during drought periods and recover rapidly during normal periods when pumping from the Town of Windsor wells (Esposti Park and North Windsor) does not occur. Drawdown associated with the Town of Windsor wells recovers almost completely during normal and wet years.

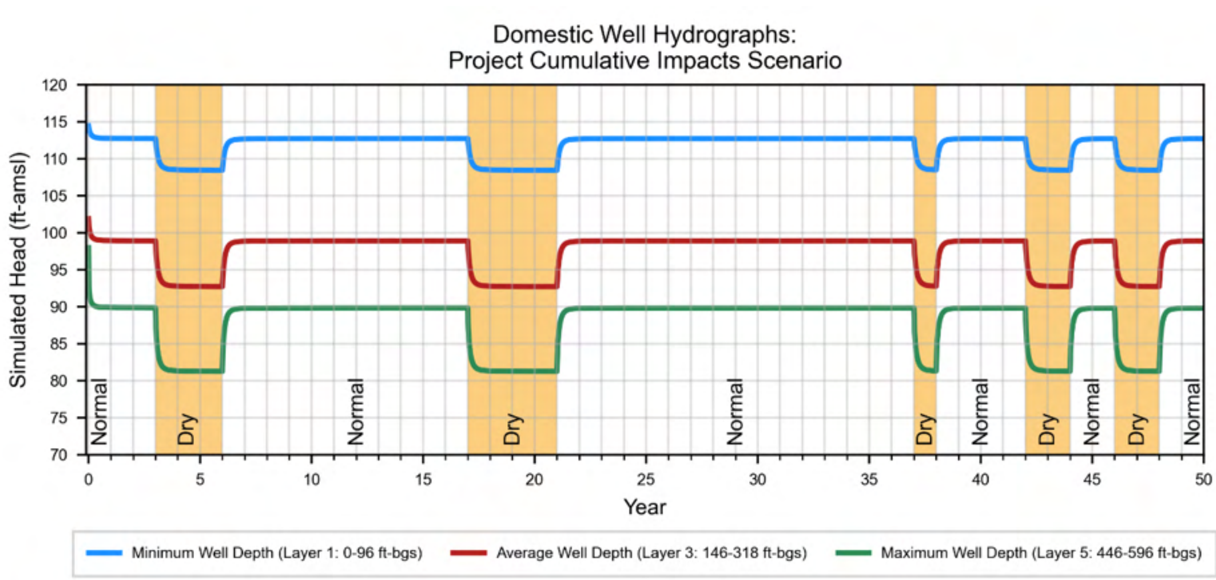


**FIGURE 18: SIMULATED DRAWDOWN AT HYPOTHETICAL NEAREST DOMESTIC WELL**

**TABLE 6: SIMULATED DRAWDOWN AT OBSERVATION POINTS – CUMULATIVE IMPACTS SCENARIOS**

| Scenario/ Time since Start of Pumping | | Predicted Maximum Drawdown at Observation Point (feet) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Location** | **GDE Upstream** | **GDE Midpoint** | **GDE Downstream** | **Mobile Home Estates Well (Well #17)** | **Nearest Irrigation Well** | **Hypothetical Average Domestic Well** | **Hypothetical Shallow Domestic Well** | **Hypothetical Deep Domestic Well** | **RMP SRP0376 (Well #13)** | **Bluebird Well** |
| | **Model Layer** | ***Layer 1*** | ***Layer 1*** | ***Layer 1*** | ***Layer 3*** | ***Layer 6*** | ***Layer 3*** | ***Layer 1*** | ***Layer 5*** | ***Layer 4*** | ***Layer 6*** |
| | **Depth Range (feet-bgs)** | ***0 to 96*** | ***0 to 96*** | ***0 to 94*** | ***146 to 318*** | ***596 to 746*** | ***146 to 318*** | ***0 to 96*** | ***446 to 596*** | ***338 to 446*** | ***596 to 746*** |
| Cumulative and Project/ After 50 years | | 1.64 | 1.64 | 1.60 | 2.60 | 9.26 | 2.92 | 1.66 | 8.04 | 1.82 | 1.46 |
| Cumulative and Project/ End of Extended Drought | | 5.89 | 5.93 | 5.76 | 8.73 | 17.49 | 9.08 | 5.91 | 16.60 | 6.66 | 8.08 |
| Town of Windsor Pumping Only/ End of Extended Drought | | 4.28 | 4.31 | 4.18 | 6.16 | 8.26 | 6.19 | 4.28 | 8.59 | 4.86 | 6.64 |

Figure 19 shows simulated drawdown effects at the midstream point of the Pruitt Creek GDEs. During dry periods, the predicted drawdown at the water table at this location is up to 6 feet. The simulated hydrograph shows that both drawdown and recovery are expected to be relatively rapid. The magnitude of the short-term drawdown associated with the Town of Windsor wells, which is shown as lasting one to four years, is more than three times greater than the long-term equilibrium drawdown induced by pumping for the Project.

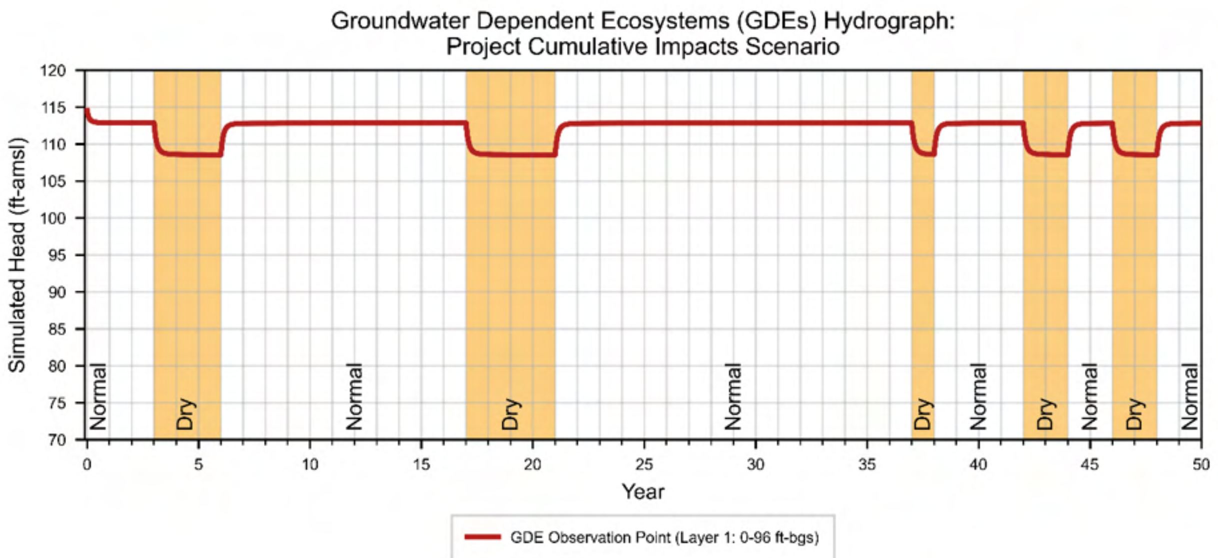


**FIGURE 19: SIMULATED DRAWDOWN AT GDES ALONG PRUITT CREEK NORTHEAST OF PROJECT SITE**

Figure 20 shows the predicted drawdown from the Project Cumulative Impacts scenario overlaid with the observed long-term hydrograph data from Well #13 (SRP0376), which is the closest Representative Monitoring Well used to assess compliance with the GSP for this area. The well is located 6,500 feet southwest of the Project well and is predicted to experience up to 6.7 feet of drawdown during dry years. Drawdown results are shown normalized to the average measured water level over the period 2012-2023 to gain perspective of the effect of cumulative drawdown on the long-term average and range of groundwater levels. Measured, long-term average, and predicted average groundwater levels are also shown relative to Minimum Thresholds and Measurable Objectives established for this well. The magnitude of simulated drawdown effects during dry years over a 50-year period, compared to the historical record for an 11-year period, shows that long-term average groundwater levels may be expected to decline by less than 2 feet, and are predicted to remain about 9 feet below the Measurable Objective for this well. Drawdown during dry years is predicted to be about 5 feet greater, driven by the additional drawdowns induced by Town of Windsor pumping; however, groundwater levels are predicted to recover to near the Measurable Objective for this well when the additional dry year pumping ceases during normal or wet years.

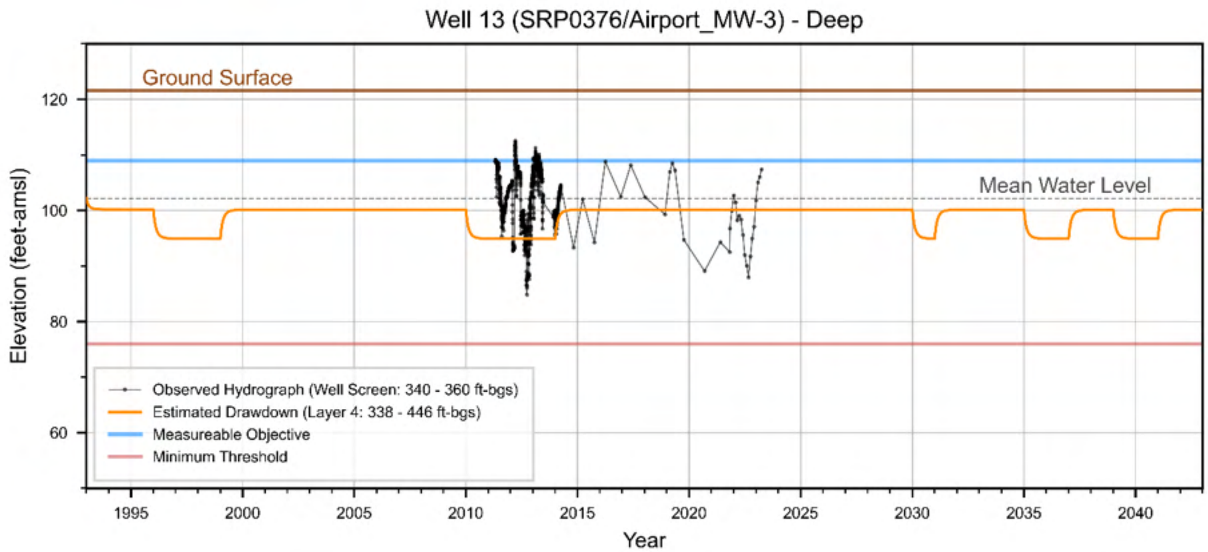


**FIGURE 20: SIMULATED DRAWDOWN AT SRP0052 AND HISTORICAL MEASURED GROUNDWATER ELEVATIONS**

# 6 IMPACT ANALYSIS

This section presents an evaluation of the potential environmental impacts associated with groundwater pumping at the Project Site with a focus on impacts related to groundwater resources. To support development of responses to comments received on the EA, the evaluation focuses on the following potential Project and cumulative impacts:

- Groundwater Drawdown:
    - Project and cumulative drawdown in the pumped aquifer, the shallow aquifer utilized by most domestic wells, and the water table; and
    - Interference drawdown to the closest irrigation, municipal supply and domestic wells.
- Consistency of the Project with the local GSP, including with the sustainable management goals, and evaluation of the likelihood the Project would interfere with its implementation by causing or contributing to:
    - Chronic lowering of groundwater levels;
    - Depletion of groundwater storage;
    - Water quality degradation due to induced contaminant migration or interference with cleanup efforts or water quality management plans;
    - Depletion of interconnected surface water, including potential flow in Pruitt Creek or impacts to GDEs; and
    - Land subsidence.

- Adequacy of groundwater supplies to meet Project and local water demand, including during dry and critically dry years.
- Cumulative impacts of the combined implementation of Project pumping and proposed future expansion of municipal pumping under the Town of Windsor 2020 UWMP.
- Consideration of climate change in the above evaluations.

The impact evaluations described below are provided in the form of reasoned evaluations organized by topic area.

## 6.1 GROUNDWATER DRAWDOWN

Regional drawdown, if it represents a substantial fraction of the overall available drawdown or groundwater in storage in an aquifer system, can result in less water supply being available for the future, insufficient availability of groundwater during dry periods, or a general increase in groundwater supply development costs. Interference drawdown is a more localized effect that occurs when the "cone of depression" that forms around a well when it is pumping intersects another well that can affect its operation by decreasing well yield, increasing pumping or maintenance costs and, in extreme cases, causing wells to go dry.

The wells potentially most vulnerable to interference drawdown are shallow wells, which have less available drawdown. As a result, the same amount of drawdown in a shallow well will potentially have a proportionally greater performance impact than with deeper wells. In this regard, it should be noted that domestic wells are often shallower than municipal, industrial and irrigation wells, but this is not always the case. A threshold of 5 feet of interference drawdown has been widely used to identify the potential for significant interference drawdown to shallow wells in groundwater resources impact assessments across the state under CEQA (JJ&A 2018). Based on available well completion data for the Site vicinity, most shallow domestic wells in the area extend at least 50 feet below the water table. Decreasing the available drawdown of a well with 50 feet of available drawdown by 10% is unlikely to result in a noticeable reduction in yield; therefore, a threshold of significance of 5 feet for shallow wells is reasonable.

Municipal, industrial and irrigation supply wells are generally completed to a significantly greater depth and constructed to support greater production capacities. Many domestic wells are also completed to greater depths below the water table. A threshold of 20 feet of interference drawdown has been widely used to identify the potential for significant interference drawdown to deeper wells in groundwater resources impact assessments across the state under CEQA (JJ&A 2018). An increased drawdown of less than 20 feet for these wells is not likely to significantly decrease well yield or result in other adverse effects, whereas drawdowns greater than 20 feet can noticeably increase the electrical costs of pumping large volumes of water from greater depths. For wells of intermediate depth, with available drawdowns between 50 and 200 feet, a threshold equal to 10 % of the available drawdown is often used.

Interference drawdown predicted to be induced by pumping for the Project at the end of the 50-year simulation period is summarized in Table 5 and may be summarized as follows:

- At the observation point representing the closest possible location for a nearby domestic well, the predicted drawdown is 1.63 feet for the shallowest reported domestic well depth in the PLSS section, 2.89 feet for average domestic well depth and 8.01 feet for the deepest reported domestic well depth. The predicted drawdown is less than 5 feet for shallow and intermediate depth wells. For the deepest reported domestic well depth, the predicted drawdown is much less than 20 feet and the reported maximum well depth is 535 feet, so this well would have at least several hundred feet of available drawdown. Based on the available data, Project interference drawdown impacts to nearby domestic wells would be less than significant.

- Predicted drawdowns induced by the Project at nearby municipal supply wells are 1.43 feet at the Town of Windsor Bluebird Well (bottom of screen interval 745 feet bgs), 2.57 feet at the closest supply well for the Mobile Home Estates small community water system (bottom of screen interval 191 feet bgs), and 3.38 feet at the Town of Windsor Esposti Park Well (bottom of screen interval 655 feet bgs). These drawdowns are much less than 20 feet or 10% of the available drawdown, and unlikely to result in adverse effects. Based on this information, impacts to municipal supply wells will be less than significant.

- The nearest irrigation supply well to the Project Site is located within the vineyard east of the Project Site. The predicted interference drawdown at this well is 9.23 feet and the reported bottom of the screen interval for this well (Well 5 in Table 1) is 310 feet bgs. The predicted drawdown is much less than 20 feet and is unlikely to result in adverse effects. Based on this information, interference drawdown impacts to nearby irrigation wells will be less than significant.

The spatial distribution of drawdown in the pumped aquifer predicted to be associated with the Project is shown in Figure 15. Drawdown exceeding 5 feet is predicted to be limited to an area measuring about ¼ square mile in a primarily rural area southeast of the Town of Windsor. Drawdown exceeding 2 feet is predicted to affect an area measuring about 1.5 by 2.5 miles. This drawdown is predicted to occur in the pumped aquifer, which has several hundred feet of available drawdown. Based on the thickness of the aquifer system and the available drawdown, the predicted amount and distribution of drawdown is not expected to significantly decrease the amount of groundwater available in storage or otherwise affect the availability of groundwater as a supply source. Based on this information, Project impacts to groundwater storage will be less than significant.

## 6.2 CONSISTENCY WITH LOCAL GROUNDWATER SUSTAINABILITY PLAN

### 6.2.1 CHRONIC GROUNDWATER LEVEL DECLINE

As discussed in Section 4.4.1 and shown in Figure 5, long-term monitoring of the Santa Rosa Plain sub-basin since the 1970s and 1980s indicates relatively stable groundwater-level conditions over time in the northern portion of the sub-basin. The Project Site is not located in an area designated as overdrafted

(SRPGSA 2022). The predicted response of the aquifer system to pumping for the Project is a relatively rapid equilibration of groundwater levels to new levels that are roughly 5 feet lower in a relatively small area (about ¼ square mile) in a primarily rural area southeast of the Town of Windsor, and 2 to 5 feet lower in an area that measures about 1.5 by 2.5 miles (Section 5.7.1; Figure 15). Figure 6 shows that groundwater levels at Representative Monitoring Points in the northern subbasin are currently above Minimum Thresholds and near the designated Measurable Objectives. The relatively small amount of drawdown induced by the Projects predicted to affect these wells will not significantly change this condition. Based on the available information, the Project will not cause or contribute to undesirable results related to chronic groundwater level decline.

### 6.2.2 DEPLETION OF GROUNDWATER STORAGE

As noted above in Section 6.2.1, Figure 6 shows that groundwater levels at Representative Monitoring Points in the northern subbasin are currently above Minimum Thresholds and near the designated Measurable Objectives. The relatively small amount of drawdown induced by the Projects predicted to affect these wells will not significantly change this condition. Figure 20 shows the predicted drawdown at the nearest Representative Monitoring Point to the Project Site. Drawdown related to Project pumping is predicted to stabilize at about 1.8 feet in normal and wet years, and to recover quickly after dry years. Assuming the observed historical range of groundwater level variability continues in the future, groundwater levels are predicted to remain well above MTs. The relatively small amount of predicted drawdown associated with the Project would not be distinguishable from ambient seasonal fluctuations in groundwater levels and would not reasonably be expected to interfere with implementation of the GSP. Therefore, implementation of the Project will not significantly decrease the available groundwater in storage by causing or contributing to undesirable results related to groundwater storage depletion.

### 6.2.3 DEGRADATION OF GROUNDWATER QUALITY

Degradation of water quality by groundwater pumping can occur when groundwater extraction changes local groundwater gradients and induces migration and spread of contamination plumes associated with nearby spill or release incidents or interferes with their cleanup. Review of the State Water Resource Control Board's GeoTracker database indicates there are two groundwater contamination incidents near the Project Site that have impacted groundwater (SWRCB 2024). These are shown on the map in Figure 9 and include the Exxon Mobile site approximately 0.7 mile west of the Project Site and the Fast and Easy Mart site approximately 1.2 mile south-southeast of the Project Site. Review of the database indicates that the status of the Exxon Mobile case is reported as "Completed, Closed," and the Fast and Easy Mart status is reported as "Active, Verification Monitoring."

Various investigation, remediation and monitoring activities have been ongoing at the Fast and Easy Mart site since an underground gasoline storage tank leak was discovered in 1995. The most recent monitoring report was issued in October 2023 (Stratus 2023) and a Case Closure Review Summary Report was prepared by Regional Water Quality Control Board Staff in December 2023 (RWQCB 2023). These reports indicate that shallow groundwater has been impacted by gasoline hydrocarbons, fuel oxygenates and hexavalent chromium. The predominant groundwater flow direction in the shallow groundwater zones ranges from northwest to southwest, and a groundwater plume has extended from the site for a distance up to about 200 feet and is relatively stable.

Drawdown impact modeling indicates that groundwater drawdown in the shallow aquifer system induced by Project pumping is predicted to be approximately 1.5 feet at the Fast and Easy Mart site (Figure 14). This is well within the range of seasonal groundwater level fluctuations reported at the site, which is 5 to 10 feet (Attachment 1). Based on the limited magnitude of the predicted drawdown, the documented groundwater gradient direction, the limited extent and stability of the existing groundwater contamination plume, and the status of remediation and monitoring activities, it is very unlikely that groundwater pumping for the Proposed Project would influence the migration of the remaining contamination plume or interfere with cleanup operations. As such, pumping for the Proposed Project is expected to have no impact on water quality.

### 6.2.4 GROUNDWATER-DEPENDENT ECOSYSTEMS AND INTERCONNECTED SURFACE WATER

As discussed in Section 4.3, the documented depth to the regional water table indicates it is unlikely that aquatic resources identified in the vicinity of the Site are groundwater connected, except for a possible perennial reach of Pruitt Creek located northeast of the Site at the foot of the Mayacamas Mountains. Surface water and underflow at this location emerges from the Mayacamas Mountains and infiltrates into the valley fill aquifer. Additional monitoring would be required to confirm whether surface water in Pruitt Creek at this location is groundwater connected, but assuming that it is, induced drawdown at the water table in the area could potentially increase vertical groundwater gradients and infiltration rates from the perennial reaches of the creek. As shown in Figure 14, the predicted water table drawdown in this area is approximately 1 foot. While this amount of drawdown may increase vertical gradients somewhat, the extent of perennial water in this reach of Pruitt Creek would be expected to be controlled, in order of importance, by (1) the rate of water outflow from the Mayacamas Mountains; (2) the vertical impedance of the streambed; and (3) the gradient driving infiltration. Based on the available information, it is unlikely that the drawdown induced by the Project would significantly decrease the extent of aquatic resources or adversely affect aquatic species through stranding or habitat loss or degradation.

A potential riparian hardwood GDE area has been mapped along Pruitt Creek within and northeast of the Project Site and extending about 0.7 mile to the northeast, as shown in Figure 3. The maximum predicted drawdown at the water table (Layer 1) is 1.6 feet beneath this potential GDE area (Table 5). Drawdown is predicted to occur relatively rapidly, with approximately 70 percent occurring in the first month of pumping and 99 percent after one year (Table 5). The GDE is reported to include riparian hardwoods including Eucalyptus, Valley oak, Oregon ash, Buckeye, California bay-laurel and Coast live oak, with native and non-native shrubs, grasses and herbs in the understory (TNC 2024; Sequoia 2022). In a riparian setting, these species typically derive their water supply from a combination of precipitation, streamflow and, when present, shallow groundwater.

Risk assessment guidelines for GDEs developed by the State of New South Wales in Australia characterize drawdowns that are less than seasonal fluctuations as posing a low risk of adverse impacts (New South Wales Department of Primary Industries 2012). Research has shown that root distribution tends to be related to groundwater history; therefore, a rapid decline in water table relative to the condition under which roots developed may strand plant roots so they cannot obtain sufficient moisture (Shafroth et al. 2000). Although roots do tend to redistribute with the water table, plants cannot proliferate new roots if the water table decline is too rapid (Richards et al. unpublished; Stella and Battles 2010; Stella et al. 2010). Even relatively modest groundwater level declines can also significantly decrease the recruitment of new seedlings even if more mature trees ultimately adapt, potentially resulting in long-term riparian habitat decline or change (TNC 2018; Amlin and Rood 2002). On the other hand, riparian woodland communities in Mediterranean climates rely on naturally variable groundwater and streamflow to sustain recruitment and succession, and naturally variable hydrologic conditions are thought to promote more resilience to rapid change and climate stress (Rhode et al. 2021).

The predicted drawdown at the mapped GDEs on and near the Site (approximately 1.6 feet) is predicted to manifest relatively rapidly; however, this amount of drawdown is estimated to be only a fraction of the seasonal groundwater level fluctuation under which these woodlands have developed (5 to 10 feet have been documented near the Site). In addition, Pruitt Creek is an uncontrolled stream with highly variable flow. We note that the woodland species present are likely only partially reliant on groundwater for their water needs. Finally, we note that NDVI trends for the wetland area show little or no change in vigor over the last several decades (see Figure 3), during which the on-Site vineyard was developed, likely decreasing groundwater levels due to irrigation pumping.

Based on the available information, the additional drawdown induced by the Project is well within the range of historical hydrologic variability under which these potential GDEs developed and thrived. The GDEs should be capable of readily adapting to the predicted modest change in groundwater levels.

### 6.2.5 SUBSIDENCE

Land subsidence can occur when compressible clays are depressurized because of groundwater extraction, triggering water to flow from the clays into the surrounding aquifer, and ultimately causing consolidation of the clay under pressure from the overlying sediments. In general, most subsidence occurs when an aquifer is initially depressurized, but it can continue for months, or even years, after clays slowly dewater and adjust to the new pressure regime. If groundwater levels subsequently recover, subsidence generally does not resume (or does not progress as rapidly) until groundwater levels fall below historical low levels. Subsidence can occur especially in confined aquifer conditions, where the drawdown associated with groundwater extraction is greater than in unconfined aquifers.

From late 2005 to 2019, the nearest subsidence monitoring station in the Santa Rosa Plain showed a total vertical change of +0.1 inch. From 2015 to 2019 the total vertical change for the station was reported as 0.01 inch, with annual changes of +0.003 inch (SRPGSA 2022). Based on the lack of active subsidence reported in the subbasin, the lack of strongly confined regional aquifers, and the fact that drawdown induced by pumping for the Project is predicted to be well within the range of annual and year-to-year groundwater level fluctuations, it is very unlikely that pumping for the Project would result in subsidence impacts. As such, the Project is expected to have no subsidence impact.

## 6.3 CUMULATIVE IMPACTS

The drawdown modeling conducted for this GRIA predicts that the aquifer system in the vicinity of the Proposed Project will equilibrate relatively quickly to pumping conditions. The maximum cumulative effect of pumping for the Project and the two proposed Town of Windsor wells therefore occurs at the end of dry and multiple dry years, when the overall pumping rate is several times greater than Project pumping alone. At the end of the simulated dry periods when Town of Windsor pumping ceases, groundwater levels recover relatively quickly. Predicted maximum cumulative drawdowns at nearby well locations are summarized in Table 6 and may be summarized as follows:

- Maximum cumulative drawdowns at the hypothetical nearest possible domestic well location to the Site are predicted to be 5.91 feet for the shallowest reported well depth, 9.08 feet for the average reported well depth, and 16.6 feet at the deepest reported well depth. The predicted drawdowns for shallow and average wells exceed the thresholds discussed in Section 6.1 (5 feet for the shallowest reported well depth and 10% of the available drawdown for an intermediate depth well) and would be considered potentially cumulatively significant. The predicted drawdown for the deep domestic well would not be considered cumulatively significant because it is much less than 20 feet or 10% of the available drawdown for the well. It should be noted that the impacts resulting from Project pumping alone for wells of these depths is not predicted to be significant and accounts for approximately 30 percent of the total predicted cumulative drawdown. After the cessation of dry year pumping, drawdowns decrease quickly to the less than significant levels resulting from Project pumping alone.

- Cumulative drawdown predicted at nearby municipal and irrigation wells ranges from 8.08 to 17.49 feet, which is less than the 20-foot or 10% of available drawdown thresholds discussed in Section 6.1. Based on this information, cumulative drawdown impacts to nearby municipal and irrigation wells would be less than significant.

- Figure 20 shows the predicted cumulative drawdown at the nearest Representative Monitoring Point (SRP0376) for the local GSP to the Project and Esposti Park wells. Drawdown is predicted to stabilize at about 1.8 feet in normal and wet years, and 6.7 feet in dry years. The repeated pattern of predicted drawdown and recovery in dry years is stable. The effect of cumulative drawdown will be to increase the range of fluctuation of groundwater levels in the well. Assuming future groundwater fluctuations are similar to historical patterns, high groundwater levels during normal and wet years will decrease only slightly and will be close to the MO, whereas low groundwater levels during dry years will be lower by about 5 feet, and up to approximately 28 feet below the MO. Average groundwater levels are predicted to be approximately 9 feet below the MO for the well during normal and wet years, and 14 feet below the MO during dry years. Groundwater levels are predicted to remain above the MT for this well for all year types. As noted previously, the pattern of drawdown during dry years and recovery during normal and wet years is consistent with sustainable groundwater management. Furthermore, the limited drawdown during normal and wet years would be indistinguishable from ambient groundwater fluctuations and is not reasonably expected to interfere with GSP implementation. For these reasons, cumulative impacts to groundwater storage are expected to be less than significant.

- Cumulative drawdown at the potential riparian hardwood GDE along Pruitt Creek on and near the Project Site is predicted to be just under 6 feet during dry years and to manifest relatively quickly. We note that Project drawdown is forecast to be in the range of 1.6 feet, which would represent a new and relatively stable baseline to which phreatophyte tree roots would have adjusted. The additional 4.2 to 4.3 feet of intermittent drawdown induced during dry years by the Town of Windsor wells is between three and four times greater than pumping for the Project alone. This amount of drawdown is similar to the low end of the range of observed seasonal groundwater level fluctuations. In the absence of groundwater level data at the Site, it may be expected that relatively rapid groundwater level fluctuations of this magnitude could exceed the ability of the trees' roots to adapt and could result in plant stress and habitat decline. Cumulative drawdown impacts at this GDE in dry years would therefore be considered potentially cumulatively significant; however, we note that adverse effects that could occur would result from the additional intermittent drawdown resulting from pumping of the Town of Windsor wells.

- Similar to Project impacts, cumulative drawdown would not be expected to result in significant surface water depletion, water quality impacts or subsidence impacts.

Based on the above analysis, the potential for significant cumulative impacts related to interference drawdown and degradation of GDEs cannot be ruled out. We note that pumping by the Town of Windsor during dry years, which is projected to be nearly four times greater than pumping for the Project, is responsible for the majority of the potential adverse impacts related to well interference, and likely all of the potential adverse impacts to GDEs.

The results of the Cumulative Impacts modeling scenarios demonstrate that pumping from the proposed Town of Windsor water supply wells contributes far more to the extent of drawdown than Project pumping. To gain additional perspective on the contribution of Project pumping and Town of Windsor pumping to the extent of cumulative drawdown, Figure 17 compares the predicted lateral extent and amount of drawdown for the pumping of the Town of Windsor wells alone (Baseline Cumulative Pumping) to the amount of drawdown associated with pumping the Project well and the Town of Windsor wells (Project Cumulative Pumping). Figure 17 shows that the Project contributes marginally to the overall extent of drawdown in the shallow and deep aquifer zones.

As discussed in Section 4.1, the PEIR for the Town of Windsor's 2011 WMP (Horizon 2011) did not include an analysis of the potential impacts of operation of the Esposti Park and North Windsor wells for supply pumping only, though it nevertheless concluded that significant impacts could occur as a result of groundwater pumping from these wells. Specifically, the PEIR indicated the following:

> *[I]f operation of the MGP resulted in extraction volumes that exceeded injection volumes, then a net deficit in aquifer volume or lowering of the groundwater table level (overdraft) could occur over time. … Pumping tests at the Esposti Park well site suggest that the*

> *shallow and intermediate/ deep aquifers are hydrologically isolated from one another and have limited connectivity. Separation of the shallow and intermediate/deep aquifer suggests that injection of water from the RRWF into the intermediate/deep aquifer and subsequent extraction of that water (from the intermediate/deep aquifer) would not affect shallow aquifer levels (and in turn not affect surface flows in creeks or wells located within the shallow aquifer). … If a stronger connection between the intermediate/deep and shallow aquifers exists (a condition not indicated by field pump tests to date), then pumping from the intermediate/deep aquifer could lower water levels in the shallow aquifer, and effectively lower the local groundwater level, with potentially corresponding effects on local wells and creeks. This could result in impacts to streamflow and groundwater supplies in nearby wells.*

Based on the above information, the Town of Windsor recognized the potential for injection and pumping of the Esposti Park well to result in potential adverse impacts to shallow domestic wells and GDEs. Furthermore, as discussed in Section 4.4.4, in the absence of data from longer-term pumping, the conclusions presented by RMC (2010) regarding the pumping test at the Esposti Park well should not be considered conclusive with respect to the competence of aquitards in the vicinity to isolate the effects of pumping the well from the shallow zone. The PEIR for the 2011 WMP (Horizon 2011) proposed implementation of mitigation measure HYD-3 to avoid or substantially lessen the potentially significant impact identified in the PEIR. Further discussion of HYD-3 is included in Section 7.1.

## 6.4 WATER SUPPLY AND ENTITLEMENTS

If the Project proceeds and the Site is taken into trust, groundwater extraction to supply the Project would occur under Federally reserved water rights. Although the Tribe would not be required to comply with SGMA and the local GSP, as discussed in Section 6.2, the proposed pumping would be consistent with SGMA and the GSP. The tribe could further choose to voluntarily participate in the sustainable groundwater management activities undertaken by SRPGSA, including coordination of any groundwater related monitoring and mitigation measures.

Figure 20 shows project-induced drawdown would decrease groundwater levels by less than 2 feet at the nearest RMP monitoring well operated by SRPGSA, which is much less than the observed seasonal fluctuation of groundwater levels in the well and would not be distinguishable from those fluctuations. Groundwater levels would remain relatively stable, except during dry years, when planned pumping by the Town of Windsor would increase drawdown by about another 5 feet. The pattern displayed by the forecast cumulative hydrograph is one of additional drawdown during dry and multiple dry years, followed by recovery during normal and wet years. This pattern is a hallmark of sustainable groundwater management.

Based on the available data, the Project is expected to have an adequate and assured water supply, including during dry and multiple dry years.

# 7 POTENTIAL MONITORING AND MITIGATION MEASURES

The results of the impact analysis discussed in Section 6 indicate no significant impacts from the Project are anticipated. However, potentially significant cumulative impacts to GDEs and shallow domestic wells are possible. Potential impacts to shallow wells are related primarily to the effects of pumping the Town of Windsor Esposti Park and North Windsor wells. Potential impacts to GDEs are possible as a result of the additional drawdown induced by pumping of the Town of Windsor wells during dry years.

As noted in Section 6.3, the PEIR for adoption of the Town of Windsor 2011 WMP recognized the potential for significant impacts to domestic wells and GDEs drawing water from the shallow zone, and stated that "implementation of Mitigation Measure HYD ‐ 3 is required to ensure impacts on groundwater level fluctuations would be less than significant" (Horizon 2011; Town of Windsor Agenda Report 2011). Although the Town has not published a CEQA analysis to evaluate the operation of the Esposti Park and North Windsor wells for groundwater extraction alone, several components of this measure would be applicable to the Town's planned operation of these wells. Mitigation measure HYD-3 includes the following (Horizon 2011, p. 3.9-25, -26, emphasis added in bold to identify potentially applicable sections):

> *To ensure the long-term sustainability of the MGP, the Town shall establish operating rules prior to commencement of the program. The operating rules may be refined over time based on additional investigations of the groundwater basin and data analyses, and incorporate the following conditions based on concerns about aquifer connectivity, the maximum amount of water withdrawn from the aquifer, and the maximum amount of water projected for injection into the aquifer. The Town shall establish a long-term monitoring program and a mitigation program to identify and mitigate long-term effects on existing groundwater wells.*
>
> 1. *Maintaining Long-Term Sustainability of Aquifer: The MGP shall be operated such that, over the long-term, there is no net decrease of the aquifer groundwater elevations and the aquifer is maintained to sustainable elevation conditions that are similar to the current existing conditions. To achieve this long-term sustainability, the total aquifer injections and extractions will be maintained within 20 percent of one another over a 10-year rolling average. Further, should long-term declines in groundwater levels result from MGP operations (outside of the range of natural fluctuation), the Town would increase the ratio of injections to extractions to reverse this trend and bring groundwater levels back up to sustainable levels.*
>
> 2. *Aquifer Connectivity: As future sites are investigated to establish other MGP wells and well fields, at least three injection and pump testing events shall be conducted with monitoring of shallow wells within a 1/2-mile radius.* ***If these tests reveal that injections into or extracting from the intermediate/deep aquifer causes a substantial increase or decrease in water levels in the shallow aquifer or in surrounding wells, alterations to surface streamflow, or impacts to natural recharge, the MGP operations shall cease and be reassessed before proceeding with***

***injection or pumping activities. MGP operations shall not proceed until there is a significant body of evidence that existing wells would not be affected.***

3. *Maximum Infiltration into Aquifer: In general, the allowable amount of infiltration into a well in a confined aquifer is controlled by depth to water and the amount of pressure in the system. Increased pressure in the system from infiltrating too much water into a confined aquifer can cause hydraulic fracturing, or break apart formations that separate an intermediate/deep and shallow aquifer system. Huismann and Olsthoorn (1983) provide a method to determine the maximum water level rise based on the injection pressures and the water level rise. This method was applied to the Esposti Park replacement well, which approximated a maximum water level rise of 97 to 145 feet. This method, or a comparable method, shall be used to determine the maximum water level rise for additional wells constructed for the MGP. MGP operation conditions for each individual well shall be operated such that the maximum water level rise is not exceeded.*

4. *Adaptive Management of MGP to Ensure Sustainability: **A long-term** injection **monitoring and testing program to assess sustainable** injection and **production rates and corresponding operation and maintenance procedures shall be developed prior to initiation** of the MGP. Long-term operating protocols shall be modified annually and as additional wells are added to the program. As a performance standard, the MGP shall be operated such that there is no substantial long-term net deficit in aquifer volume.*

5. *Participation in Santa Rosa Plain Managed Groundwater Program: The Town's continued participation in the Santa Plain Rosa Managed Groundwater Program will help to ensure that the MGP is consistent with overall basin management.*

It is assumed that the Town of Windsor will likely adopt applicable monitoring and mitigation measures adapted from HYD-3 to identify and substantially lessen or prevent potentially significant impacts associated with its operation of the Esposti Park and North Windsor Wells. If such measures are adopted, the Tribe would participate in the development and implementation of these measures in proportion to its contribution to the potentially significant impacts associated with drawdown induced by the Project wells. In the event that the Town of Windsor does not implement a monitoring and mitigation program associated with the operation of the two new municipal wells, the Tribe would implement its own program, as described below.

## 7.1 BASELINE AND PROJECT MONITORING PROGRAM

### 7.1.1 GROUNDWATER LEVEL MONITORING

The Tribe shall implement a groundwater level monitoring program consisting of the following:

- A Groundwater Level Monitoring Workplan shall be developed and implemented to verify whether vegetation stress and habitat degradation is occurring along the riparian area of Pruit Creek through the Project Site. The GDE Monitoring Plan shall describe the program procedures, schedules, responsibilities, documentation requirements.
- Monitoring of at least one of the existing on-site supply wells, which shall be repurposed for monitoring purposes to assess groundwater levels in the pumped aquifer and at the water table beneath the Project site or, if it is not feasible to convert one of the existing supply wells into a monitoring well, installing and monitoring an on-site monitoring well to an equivalent depth.
- Installation of additional on-site monitoring wells in strategic locations to monitor groundwater levels in the shallow aquifer. Locations shall include:
    - Near the Pruitt Creek GDE;
    - Near the southwestern boundary of the site; and
    - Near the eastern side of the northern boundary of the site.

Monitoring shall begin at least one year prior to initiation of Project pumping and shall continue for a period of least 5 years after pumping of the Town of Windsor's Esposti Park well commences in order to help assess baseline conditions and the vertical connectivity of the aquifer system and the potential cumulative effects of Town of Windsor and Project pumping on shallow domestic wells and GDEs.

Groundwater level measurements shall be collected in the spring and fall of each year using an electronic well sounder to assess the depth to groundwater beneath a designated reference point. In addition, recording pressure transducers shall be deployed to assess short term changes in groundwater levels that can be compared to pumping of the on-site supply well(s) or nearby wells operated by the Town of Windsor and other parties. Observed groundwater levels shall be compared to predicted groundwater levels presented in the GRIA to help guide the implementation of appropriate well interference measures in cooperation with the Town of Windsor, if required. An annual monitoring report shall be submitted to the BIA by April 1 of the following year.

### 7.1.2 GDE VERIFICATION MONITORING

Vegetation stress and riparian habitat degradation is not expected to occur as a result of Project pumping but may occur during dry years as a result of pumping by the Town of Windsor. To verify whether vegetation stress and habitat degradation occurs as a result of non-Project dry year pumping, a GDE verification monitoring program shall be implemented at the expense of the Tribe, including the following:

- A Groundwater Dependent Ecosystem (GDE) Verification Monitoring Workplan shall be developed and implemented to verify whether vegetation stress and habitat degradation is occurring along the riparian area of Pruit Creek through the Project Site. The GDE Monitoring Plan shall describe the program procedures, schedules, responsibilities, documentation requirements.

- Baseline resource characterization and data acquisition shall be conducted by a qualified biologist in the on-Site portion of the GDE, including documentation of species composition and habitat condition, and documentation of photo points and reference transects.

- Data collection at photo points and transects shall be conducted annually by a qualified biologist.

- Satellite data available from the Landsat or Sentinel program shall be assessed annually and compared to a baseline and to shallow groundwater level trends.

- Baseline data shall be analyzed for a period of at least six representative hydrologic years by using the satellite data to calculate a vegetation index such as NDVI or Leaf Area Index (LAI).

- Annual data shall be analyzed and compared to the baseline data to assess whether there is quantifiable remote sensing evidence of plant stress or reduced vigor.

- The biological and satellite data shall be evaluated, including consideration of groundwater levels in the shallow aquifer, Town of Windsor pumping records and precipitation records in a nearby representative meteorological station to assess whether a loss of vegetation vigor has occurred that may result in habitat degradation and that is attributable to groundwater level changes caused by groundwater pumping.

- An annual monitoring report shall be submitted to the BIA by April 1 of the following year. If the program verifies that loss of plant vigor that may lead to habitat degradation is occurring, a meeting shall be convened between BIA, Sonoma County and the Town of Windsor to discuss and agree to appropriate changes in the monitoring procedures, parties responsible for program implementation and cost sharing.

## 7.2 WELL INTERFERENCE DRAWDOWN MITIGATION

The following mitigation measures are provided for consideration to lessen or prevent potentially significant cumulative impacts related to well interference under a scenario in which the Town of Windsor is operating two new municipal wells under dry year and multiple dry year conditions as proposed in the 2020 UWMP (Woodard & Curran 2021).

Should the Town of Windsor determine pursuant to mitigation measure HYD-3 Section 2 in the Town's PEIR for adoption of the 2011 WMP (Horizon 2011), or an equivalent mitigation measure adopted in a subsequent CEQA document for these wells, that aquifer connectivity in the vicinity of the Esposti Park and/or North Windsor wells causes their operation to induce a substantial decrease in water levels in the shallow aquifer or in surrounding wells, alterations to surface streamflow, or impacts to natural recharge, then the Tribe shall participate in the development and implementation of an interference drawdown monitoring and mitigation plan, and shall pay a share of the mitigation costs that is proportional to its contribution to the shallow aquifer impact being mitigated. The Tribe's obligation to contribute proportionate fair share funding shall be limited to measures to address impacts to existing shallow or domestic water supply wells from groundwater pumping; the Tribe shall have no obligation to participate in or fund other water supply initiatives or infrastructure improvements. Absent implementation of a mitigation plan by the Town of Windsor, the following monitoring and mitigation measures to be implemented by the Tribe are provided for consideration to lessen or prevent potentially significant cumulative impacts related to well interference:

- Property owners and water agencies in the area where predicted drawdown exceeds 5 feet shall be notified by certified letter of the existence of a Well Interference Drawdown Monitoring and Mitigation Program and invited to register any domestic wells in the predicted 5-foot drawdown area and any municipal, industrial, or irrigation wells in the predicted 20-foot drawdown area to participate in the program. To register for the program, well owners will be required to complete a Well Information Questionnaire regarding the construction, use, history and performance of their well, and to sign an Access Agreement that allows access for periodic measurement of water levels and assessment of well conditions and performance. A drawdown monitoring program shall be implemented to assess the extent and distribution of drawdown at the Site and in the vicinity.

- Well owners may submit claims for diminished well capacity or increased well maintenance costs. Such claims shall be evaluated to verify their veracity and whether the capacity loss or increased maintenance cost has occurred as a result of the Project. If well performance is found to be diminished by more than 25 percent or to be no longer adequate to meet historical water demands due to interference drawdown, registered participants will be eligible to receive reimbursement for reasonable and customary costs for well replacement, deepening or rehabilitation, or pump lowering as needed to restore adequate well function. In addition, the cost of additional maintenance attributable to interference drawdown caused by the Project will be eligible for reimbursement. The cost of reimbursement shall be borne by the Tribe.

- As an alternative to reimbursement, the Tribe may, at its sole discretion, elect to connect the claimant to an alternative potable water source such as the casino’s water system at the Tribe’s expense. Based on review of the extent to which the claim is due to drawdown caused by the Project vs. pumping by the Town of Windsor, the Tribe may request reimbursement from the Town of Windsor for a fair share in proportion to the degree of the Project’s contribution to the drawdown that caused the diminished yield or increased maintenance cost.

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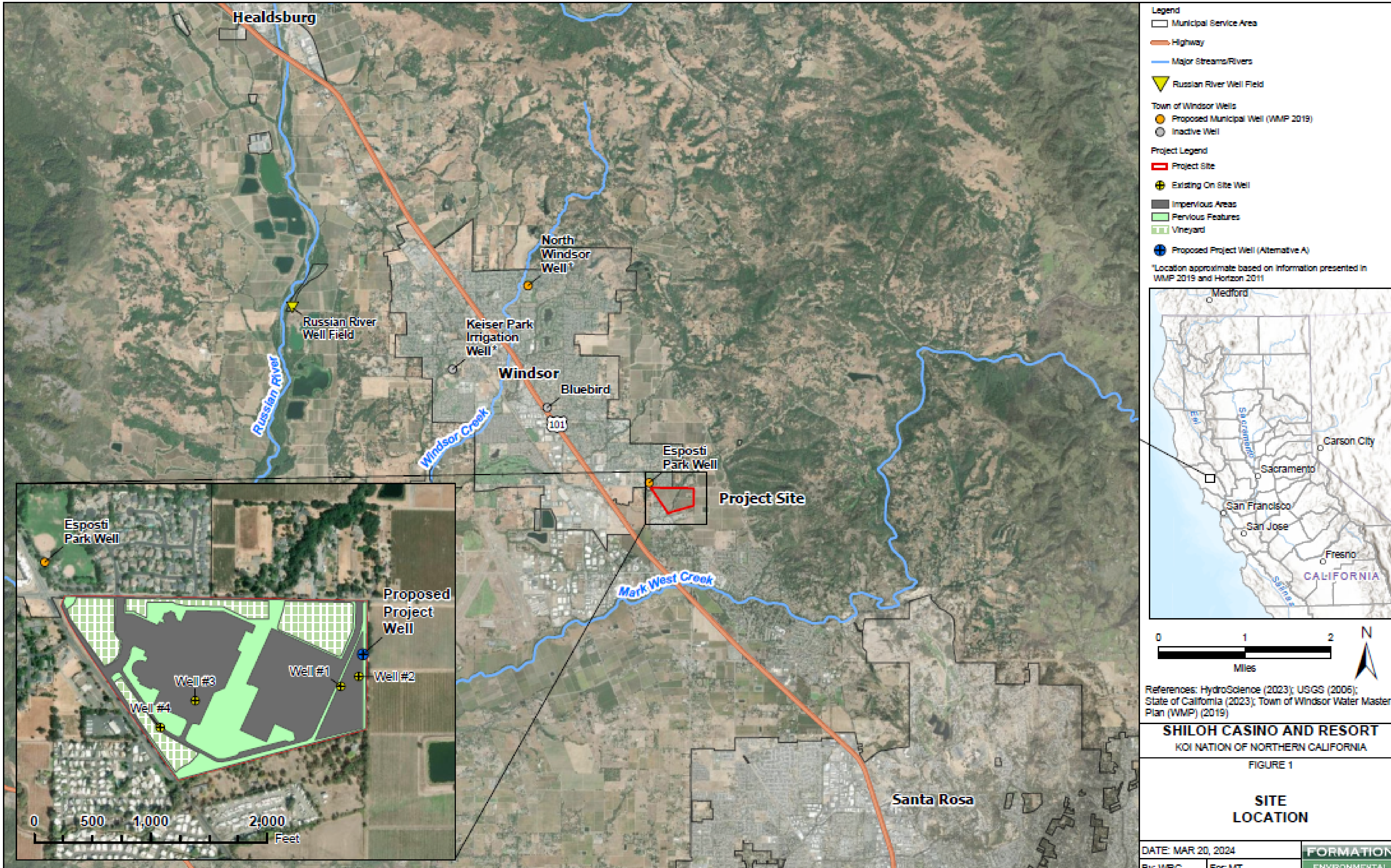
# TABLES

# Table 1
## Well Construction Details

| Well ID | Alias | Well Use | Distance from Site (mi) | Water Supply Zone | Installation Date | Latitude | Longitude | TOC Elevation[5] (ft amsl) | Ground Surface Elevation (ft amsl) | Casing Stick-Up (ft) | Well Diameter (inches) | Total Depth (ft bgs) | Total Depth (ft btoc) | Top of Screen (ft bgs) | Bottom of Screen (ft bgs) | Top of Screen (ft amsl) | Bottom of Screen (ft amsl) | Estimated Yield (gpm) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **On-Site Wells** | | | | | | | | | | | | | | | | | | |
| Well #1 | 3560/Well #1 | Domestic, Irrigation | -- | Shallow, Intermediate, Deep | 11/7/1996 | 38.524 | -122.771 | -- | -- | -- | 8 | 360 | -- | 100 | 360 | -- | -- | 280 |
| Well #2 | 4820/Well #2 | Domestic | -- | Intermediate | 9/12/2002 | 38.524 | -122.770 | -- | -- | -- | 5 | 255 | -- | 120 | 255 | -- | -- | 120 to 140 |
| Well #3 | 3925/Well #3 | Irrigation - Agriculture | -- | Intermediate-Deep | 4/1/2000 | 38.523 | -122.775 | -- | -- | -- | 12 | 580 | -- | 120 (upper)<br>200 (middle)<br>310 (middle)<br>450 (lower) | 160 (upper)<br>290 (middle)<br>430 (middle)<br>550 (lower) | -- | -- | 600 to 800 |
| Well #4 | Well #4 | Irrigation - Agriculture | -- | Intermediate-Deep | -- | 38.523 | -122.776 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 600 to 800 |
| **Off-Site Wells** | | | | | | | | | | | | | | | | | | |
| 17 | Well 01 | Municipal | 0.21 | Shallow-Intermediate | -- | 38.522 | -122.777 | -- | -- | -- | -- | -- | -- | 115 | 191 | -- | -- | -- |
| 16 | Well 01 | Municipal | 0.25 | Unknown | -- | 38.523 | -122.778 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 18 | Well 02 - Standby | Municipal | 0.31 | Shallow-Intermediate | -- | 38.520 | -122.775 | -- | -- | -- | -- | -- | -- | 102 | 208 | -- | -- | -- |
| 19 | Well 03 | Municipal | 0.32 | Unknown | -- | 38.519 | -122.774 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Esposti Irrigation | Esposti Irrigation Well | Irrigation - Agriculture | 0.35 | Shallow-Intermediate | 8/23/1989 | 38.526 | -122.779 | -- | -- | -- | 8 | 300 | -- | 100 (upper)<br>240 (lower) | 220 (upper)<br>300 (lower) | -- | -- | 230 |
| Esposti Park | SRP0728/Esposti | Public Supply | 0.35 | Deep | 3/27/2010 | 38.526 | -122.779 | 140.93 | 139 | 1.93 | 10 | 670 | 671.93 | 380 (upper)<br>430 (middle)<br>460 (middle)<br>480 (middle)<br>545 (middle)<br>615 (lower) | 420 (upper)<br>450 (middle)<br>470 (middle)<br>510 (middle)<br>565 (middle)<br>655 (lower) | -241 | -794 | 400 |
| 20 | 94785 | Domestic | 0.43 | Unknown | -- | 38.518 | -122.771 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 6 | SRP0052 | Domestic | 0.48 | Shallow | 2/16/1960 | 38.517 | -122.772 | 136.84 | 136.84 | 0.00 | 8 | 95 | 95 | 82 | 95 | 54.84 | 41.84 | 24 |
| 5 | 08N08W20Q001M | Irrigation | 0.50 | Shallow-Intermediate | -- | 38.519 | -122.767 | 146.04 | 142.84 | 3.20 | -- | 312 | 315.20 | 56 | 310 | 86.84 | -167.16 | |
| 21 | Well 01 - Inactive | Municipal | 0.66 | Shallow | -- | 38.514 | -122.774 | -- | -- | -- | -- | -- | -- | 64 | 84 | -- | -- | -- |
| 8 | SRP-27 | Unknown | 0.75 | Unknown | -- | 38.513 | -122.776 | 131 | 131 | 0.00 | -- | -- | -- | -- | -- | -- | -- | -- |
| 7 | 5475 | Domestic | 0.78 | Shallow | 7/30/1968 | 38.514 | -122.768 | 141.84 | 140.84 | 1.00 | 6 | 64 | 65 | 52 | 64 | 88.84 | 76.84 | 12 |
| 22 | 94784 | Domestic | 0.91 | Shallow | -- | 38.513 | -122.765 | -- | -- | -- | -- | 90 | -- | -- | -- | -- | -- | -- |
| 14 | S-NSF-VP16 | Domestic | 0.96 | Shallow | -- | 38.537 | -122.767 | -- | -- | -- | -- | 107 | -- | 87 | 107 | -- | -- | -- |
| 29 | Main Well | Municipal | 0.97 | Shallow-Intermediate | -- | 38.510 | -122.779 | -- | -- | -- | -- | -- | -- | 44 | 250 | -- | -- | -- |
| 9 | SRP0707/Fulton | Monitoring | 1.08 | Shallow | 10/18/2019 | 38.509 | -122.770 | 143.92 | 144.29 | -0.37 | 10 | 50 | 49.63 | -- | -- | -- | -- | -- |
| 11 | SRP0374/AirportMW1 | Observation | 1.08 | Shallow | -- | 38.512 | -122.786 | 121.6 | 121.6 | 0.00 | -- | 60 | 60 | 40 | 60 | 81.6 | 61.6 | -- |
| 12 | SRP0375/AirportMW2 | Observation | 1.08 | Intermediate | -- | 38.512 | -122.786 | 121.6 | 121.6 | 0.00 | -- | 140 | 140 | 120 | 140 | 1.6 | -18.4 | -- |
| 13 | SRP0376/Airport_MW-3 | Observation | 1.08 | Intermediate-Deep | -- | 38.512 | -122.786 | 121.6 | 121.6 | 0.00 | -- | 360 | 360 | 340 | 360 | -218.4 | -238.4 | -- |
| 10 | SRP-26 | Unknown | 1.20 | Intermediate-Deep | -- | 38.510 | -122.761 | 131 | 131 | 0.00 | -- | 390 | 390 | -- | -- | -- | -- | -- |
| 15 | Well 01 | Municipal | 1.20 | Intermediate | -- | 38.537 | -122.788 | -- | -- | -- | -- | -- | -- | 240 | 315 | -- | -- | -- |
| 23 | 94780 | Municipal | 1.54 | Deep | -- | 38.514 | -122.748 | -- | -- | -- | -- | 500 | -- | -- | -- | -- | -- | -- |
| 24 | 94779 | Municipal | 1.66 | Intermediate-Deep | -- | 38.517 | -122.744 | -- | -- | -- | -- | 368 | -- | -- | -- | -- | -- | -- |
| Bluebird | SRP0724/Bluebird | Observation | 1.82 | Deep | 5/5/2010 | 38.539 | -122.801 | 118.34 | 117 | 1.34 | 10 | 765 | 766.34 | 695 | 745 | -578 | -628 | -- |
| 28 | Well 11 | Municipal | 2.21 | Shallow | -- | 38.556 | -122.778 | -- | -- | -- | -- | -- | -- | 55 | 75 | -- | -- | -- |
| 27 | 08N09W13A002M | Domestic | 2.22 | Shallow | 9/6/1973 | 38.547 | -122.803 | 123.64 | 122.84 | 0.80 | 8.625 | 109 | 110 | 87 | 109 | 35.84 | 13.84 | 6 |
| 26 | SRP0708/Mark_West | Observation | 2.53 | Shallow | 10/22/2019 | 38.504 | -122.735 | 196.18 | 196.58 | -0.40 | 2.375 | 25 | 25 | 15 | 25 | 181.58 | 171.58 | -- |
| 25 | SRP0019 | Irrigation - Private | 3.06 | Deep | -- | 38.491 | -122.812 | 93.62 | 92.82 | 0.80 | -- | 1048* | 1049 | -- | -- | -- | -- | -- |

Notes:
1. ft asml - feet above mean sea level
2. ft bgs - feet below ground surface
3. TOC = top of casing
4. -- = not available
5. The elevation is based on the ground surface elevation and the stick-up measurement.
6. * = Total depth uncertain according to USGS

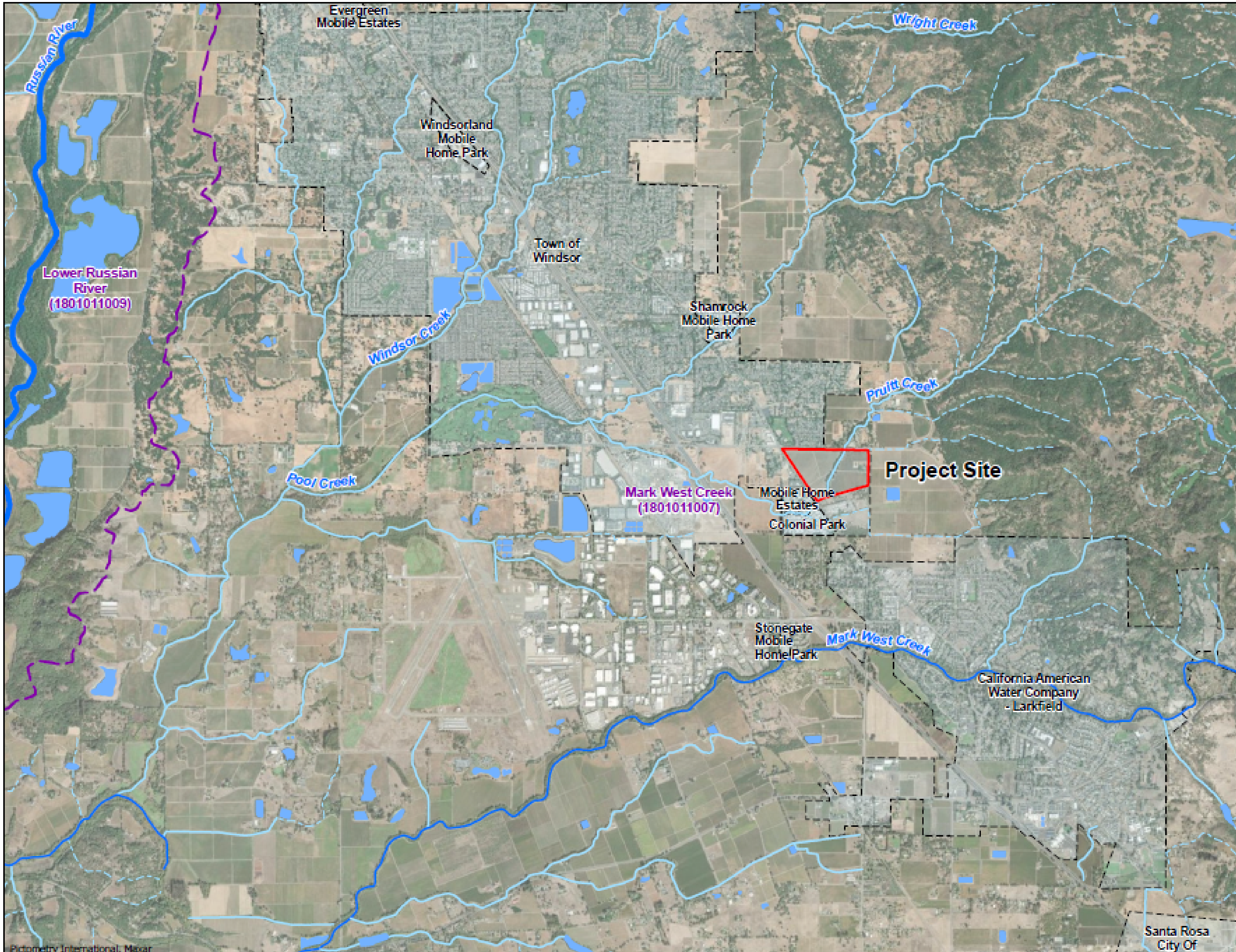
# FIGURES




SHILOH CASINO AND RESORT
KOI NATION OF NORTHERN CALIFORNIA

FIGURE 1

SITE LOCATION

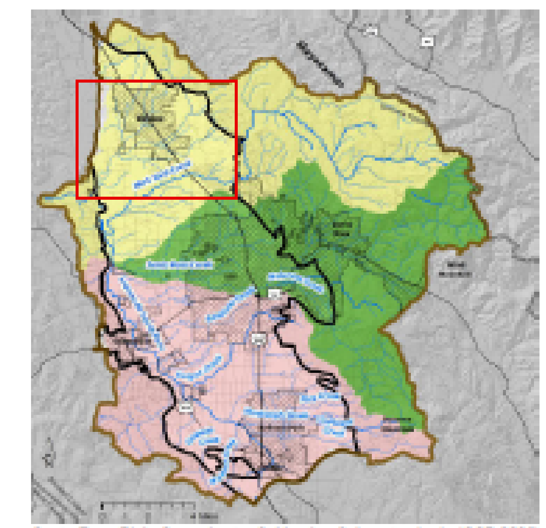



Legend

- Project Site
- Watersehd Boundary (HUC-10)
- Water Service Areas

Stream/River

- Ephemeral
- Intermittent
- Perennial
- Major River
- Lake, Reservior



Santa Rosa Plain Groundwater Subbasin - Sub-watersheds (GSP 2022)

0 2,500 5,000
Feet

N

Reference: National Hydrography Dataset (USGS 2024)

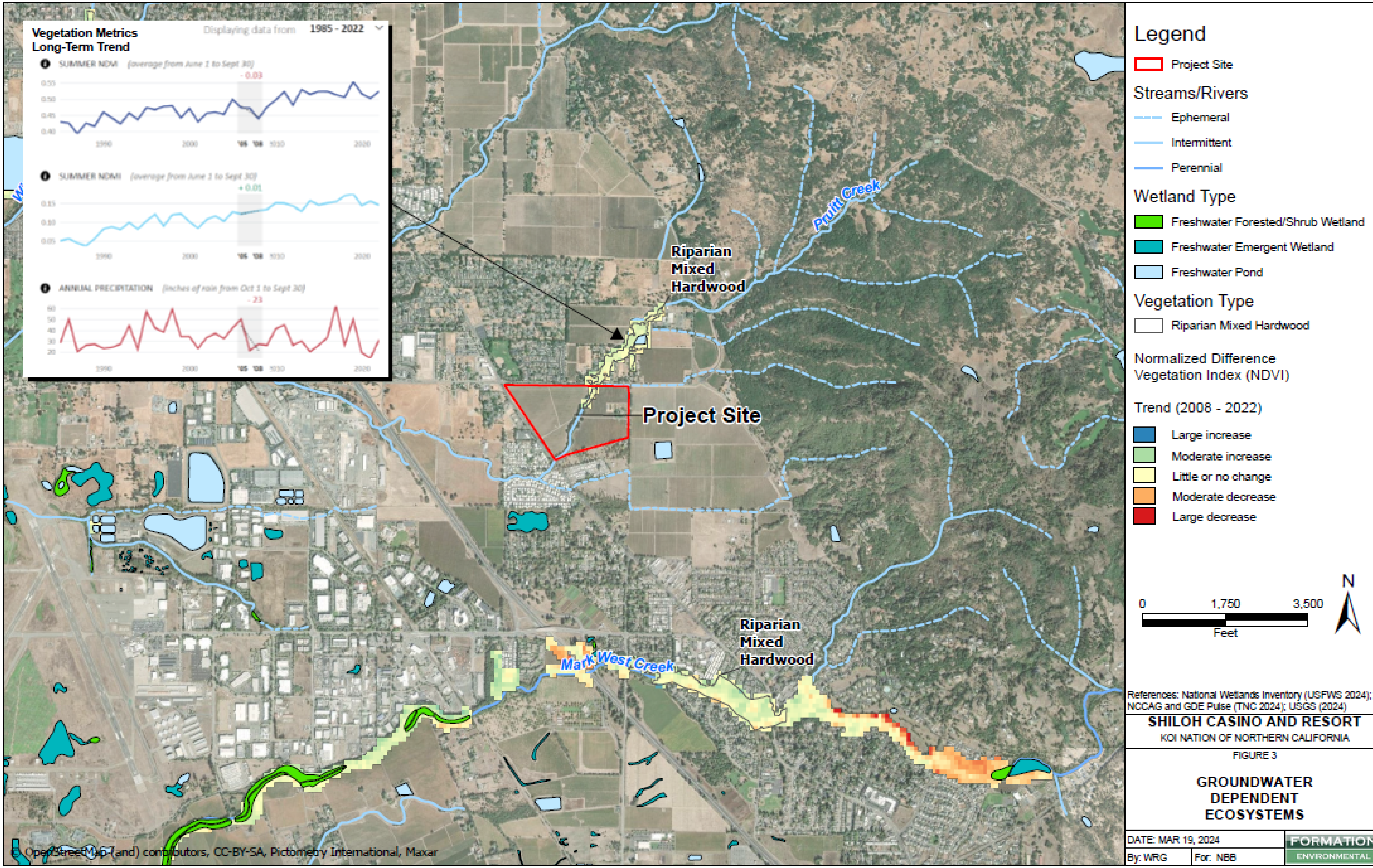
**SHILOH CASINO AND RESORT**

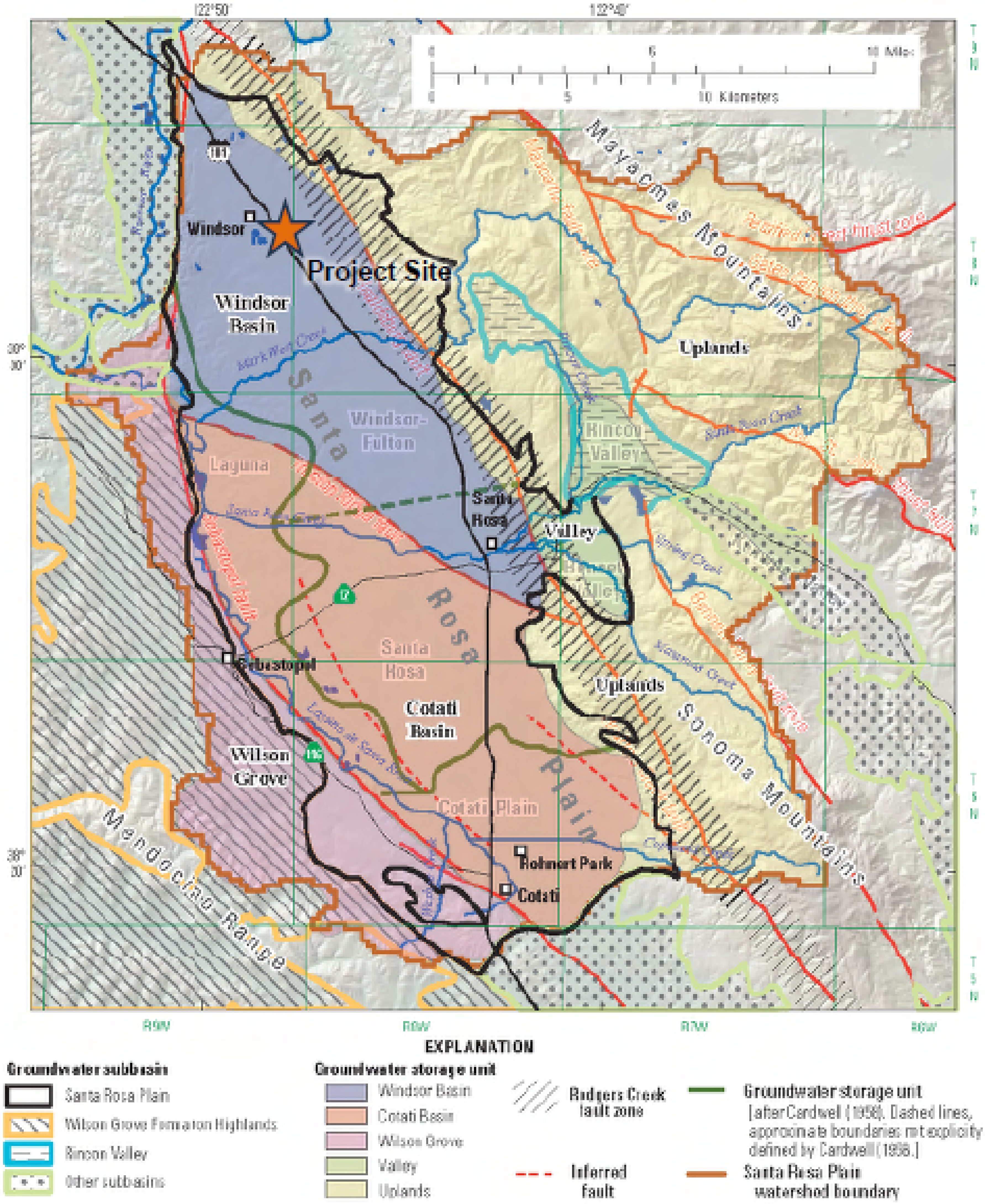
KOI NATION OF NORTHERN CALIFORNIA

FIGURE 2

**HYDROLOGIC SETTING**

| DATE: MAR 19, 2024 | | FORMATION ENVIRONMENTAL |
|---|---|---|
| By: WRG | For: NBB | |


Vegetation Metrics
Long-Term Trend
Displaying data from 1985 - 2022
SUMMER NDVI (average from June 1 to Sept 30)
- 0.03
SUMMER NDMI (average from June 1 to Sept 30)
+ 0.01
ANNUAL PRECIPITATION (inches of rain from Oct 1 to Sept 30)
- 23
Riparian Mixed Hardwood
Pruitt Creek
Project Site
Mark West Creek
Riparian Mixed Hardwood
© OpenStreetMap (and) contributors, CC-BY-SA, Pictometry International, Maxar
Legend
Project Site
Streams/Rivers
Ephemeral
Intermittent
Perennial
Wetland Type
Freshwater Forested/Shrub Wetland
Freshwater Emergent Wetland
Freshwater Pond
Vegetation Type
Riparian Mixed Hardwood
Normalized Difference Vegetation Index (NDVI)
Trend (2008 - 2022)
Large increase
Moderate increase
Little or no change
Moderate decrease
Large decrease
0 1,750 3,500
Feet
N
References: National Wetlands Inventory (USFWS 2024); NCCAG and GDE Pulse (TNC 2024); USGS (2024)
SHILOH CASINO AND RESORT
KOI NATION OF NORTHERN CALIFORNIA
FIGURE 3
GROUNDWATER DEPENDENT ECOSYSTEMS
DATE: MAR 19, 2024
By: WRG
For: NBB
FORMATION ENVIRONMENTAL




Santa Rosa Plain Groundwater Subbasin (no. 1-055), Sonoma County, California. Figure 24 from USGS SIR 2013-5118, Chapter B.

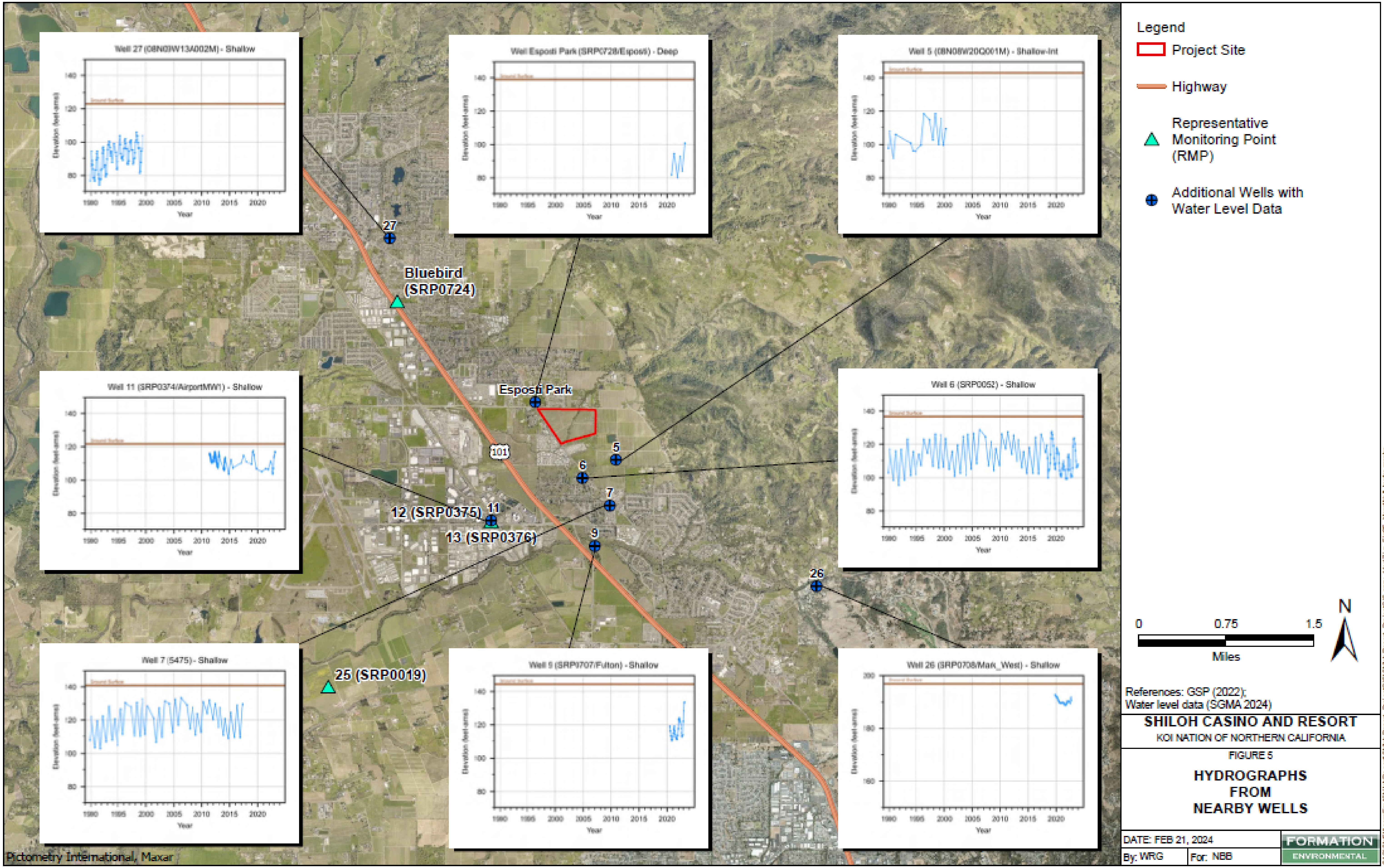
**SHILOH CASINO AND RESORT**
KOI NATION OF NORTHERN CALIFORNIA

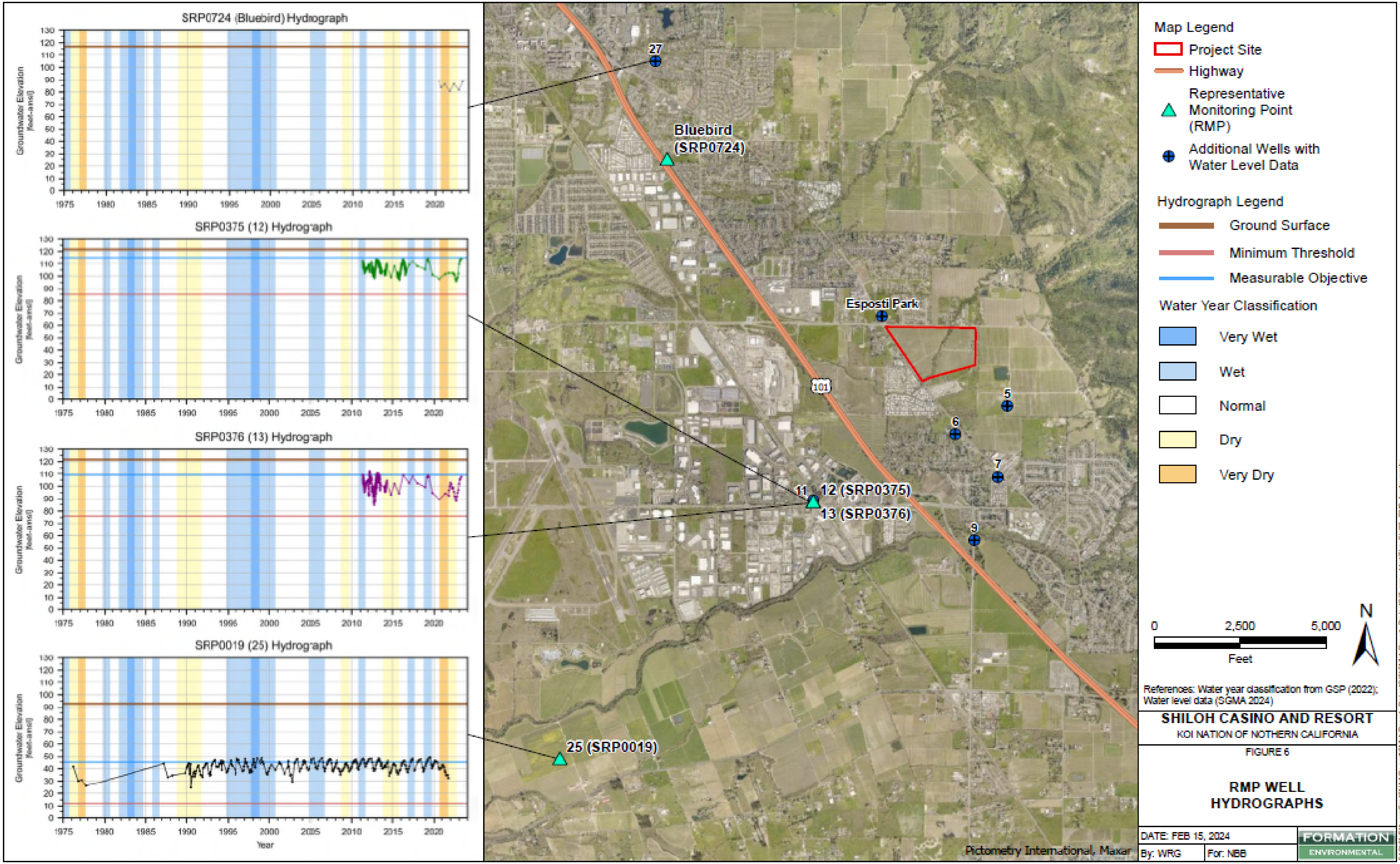
FIGURE 4

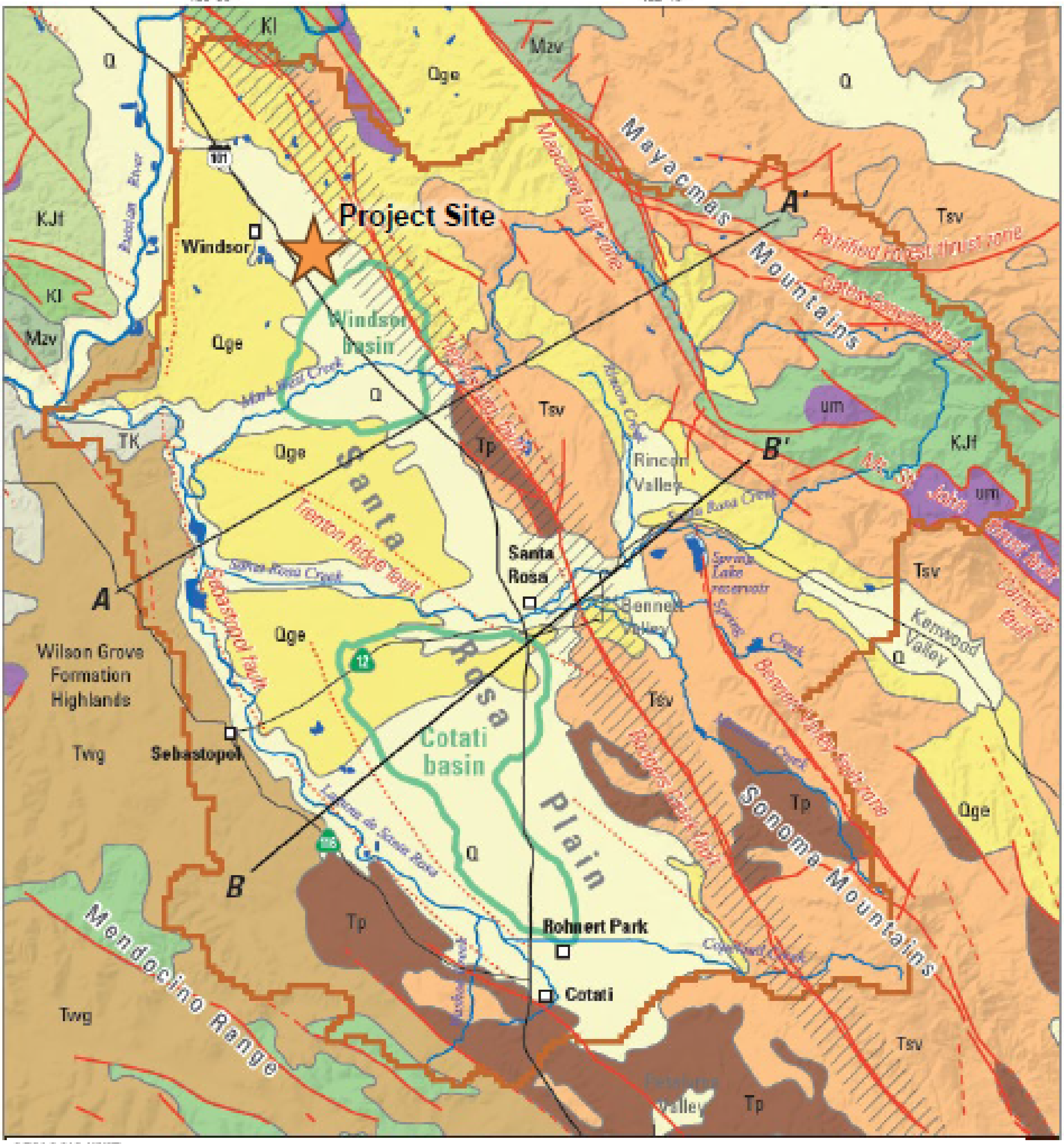
**HYDROGEOLOGIC SETTING**

DATE: JAN 22, 2024
BY: WRG
FOR: NBB

FORMATION ENVIRONMENTAL


Legend
Project Site
Highway
Representative Monitoring Point (RMP)
Additional Wells with Water Level Data
Well 27 (08N09W13A002M) - Shallow
Well Esposti Park (SRP0728/Esposti) - Deep
Well 5 (08N08W20Q001M) - Shallow-Int
Well 11 (SRP0374/AirportMW1) - Shallow
Well 6 (SRP0052) - Shallow
Well 7 (5475) - Shallow
Well 9 (SRP0707/Fulton) - Shallow
Well 26 (SRP0708/Mark_West) - Shallow
Ground Surface
Elevation (feet-amsl)
Year
27
Bluebird (SRP0724)
Esposti Park
101
5
6
7
12 (SRP0375)
11
13 (SRP0376)
9
26
25 (SRP0019)
Pictometry International, Maxar
0
0.75
1.5
Miles
N
References: GSP (2022);
Water level data (SGMA 2024)
SHILOH CASINO AND RESORT
KOI NATION OF NORTHERN CALIFORNIA
FIGURE 5
HYDROGRAPHS FROM NEARBY WELLS
DATE: FEB 21, 2024
By: WRG
For: NEB
FORMATION ENVIRONMENTAL


SRP0724 (Bluebird) Hydrograph
SRP0375 (12) Hydrograph
SRP0376 (13) Hydrograph
SRP0019 (25) Hydrograph
Groundwater Elevation [feet-amsl]
Year
27
Bluebird (SRP0724)
Esposti Park
101
5
6
7
9
11
12 (SRP0375)
13 (SRP0376)
25 (SRP0019)
Pictometry International, Maxar
Map Legend
Project Site
Highway
Representative Monitoring Point (RMP)
Additional Wells with Water Level Data
Hydrograph Legend
Ground Surface
Minimum Threshold
Measurable Objective
Water Year Classification
Very Wet
Wet
Normal
Dry
Very Dry
0
2,500
5,000
Feet
N
References: Water year classification from GSP (2022); Water level data (SGMA 2024)
SHILOH CASINO AND RESORT
KOI NATION OF NORTHERN CALIFORNIA
FIGURE 6
RMP WELL HYDROGRAPHS
DATE: FEB 15, 2024
By: WRG
For: NBB
FORMATION ENVIRONMENTAL




GEOLOGIC UNIT

**Cenozoic**

*Sedimentary rocks*

Quaternary

- Q — Recent alluvium, landslide, and sand dune deposits

Plio-Pleistocene and Pliocene

- Qge — Glen Ellen Formation

Pliocene and Miocene

- Twg — Wilson Grove Formation
- Tp — Petaluma Formation

*Volcanic rocks*

Pliocene and Miocene

- Tsv — Sonoma Volcanics

**Mesozoic**

*Sedimentary and metasedimentary rocks*

Tertiary-Cretaceous

- TK — Coastal belt rocks

Cretaceous

- Kl — Lower Cretaceous marine
- KJf — Franciscan Complex

*Plutonic, metavolcanic, and mixed rocks*

- um — Ultramafic rocks
- Mzv — Volcanic and metavolcanic

Water

Santa Rosa Plain watershed boundary

Fault—Dashed where approximately located, dotted where concealed

Rodgers Creek fault zone

Location of deep basins as defined the –14 milligal isostatic gravity contour of Langenheim and others (2006)

A A' Line of geologic section shown on figures 2, 25

0 5 10 Miles

0 5 10 Kilometers

Santa Rosa Plain Watershed, Sonoma County, California. Figure 1 from USGS SIR 2013-5118, Chapter B.

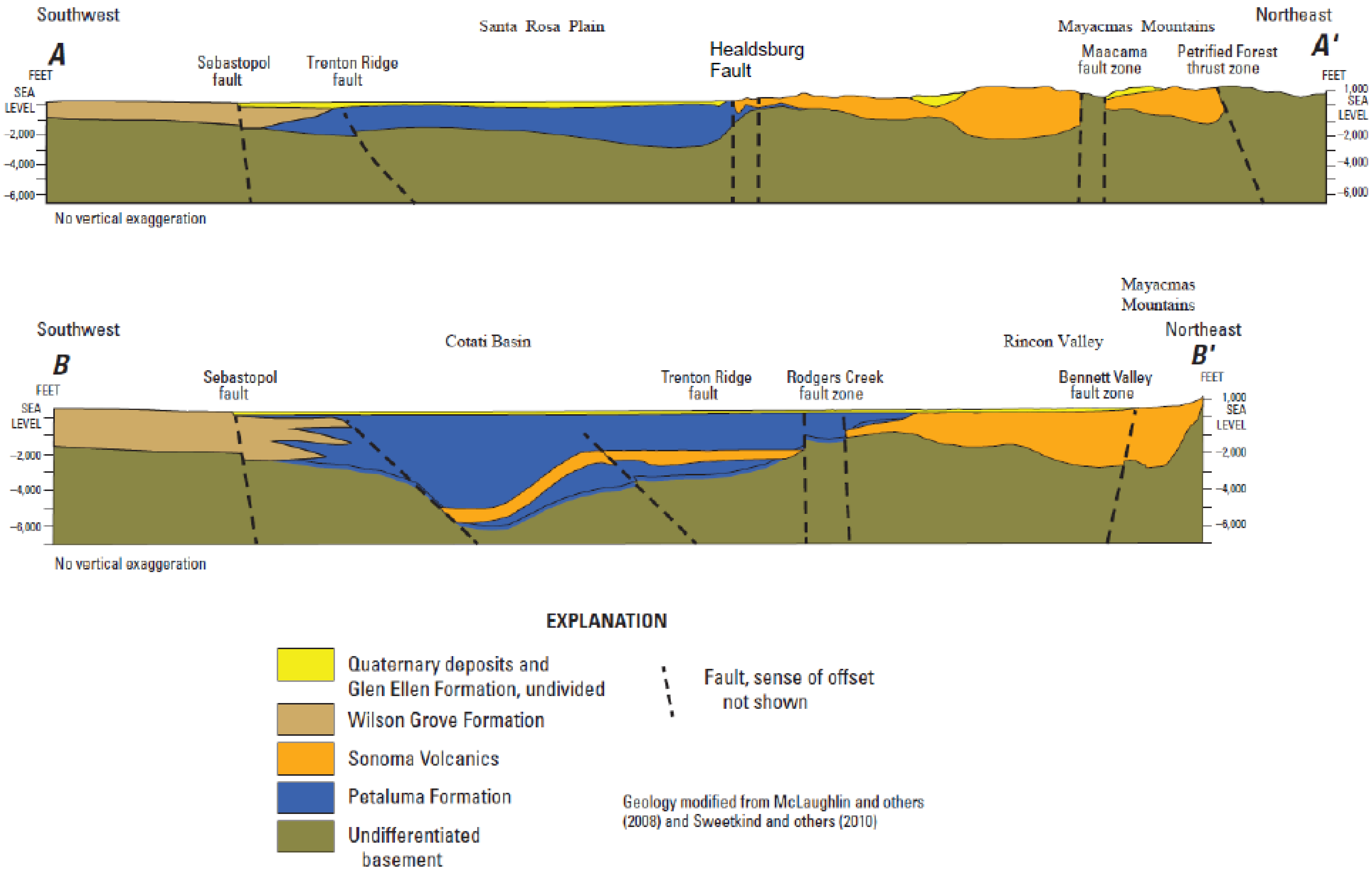
**SHILOH CASINO AND RESORT**
KOI NATION OF NORTHERN CALIFORNIA

FIGURE 7

**GEOLOGIC SETTING**

DATE: FEB 14, 2024
BY: CFJ FOR: NBB

FORMATION ENVIRONMENTAL




Modified from: Santa Rosa Plain Watershed, Sonoma County, California.
USGS SIR 2013-5118. Chapter B. Figure 1.

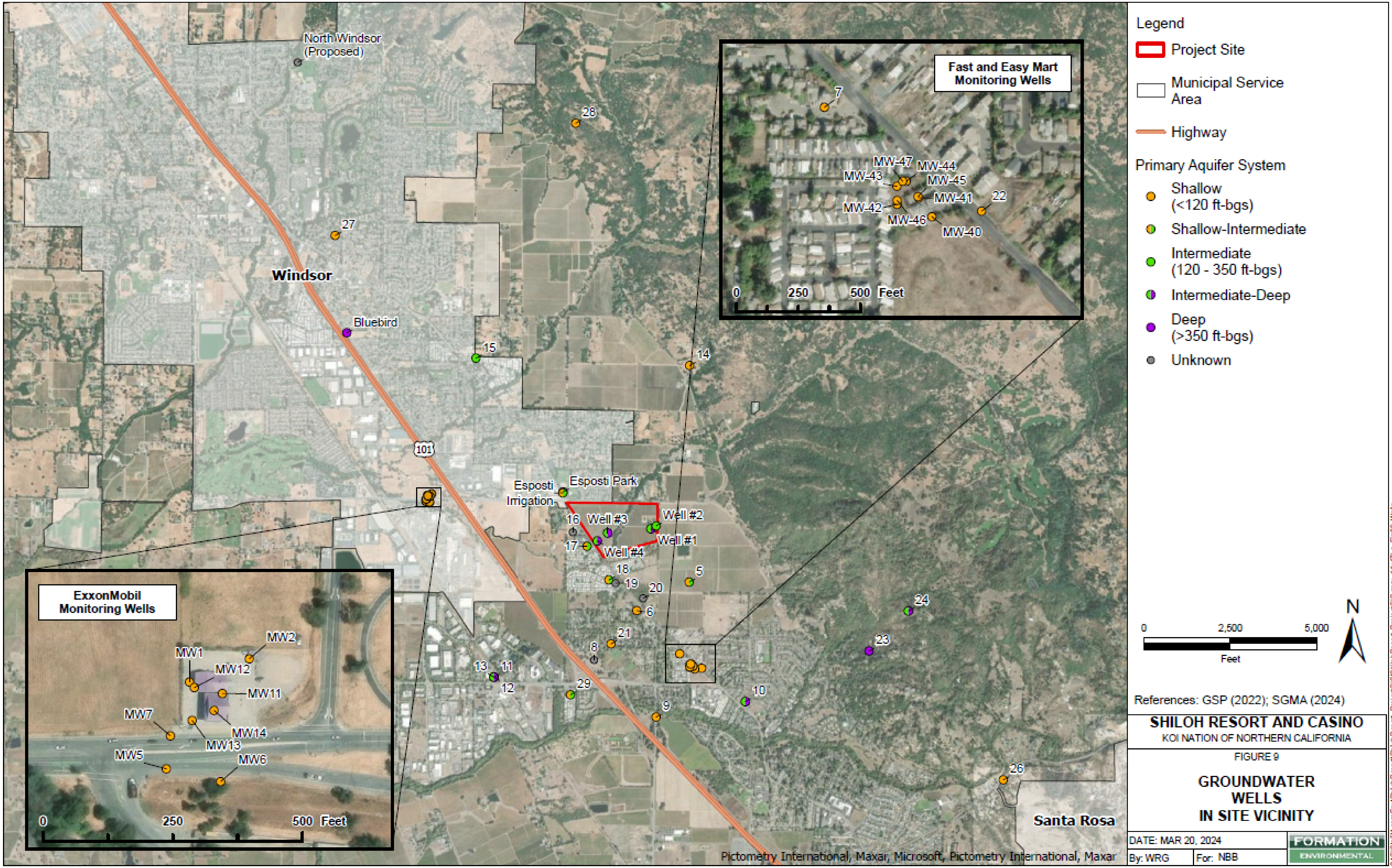
**SHILOH CASINO AND RESORT**
KOI NATION OF NORTHERN CALIFORNIA

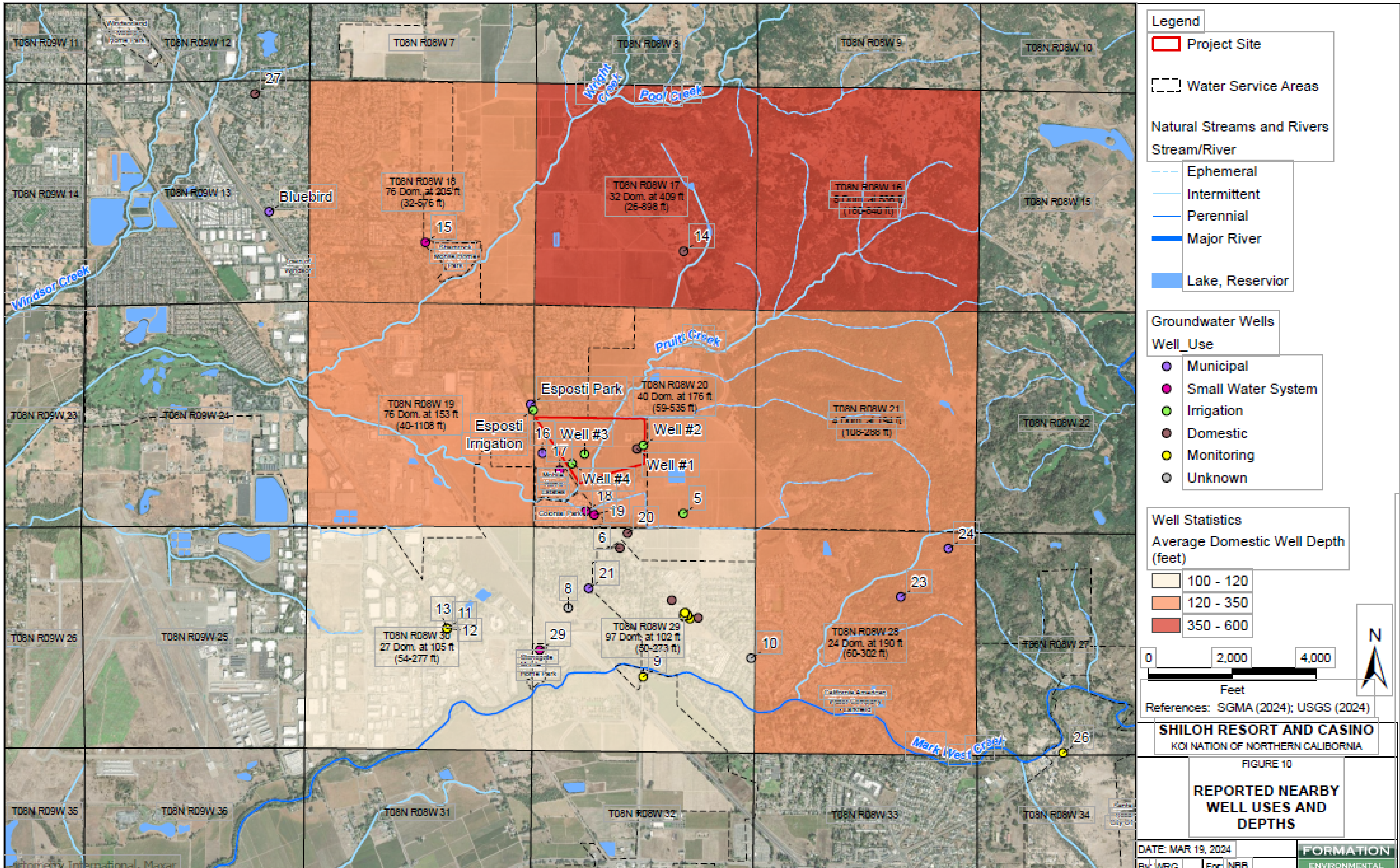
FIGURE 8

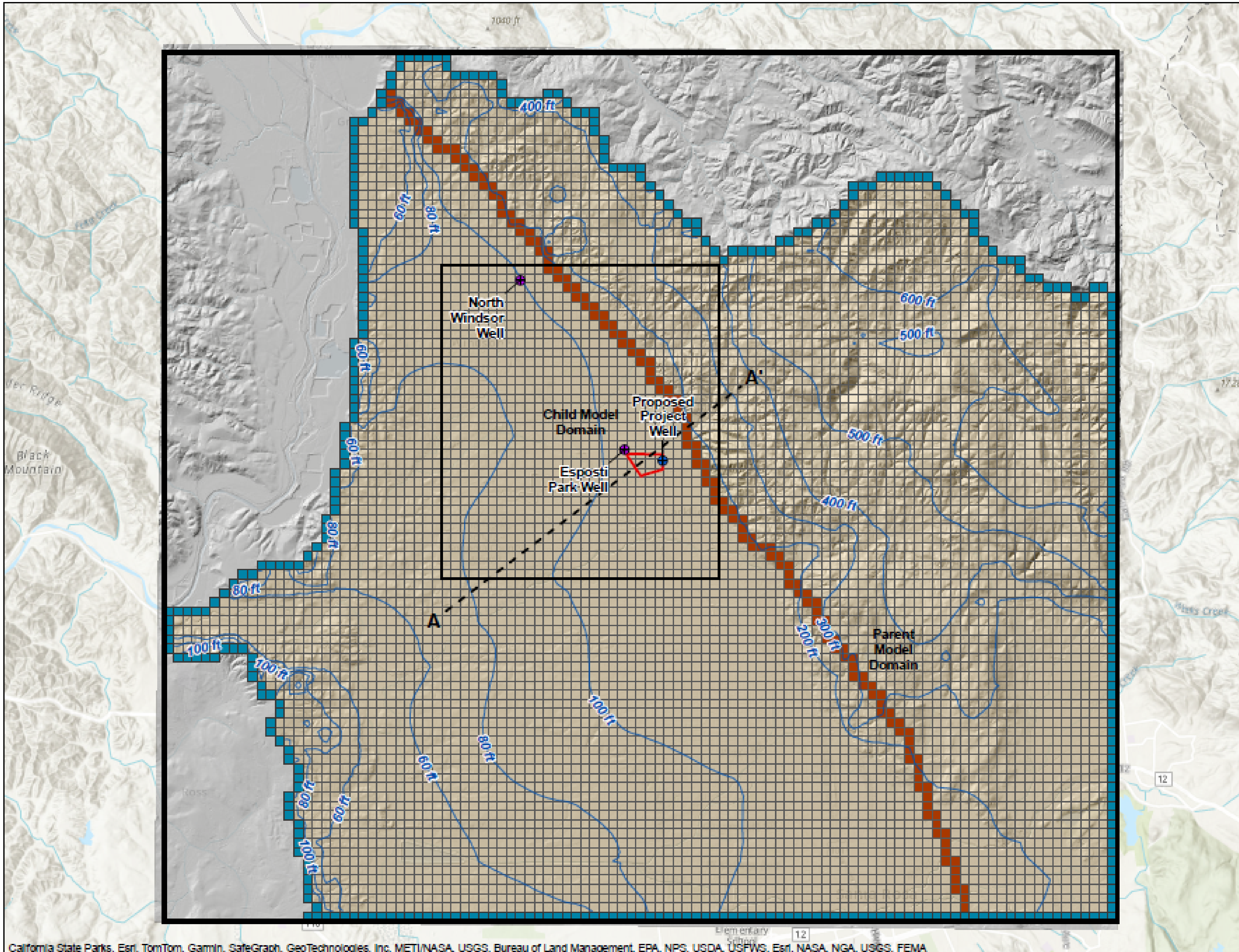
**REGIONAL GEOLOGIC CROSS SECTIONS**

DATE: FEB 14, 2024
BY: CFJ
FOR: NBB

FORMATION ENVIRONMENTAL


Legend
Project Site
Municipal Service Area
Highway
Primary Aquifer System
Shallow (<120 ft-bgs)
Shallow-Intermediate
Intermediate (120 - 350 ft-bgs)
Intermediate-Deep
Deep (>350 ft-bgs)
Unknown
Fast and Easy Mart Monitoring Wells
ExxonMobil Monitoring Wells
North Windsor (Proposed)
Windsor
Bluebird
101
Esposti Irrigation
Esposti Park
Well #1
Well #2
Well #3
Well #4
Santa Rosa
7
MW-47
MW-44
MW-43
MW-45
MW-41
MW-42
MW-46
MW-40
22
MW1
MW2
MW12
MW11
MW7
MW14
MW13
MW5
MW6
5
6
8
9
10
11
12
13
14
15
16
17
18
19
20
21
23
24
26
27
28
29
0 250 500 Feet
0 2,500 5,000 Feet
N
References: GSP (2022); SGMA (2024)
Pictometry International, Maxar, Microsoft, Pictometry International, Maxar
SHILOH RESORT AND CASINO
KOI NATION OF NORTHERN CALIFORNIA
FIGURE 9
GROUNDWATER WELLS IN SITE VICINITY
DATE: MAR 20, 2024
By: WRG
For: NBB
FORMATION ENVIRONMENTAL


Legend
Project Site
Water Service Areas
Natural Streams and Rivers
Stream/River
Ephemeral
Intermittent
Perennial
Major River
Lake, Reservior
Groundwater Wells
Well_Use
Municipal
Small Water System
Irrigation
Domestic
Monitoring
Unknown
Well Statistics
Average Domestic Well Depth (feet)
100 - 120
120 - 350
350 - 600
0
2,000
4,000
Feet
N
References: SGMA (2024); USGS (2024)
SHILOH RESORT AND CASINO
KOI NATION OF NORTHERN CALIBORNIA
FIGURE 10
REPORTED NEARBY WELL USES AND DEPTHS
DATE: MAR 19, 2024
By: WRG
For: NBB
FORMATION ENVIRONMENTAL
T08N R09W 11
T08N R09W 12
T08N R08W 7
T08N R08W 8
T08N R08W 9
T08N R08W 10
T08N R09W 14
T08N R09W 13
T08N R08W 18
76 Dom. at 205 ft
(32-576 ft)
T08N R08W 17
32 Dom. at 409 ft
(26-898 ft)
T08N R08W 16
T08N R08W 15
T08N R09W 23
T08N R09W 24
T08N R08W 19
76 Dom. at 153 ft
(40-1108 ft)
T08N R08W 20
40 Dom. at 176 ft
(59-535 ft)
T08N R08W 21
(108-288 ft)
T08N R08W 22
T08N R09W 26
T08N R09W 25
T08N R08W 30
27 Dom. at 105 ft
(54-277 ft)
T08N R08W 29
97 Dom. at 102 ft
(50-273 ft)
T08N R08W 28
24 Dom. at 190 ft
(60-302 ft)
T08N R08W 27
T08N R09W 35
T08N R09W 36
T08N R08W 31
T08N R08W 32
T08N R08W 33
T08N R08W 34
Wright Creek
Pool Creek
Windsor Creek
Pruitt Creek
Mark West Creek
Bluebird
Esposti Park
Esposti Irrigation
Well #1
Well #2
Well #3
Well #4
Colonial Park
5
6
8
9
10
11
12
13
14
15
16
17
18
19
20
21
23
24
26
27
29
Pictometry International, Maxar




Legend

Project Boundary

Model Properties

Active Area

Constant Head Boundary

Horizontal Flow Barrier

Model Extents

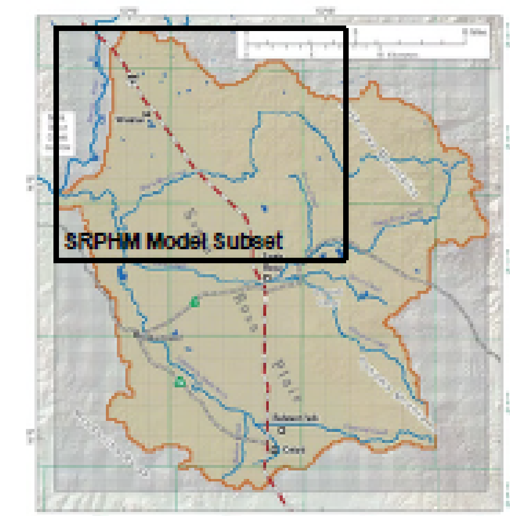
Initial Head Contours (Sept 2010)

Modeled Wells

Municipal

Proposed (Alternative A)

Cross-Section Line (A - A')




0 1.25 2.5

Miles

N

References: Santa Rosa Plain Hydrologic Model (Woolfenden and Nishikawa 2014); USGS (2024)

**SHILOH RESORT AND CASINO**

KOI NATION OF NORTHERN CALIFORNIA

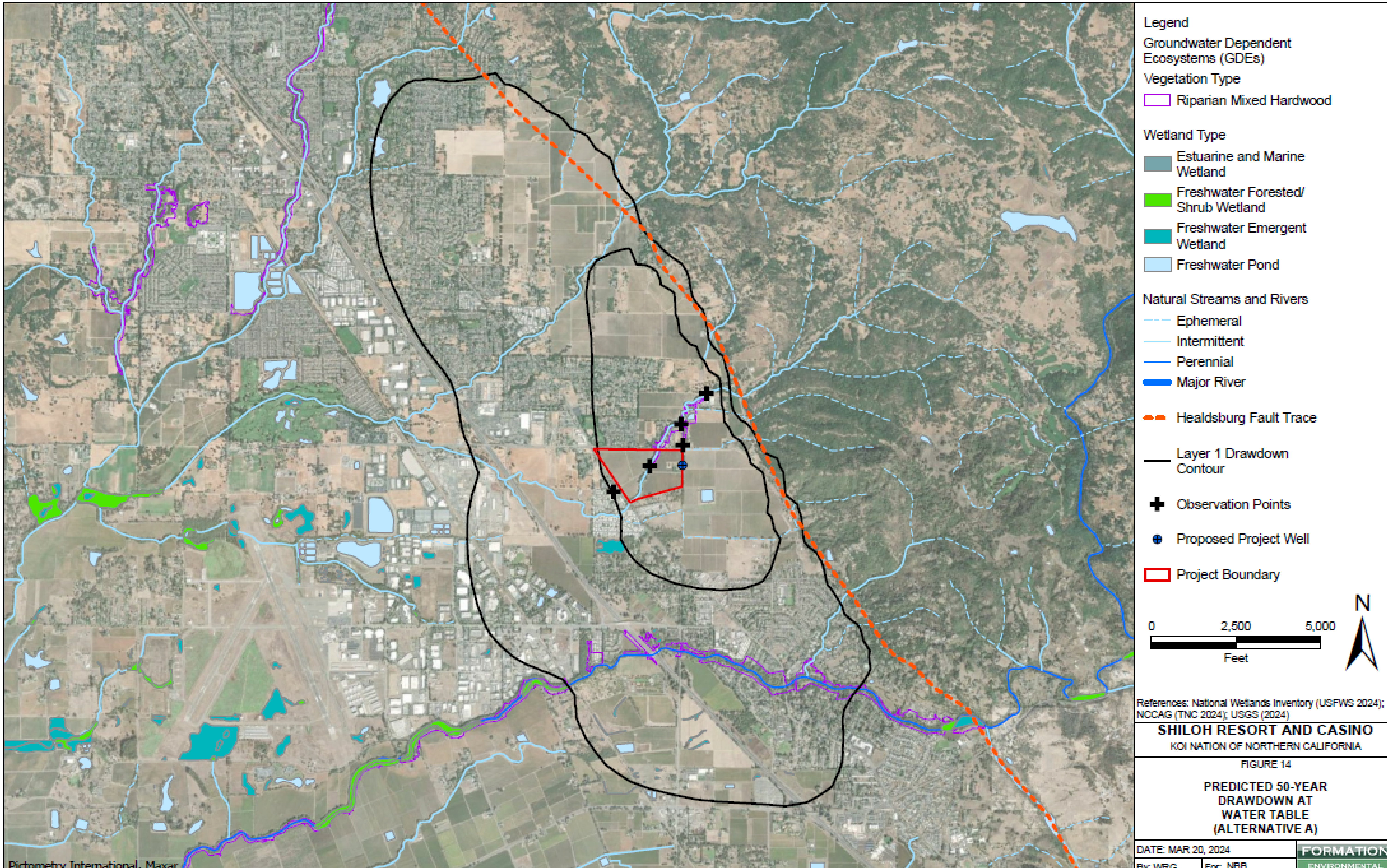
FIGURE 11

**MODEL DOMAIN AND BOUNDARY CONDITIONS**

DATE: FEB 21, 2024

By: WRG For: NBB

FORMATION ENVIRONMENTAL

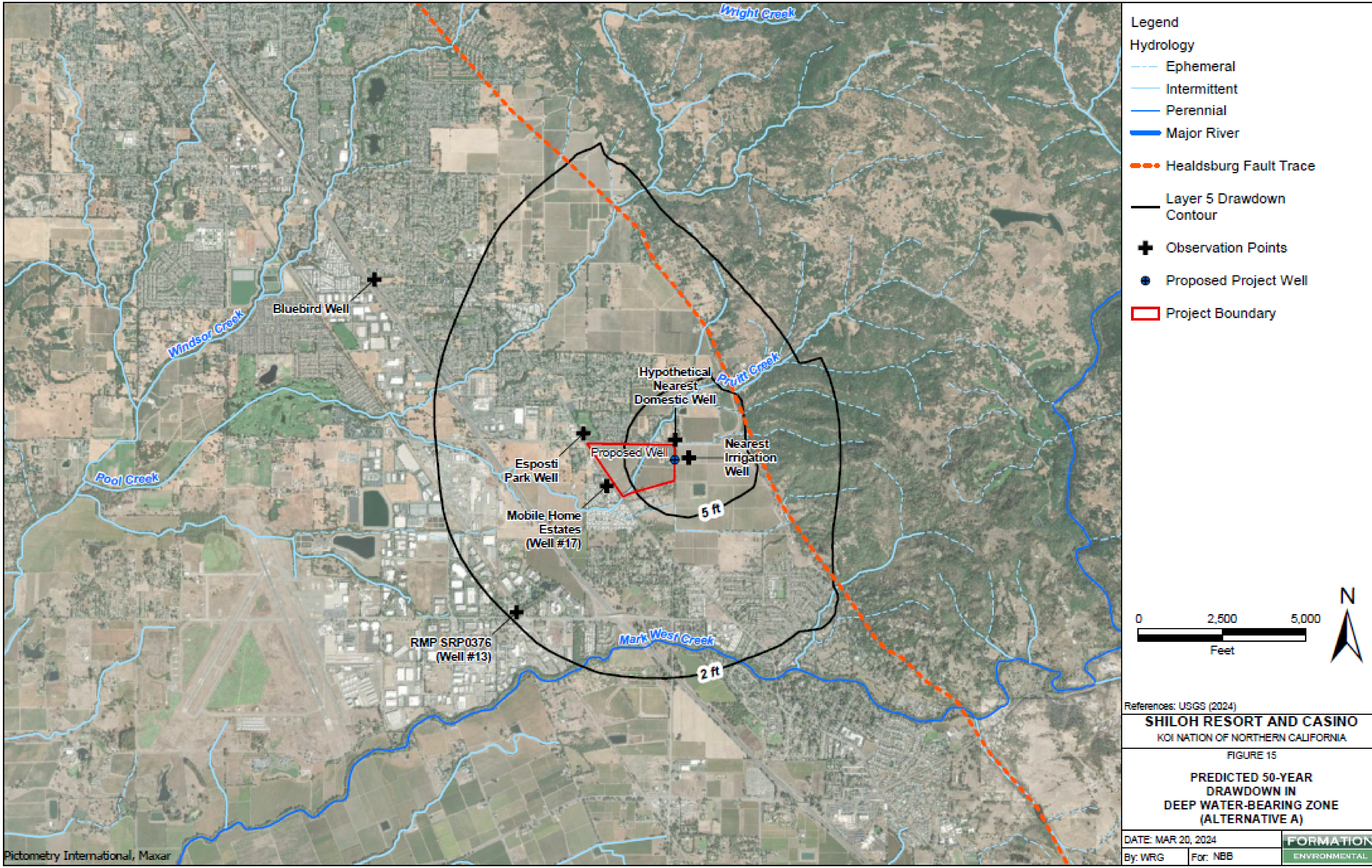


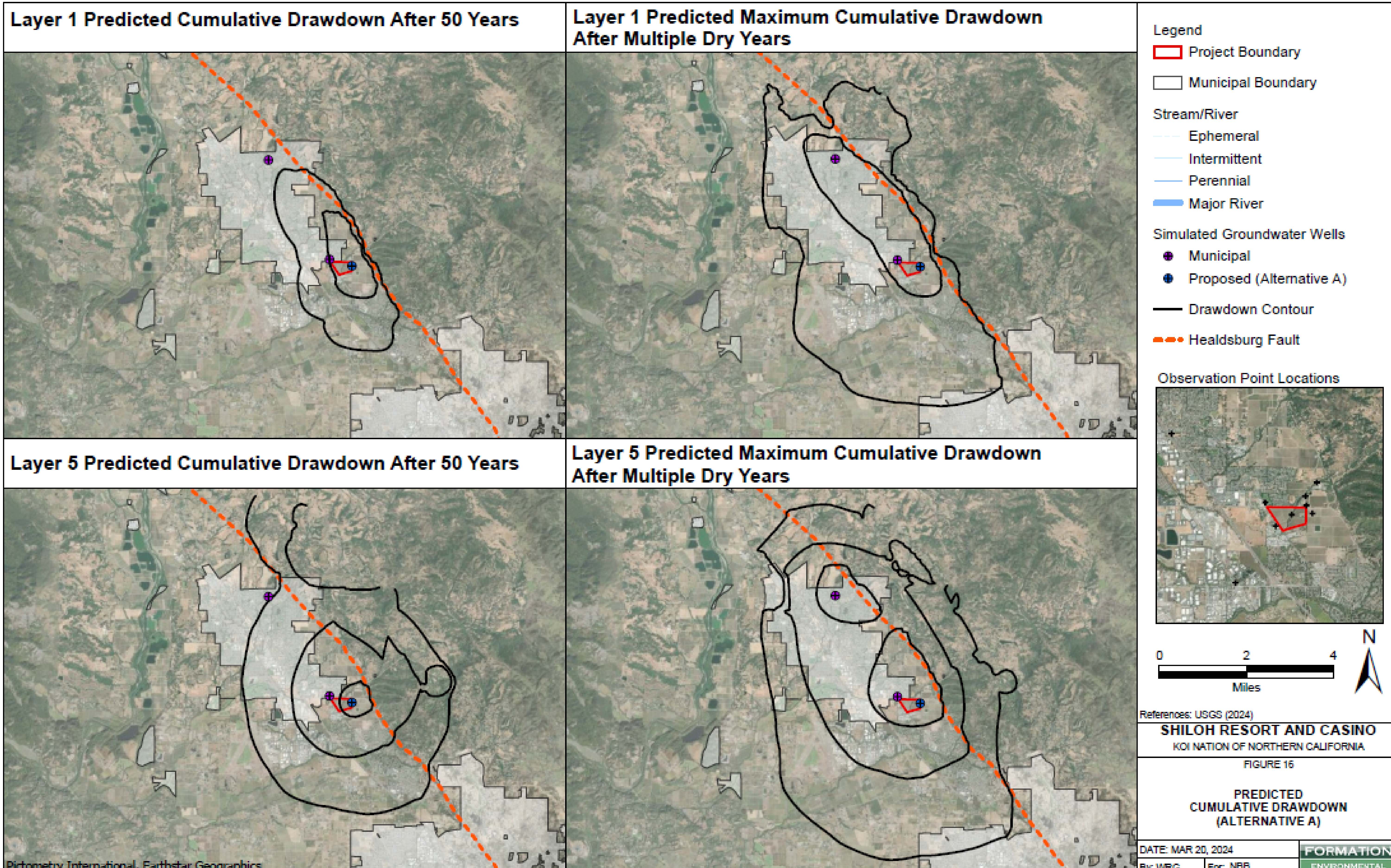

**SHILOH RESORT AND CASINO**
KOI NATION OF NORTHERN CALIFORNIA

FIGURE 14

**PREDICTED 50-YEAR DRAWDOWN AT WATER TABLE (ALTERNATIVE A)**

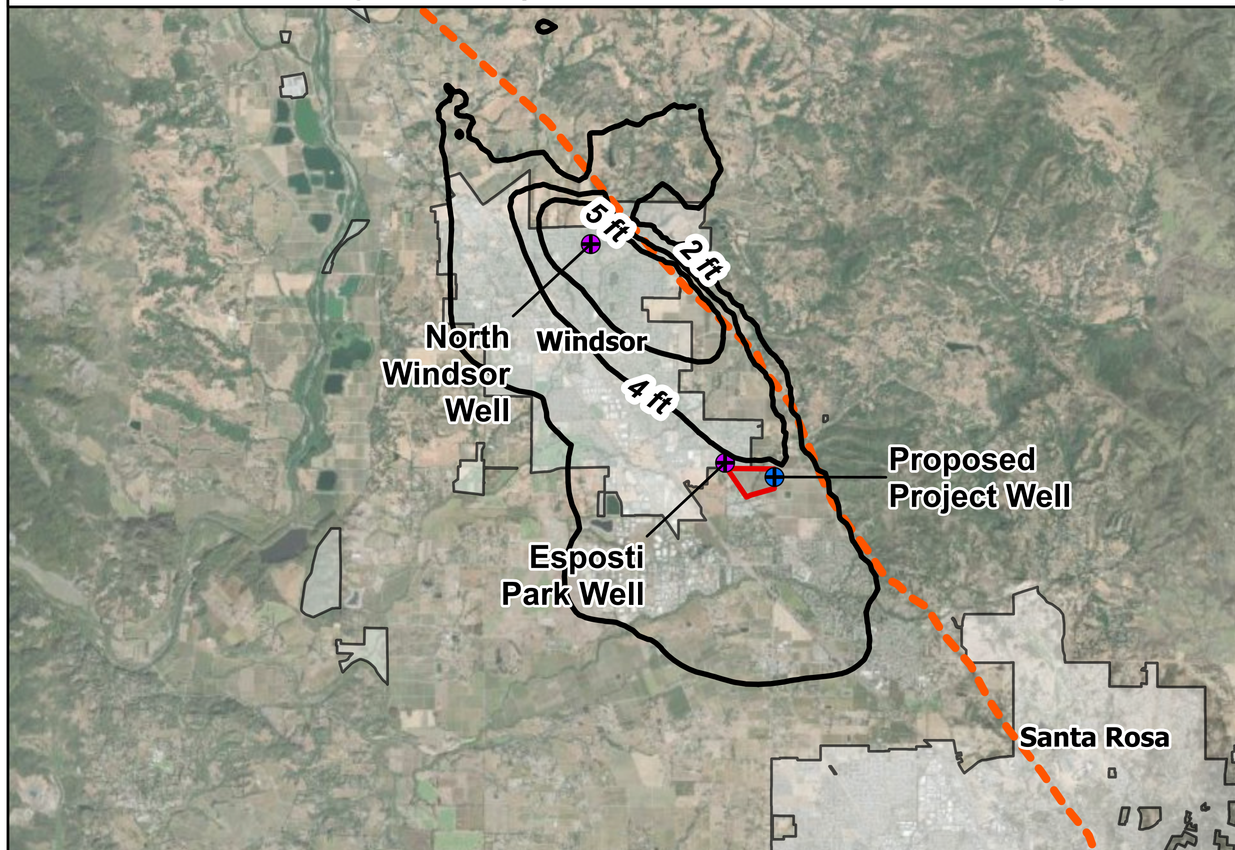
DATE: MAR 20, 2024
By: WRG | For: NBB
FORMATION ENVIRONMENTAL


Wright Creek
Windsor Creek
Pool Creek
Pruitt Creek
Mark West Creek
Bluebird Well
Hypothetical Nearest Domestic Well
Proposed Well
Nearest Irrigation Well
Esposti Park Well
Mobile Home Estates (Well #17)
RMP SRP0376 (Well #13)
5 ft
2 ft
Pictometry International, Maxar
Legend
Hydrology
Ephemeral
Intermittent
Perennial
Major River
Healdsburg Fault Trace
Layer 5 Drawdown Contour
Observation Points
Proposed Project Well
Project Boundary
0
2,500
5,000
Feet
N
References: USGS (2024)
SHILOH RESORT AND CASINO
KOI NATION OF NORTHERN CALIFORNIA
FIGURE 15
PREDICTED 50-YEAR DRAWDOWN IN DEEP WATER-BEARING ZONE (ALTERNATIVE A)
DATE: MAR 20, 2024
By: WRG
For: NBB
FORMATION ENVIRONMENTAL

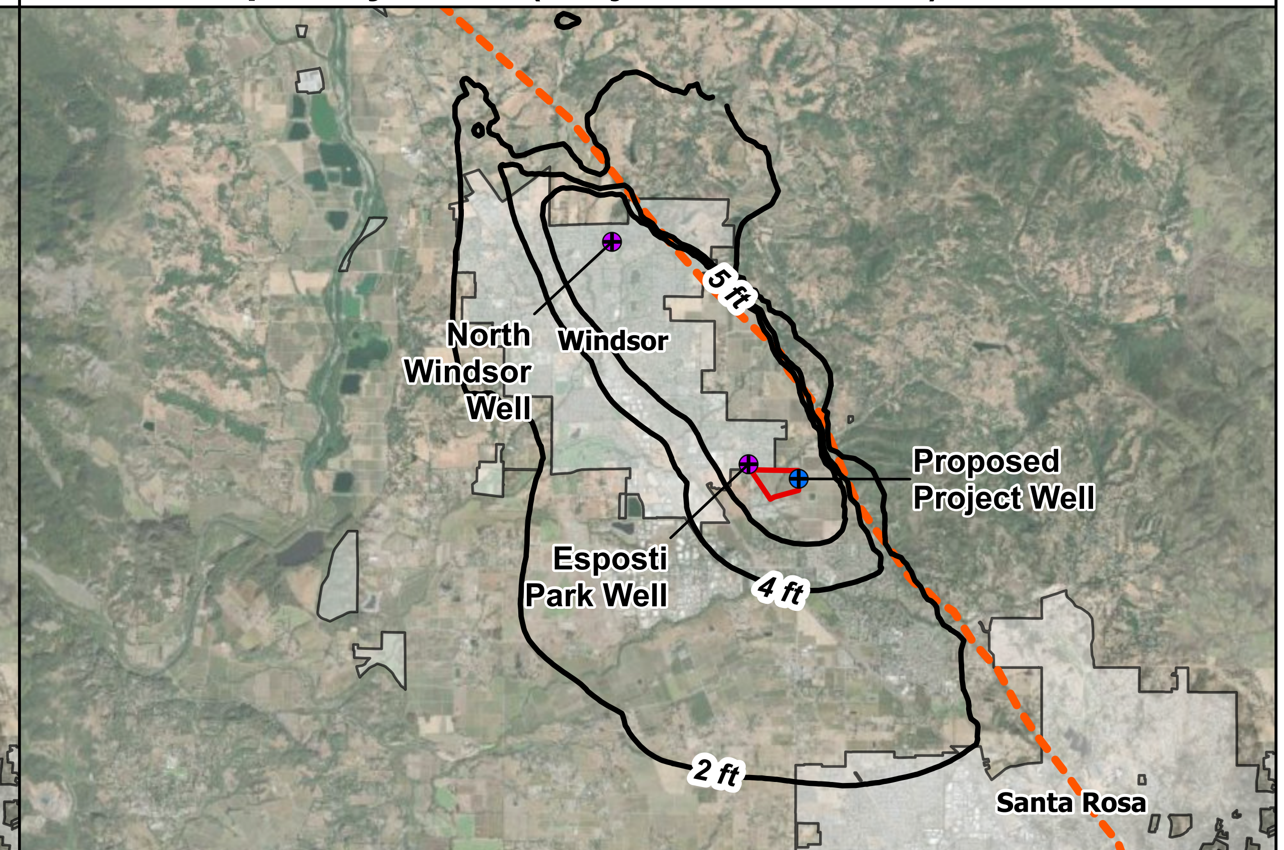


Layer 1 Predicted Cumulative Drawdown After 50 Years
Layer 1 Predicted Maximum Cumulative Drawdown After Multiple Dry Years
Layer 5 Predicted Cumulative Drawdown After 50 Years
Layer 5 Predicted Maximum Cumulative Drawdown After Multiple Dry Years
Legend
Project Boundary
Municipal Boundary
Stream/River
Ephemeral
Intermittent
Perennial
Major River
Simulated Groundwater Wells
Municipal
Proposed (Alternative A)
Drawdown Contour
Healdsburg Fault
Observation Point Locations
0
2
4
Miles
N
References: USGS (2024)
SHILOH RESORT AND CASINO
KOI NATION OF NORTHERN CALIFORNIA
FIGURE 16
PREDICTED CUMULATIVE DRAWDOWN (ALTERNATIVE A)
DATE: MAR 20, 2024
By: WRG
For: NBB
FORMATION ENVIRONMENTAL
Pictometry International, Earthstar Geographics

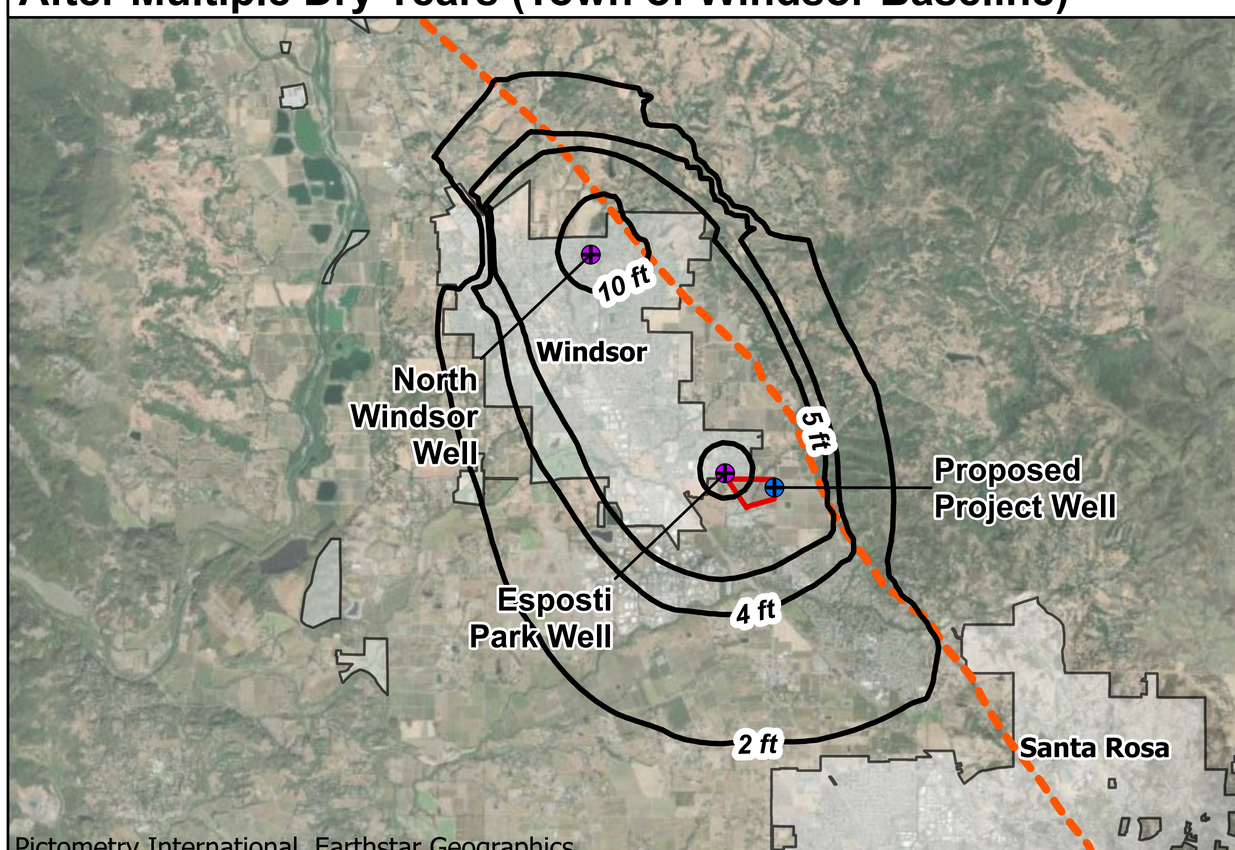
## Layer 1 Predicted Maximum Cumulative Drawdown After Multiple Dry Years (Town of Windsor Baseline)



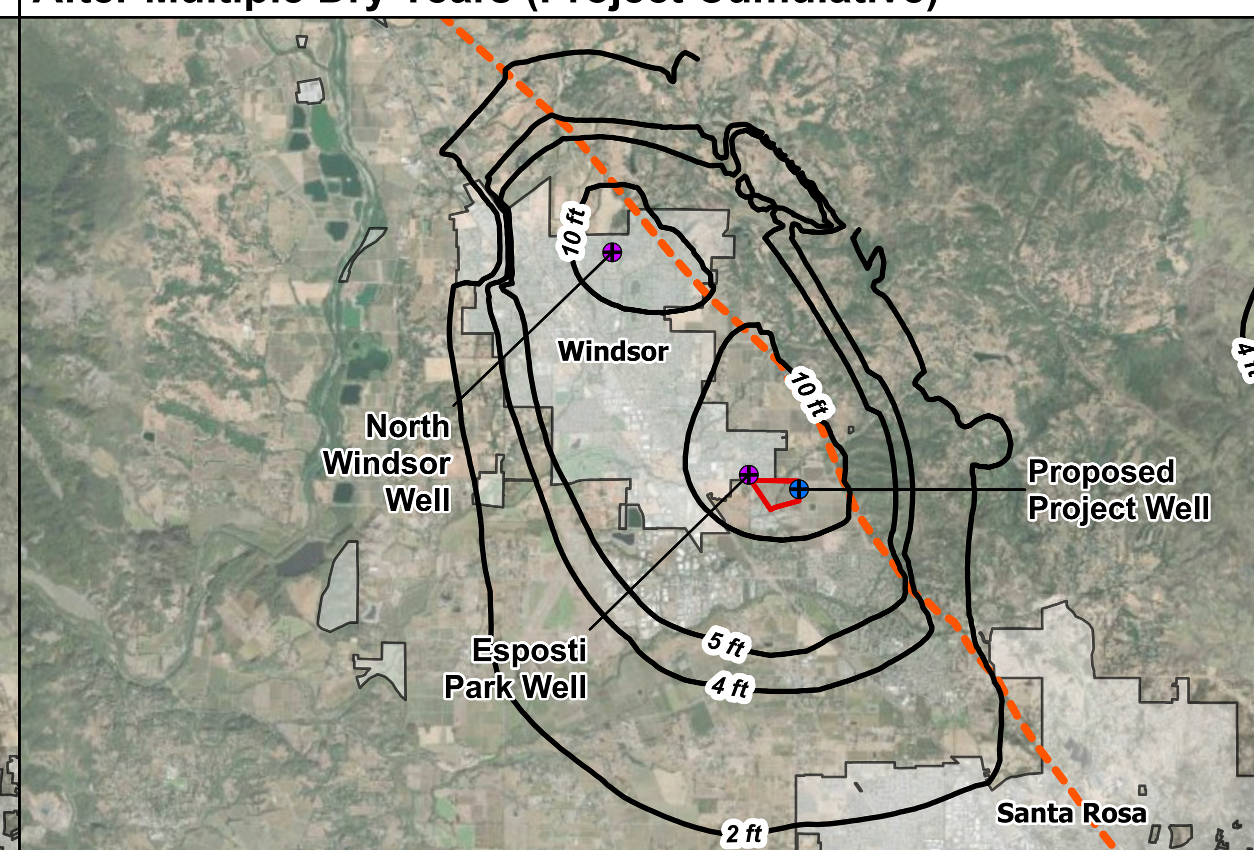

## Layer 1 Predicted Maximum Cumulative Drawdown After Multiple Dry Years (Project Cumulative)




## Layer 5 Predicted Maximum Cumulative Drawdown After Multiple Dry Years (Town of Windsor Baseline)




## Layer 5 Predicted Maximum Cumulative Drawdown After Multiple Dry Years (Project Cumulative)




Legend

- Project Boundary
- Municipal Boundary

Stream/River

- Ephemeral
- Intermittent
- Perennial
- Major River

Simulated Groundwater Wells

- Municipal
- Proposed (Alternative A)
- Healdsburg Fault
- Drawdown Contour

Observation Point Locations


0 2 4
Miles
N

References: USGS (2024)

**SHILOH RESORT AND CASINO**

KOI NATION OF NORTHERN CALIFORNIA

FIGURE 17

**PREDICTED CUMULATIVE DRAWDOWN AFTER MULTIPLE DRY YEARS (TOWN OF WINDSOR BASLINE VS PROJECT CUMULATIVE)**

DATE: MAR 20, 2024

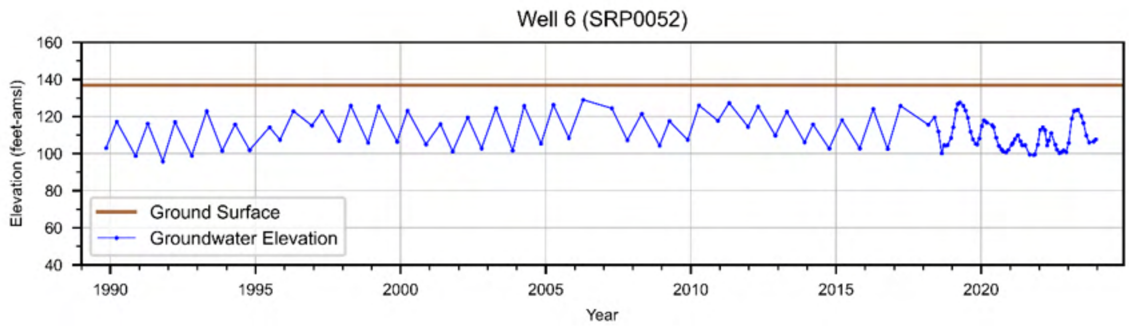
By: WRG For: NBB

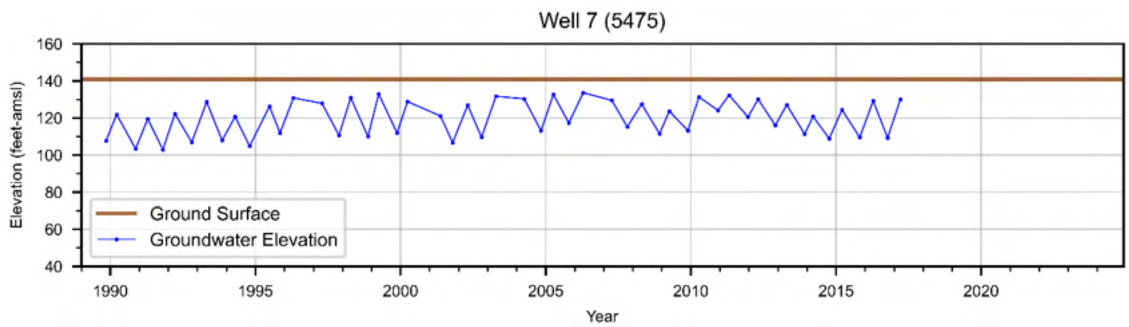
FORMATION ENVIRONMENTAL

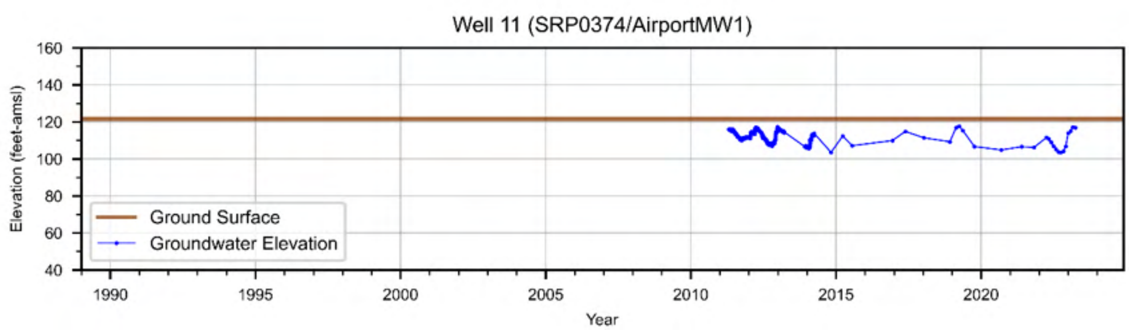
S:\GIS\a5\AcornEnv\ShilohResort\ShilohResort_ProjectGIS\ShilohResort_ProjectGIS.aprx 11x17Ln_Fig17_BaselineVCumulative

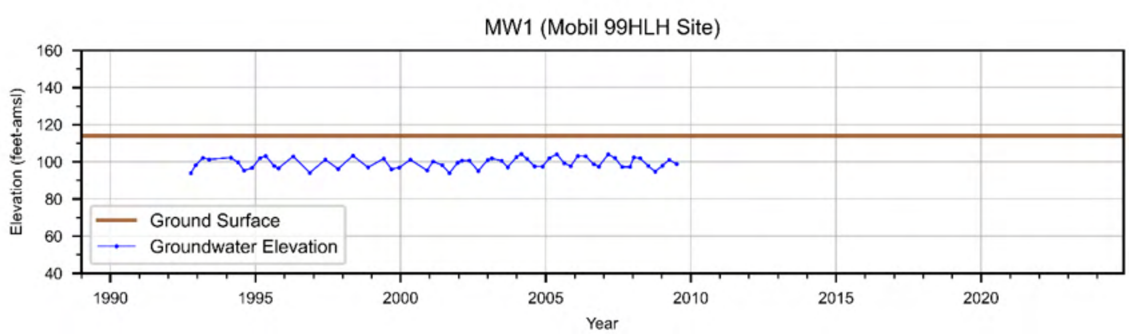
# ATTACHMENTS

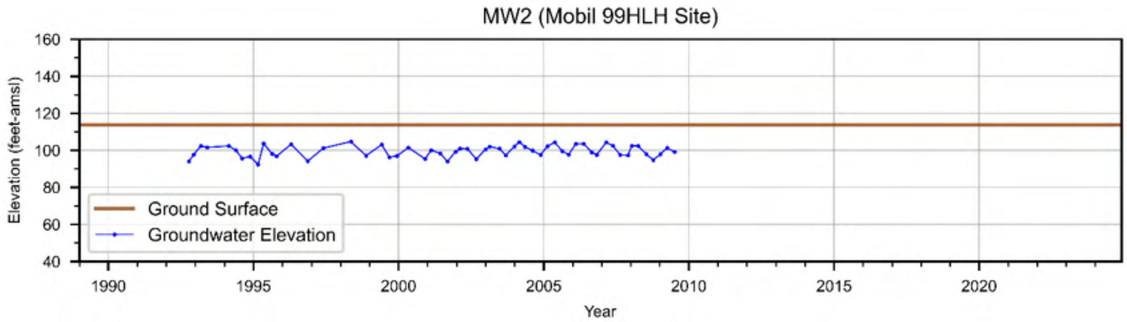
# ATTACHMENT 1 – SHALLOW MONITORING WELL HYDROGRAPHS

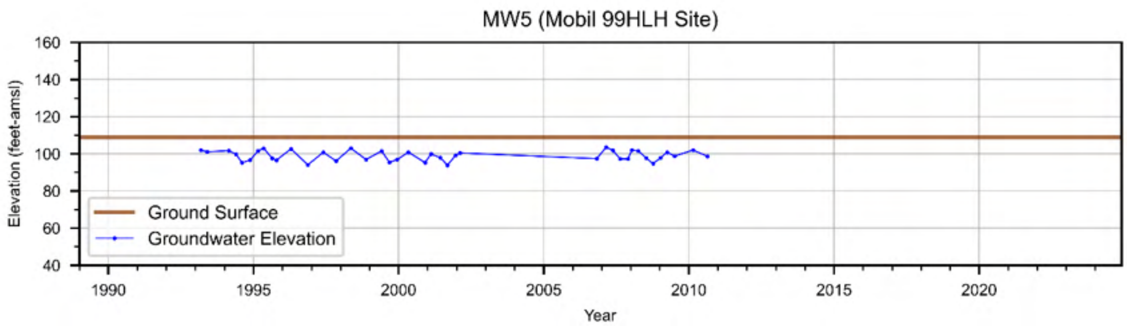


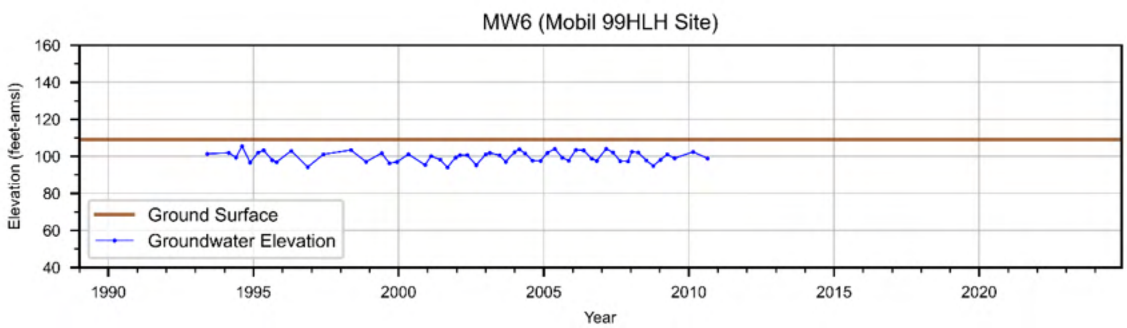



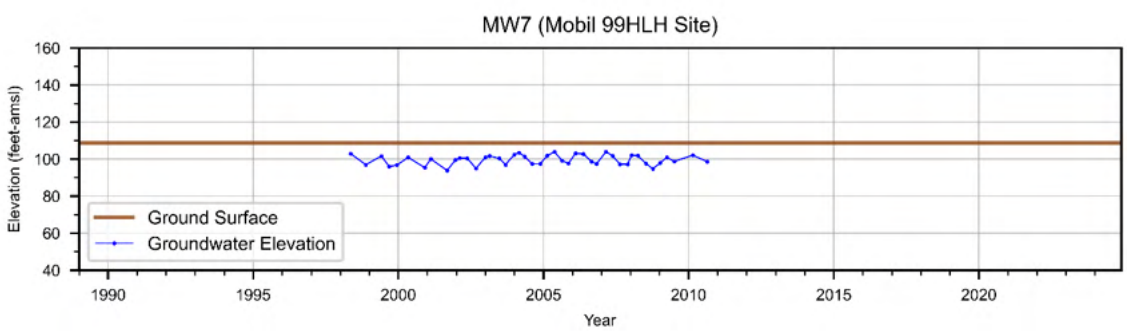



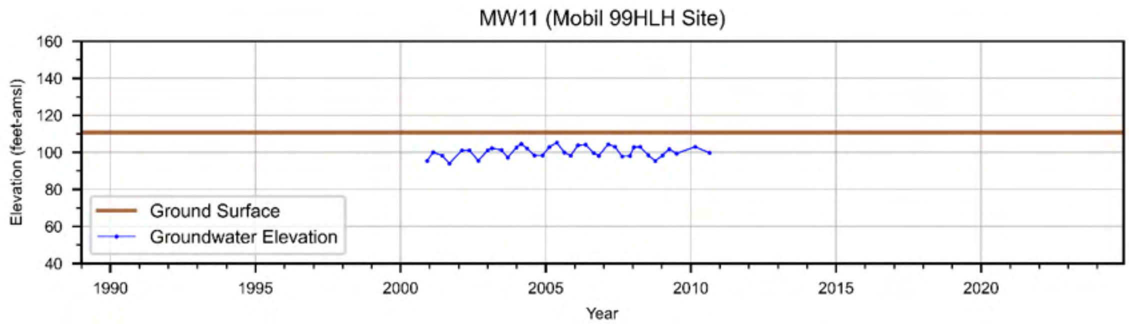



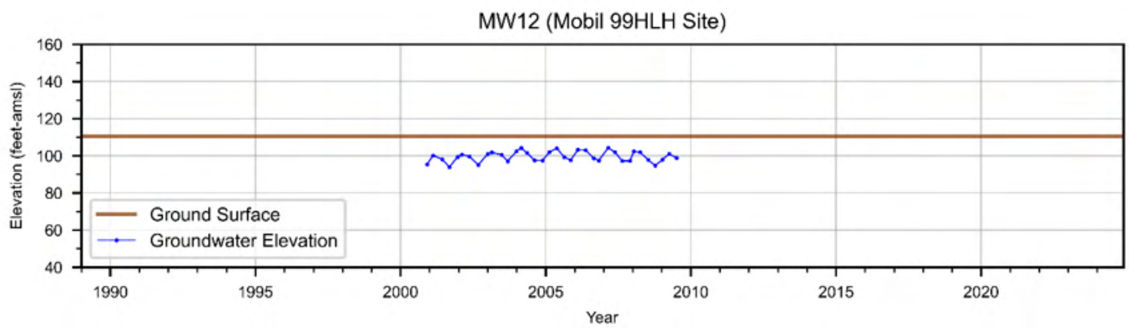

MW2 (Mobil 99HLH Site)
Elevation (feet-amsl)
160
140
120
100
80
60
40
Ground Surface
Groundwater Elevation
1990
1995
2000
2005
2010
2015
2020
Year

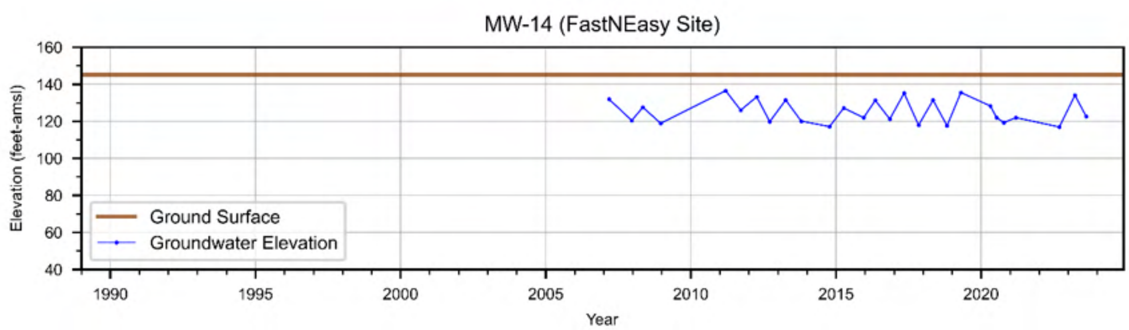

MW5 (Mobil 99HLH Site)
Elevation (feet-amsl)
160
140
120
100
80
60
40
Ground Surface
Groundwater Elevation
1990
1995
2000
2005
2010
2015
2020
Year

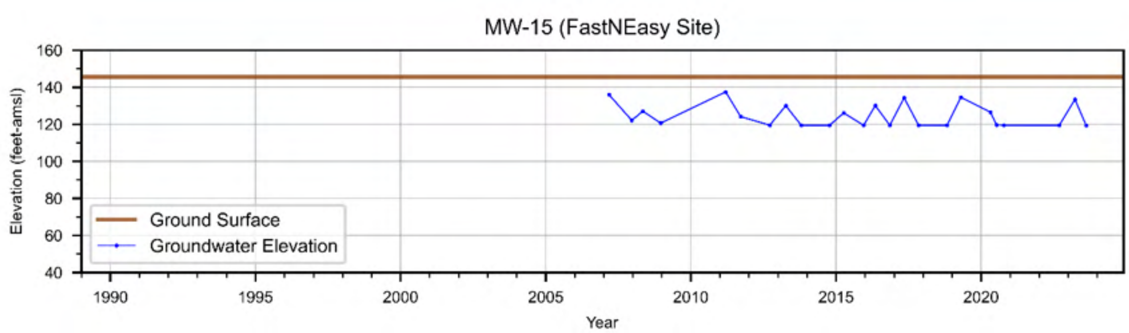

MW6 (Mobil 99HLH Site)
Elevation (feet-amsl)
160
140
120
100
80
60
40
Ground Surface
Groundwater Elevation
1990
1995
2000
2005
2010
2015
2020
Year

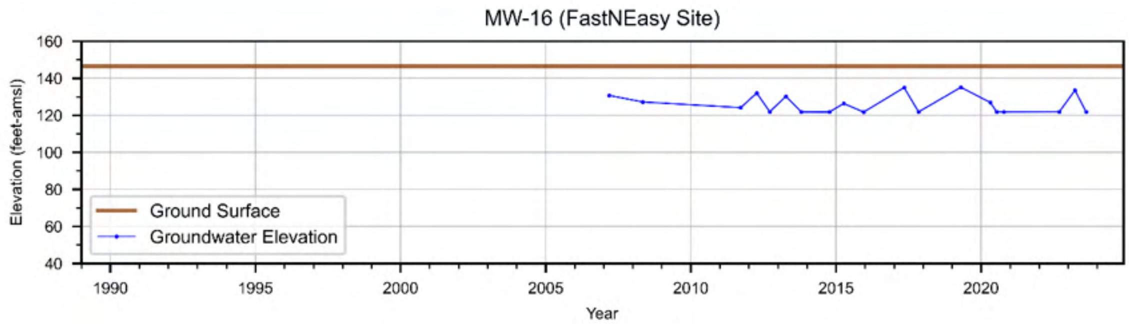

MW7 (Mobil 99HLH Site)
Elevation (feet-amsl)
160
140
120
100
80
60
40
Ground Surface
Groundwater Elevation
1990
1995
2000
2005
2010
2015
2020
Year

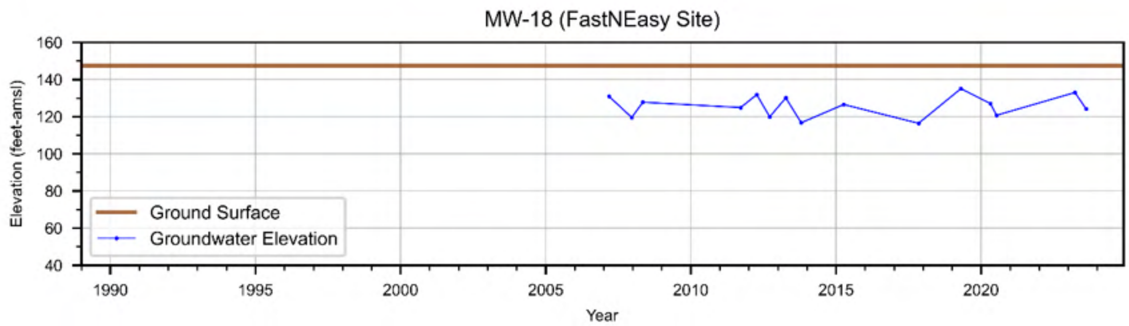

MW11 (Mobil 99HLH Site)
Elevation (feet-amsl)
Year
Ground Surface
Groundwater Elevation

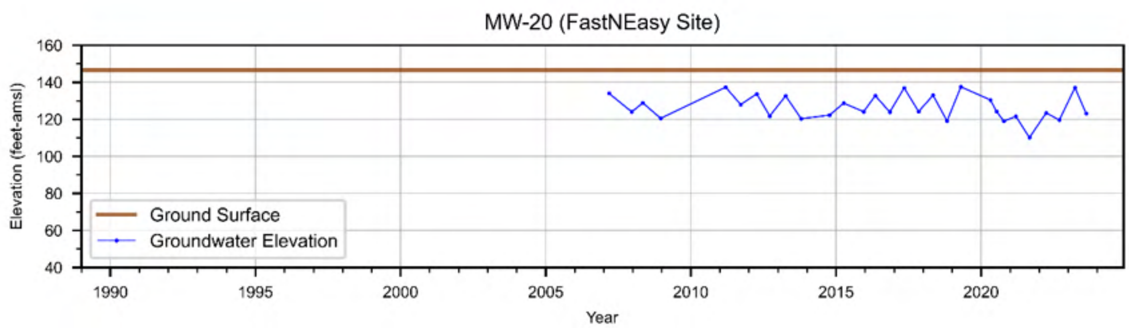

MW12 (Mobil 99HLH Site)
Elevation (feet-amsl)
Year
Ground Surface
Groundwater Elevation

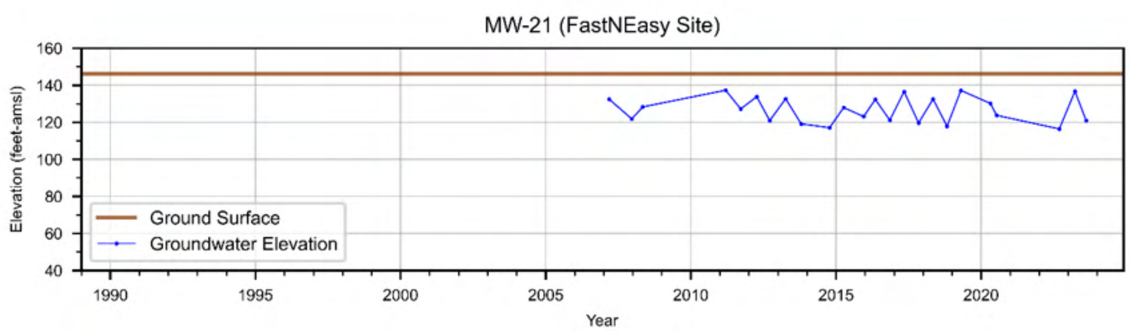

MW-14 (FastNEasy Site)
Elevation (feet-amsl)
Year
Ground Surface
Groundwater Elevation

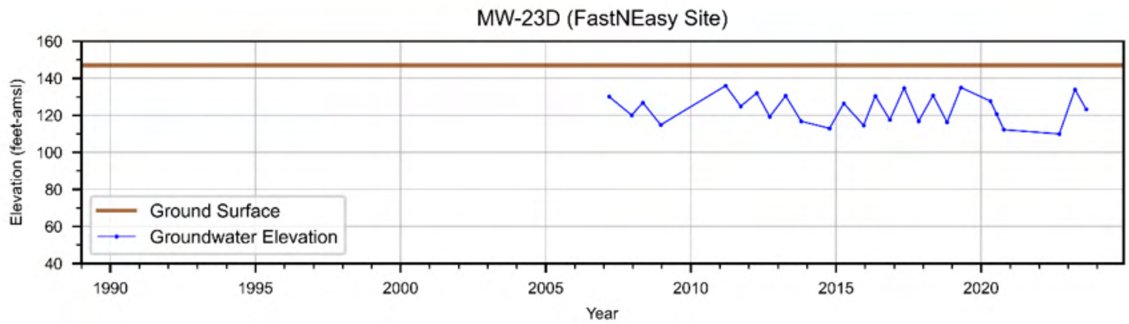

MW-15 (FastNEasy Site)
Elevation (feet-amsl)
Year
Ground Surface
Groundwater Elevation

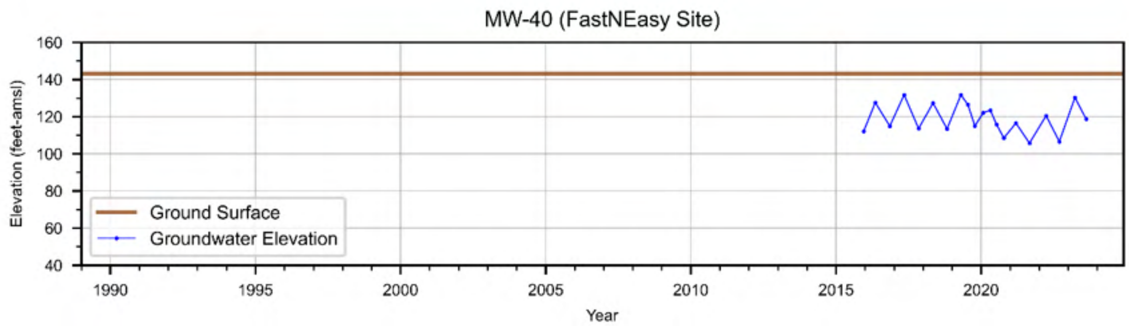

MW-16 (FastNEasy Site)
Elevation (feet-amsl)
Year
Ground Surface
Groundwater Elevation

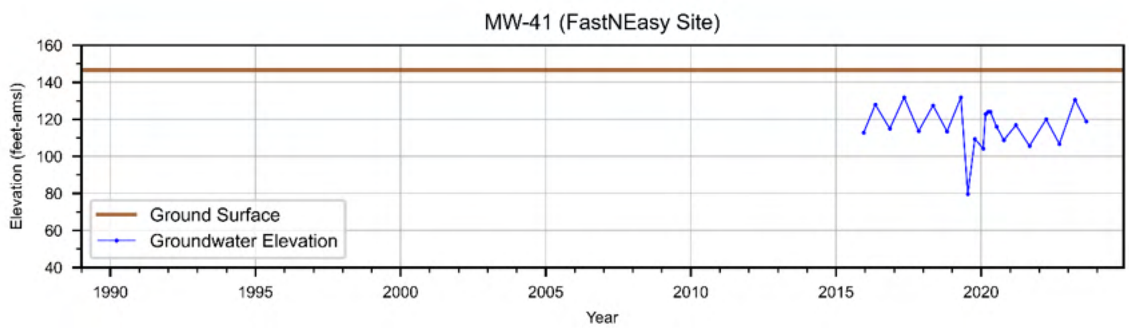

MW-18 (FastNEasy Site)
Elevation (feet-amsl)
Year
Ground Surface
Groundwater Elevation

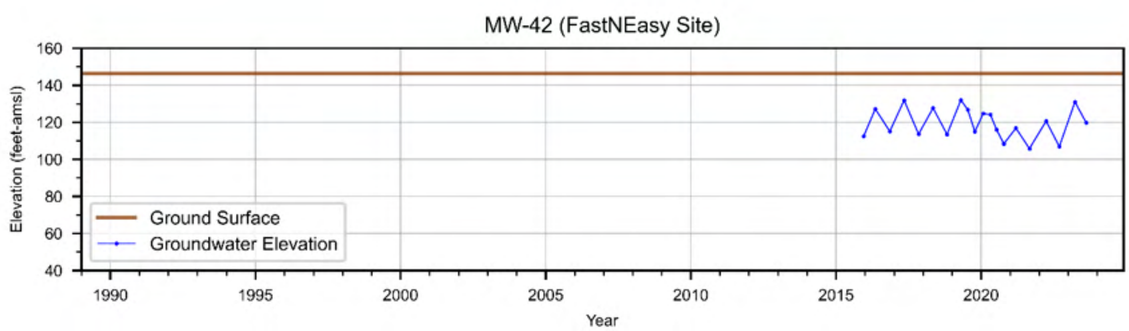

MW-20 (FastNEasy Site)
Elevation (feet-amsl)
Year
Ground Surface
Groundwater Elevation

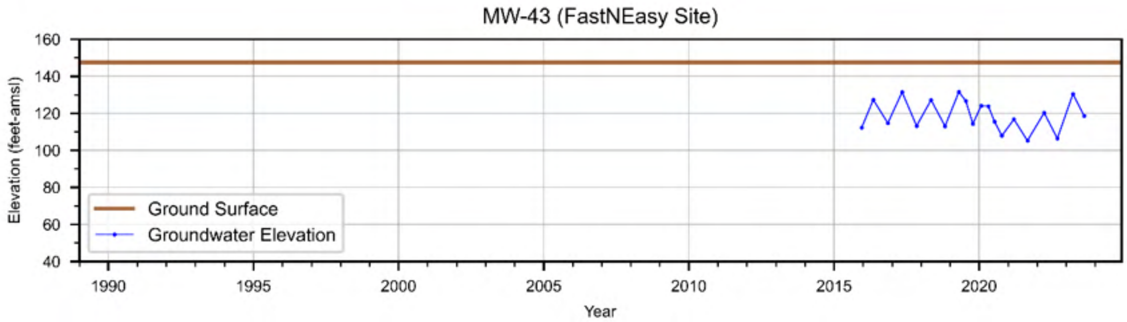

MW-21 (FastNEasy Site)
Elevation (feet-amsl)
Year
Ground Surface
Groundwater Elevation

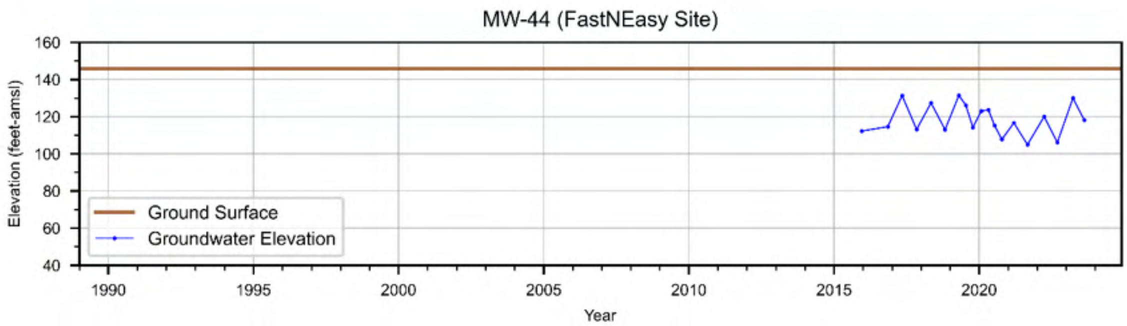

MW-23D (FastNEasy Site)
Elevation (feet-amsl)
Year
Ground Surface
Groundwater Elevation

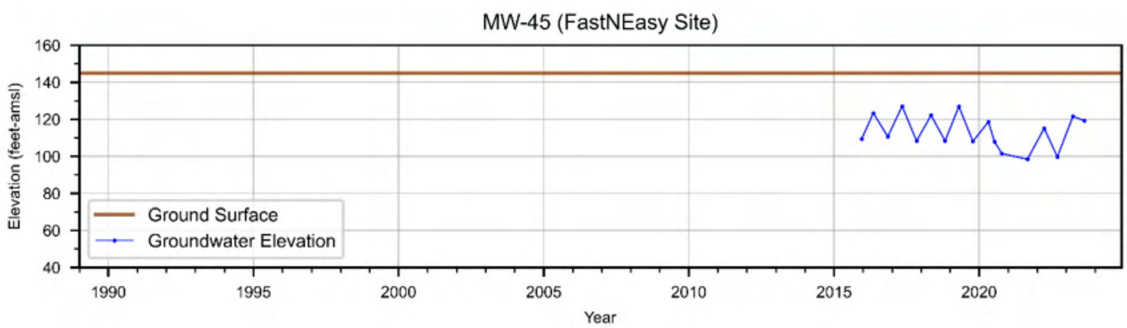

MW-40 (FastNEasy Site)
Elevation (feet-amsl)
Year
Ground Surface
Groundwater Elevation

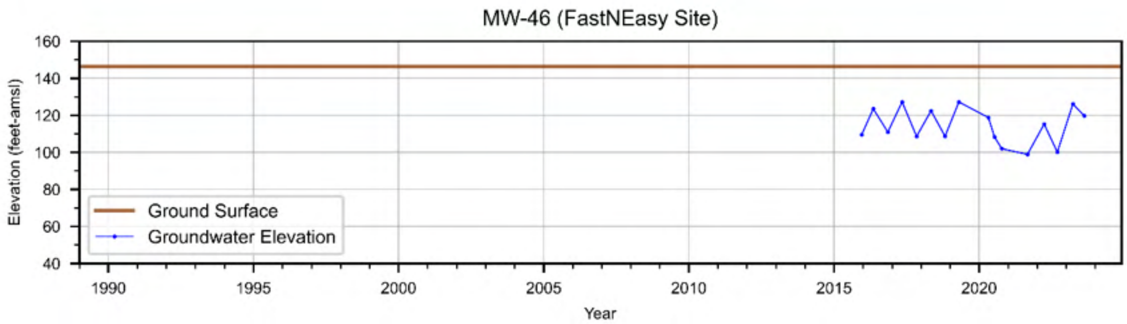

MW-41 (FastNEasy Site)
Elevation (feet-amsl)
Year
Ground Surface
Groundwater Elevation

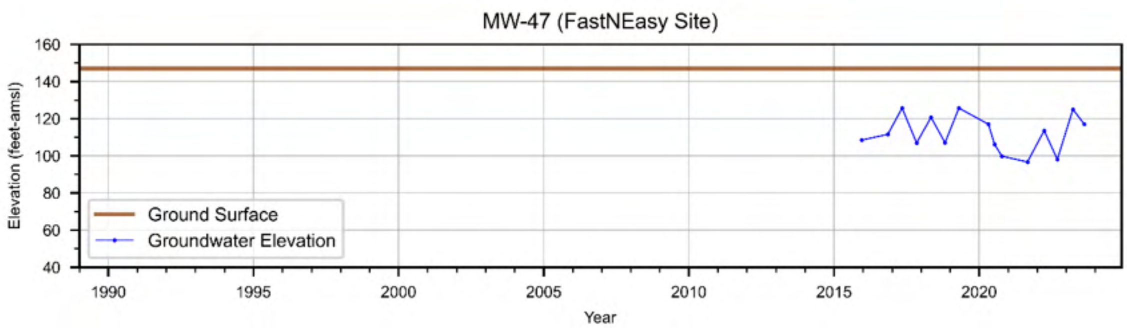

MW-42 (FastNEasy Site)
Elevation (feet-amsl)
Year
Ground Surface
Groundwater Elevation


MW-43 (FastNEasy Site)
Elevation (feet-amsl)
160
140
120
100
80
60
40
Ground Surface
Groundwater Elevation
1990
1995
2000
2005
2010
2015
2020
Year


MW-44 (FastNEasy Site)
Elevation (feet-amsl)
160
140
120
100
80
60
40
Ground Surface
Groundwater Elevation
1990
1995
2000
2005
2010
2015
2020
Year


MW-45 (FastNEasy Site)
Elevation (feet-amsl)
160
140
120
100
80
60
40
Ground Surface
Groundwater Elevation
1990
1995
2000
2005
2010
2015
2020
Year


MW-46 (FastNEasy Site)
Elevation (feet-amsl)
160
140
120
100
80
60
40
Ground Surface
Groundwater Elevation
1990
1995
2000
2005
2010
2015
2020
Year


MW-47 (FastNEasy Site)
Elevation (feet-amsl)
160
140
120
100
80
60
40
Ground Surface
Groundwater Elevation
1990
1995
2000
2005
2010
2015
2020
Year

# Appendix E

# Expanded Regulatory Setting

# Expanded Regulatory Setting

## INTRODUCTION

This section summarizes the framework of laws, regulations, and agreements pertaining to the sites and actions outlined throughout the Environmental Impact Statement (EIS). The relevant legislation is organized by resource category, and while most regulations discussed within the document are described here, this list is not comprehensive and is limited to the primary regulations relevant to the analysis within the EIS.

## LAND RESOURCES – SECTION 3.2 OF THE EIS

### Federal

#### Clean Water Act

The Clean Water Act (CWA) prohibits sediment and erosion discharge into navigable waters of the United States and establishes water quality goals. A Construction General Permit is required if a project will disturb one or more acres of soil. A site-specific Stormwater Pollution Prevention Plan (SWPPP) is required under this permit. For more information on the CWA and the SWRCB, see **Water Resources – Section 3.3 of the EIS** below.

### State and Local

#### Alquist-Priolo Earthquake Fault Zoning Act

The Alquist-Priolo Earthquake Fault Zoning Act (Alquist-Priolo Act; formerly the Alquist-Priolo Special Studies Zone Act), signed into law December 1972 after the 1971 San Fernando earthquake, requires the delineation of zones along active and potentially active faults in California. The California Geological Survey defines an "active" fault as one that exhibits evidence of activity during the last 11,000 years. Faults that exhibit evidence of Quaternary activity (within the last 1.6 million years) are considered to be "potentially active." The purpose of the Alquist-Priolo Act is to regulate development on or near fault traces to reduce the hazard of fault rupture and to prohibit the location of most off-Reservation structures for human occupancy across these traces.

#### Seismic Hazards Mapping Act

The Seismic Hazards Mapping Act was enacted in 1990 to protect the public from the effects of strong ground shaking, liquefaction, landslides, ground failure, or other hazards caused by earthquakes. This act requires a state geologist to delineate various seismic hazard zones and requires cities, counties, and other local permitting agencies to regulate certain development projects within the portions of those zones where they have jurisdiction. Before a development permit is granted by a city, county or other local permitting agency for a site within a seismic hazard zone, a geotechnical investigation must be conducted, and appropriate mitigation measures must be incorporated into the project's design.

### Surface Mining and Reclamation Act

The Surface Mining and Reclamation Act of 1975 requires all jurisdictions to incorporate mapped mineral resources designations approved by the California Mining and Geology Board within their general plans. The Surface Mining and Reclamation Act was enacted to limit new development in areas with significant mineral deposits. The California Department of Conservation's Office of Mine Reclamation and the California Mining and Geology Board are jointly charged with ensuring proper administration of the act's requirements. The California Mining and Geology Board circulates regulations to clarify and interpret the act's provisions and also serves as a policy and appeals board.

# WATER RESOURCES – SECTION 3.3 OF THE EIS

## Federal

### Executive Order 11988

Executive Order (EO) 11988 requires federal agencies to avoid to the extent possible the long and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative. Specifically, EO 11988 states that agencies shall first determine whether the proposed action will occur in a floodplain. EO 11988 defines a floodplain as an area that has a one percent or greater chance of flooding in any given year. Second, if an agency proposes to allow an action to be located in a floodplain, the agency shall consider alternatives to avoid adverse effects and incompatible development in the floodplains. If the only practicable alternative action requires siting in a floodplain, the agency shall minimize potential harm to or within the floodplain.

### Clean Water Act

CWA (33 U.S. Code [USC] § 1251-1376), as amended by the Water Quality Act of 1987, is the major federal legislation governing water quality. The objective of the CWA is "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters." The U.S. Environmental Protection Agency (USEPA) is delegated as the administrative agency under the CWA. Relevant sections of the CWA are as follows.

- Sections 303 and 304 provide for water quality standards, criteria, and guidelines. Section 303(d) requires states to identify impaired off-Reservation water bodies, rank these impaired bodies based on severity of contamination and uses for the waters, and develop water quality management strategies, usually in the form of total maximum daily loads for the contaminant(s) of concern.
- Section 401 (Water Quality Certification) requires an applicant for any federal permit that proposes an activity that may result in a discharge to Waters of the U.S., to obtain certification from the USEPA for on-trust land activities, or the state for off-Reservation activities, that the discharge will comply with other provisions of the CWA.
- Section 402 establishes the National Pollutant Discharge Elimination System (NPDES), a permitting system for the discharge of any pollutant (except for dredged or fill material) into Waters of the U.S. Each NPDES permit contains limits on concentrations of pollutants discharged to surface waters to prevent degradation of water quality and protect beneficial uses.

The Federal Antidegradation Policy was adopted as part of the 1972 amendments to the CWA. Federal policy (Code of Federal Regulations [CFR], Title 40, Part 131.12) specifies that each state must develop, adopt, and retain an anti-degradation policy to protect the minimum level of off-Reservation surface water quality necessary to support existing uses. Each state must also develop procedures to implement the anti-degradation policy through water quality management processes. Each state anti-degradation policy must include implementation methods consistent with the provisions outlined in 40 CFR § 131.12. On trust land, these issues are addressed by the USEPA.

### *General NPDES Permit for Construction*

In 1990, an amendment to the CWA directed the NPDES permitting program to address non-point source pollution from construction activities. Construction activities include clearing, grading, excavation, stockpiling, and reconstructing existing facilities involving removal and replacement of existing foundations or other hardscapes. Construction projects disturbing one or more acres of soil must be covered under the NPDES Construction General Permit process. For tribal projects on land held in trust by the federal government, the Tribe proposing the project must apply for coverage under the USEPA's NPDES Construction General Permit. Project proponents are required to submit to the USEPA a complete Notice of Intent (NOI) to comply with the permit. A complete NOI package consists of an NOI form, site map, and fee. The USEPA's NPDES Construction General Permit also requires the development and implementation of a SWPPP. The SWPPP contains a site map showing the construction site perimeter, existing and proposed buildings, lots and roadways, stormwater collection and discharge points, general topography both before and after construction, and drainage patterns across the site. The SWPPP must list Best Management Practices (BMP) that will be implemented during construction and operation to address stormwater runoff rates and quality. SWPPP BMPs include the following categories:

- Site planning considerations, such as preservation of existing vegetation;
- Vegetation stabilization through methods such as seeding and planting;
- Physical stabilization through use of dust control and stabilization measures;
- Diversion of runoff by utilizing earth dikes and temporary drains and swales;
- Velocity reduction through measures such as slope roughening/terracing; and
- Sediment trapping/filtering through use of silt fences, straw bales and sand bag filters, and sediment traps and basins.

## Safe Drinking Water Act

Under the mandate of the Safe Drinking Water Act, the USEPA sets legally enforceable National Primary Drinking Water Regulations (primary standards) that apply to public water systems. These standards are established to protect human health by limiting the levels of contaminants in drinking water. The USEPA also defines National Secondary Drinking Water Regulations (secondary standards) for contaminants that cause cosmetic and aesthetic effects, but not for health effects. The USEPA recommends that these secondary standards be met but does not require systems to comply with them.

The USEPA does not oversee the construction and permitting of groundwater wells, but requires that public health standards, such as an effectively installed sanitary seal, are in place, and recommends that water systems be installed to meet California Department of Public Health Standards. The USEPA will also primarily establish monitoring and operational requirements, which will typically be specific to the project area. Both primary and secondary drinking water standards are expressed as either Maximum Contaminant Levels, which define the highest level of a contaminant allowed in drinking water, or Maximum Contaminant Level Goals, which define the level of a contaminant below which there is no known or expected risk to health. Monitoring requirements typically include total coliform, nitrate, inorganic chemicals, volatile organic chemicals, non-volatile synthetic organic chemicals, secondary drinking water standard constituents, and general chemistry (including alkalinity, hardness, and minerals). The frequency of sampling varies and may be reduced over time.

### Federal Emergency Management Agency

The Disaster Relief Act of 1974 as amended by the Robert T. Stafford Disaster Relief and Emergency Assistance Act of 1988 created the Federal Emergency Management Agency (FEMA), which is responsible for determining flood elevations and floodplain boundaries based on U.S. Army Corps of Engineers (USACE) studies. FEMA is also responsible for distributing Flood Insurance Rate Maps, which are used in the National Flood Insurance Program. These maps identify the locations of special flood hazard areas, including 100-year floodplains.

## State and Local

### Porter-Cologne Water Quality Control Act

The Porter-Cologne Water Quality Control Act provides the basis for surface water and groundwater quality regulation within California. The act established the authority of the SWRCB and the nine Regional Water Quality Control Boards (RWQCB). The act requires the State, through the SWRCB and the RWQCBs, to designate beneficial uses of surface waters and groundwater and specify water quality objectives designed to protect those uses. These water quality objectives are presented in the Regional Water Quality Control Plans. The surface water quality standards for State of California include both narrative and numerical water quality objectives to keep California's waters swimmable, fishable, drinkable, and suitable for use by industry, agriculture, and the citizens of the state.

### Sustainable Groundwater Management Act

The intent of the California Sustainable Groundwater Management Act (SGMA; Water Code § 10720 et seq.) is to "enhance local management of groundwater consistent with rights to use or store groundwater… [and] to preserve the security of water rights in the state to the greatest extent possible consistent with the sustainable management of groundwater." The SGMA states that "any local agency or combination of local agencies overlying a groundwater basin may elect to be a groundwater sustainability agency for that basin" (Water Code § 10723). A groundwater sustainability agency will be formed within each groundwater basin to prepare and implement a plan for long-term groundwater sustainability.

The Santa Rosa Plain Groundwater Sustainability Agency was formed in June 2017 to comply with the SGMA. Member agencies include the City of Cotati, Sonoma County, Gold Ridge Resource Conservation District, Independent Water Systems, the City of Rohnert Park, the City of Santa Rosa, Sonoma Resource Conservation District, Sonoma Water, the Town of Windsor, and the City of Sebastopol. The Groundwater Sustainability Plan for the Santa Rosa Plain Subbasin was submitted to the California Department of Water Resources in January 2022 (Santa Rosa Plain Groundwater Sustainability Agency, 2022).

### Title 22 California Code of Regulations

Title 22 CCR Division 4, Chapter 3 regulates the sources, uses, and quality standards of recycled water in the State. Article 3, Section 60304(a) requires that any recycled water used for the irrigation of food crops, parks and playgrounds, and residential landscaping shall be a disinfected tertiary recycled water. Article 1, Section 60301.230 defines disinfected tertiary recycled water as a wastewater that has been filtered and disinfected, and which meets the following criteria:

A. The filtered wastewater has been disinfected by either: (1) 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 (2) 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.

B. The median concentration of total coliform bacteria measured in the disinfected effluent does not exceed a most probable number (MPN) of 2.2 per 100 milliliter (mL) using 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 mL in more than one sample in a 30-day period. No sample shall exceed an MPN of 240 total coliform bacteria per 100 mL.

### State Water Resources Control Board Order - Water Reclamation Requirements for Recycled Water Use

The State Water Resources Control Board issued Order WQ 2016-0068-DDW (General Order) on June 7, 2016 in response to the Governor's proclamations of a Drought State of Emergency on January 17, 2014 and April 25, 2014. The primary goal of General Order is to alleviate pressure on potable water supplies during drought conditions by streamlining the permitting process associated with the use of recycled water. The General Order authorizes producers, distributors, and users to utilize recycled water for purposes consistent with the Uniform Statewide Recycling Criteria, excluding direct or indirect potable reuse. The order aims to streamline the permitting process by allow producers and distributors of recycled water to facilitate recycled water use as water recycling "administrators". The General Order explicitly prohibits activities like replenishing groundwater resources and any form of direct or indirect potable reuse of recycled water that could harm the environment or human health. To ensure compliance, the order outlines comprehensive requirements for the treatment, storage, distribution, and utilization of recycled water. These requirements align with the Uniform Statewide Recycling Criteria and Basin Plan standards outlined in Title 22 of the CCR. The order establishes monitoring protocols, reporting requirements, and compliance schedules to ensure that discharges do not harm water quality or public health.

# AIR QUALITY – SECTION 3.4 OF THE EIS

## Federal

### Clean Air Act of 1970

The Clean Air Act (CAA; 42 USC Chapter 85) is the federal legislation for the protection of air quality. The CAA gives the USEPA authority to regulate air quality by promulgating standards and levels for air quality and enforcing those standards and levels on federal, state, and tribal land. The CAA requires the USEPA to regulate hazardous air pollutants, which are those pollutants that are known or suspected to cause cancer or other serious health effects, such as reproductive effects or birth defects, or adverse environmental effects.

The Federal CAA of 1970, as amended, establishes air quality standards for several critical air pollutants (CAPs): ozone ($O_3$), carbon monoxide (CO), particulate matter (PM), nitrogen dioxide ($NO_2$), sulfur dioxide ($SO_2$), and lead (Pb). These pollutants are termed "criteria" pollutants because the USEPA has established specific concentration threshold criteria based upon specific medical evidence of health effects or visibility reduction, soiling, nuisance, and other forms of damage. These National Ambient Air Quality Standards (NAAQS) are divided into primary standards and secondary standards. Primary standards are designed to protect the public health and secondary standards are intended to protect the public welfare from effects such as visibility reduction, soiling, nuisance, and other forms of damage. NAAQS and California Ambient air quality standards (CAAQS) are presented in **Table 1.**

Areas are designated attainment, nonattainment, or maintenance by the USEPA depending on whether the area is below or exceed the established NAAQS. Nonattainment areas must take steps towards attainment within a specific period of time. Once an area reaches attainment for particular criteria pollutant, then the area is re-designated attainment or maintenance. The CAA places most of the responsibility on states to achieve compliance with the NAAQS. States, municipal statistical areas, and counties that contain areas of nonattainment are required to develop a State Implementation Plan (SIP), which outlines policies and procedures designed to bring the state into compliance with the NAAQS.

**Table 1: Ambient Air Quality Standards**

| Pollutant | Averaging Time | Standard (parts per million) | | Standard (microgram per cubic meter) | | Violation Criteria | |
|---|---|---|---|---|---|---|---|
| | | CAAQS | NAAQS | CAAQS | NAAQS | CAAQS | NAAQS |
| $O_3$ | 1 hour | 0.09 | N/A | 180 | N/A | If exceeded | N/A |
| | 8 hours | 0.070 | 0.070 | 137 | 137 | N/A | If exceeded on more than 3 days in 3 years |
| CO | 8 hours | 9.0 | 9 | 10,000 | 10,000 | If exceeded | If exceeded on more than 1 day per year |
| | 1 hour | 20 | 35 | 23,000 | 40,000 | If exceeded | If exceeded on more than 1 day per year |
| $NO_2$ | Annual arithmetic mean | 0.030 | 0.053 | 57 | 100 | N/A | If exceeded |
| | 1 hour | 0.18 | 0.100 | 470 | 188 | If exceeded | N/A |
| $SO_2$ | Annual arithmetic mean | N/A | 0.030 | N/A | N/A | N/A | If exceeded |
| | 24 hours | 0.04 | 0.14 | 105 | N/A | If exceeded | If exceeded on more than 1 day per year |
| | 1 hour (primary) | 0.25 | 0.075 | 655 | 196 | N/A | N/A |
| | 3 hours (secondary) | N/A | 0.5 | N/A | N/A | | If exceeded on more than 1 day per year |
| $PM_{10}$ | Annual arithmetic mean | N/A | N/A | 20 | N/A | If exceeded | If exceeded |

| Pollutant | Averaging Time | Standard (parts per million) | | Standard (microgram per cubic meter) | | Violation Criteria | |
|---|---|---|---|---|---|---|---|
| | | CAAQS | NAAQS | CAAQS | NAAQS | CAAQS | NAAQS |
| | 24 hours | N/A | N/A | 50 | 150 | If exceeded | If exceeded on more than 1 day per year |
| $PM_{2.5}$ | Annual arithmetic mean (primary) | N/A | N/A | 12 | 12 | If exceeded | If exceeded |
| | Annual arithmetic mean (secondary) | N/A | N/A | N/A | 15 | If exceeded | If exceeded |
| | 24 hours | N/A | N/A | N/A | 35 | If exceeded | If exceeded on more than 1 day per year |
| Lead | 30 day Avg. | N/A | N/A | 1.5 | N/A | If equaled or exceeded | N/A |
| | Rolling 3-month Avg. | N/A | N/A | N/A | 0.15 | N/A | If exceeded |
| Visibility Reducing Particles | 8 hour | Extinction coefficient of 0.23 per kilometer – visibility of ten miles or more. | No Federal Standard | N/A | No Federal Standard | N/A | N/A |
| Sulfates | 24 hour | | No Federal Standard | 25 | No Federal Standard | If equaled or exceeded | N/A |
| $H_2S$ | 1 hour | 0.03 | No Federal Standard | 42 | No Federal Standard | If equaled or exceeded | N/A |
| Vinyl Chloride | 24 hour | 0.01 | No Federal Standard | 26 | No Federal Standard | If equaled or exceeded | N/A |

Source: California Air Resources Board, 2016

### *Ozone*

Photochemical reactions involving reactive organic gases (ROG)/volatile organic compounds (VOC) and nitrogen oxides ($NO_X$) resulting from the incomplete combustion of fossil fuels are the largest source of ground-level $O_3$.

Because photochemical reaction rates depend on the intensity of ultraviolet light and air temperature, $O_3$ is primarily a summer air pollution problem. As a photochemical pollutant, $O_3$ is formed only during daylight hours under appropriate conditions. However, it is destroyed throughout the day and night. $O_3$ is considered a regional pollutant as the reactions forming it take place over time and are often most noticeable downwind from the sources of the emissions. The Bay Area Air Quality Management District is designated as nonattainment for $O_3$ by the USEPA

### *Particulate Matter 2.5*

Particle pollution is a mixture of microscopic solids and liquid droplets suspended in air. This pollution, also known as $PM_{2.5}$, is made up of a number of components, including acids (such as nitrates and sulfates), organic chemicals, metals, soil or dust particles, and allergens (such as fragments of pollen or mold spores). The size of particles is directly linked to their potential for causing health problems. Particles smaller than 2.5 µm pose the greatest problems because they can be inhaled deep into the lungs. Exposure to such particles can affect respiratory system function.

### *Carbon Monoxide*

CO is not readily dispersed throughout the atmosphere; therefore, it is considered a localized air quality issue as it is close to the emission source. CO emissions generally cause an acute (short-term) health threat. CO is a pollutant of concern at major signalized intersections (greater than 100,000 vehicles per day) that exhibit prolonged vehicle idling times. The Bay Area Air Quality Management District is designated as maintenance for CO by the USEPA (USEPA, 2022).

### *Hazardous Air Pollutants*

In addition to the above-listed CAPs, Hazardous Air Pollutants (HAP) are a group of chemical pollutants which can cause adverse effects to human health and/or the environment. HAPs are a list of over 188 airborne chemicals developed by the USEPA. Sources of HAPs include industrial processes, such as petroleum refining and chrome plating operations; commercial operations, such as gasoline stations and dry cleaners; cigarette smoke; and motor vehicle exhaust. Cars and trucks release at least 40 different HAPs. The most important, in terms of health risk, are diesel particulate matter (DPM), benzene, formaldehyde, 1,3-butadiene, and acetaldehyde. Health effects of HAPs can include cancer, birth defects, and neurological damage.

HAPs are less pervasive in the urban atmosphere than CAPs but are linked to short-term (acute) or long-term (chronic or carcinogenic) adverse human health effects. The majority of the estimated health risk from HAPs can be attributed to relatively few compounds. The most important HAPs are found in DPM. Diesel engines emit a complex mixture of air pollutants, composed of gaseous and solid material. Diesel exhaust contains a variety of harmful gases and over 40 other cancer-causing substances, and the visible emissions in diesel exhaust are PM that includes carbon particles or “soot.” Exposure to DPM is a health hazard, particularly to children whose lungs are still developing and the elderly who may have other serious health problems. Due to the controversy surrounding DPM, an assessment of the potential impacts of DPM releases associated with the Proposed Project has been included in the EIS Section 3.4.3.

## Federal General Conformity

Under the General Conformity Rule, updated in 2010, the lead agency with respect to a federal action is required to demonstrate that the proposed federal action conforms to the applicable SIP before the action is taken. There are two phases to a demonstration of general conformity.

- The Conformity Review process, which entails an initial review of the federal action to assess whether a full conformity determination is necessary
- The Conformity Determination process, which requires that a proposed federal action be demonstrated to conform to the applicable SIP

The Conformity Review requires the lead agency to compare estimated emissions to the applicable general conformity levels (40 CFR 93.153 [b][1] and [2]), which these can be seen in **Table 2** and **Table 3**. If the emission estimates from step one is below the applicable threshold(s), then a general conformity determination is not necessary and the full Conformity Determination is not required. If emission estimates are greater than the applicable threshold(s), the lead agency must conduct a Conformity Determination.

**Table 2: 40 CFR 93.153 [b][1] Emission Rates for Nonattainment Areas (NAAs)**

| Pollutant | Tons per Year |
|---|---|
| Ozone (VOC's or NOX): | |
| Serious NAA's | 50 |
| Severe NAA's | 25 |
| Extreme NAA's | 10 |
| Other ozone NAA's outside ozone transport region | 100 |
| Other ozone NAA's inside an ozone transport region: | |
| VOC | 50 |
| NOx | 100 |
| Carbon Monoxide: all maintenance areas | 100 |
| $SO_2$ or $NO_2$: All NAAs | 100 |
| $PM_{10}$: | |
| Moderate NAA's | 100 |
| Serious NAAs | 70 |
| PM2.5 (direct emissions, SO2, NOX, VOC, and Ammonia): | |
| Moderate NAA's | 100 |
| Serious NAAs | 70 |
| PD: all NAA's | 25 |

**Table 3: 40 CFR 93.153 [b][2] Emission Rates for Maintenance Areas**

| Pollutant | Tons per Year |
|---|---|
| Ozone (NOX), $SO_2$ or $NO_2$: | |
| All maintenance areas | 100 |
| Ozone (VOC's) | |
| Maintenance areas inside an ozone transport region | 50 |
| Maintenance areas outside an ozone transport region | 100 |
| Carbon monoxide: All maintenance areas | 100 |
| $PM_{10}$: All maintenance areas | 100 |
| $PM_{2.5}$ (direct emissions, $SO_2$, NOx, VOC, and Ammonia) | 100 |
| All maintenance areas | 100 |
| Pb: All maintenance areas | 25 |

## Federal Class I Areas

Title 1, Part C of the CAA was established in part to preserve, protect, and enhance the air quality in national parks, national wilderness areas, national monuments, national seashores, and other areas of special national or regional natural, recreational, scenic, or historic value. The CAA designates all international parks, national wilderness areas, and memorial parks larger than 5,000 acres and national parks larger than 6,000 acres as “Class I areas.” The CAA prevents significant deterioration of air quality in Class I areas under the Prevention of Significant Deterioration (PSD) Program. The PSD Program protects Class I areas by allowing only a small increment of air quality deterioration in these areas by requiring assessment of potential impacts on air quality related values of Class I areas.

Any major source of emissions within 100 kilometers (62.1 miles) from a federal Class I area is required to conduct a pre-construction review of air quality impacts on the area(s). A “major source” for the PSD Program is defined as a facility that will emit (from direct stationary sources) 250 tons per year (tpy) of regulated pollutant. For certain industries, these requirements apply to facilities that emit (through direct stationary sources) 100 tpy or more of a regulated pollutant. Mobile sources (e.g., vehicle emissions) are by definition not stationary sources and are therefore not subject to the PSD program.

## Tribal New Source Review

The Tribal Minor New Source Review (NSR) permitting program was established by the USEPA under the CAA. The minor NSR program applies to both new minor sources and minor modifications to both major and minor projects in attainment and nonattainment areas. NSR programs must comply with the standards and control strategies of the Tribal Implementation Plan (TIP) or SIP. If there is not an applicable SIP or TIP, the USEPA issues permits and implements the program. A General Permit under the minor NSR program would be required on tribal trust land if stationary source allowable emissions of regulated pollutants would exceed the thresholds presented in 40 CFR 49.153, Table 1 (presented in **Table 4**). This General Permit serves as a preconstruction permit containing limitations and other restrictions specifying the construction, modification, and operation of a minor source. The applicability of Tribal NSR is made on a source's potential to emit (PTE). For emergency generators, the USEPA has determined that 500 hours per year should be assumed as a reasonable and realistic "worst-case" estimate on a PTE basis (USEPA, 1995).

**Table 4: Tribal Minor New Source Review Thresholds**

| Pollutant | Emissions Thresholds for Nonattainment Areas (tpy) | Emissions Thresholds for Attainment Areas (tpy) |
|---|---|---|
| NOx | 5 | 10 |
| ROG | 2 | 5 |
| PM | 5 | 10 |
| $PM_{10}$ | 1 | 5 |
| $PM_{2.5}$ | 0.6 | 3 |
| CO | 5 | 10 |
| $SO_2$ | 5 | 10 |
| Pb | 0.1 | 0.1 |

Source: 40 CFR 49.153.

## Climate Change

On February 19, 2021, Secretary of the Interior Deb Haaland issued Secretarial Order (SO) 3399 to prioritize action on climate change throughout the Department and to restore transparency and integrity in the Department's decision-making processes. SO 3399 specifies that when considering the impact of GHG emissions from a proposed action, Bureaus/Offices should use appropriate tools, methodologies, and resources available to quantify GHG emissions and compare GHG quantities across alternatives. SO 3399 acknowledges that identifying the interactions between climate change and the environmental impacts of a proposed action in NEPA documents can help decision makers identify opportunities to reduce GHG emissions, improve environmental outcomes, and contribute to protecting communities from the climate crisis.

On January 9, 2023, the Council on Environmental Quality issued National Environmental Policy Act Guidance on Consideration of Greenhouse Gas Emissions and Climate Change (88 Fed. Reg. 1196). This interim guidance directs agencies to consider the potential effects of a proposed action on climate change and the effects of climate change on a proposed action and its environmental impacts. CEQ recommends that agencies quantify a proposed action's projected GHG emissions for the expected lifetime of the action and provide additional context for GHG emissions, including the use of the best available social cost of GHG (SC–GHG) estimates, to translate climate impacts into the more accessible metric of dollars. This guidance does not propose a specific, quantitative threshold of significance; however, it states that agencies should consider the potential for mitigation measures to reduce or mitigate GHG emissions and climate change effects when those measures are reasonable and consistent with achieving the purpose and need for the proposed action. CEQ recommends that agencies explain how the proposed action and alternatives would help meet or detract from achieving relevant climate action goals and commitments, including federal goals, international agreements, state or regional goals, Tribal goals, agency-specific goals, or others as appropriate.

## State and Local

### California Air Resources Board

The California Air Resources Board (CARB), a part of the California Environmental Protection Agency (Cal/EPA), is responsible for the coordination and administration of both federal and State air pollution control programs within California. In this capacity, CARB conducts research, sets the CAAQS, compiles emission inventories, develops suggested control measures, and provides oversight of local programs. CARB establishes emissions standards for motor vehicles sold in California as well as consumer products (e.g., hairspray, aerosol paints, and barbecue lighter fluid), and various types of commercial equipment. It also sets fuel specifications to further reduce vehicular emissions. CARB also has primary responsibility for the development of California's SIP, for which it works closely with the Air Quality Management District's and the USEPA.

### California Clean Air Act and Regional Air Quality Standards

#### *Air Quality*

The California Clean Air Act of 1988 requires nonattainment areas to achieve and maintain the CAAQS by the earliest practicable date, as well as requires local air districts to develop plans for attaining the State $O_3$, CO, $SO_2$, and NOx standards.

At a local level, the Bay Area Air Quality Management District (BAAQMD) has jurisdiction over the southern portion of Sonoma County. The BAAQMD attains and maintains air quality conditions in Sonoma County through a comprehensive program of planning, regulation, enforcement, technical innovation, and promotion of the understanding of air quality issues. The clean air strategy of the BAAQMD includes the preparation of plans for the attainment of ambient air quality standards, adoption, and enforcement of rules and regulations concerning sources of air pollution, and issuance of permits for stationary sources of air pollution.

### Odor

Because offensive odors rarely cause any physical harm and no requirements for their control are included in state or federal air quality regulations, local air districts often have no numerical rules or standards related to odor emissions, other than regulations related to nuisances. The BAAQMD 2017 *California Environmental Quality Act Air Quality Guidelines*, specifically Table 3-3 in the document, outlines the distances used to screen odors for certain land uses, but screening criteria is recommended for informational purposes in conjunctions with other assessment tools, such as odor parameters and complaint history (BAAQMD, 2017).

### Global Climate Change

California has been a leader among states in outlining and aggressively implementing a comprehensive climate change strategy that is designed to result in a substantial reduction in total statewide GHG emissions in the future. California's climate change strategy is multifaceted and involves a number of State agencies implementing a variety of State laws and policies. These California laws and policies are summarized below in addition to the local air district's guidelines for determining a project's impacts on climate change.

#### *State*

Executive Order S-3-05

EO S-3-05 established the following statewide emission reduction targets:

- Reduce GHG emissions to 2000 levels by 2010.
- Reduce GHG emissions to 1990 levels by 2020.
- Reduce GHG emissions to 80 percent below 1990 levels by 2050.

EO S-3-05 created a Climate Action Team (CAT) headed by the Cal/EPA and including several other State jurisdictional agencies. The CAT is tasked by EO S-3-05 with outlining the effects of climate change on California and recommending an adaptation plan. The CAT is also tasked with creating a strategy to meet the target emission reductions. In April 2006, the CAT published an initial report that accomplished these two tasks.

California Global Warming Solutions Act of 2006 (Assembly Bill 32)

Assembly Bill (AB) 32 codifies a key requirement of EO S-3-05: the requirement to reduce State-wide GHG emissions to 1990 levels by 2020. AB 32 tasks CARB with monitoring State sources of GHGs and designing emission reduction measures to comply with the law's emission reduction requirements. However, AB 32 also continues the CAT's efforts to meet the requirements of EO S-3-05 and states that the CAT should coordinate overall state climate policy.

In order to accelerate the implementation of emission reduction strategies, AB 32 requires that CARB identify a list of discrete early action measures that can be implemented relatively quickly. In October 2007, CARB published a list of early action measures that could be implemented and would serve to meet about a quarter of the required 2020 emissions reductions. In order to assist CARB in identifying early action measures, the CAT published a report in April 2007 that updated their 2006 report and identified strategies for reducing GHG emissions. In the October 2007 report, CARB cited the CAT strategies and other existing strategies that may be utilized in achieving the remainder of the emissions reductions.

AB 32 required that CARB prepare a comprehensive "scoping plan" that identifies all strategies necessary to fully achieve the required 2020 emissions reductions. CARB provided its first update to the Climate Change Scoping Plan in May 2014. The purpose of the update was to identify the next steps for California's leadership on climate change. The updated Plan outlined the progress California has made to date regarding near-term 2020 GHG limits, such as cleaner and more efficient energy, cleaner transportation, and CARB's Cap-and-Trade Program. The updated Plan identifies six key areas where further control strategies are needed: energy, transportation (vehicles/equipment, sustainable communities, housing, fuels, and infrastructure), agriculture, water, waste management, and natural and working lands. In 2016, the Legislature passed Senate Bill (SB) 32. This established a benchmark for California to reduce GHG emissions to 40 percent below 1990 levels by 2030. CARB is in the process of updating the Scoping Plan to reflect the 2030 target and released a proposed update in January 2017. Under the Proposed Scoping Plan, the six key areas where further control strategies are needed, as identified in the first update, are still included in addition to a seventh area targeting the industrial sector.

Executive Order S-01-07

EO S-01-07 mandates a State-wide goal to reduce the carbon intensity of transportation fuels by at least 10 percent by 2020. This target reduction was identified by CARB as one of the AB 32 early action measures identified in their October 2007 report.

Executive Order B-30-15

EO B-30-15 sets interim GHG targets of 40 percent below 1990 by 2030, to ensure California will meet the 2050 targets set by AB 32.

EO N-79-20/ Advanced Clean Cars II

Advanced Clean Cars II accelerates requirements that automakers deliver an increasing number of zero-emission light-duty vehicles each year (beginning with 2026 models) and codifies EO N-79-20. The regulation applies to automakers (not dealers) and covers only new vehicle sales. It does not impact existing vehicles on the road, which will still be legal to own and drive. Sales of new zero-emission vehicles and plug-in hybrids will start with 35% in 2026, build to 68% in 2030, and reach 100% in 2035. In other words, 100% of new cars and light trucks sold in California will be zero-emission vehicles, including plug-in hybrid electric vehicles, by 2035.

Senate Bill 350

SB 350 codifies the GHG targets for 2030 set by EO B-30-15. To meet these goals, SB 350 also raises the Renewables Portfolio Standards from 33 percent renewable generation by 2020 to 50 percent renewable generation by December 31, 2030.

Senate Bill 375

SB 375 provides for the creation of a new regional planning document called a sustainable communities strategy (SCS). An SCS is a blueprint for regional transportation infrastructure and development that is designed to reduce GHG emission from cars and light trucks to target levels that will be set by CARB for 18 regions throughout California. Each of the various metropolitan planning organizations must prepare an SCS and include it in that region's regional transportation plan. The SCS can influence transportation, housing, and land use planning. CARB will determine whether the SCS will achieve the region's GHG emissions reduction goals. Under SB 375, certain qualifying in-fill residential and mixed-use projects would be eligible for streamlined California Environmental Quality Act (CEQA) review.

AB 1279 (California Climate Crisis Act)

AB 1279 declares the policy of the State to achieve net zero greenhouse gas emissions as soon as possible, but no later than 2045. By 2045, statewide anthropogenic greenhouse gas emissions should be reduced to at least 85% below the 1990 levels, and thereafter, the State aims to achieve and maintain net negative greenhouse gas emissions. AB 1279 requires the State Board to work with relevant State agencies to ensure that updates to the scoping plan identify and recommend measures to achieve these policy goals and to identify and implement a variety of policies and strategies that enable carbon dioxide removal solutions and carbon capture, utilization, and storage technologies in California. AB 1279 also requires the State Board to submit an annual report.

### *Bay Area Air Quality Management Basin*

BAAQMD publishes thresholds of significance for evaluating the significance of climate impacts from land use projects and plans. Its most recent guidelines for climate can be found in its 2022 Justification Report. The thresholds described within the report evaluate significance based a project's effect on California's efforts to meet the State's long-term climate goal rather than setting emission standards. **Table 5** shows the criterium the project must meet during operation in order to be considered to have a less than significant impact on climate change. No standards are set for construction of a project because of their small one-time contribution to climate change (BAAQMD, 2022).

**Table 5: BAAQMD's Climate Change Thresholds for Land Use Projects***

| | |
|---|---|
| A | 1. Buildings<br>a. The project will not include natural gas appliances or natural gas plumbing (in both residential and nonresidential development).<br>b. The project will not result in any wasteful, inefficient, or unnecessary energy usage as determined by the analysis required under CEQA Section 21100(b)(3) and Section 15126.2(b) of the State CEQA Guidelines. |
| | 2. Transportation<br>a. Achieve a reduction in project-generated vehicle miles traveled (VMT) below the regional average consistent with the current version of the California Climate Change Scoping Plan (currently 15 percent) or meet a locally adopted Senate Bill 743 VMT target, reflecting the recommendations provided in the Governor's Office of Planning and Research's Technical Advisory on Evaluating Transportation Impacts in CEQA:<br>i. Residential projects: 15 percent below the existing VMT per capita<br>ii. Office projects: 15 percent below the existing VMT per employee<br>iii. Retail projects: no net increase in existing VMT<br>b. Achieve compliance with off-street electric vehicle requirements in the most recently adopted version of CALGreen Tier 2. |
| B | Projects must be consistent with a local GHG reduction strategy that meets the criteria under State CEQA Guidelines Section 15183.5(b). |

Source: BAAQMD, 2022
* A project must meet either criterium A or B to be considered to have a less than significant impact.

## Climate Change and Its Potential Impacts

Certain gases in the earth's atmosphere, classified as GHGs, play a critical role in determining the earth's surface temperature. GHGs include all of the following compounds: carbon dioxide ($CO_2$), methane ($CH_4$), nitrous oxide ($N_2O$), hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride (Health & Safety Code § 38505[g]). In addition to natural sources, human activities are exerting a substantial and growing influence on climate by changing the composition of the atmosphere and the ocean, and by modifying the land surface through deforestation and urbanization that reduces carbon capture and decreases albedo (Intergovernmental Panel on Climate Change [IPCC], 2014). In particular, increased consumption of fossil fuels has substantially increased atmospheric levels of GHGs. Emissions of these gases are attributable to human activities associated with the industrial/manufacturing, utilities, transportation, residential, commercial, and agricultural sectors (CARB, 2021).

In 2019, transportation generated 41% of California's GHG emissions. This was followed by the industrial sector (24%), electricity generation in state (9%), commercial and residential (8%), agriculture and forestry (7%), commercial (6%), and electricity generation imports (5%) (CARB, 2021). Emissions of $CO_2$ and $N_2O$ are byproducts of fossil fuel combustion, among other sources. $CH_4$ results from off-gassing associated with agricultural practices and landfills. Sinks of $CO_2$ include uptake by vegetation and dissolution into the ocean.

According to the United Nations IPCC and the USEPA, it is very likely (greater than 95% probability) that human activity is responsible for rising temperatures. The IPCC expects global temperatures to increase another 2 to 10 degrees Fahrenheit by 2100, depending on how much atmospheric GHG concentrations continue to rise.

Climate change has the potential to impact California and the Bay Area natural and economic environment. The following is an abbreviated list of potential climate change impacts.

- Rising sea levels along the California coastline, particularly in San Francisco and the Sacramento-San Joaquin River Delta due to ocean expansion.
- Extreme heat conditions, such as heat waves and very high temperatures, which could last longer and become more frequent.
- An increase in heat-related human deaths and infectious diseases and a higher risk of respiratory problems caused by deteriorating air quality.
- Reduced snow pack and stream flow in the Sierra Nevada mountains, affecting winter recreation and water supplies.
- Potential increase in the severity of winter storms, affecting peak stream flows and flooding.
- Changes in growing season conditions that could affect California agriculture, causing variations in crop quality and yield.
- Changes in distribution of plant and wildlife species due to changes in temperature, competition of colonizing species, changes in hydrologic cycles, changes in sea levels, and other climate-related effects.

# BIOLOGICAL RESOURCES – SECTION 3.5 OF THE EIS

## Federal

### Federal Endangered Species Act

The Federal Endangered Species Act (FESA) protects species that are at risk of extinction and provides for the conservation of the ecosystems on which they depend. The U.S. Fish & Wildlife Service (USFWS) and the National Oceanic and Atmosphere Administration, Fisheries Service (NOAA Fisheries) share responsibility for implementing FESA. Generally, USFWS manages terrestrial and freshwater species, while NOAA Fisheries is responsible for marine and anadromous species. Section 9 (§ 1538) prohibits the "take" of a listed species by anyone, including private individuals and state and local agencies. Threatened and endangered species on the federal list (50 CFR Sections 17.11 and 17.12) are protected from take, which is defined as direct or indirect harm. If "take" of a listed species is incidental to an otherwise lawful activity, this triggers the need for consultation under Section 7 of the FESA for federal agencies.

Pursuant to the requirements of the FESA, a federal agency reviewing a proposed project within its jurisdiction must determine whether any federally listed species may be present on the proposed project site and whether the proposed project will have a potentially significant impact upon such species. A discussion of regionally listed species is provided in consideration of potential impacts associated with project implementation. Under the FESA, habitat loss is considered to be an impact to the species. In addition, the agency is required to determine whether the project is likely to jeopardize the continued existence of any species that is proposed for listing under the FESA or to result in the destruction or adverse modification of critical habitat proposed to be designated for such species (16 USC Section 1536[3], [4]). Therefore, project-related impacts to these species, or their habitats, would be considered significant.

### Magnuson-Stevens Act and Sustainable Fisheries Act

The Magnuson–Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) is the primary law that governs marine fisheries management in U.S. federal waters. First passed in 1976, the Magnuson-Stevens Act fosters the long-term biological and economic sustainability of marine fisheries. Its objectives include: preventing overfishing; rebuilding overfished stocks; increasing long-term economic and social benefits; ensuring a safe and sustainable supply of seafood; and protecting habitat that fish need to spawn, breed, feed, and grow to maturity. The Sustainable Fisheries Act of 1996 (Public Law 104-297) amended the Magnuson-Stevens Act to establish new requirements for fishery management councils to identify and describe Essential Fish Habitat (EFH) and to protect, conserve, and enhance EFH for the benefit of fisheries. EFH is defined as those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. The Sustainable Fisheries Act also established a federal EFH consultation process that advises federal agencies to avoid, minimize, mitigate, or otherwise offset adverse effects on EFH (NOAA Fisheries, 2022a). Consultation is required if a federal agency has authorized, funded, or undertaken part or all of a proposed activity and the action will adversely affect EFH. An adverse effect includes direct or indirect physical, chemical, or biological alternations to waters or substrate, species and their habitat, quality and/or quantity of EFH, or other ecosystem components. If a federal agency determines that an action will not adversely affect EFH, and NOAA Fisheries agrees, no consultation is required (NOAA Fisheries, 2022b). A 2002 update to EFH regulations allowed fishery management councils to designate Habitat Areas of Particular Concern, specific areas within EFH that have extremely important ecological functions and/or are especially vulnerable to degradation (NOAA Fisheries, 2022a).

## Migratory Bird Treaty Act

Migratory birds are protected under the federal Migratory Bird Treaty Act (MBTA) of 1918 (16 USC 703-711). The MBTA makes it unlawful to take, possess, buy, sell, purchase, or barter any migratory bird listed under 50 CFR 10, including feathers or other parts, nests, eggs, or products, except as allowed by implementing regulations (50 CFR 21). The direct injury or death of a migratory bird due to construction activities or other construction-related disturbance that causes nest abandonment, nestling abandonment, or forced fledging would be considered take under federal law. As such, project-related disturbances must be reduced or eliminated during the nesting season. The general nesting season extends from February 15 to September 15.

The 1988 amendment to the Fish and Wildlife Conservation Act mandates USFWS to identify species subspecies and populations/taxa of all migratory nongame birds that without additional conservation action are likely to become candidates for listing under FESA. The Birds of Conservation Concern 2021 (BCC 2021) is the most recent effort to carry out this mandate. The overall goal of this report is to identify those bird taxa (beyond those already designated as federally threatened or endangered) that represent the highest conservation priorities of the USFWS. The BCC 2021 is intended to stimulate coordinated, collaborative and proactive conservation actions among international, federal, state, tribal and private partners. Bird taxa considered for the BCC 2021 lists include nongame birds, gamebirds without hunting seasons or where harvest is minimal, and subsistence-hunted nongame birds in Alaska. Excluded from consideration for the BCC 2021 are bird species not protected under the MBTA, taxa already listed as threatened or endangered under FESA, or taxa that only occur irregularly or peripherally in the U.S (USFWS, 2021).

## Bald and Golden Eagle Protection Act

The Bald and Golden Eagle Protection Act was originally enacted in 1940 to protect bald eagles and was later amended to include golden eagles (16 USC Subsection 668-668). This act prohibits take, possession, and commerce of bald and golden eagles and associated parts, feathers, nests, or eggs with limited exceptions. The definition of take is the same as the definition under the FESA. The USFWS established five recovery programs in the mid-1970s based on geographical distribution of the species, which California located in the Pacific Recovery Region. Habitat conservation efforts in the Pacific Recovery Region, including laws and management practices at federal, state, and community levels, have helped facilitate bald eagle population increases. Critical habitat for bald and golden eagles was not designated as part of the Pacific Recovery Plan created under FESA. Likewise, critical habitat was not designated by regulation under FESA. In 1995, the USFWS reclassified the bald eagle from endangered to threatened under FESA in the contiguous 48 states, excluding Michigan, Minnesota, Wisconsin, Oregon, and Washington where it had already been listed as threatened. In 2007, the bald eagle was federally delisted under FESA. However, the provisions of the act remain in place for protection of bald and golden eagles.

### Clean Water Act - Sections 404 and 401

Any project that involves discharge of dredged or fill material into navigable Waters of the U.S. must first obtain authorization from the USACE, under Section 404 of the CWA. Projects requiring a 404 permit under the CWA also require a Section 401 certification from either USEPA for trust land, or the RWQCB for non-trust land. These two agencies also administer the NPDES general permits for construction activities disturbing one acre or more.

The term "Waters of the United States" is defined as:

- All waters currently used, or were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters subject to the flow of the tide;
- All interstate waters including interstate wetlands; or
- All other waters, such as intrastate lakes, rivers, streams (including intermittent streams), mudflats, sand flats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds, where the use or degradation of which could affect interstate or foreign commerce including any such waters.

The term "Wetlands" is defined as:

- Waters of the U.S. that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands that meet these criteria during only a portion of the growing season are classified as seasonal wetlands.

## State and Local

### California Endangered Species Act

The California Endangered Species Act (CESA) declares that deserving plant or animal species will be given protection by the state because they are of ecological, educational, historical, recreational, aesthetic, economic, and scientific value to the people of the State. The CESA established that it is State policy to conserve, protect, restore, and enhance state-listed species and their habitats. Under State law, plant and animal species may be formally listed by the California Fish and Game Commission.

The CESA authorizes that private entities may take listed species under FESA and CESA, pursuant to a federal incidental take permit issued in accordance with Section 10 of the FESA, if the California Department of Fish and Wildlife (CDFW) certifies that the incidental take statement or incidental take permit is consistent with the CESA (California Fish & Game Code § 2080.1[a]).

### California Fish and Game Code

The California Fish and Game Code defines "take" (Section 86) and prohibits take of a species listed under the CESA (California Fish and Game Code § 2080), or otherwise special-status (California Fish and Game Code §§ 3511, 4700, and 5050). Section 2081(b) and (c) of the CESA allows CDFW to issue an incidental take permit for a State-listed species if specific criteria outlined in Title 14 CCR §§ 783.4(a), (b) and CDFW Code § 2081(b) are met. The

CDFW Code § 3503 states that it is unlawful to take, possess, or needlessly destroy the nest or eggs of any bird except as otherwise provided by the code. Section 3503.5 states that it is unlawful to take, possess, or destroy any birds in the taxonomic order Falconiformes or Strigiformes (birds of prey) or to take, possess, or destroy the nest or eggs of any such bird. Section 3513 states that it is unlawful to take or possess any migratory non-game bird as designated in the MBTA or any part of such migratory non-game bird except as provided by rules and regulations adopted by the U.S. Secretary of the Interior under provisions of the MBTA. If a project is planned in an area where a species or specified bird occurs, an applicant must design the project to avoid all take; the CDFW cannot provide take authorization under the CESA.

### Native Plant Protection Act of 1977

Native Plant Protection Act of 1977 and implementing regulations in Section 1900 et seq. of the California Fish and Game Code designate special-status plant species and provide specific protection measures for identified populations. The CDFW administers the Native Plant Protection Act.

### Sonoma County General Plan

The Sonoma County General Plan is the master policy document that provides the general framework for all zoning and land use decisions within a community. The Open Space and Resource Conservation Element includes objectives and policies regarding biotic resources, including biotic habitat areas (e.g., special status species habitat, marches and wetlands, and sensitive natural communities), riparian corridors, and marine fishery and harbor resources. These policies are required for projects that fall under the jurisdiction of the County and are applicable to off-Reservation impacts, including roadway access and improvement projects.

### Sonoma County Zoning Ordinance

The Sonoma County Zoning Regulations establishes various districts within the unincorporated territory of the county and designates lawful permitted uses, as well as uses which may be approved through the use permit process. The County Zoning Regulations include protections and designations for agricultural and resource zones, including protections for lands needed for watershed, fish and wildlife habitat, and biotic resources. Additionally, the County Zoning Regulations include a Riparian Corridor (RC) Combining Zone, which protects biotic resource communities, including critical habitat areas within and along riparian corridors, for their habitat and environmental value, and to implement the provisions of the General Plan Open Space and Resource Conservation and Water Resources Elements. If applicable, the RC Combining Zone establishes minimum streamside conservation area and minimum setback for agricultural cultivation. The Sonoma County Zoning Regulations are appliable applicable to off-Reservation impacts, including roadway access and improvement projects

# CULTURAL AND PALEONTOLOGICAL RESOURCES – SECTION 3.6 OF THE EIS

## Federal

### National Historic Preservation Act

Section 106 of the National Historic Preservation Act (NHPA), as amended, and its implementing regulations found in 36 CFR Part 800 require federal agencies to identify cultural resources that may be affected by actions involving federal lands, funds, or permitting. The BIA must comply with Section 106 for the proposed trust acquisition. The significance of the resources must be evaluated using established criteria outlined in 36 CFR 60.4, as described below.

If a resource is determined to be a historic property, Section 106 of the NHPA requires that effects of the federal undertaking on the resource be determined. A historic property is defined as:

> *…any prehistoric or historic district, site, building, structure or object included in, or eligible for inclusion in the National Register of Historic Places, including artifacts, records, and material remains related to such a property… (NHPA Sec. 301[5])*

Section 106 of the NHPA prescribes specific criteria for determining whether a project would adversely affect a historic property, as defined in 36 CFR 800.5. An impact is considered adverse when prehistoric or historic archaeological sites, structures, or objects that are listed on or eligible for listing in the National Register of Historic Places (NRHP) are subjected to the following:

- Physical destruction of or damage to all or part of the property;
- Alteration of a property;
- Removal of the property from its historic location;
- Change of the character of the property's use or of physical features within the property's setting that contribute to its historic significance;
- Introduction of visual, atmospheric, or audible elements that diminish the integrity of the property's significant historic features;
- Neglect of a property that causes its deterioration; and
- Transfer, lease, or sale of the property out of federal control without adequate and legally enforceable restrictions or conditions to ensure long-term preservation of the property's historic significance.

If the historic property will be adversely affected by the undertaking, then prudent and feasible measures to resolve adverse impacts must be taken. The State Historic Preservation Office must be provided an opportunity to review and comment on these measures prior to project implementation.

### *National Register of Historic Places*

The eligibility of a resource for listing in the NRHP is determined by evaluating the resource using criteria defined in 36 CFR § 60.4 as follows.

The quality of significance in American history, architecture, archaeology, and culture is present in districts, sites, buildings, structures, and objects of state and local importance that possess integrity of location, design, setting, materials, workmanship, feeling, association, and:

A) That are associated with events that have made a significant contribution to the broad patterns of our history;
B) That are associated with the lives of persons significant in our past;
C) That embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
D) That have yielded, or may be likely to yield, information important to prehistory or history.

Sites younger than 50 years, unless of exceptional importance, are not eligible for listing in the NRHP.

In addition to meeting at least one of the criteria listed above, the property must also retain enough integrity to enable it to convey its historic significance. The NRHP recognizes seven aspects or qualities that, in various combinations, define integrity. These seven elements of integrity are location, design, setting, materials, workmanship, feeling, and association. To retain integrity a property will always possess several, and usually most, of these aspects.

While most historic buildings and many historic archaeological properties are significant because of their association with important events, people, or styles (Criteria A, B, and C), the significance of most prehistoric and some historic-period archaeological properties is usually assessed under Criterion D. Criterion D stresses the importance of the information contained in an archaeological site rather than its intrinsic value as a surviving example of a type or its historical association with an important person or event. It places importance not on physical appearance but rather on information potential.

## Native American Graves Protection and Repatriation Act

The Native American Graves Protection and Repatriation Act (NAGPRA), 25 USC 3001 et seq*.,* provides a process for museums and federal agencies to return Native American cultural items – human remains, funerary objects, sacred objects, or objects of cultural patrimony – to lineal descendants, and culturally affiliated Indian tribes and Native Hawaiian organizations. NAGPRA includes provisions for unclaimed and culturally unidentifiable Native American cultural items, intentional and inadvertent discovery of Native American cultural items on federal and Tribal lands, and penalties for noncompliance and illegal trafficking.

## Archaeological Resources Protection Act of 1979

The Archaeological Resources Protection Act of 1979 (ARPA; Public Law 96-95; 16 USC 470aa-mm) provides for the protection of archaeological resources and sites that are on public and Indian lands, and fosters increased cooperation and exchange of information between governmental authorities, the professional archaeological community, and private individuals having collections of archaeological resources and data that were obtained before October 31, 1979. ARPA also provides for penalties for noncompliance and illegal trafficking.

## Paleontological Resources Preservation Act

Paleontological resources are defined as the traces or remains of prehistoric plants and animals. Such remains often appear as fossilized or petrified skeletal matter, imprints, or endocasts, and reside in sedimentary rock layers. Paleontological resources are considered important for their scientific and educational value. Fossil remains of vertebrates are considered significant. Invertebrate fossils are considered significant if they function as index fossils. Index fossils are those that appear in the fossil record for a relatively short and known period of time. This allows geologists to interpret the age range of the geological formations in which they are found.

The Paleontological Resources Preservation subtitle of the Omnibus Public Land Management Act, 16 USC 470aaa to aaa-11 requires the U.S. Department of Agriculture (USDA) and the U.S. Department of the Interior to issue implementation regulations to provide for the preservation, management, and protection of paleontological resources on federal lands and ensure that these resources are available for current and future generations to enjoy as part of America's national heritage.

# SOCIOECONOMIC CONDITIONS – SECTION 3.7 OF THE EIS

## Federal

### Executive Order 12898

Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority and Low-Income Populations*, as amended, directs federal agencies to develop an Environmental Justice Strategy that identifies and addresses disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority populations and low-income populations. The CEQ has oversight responsibility of the federal government's compliance with EO 12898 and NEPA. The CEQ, in consultation with the USEPA and other agencies, has developed guidance to assist federal agencies with their NEPA procedures so that environmental justice concerns are effectively identified and addressed.

The document *Final Guidance for Incorporating Environmental Justice Concerns in EPA's NEPA Compliance Analyses* provides the following direction on how to analyze the impacts of actions on low-income and minority populations:

> *Under NEPA, the identification of a disproportionately high and adverse human health or environmental effect on a low-income population, minority population, or Indian tribe does not preclude a proposed agency action from going forward, nor does it necessarily compel a conclusion that a proposed action is environmentally unsatisfactory. Rather, the identification of such an effect should heighten agency attention to alternatives (including alternative sites), mitigation strategies, monitoring needs, and preferences expressed by the affected community or population. (USEPA, 1998)*

As previously stated, according to guidance from the CEQ (1997) and USEPA (1998), agencies should consider the composition of the affected area, to determine whether minority populations, low-income populations, or Indian tribes are present in the area affected by a proposed action and, if so, whether there may be disproportionately high and adverse environmental effects to those populations.

Communities may be considered "minority" under the executive order if one of the following characteristics apply.

- The cumulative percentage of minorities within a census tract is greater than 50 percent (primary method of analysis); or
- The cumulative percentage of minorities within a census tract is less than 50 percent, but the percentage of minorities is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis (secondary method of analysis).

According to USEPA, either the county or the state can be used when considering the scope of the "general population." A definition of "meaningfully greater" is not given by the CEQ or USEPA, although the latter has noted that any affected area that has a percentage of minorities above the state's percentage is a potential minority community and any affected area with a minority percentage double that of the state's is a definite minority community under EO 12898.

Communities may be considered "low-income" under the EO if one of the following characteristics applies.

- The median household income for a census tract is below the poverty line (primary method of analysis); or

- Other indications are present that indicate a low-income community is present within the census tract (secondary method of analysis).

In most cases, the primary method of analysis will suffice to determine whether a low-income community exists in the affected environment. However, when a census tract income may be just over the poverty line or where a low-income pocket within the tract appears likely, the secondary method of analysis may be warranted. Other indications of a low-income community under the secondary method of analysis include presence of households whose income is less than or equal to 200% of the poverty level (USEPA, 2022b).

### Executive Order 14096

EO 14096, issued in April of 2023, amends and expands certain provisions of EO 12898, and includes the following:

- Expands definition of potentially disadvantaged communities to include persons with a Tribal affiliation and disabled persons;
- Requires Federal Agencies to fulfill environmental justice reporting requirements and prepare strategic plans; and
- Describes additional reporting and notification requirements related to toxic spills.
- Requires that federal agencies conduct NEPA analysis in a manner that:
    - *(A) analyzes direct, indirect, and cumulative effects of Federal actions on communities with environmental justice concerns;*
    - *(B) considers best available science and information on any disparate health effects (including risks) arising from exposure to pollution and other environmental hazards, such as information related to the race, national origin, socioeconomic status, age, disability, and sex of the individuals exposed; and*
    - *(C) provides opportunities for early and meaningful involvement in the environmental review process by communities with environmental justice concerns potentially affected by a proposed action, including when establishing or revising agency procedures under NEPA.*

# TRANSPORTATION/CIRCULATION – SECTION 3.8 OF THE EIS

No regulations applicable to the development of the Project Site were identified during the traffic and circulation analysis.

# LAND USE – SECTION 3.9 OF THE EIS

## Federal

### Farmland Protection Policy Act

The Farmland Protection Policy Act (FPPA) is intended to minimize the impact federal programs have on the unnecessary and irreversible conversion of farmland to nonagricultural uses. It assures that federal programs are administered in a matter that is compatible with state and local units of government, and private programs and policies to protect farmland (7 U.S.C. § 4201).

The Natural Resource Conservation Service (NRCS) is responsible for the implementation of the FPPA and categorizes farmland in a number of ways. These categories include prime farmland, farmland of statewide importance, and unique farmland. Prime farmland is considered to have the best possible features to sustain long-term productivity. Farmland of statewide importance includes farmland similar to prime farmland, but with minor shortcomings, such as greater slopes or less ability to store soil moisture. Unique farmland is characterized by inferior soils and, depending on climate, generally needs irrigation.

The NRCS fulfills the directives of the Soil and Water Conservation Act (16 USC § 2001-2009) by identifying significant areas of concern for the protection of national resources. NRCS uses a land evaluation and site assessment system to establish a Farmland Conversion Impact Rating (FCIR) score. The FCIR is completed on form AD-1006. The FCIR form has two components: land evaluation, which rates soil quality up to 100 points, and the site assessment, which measures other factors that affect the property's viability up to 160 points.

The total FCIR score is used as an indicator for the project's sponsor to consider alternative sites if the potential adverse impacts on the farmland exceed the allowable level; however, the FPPA does not require federal agencies to alter projects to avoid or minimize farmland conversion. Sites receiving a combined score of less than 160 (out of 260 possible points) do not require further evaluation. For sites with a combined score greater than 160 points, at least two other alternatives are required to be considered and the alternative with the lowest number of points selected unless there are other overriding considerations.

### Federal Aviation Regulation

In accordance with 14 CFR 77, which provides requirements, standards, and processes for determining obstructions to air navigation, the Federal Aviation Administration's (FAA's) primary objective is to promote air safety and the efficient use of the navigable airspace. In furthering this mission, the FAA conducts aeronautical studies based on information provided on FAA Form 7460-1, Notice of Proposed Construction or Alteration, by proponents of construction or development in the vicinity of airports. Developers must file Form 7460-1 with the FAA at least 45 days prior to construction if any of the following parameters are met:

- Proposed structure(s) will exceed 200 feet above ground level;
- Proposed structure(s) will be in proximity to an airport and will exceed the slope ratio;
- Proposed structure(s) involves construction of a traverseway (i.e., highway, railroad, waterway, etc.) and once adjusted upward with the appropriate vertical distance would exceed a standard of 77.9(a) or (b);
- Proposed structure(s) will emit frequencies, and do/does not meet the conditions of the FAA Colocation Policy;
- Proposed structure(s) will be in an instrument approach area and might exceed part 77 Subpart C;
- Proposed structure(s) will be in proximity to a navigation facility and may impact the assurance of navigation signal reception;
- Proposed structure(s) will be on an airport or heliport; or
- Filing has been requested by the FAA (FAA, 2017a).

## State and Local

### Sonoma County General Plan 2020

The Sonoma County General Plan was adopted in 2008 and replaced the previous plan adopted in 1989. The Land Use Element provides the distribution, location, and extent of uses for each land use category. The Land Use Element has a time horizon of 2020. The Land Use Element provides the following description of land designations found on the Project Site. **Figure 3.9-1** provides a map of the County's land use designations for the Project Site and adjacent parcels.

*Land Intensive Agricultural Areas (LIA) – This designation is designed to enhance and protect lands capable of and generally used for animal husbandry and the production of food, fiber, and plant materials. The soil type and climate support relatively high production per acre of land.*

Additionally, the Project Site is within multiple combining districts as defined by the County's zoning ordinance, including the Floodway Combining District, Floodplain Combining District, Scenic Resources Combining District, Riparian Corridor Combining Zone, and Valley Oak Habitat Combining District. These combining district designations apply land use regulations to the Project Site in addition to the land use regulations associated with its main zoning designation, LIA.

### *Land Use Element*

The Sonoma County General Plan Land Use Element contains goals, objectives, and policies to guide development within the County.

**GOAL LU-1:** Accommodate Sonoma County's fair share of future growth in the San Francisco Bay Area region as shown below under Goals LU-2 and LU-5 in a manner consistent with environmental constraints, maintenance of the high quality of life enjoyed by existing residents, and the capacities of public facilities and services. Achieve a desirable balance between job opportunities and population growth.

**Objective LU-1.2:** Encourage the major share of commercial and industrial growth in the cities but accommodate a limited amount of this growth in unincorporated communities with urban services.

**Policy LU-1r:** Recognizing the County's General Plan and zoning are not applicable on tribal trust lands, encourage tribes to consult with the County on a government-to-government basis to develop mutually compatible land uses, considering both County and tribal General Plans, with particular focus on areas of joint interest and boundaries.

**GOAL LU-2** Accommodate the major share of future growth within the nine existing cities and their expansion areas and within selected unincorporated communities, which are planned to have adequate water and sewer capacities.

**Objective LU-2.1:** Accommodate a population increase of about 19,064 residents over the 2000 baseline in the unincorporated areas outside of the designated Urban Service Areas.

**Objective LU-2.2:** Allocate the largest portion of unincorporated area growth to communities with public sewer and water services.

**Objective LU-2.3:** Limit the amount of population growth and development in rural portions of the County outside of the cities and the unincorporated communities.

**GOAL LU-5:** Identify important open space areas between and around the county's cities and communities. Maintain them in a largely open or natural character with low intensities of development.

**Objective LU-5-1:** Retain low intensities of use in Community Separators between and around cities and communities as designated in the Open Space and Resource Conservation Element.

**Policy LU-5b:** Avoid commercial and industrial land uses in Community Separators. Allow the full range of uses allowed in the agricultural and resource categories.

**GOAL LU-7:** Prevent unnecessary exposure of people and property to environmental risks and hazards. Limit development on lands that are especially vulnerable or sensitive to environmental damage.

> **Objective LU-7.1:** Restrict development in areas that are constrained by the natural limitations of the land, including but not limited to, flood, fire, geologic hazards, groundwater availability and septic suitability.
>
> > **Policy LU-7c:** Prohibit new permanent structures within any floodway. Require that any development that may be permitted within the flood plain to be raised above the 100-year flood elevation.

**GOAL LU-9:** Protect lands currently in agricultural production and lands with soils and other characteristics that make them potentially suitable for agricultural use. Retain large parcel sizes and avoid incompatible non-agricultural uses.

> **Objective LU-9.1:** Avoid conversion of lands currently used for agricultural production to non-agricultural use.
>
> **Objective LU-9.4:** Discourage uses in agricultural areas that are not compatible with long term agricultural production

**GOAL LU-10:** The uses and intensities of any land development shall be consistent with preservation of important biotic resource areas and scenic features.

> **Objective LU-10.1:** Accomplish development on lands with important biotic resources and scenic features in a manner which preserves or enhances these features.

**GOAL LU-11:** Promote a sustainable future where residents can enjoy a high quality of life for the long term, including a clean and beautiful environment and a balance of employment, housing, infrastructure, and services.

> **Objective LU-11.1:** Use the following sustainability policies pertaining to land use and development in the unincorporated area:
>
> > **Policy LU-11f:** Encourage conservation of undeveloped land, open space, and agricultural lands, protection of water and soil quality, restoration of ecosystems, and minimization or elimination of the disruption of existing natural ecosystems and flood plains.

### *Open Space and Resource Conservation Element*

As described in the Open Space and Resource Conservation Element of the Sonoma County General Plan, community Separators are rural open space and agricultural and resource lands that separate cities and other communities, prevent sprawl, protect natural resources, and provide city and community identity by providing visual relief from continuous urbanization. The Project Site is within the Windsor-Larkfield-Santa Rosa Community Separator.

The Sonoma County General Plan Open Space and Resource Conservation Element contains goals, objectives, and policies to guide development within the County.

**GOAL OSRC-1:** Preserve the visual identities of communities by maintaining open space areas between cities and communities.

**Objective OSRC-1.1:** Preserve important open space areas in the Community Separators shown on Figures OSRC-5a through OSRC-5i of the Open Space and Resource Conservation Element.

**Objective OSRC-1.2:** Retain a rural character and promote low intensities of development in Community Separators. Avoid their inclusion in City Urban Growth Boundaries or Spheres of Influence. Avoid their inclusion within Urbans Service Areas for unincorporated communities.

**Objective OSRC-1.3:** Preserve existing groundwater recharge and stormwater detention areas within Community Separators.

**Objective OSRC-1.4:** Preserve existing specimen trees and tree stands within Community Separators.

**Policy OSRC-1b:** Avoid commercial or industrial uses in Community Separators other than those that are permitted by the agricultural or resource land use categories.

**Policy OSRC-1f:** Unless there are existing design guidelines that have been adopted for the affected area, it is required that new structures within Community Separators meet the following criteria:

- Site and design structures to take maximum advantage of existing topography and vegetation in order to substantially screen them from view from public roads. Minimize cuts and fills on hills and ridges;
- Minimize the removal of trees and other mature vegetation; avoid removal of specimen trees, tree groupings, and windbreaks;
- Where existing topography and vegetation would not screen structures from view from public roads, install landscaping consisting of native vegetation in natural groupings that fits with the character of the area in order to substantially screen structures from view. Screening with native, fire-retardant plants may be required;
- Design structures to use building materials and color schemes that blend with the natural landscape and vegetation;
- To the extent feasible, cluster structures on each parcel within existing built areas, and near existing natural features such as tree groupings;
- Utilities are underground where economically practical;
- On hills and ridges, avoid structures that project above the silhouette of the hill or ridge against the sky as viewed from public roads, and substantially screen driveways from view where practical; and
- Minimize impervious surfaces and encourage groundwater recharge with effective design features and materials that allow stormwater infiltration and detention.

### *Agricultural Resources Element*

The Sonoma County General Plan Open Space and Resource Conservation Element contains goals, objectives, and policies to guide development within the County.

**GOAL AR-4:** Allow farmers to manage their operations in an efficient, economic manner with minimal conflict with nonagricultural uses.

**Objective AR-4.1:** Apply agricultural land use categories only to areas or parcels capable of the commercial production of food, fiber and plant material, or the raising and maintaining of farm animals including horses, donkeys, mules, and similar livestock. Establish agricultural production as the highest priority use in these areas or parcels.

**Policy AR-4a:** The primary use of any parcel within the three agricultural land use categories shall be agricultural production and related processing, support services, and visitor serving uses. Residential uses in these areas shall recognize that the primary use of the land may create traffic and agricultural nuisance situations, such as flies, noise, odors, and spraying of chemicals.

**GOAL AR-6:** Allow new visitor serving uses and facilities in some agricultural areas but limit them in scale and location. These uses must be beneficial to the agricultural industry and farm operators and compatible with long term agricultural use of the land.

**Objective AR-6.1:** Give the highest priority in all agricultural land use categories to agricultural production activities. Visitor serving uses shall promote agriculture and enhance marketing of Sonoma County agricultural products but shall be secondary and incidental to agricultural production.

**Policy AR-6a:** Permit visitor serving uses in agricultural categories that promote agricultural production in the County, such as tasting rooms, sales and promotion of products grown or processed in the County, educational activities and tours, incidental sales of items related to local area agricultural products, and promotional events that support and are secondary and incidental to local agricultural production.

**Policy AR-6d:** Follow these guidelines for approval of visitor serving uses in agricultural areas:

- The use promotes and markets only agricultural products grown or processed in the local area.
- The use is compatible with and secondary and incidental to agricultural production activities in the area. The use will not require the extension of sewer and water.
- The use is compatible with existing uses in the area.
- Hotels, motels, resorts, and similar lodging are not allowed.
- Activities that promote and market agricultural products such as tasting rooms, sales and promotion of products grown or processed in the County, educational activities and tours, incidental sales of items related to local area agricultural products are allowed.
- Special events on agricultural lands or agriculture related events on other lands in the Sonoma Valley Planning Area will be subject to a pilot event coordination program which includes tracking and monitoring of visitor serving activities and schedule management, as necessary, to reduce cumulative impacts.

## Sonoma County Zoning Ordinance

The Sonoma County Zoning Ordinance (Chapter 26 of the Sonoma County Code) regulates development in the unincorporated areas of the County by establishing districts and designating lawful permitted uses and uses which may be approved through the use permit process. The Zoning Ordinance provides the following description of zoning found on the Project Site. Figure 3.9-2 of the EIS provides a map of the County's zoning for the Project Site and adjacent parcels.

*LIA – The purpose of this district is to enhance and protect lands best suited for permanent agricultural use and capable of relatively high production per acre of land.*

## Shiloh Road Vision Plan

The Shiloh Road Vision Plan, implemented by the Town of Windsor General Plan, is a planning document that provides guiding principles to ensure the Shiloh Road Village area conveys an image that is both unique and consistent with regional architecture and one that evokes a strong sense of place and promotes walking and bicycling. The Project Site is adjacent to but outside of the jurisdiction of the Town of Windsor General Plan or the Shiloh Road Vision Plan.

## Williamson Act

The California Land Conservation Act of 1965, commonly known as the Williamson Act, is designed to preserve farmlands and open space lands by discouraging premature and unnecessary conversion to urban uses. Under the provisions of the Williamson Act, landowners contract with the county to maintain agricultural or open space use of their lands in return for a reduced property tax assessment. The contract is self-renewing and the landowner may notify the county at any time of intent to withdraw the land from its preserve status. Withdrawal involves a 10-year period of tax adjustment to full market value before protected open space can be converted to urban uses. Alternatively, landowners can petition the County to withdraw prematurely from a Williamson Contract. In order to cancel a contract without instituting the 10-year tax adjustment period, the County must make the required findings that the cancellation is consistent with the purposes of the Williamson Act, and that cancellation is in the public interest. The Project Site is actively cultivated for the production of wine grapes; however, it is not under a Williamson Act contract.

## Right to Farm Act

California Civil Code Section 3482.5, also known as the Right to Farm Act, contains provisions to ensure that agricultural operations are not considered nuisances, so long as they do not obstruct navigable waterways or public areas. This ordinance supersedes any conflicting local regulations but does not prohibit local jurisdictions from adopting ordinances that allow notification to those in close proximity to an agricultural activity that they are subject to the provisions of the Right to Farm Act.

## Sonoma County Right to Farm Ordinance

The Sonoma County Right to Farm Ordinance, codified in the Code or Ordinances as Ord. No. 5203 § 5, 1999, is the declared policy of the County to conserve, protect, enhance, and encourage agricultural operations on agricultural land within the unincorporated area of the County. Where nonagricultural land uses extend onto agricultural land or exist side by side, agricultural operations are frequently the subject of nuisance complaints. As a result, some agricultural operations are forced to cease or curtail their operations and many others are discouraged from making investments in improvements to their operations, all to the detriment of adjacent agricultural uses and the economic viability of the County's agricultural industry as a whole. The Sonoma County Right to Farm Ordinance intends to reduce the loss to the County of its agricultural resources by limiting the circumstances under which properly conducted agricultural operations on agricultural land may be considered a nuisance.

# PUBLIC SERVICES AND UTILITIES– SECTION 3.10 OF THE EIS

## Federal

### **Safe Drinking Water Act** and **Clean Water Act**

See **Water Resources – Section 3.3 of the EIS** above.

### Public Law 280

Public Law 280 was enacted in 1953 to grant certain states criminal jurisdiction over Indians on reservations in addition to permitting civil litigation under tribal or federal court jurisdiction to be handled by state courts. The states mandated to assume criminal and civil jurisdiction over federal Indian lands are Alaska, California, Minnesota, Nebraska, Oregon, and Wisconsin, although certain tribal lands are exempt, including Metlakatla Indian Community on the Annette Island Reserve, Red Lake Reservation, and Warm Springs Reservation. In addition to these states, other states elected to assume full or partial responsibility, including Arizona, Florida, Idaho, Iowa, Montana, Nevada, North Dakota and Utah. The federal government relinquished all special criminal jurisdictions over Indian offenders and victims in these states. However, Public Law 280 does not grant states the following regulatory powers over lands held in federal trust or tribes:

- Federally guaranteed fishing, tribal hunting, and trapping rights;
- Fundamental tribal governmental functions, such as domestics relations and tribal enrollment; and
- Authority to impose state taxes.

Due to the one-sided process that imposed state jurisdiction on tribes and the complete failure to recognize tribal sovereignty and tribal self-determination, Public Law 280 was opposed by Indian Nations from its enactment. Subsequent acts of Congress, court decisions, and state actions to retrocede (or give back) jurisdiction back to the federal government have mitigated some of the effects of the 1953 law and strengthened tribes' jurisdiction over civil and criminal matters on their reservations.

## State and Local

### California Integrated Waste Management Act (Assembly Bill 939)

In 1989, the State of California enacted AB 939, the California Integrated Waste Management Act, which requires jurisdictions to conduct a solid waste disposal needs assessment that estimates the disposal capacity needed to accommodate projected solid waste generated within the jurisdiction and to identify a minimum of 15 years of permitted disposal capacity. All local jurisdictions are required to divert 50 percent of their total waste stream from landfill disposal.

# NOISE – SECTION 3.11 OF THE EIS

## Federal

### Federal Highway Administration Construction Noise Abatement Criteria

The Federal Highway Administration (FHWA) Construction Noise Handbook (2006) provides guidance with respect to the development of construction noise level thresholds. Based on that guidance and measured ambient noise levels in the Project Site vicinity, the criteria in Table 6 were developed for use in evaluating the significance of construction noise impacts.

**Table 6: Federal Construction Noise Thresholds**

| Noise Receptor Locations and Land Uses | Daytime (7 a.m. - 6 p.m.) | Nighttime (10 p.m. - 7 a.m.) |
|---|---|---|
| | | |
| Noise-Sensitive Locations (residences, institutions, hotels, etc.) | 90 $L_{max}$ | 80 $L_{max}$ |
| Commercial Areas (businesses, offices, stores, etc.) | None | None |
| Industrial Areas (factories, plants, etc.) | None | None |

Source: **Appendix L**

## Federal Noise Abatement Criteria

Operational noise standards used in this study are FHWA Noise Abatement Criteria (NAC) for the assessment of noise consequences related to surface traffic and other project-related noise sources. These standards are discussed below. The FHWA establishes NAC for various land uses that have been categorized based upon activity. Land uses are categorized on the basis of their sensitivity to noise as indicated in **Table 7**. The FHWA NAC is based on peak traffic hour noise levels. Sensitive receptors with the potential to be impacted by the project alternatives primarily consist of residential land uses; thus, the Category B noise standard (67 dBA $L_{eq}$) would apply to those uses.

**Table 7: Federal Noise Abatement Criteria Hourly A-Weighted Sound Level Decibels**

| Activity Category | Activity Criteria Leq (h), dBA | Evaluation Location | Activity Category Description |
|---|---|---|---|
| A | 57 | Exterior | Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose. |
| B | 67 | Exterior | Residential. |
| C | 67 | Exterior | Active sport areas, amphitheaters, auditoriums, campgrounds, cemeteries, daycare centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, recreation areas, Section 4(f) sites, schools, television studios, trails and trail crossings. |
| D | 52 | Interior | Auditoriums, daycare centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or non-profit institutional structures, radio studios, recording studios, schools, and television studios. |
| E[1] | 72 | Exterior | Hotels, motels, offices, restaurants/bars, and other developed lands, properties or activities not included in A-D or F. |
| F | -- | -- | Agriculture, airports, bus yards, emergency services, industrial, logging, maintenance facilities, shipyards, utilities (water resources, water treatment, electricity), and warehousing. |
| G | -- | -- | Undeveloped lands that are not permitted. |

Source: **Appendix L**

## State and Local

### Sonoma County General Plan 2020

The following policies from the Sonoma County Noise Element of the 2020 General Plan may be applicable to the project:

**Policy NE-1a:** Designate areas within Sonoma County as noise impacted if they are exposed to existing or projected exterior noise levels exceeding 60 dB $L_{dn}$, 60 dB CNEL, or the performance standards of Table NE-2 (Table NE-2 is reproduced below as **Table 8**).

**Table 8: Maximum Allowable Noise Exposures for Non-transportation Sources (Table NE-2)**

| Hourly Noise Metric | Maximum Exterior Noise Level Standards [dBA] | |
|---|---|---|
| | Daytime: 7 a.m. to 10 p.m. | Nighttime: 10 p.m. to 7 a.m. |
| L50 (30 minutes in any hour) | 50 | 45 |
| L25 (15 minutes in any hour) | 55 | 50 |
| L08 (5 minutes in any hour) | 60 | 55 |
| L02 (1 minute in any hour) | 65 | 60 |

Notes: The sound level exceeded n% of the time in any hour. For example, the L50 is the value exceeded 50% of the time or 30 minutes in any hour; this is the median noise level. The L02 is the sound level exceeded 1 minute in any hour.
Source: **Appendix L**

**Policy NE-1b:** Avoid noise sensitive land use development in noise impacted areas unless effective measures are included to reduce noise levels. For noise due to traffic on public roadways, railroads and airports, reduce exterior noise to 60 dB $L_{dn}$ or less in outdoor activity areas and interior noise levels to 45 dB $L_{dn}$ or less with windows and doors closed. Where it is not possible to meet this 60 dB $L_{dn}$ standard using a practical application of the best available noise reduction technology, a maximum level of up to 65 dB $L_{dn}$ may be allowed but interior noise level shall be maintained so as not to exceed 45 dB $L_{dn}$. For uses such as Single Room Occupancy, Work-Live, Mixed-Use Projects, and Caretaker Units, exterior noise levels above 65 dB $L_{dn}$ or the Table NE-2 standards may be considered if the interior standards of 45 dB $L_{dn}$ can be met. For schools, libraries, offices, and other similar uses, the interior noise standard shall be 45 dB $L_{eq}$ in the worst-case hour when the building is in use.

**Policy NE-1c:** Control non-transportation related noise from new projects. The total noise level resulting from new sources shall not exceed the standards in General Plan Table NE-2 (reproduced below as **Table 8**), of the recommended revised policies as measured at the exterior property line of any adjacent noise sensitive land use. Limit exceptions to the following:

(1) If the ambient noise level exceeds the standard in **Table 8**, adjust the standard to equal the ambient level, up to a maximum of 5 dBA above the standard, provided that no measurable increase (i.e., +/- 1.5 dBA) shall be allowed.

(2) Reduce the applicable standards in Table 3 by five dBA for simple tone noises, noises consisting primarily of speech or music, or for recurring impulsive noises, such as pile drivers and dog barking at kennels.

(3) Reduce the applicable standards in Table 3 by 5 decibels if the proposed use exceeds the ambient level by 10 or more decibels.

(5) Noise levels may be measured at the location of the outdoor activity area of the noise sensitive land use, instead of at the exterior property line of the adjacent noise sensitive use where:
   (a) The property on which the noise sensitive use is located has already been substantially developed pursuant to its existing zoning, and
   (b) There is available open land on these noise sensitive lands for noise attenuation.

**Policy NE-1d:** Consider requiring an acoustical analysis prior to approval of any discretionary project involving a potentially significant new noise source or a noise sensitive land use in a noise impacted area. The analysis shall:

(1) Be the responsibility of the applicant,
(2) Be prepared by a qualified acoustical consultant,
(3) Include noise measurements adequate to describe local conditions,
(4) Include estimated noise levels in terms of $L_{dn}$ and/or the standards of Table NE-2 (reproduced as **Table 8**) for existing and projected future (20 years hence) conditions, based on accepted engineering data and practices, with a comparison made to the adopted policies of the Noise Element. Where low frequency noise (ex: blasting) would be generated, include assessment of noise levels and vibration using the most appropriate measuring technique to adequately characterize the impact,
(5) Recommend measures to achieve compliance with this Element. Where the noise source consists of intermittent single events, address the effects of maximum noise levels on sleep disturbance,
(6) Include estimates of noise exposure after these measures have been implemented, and
(7) Be reviewed by the Permit and Resource Management Department and found to be in compliance with PRMD guidelines for the preparation of acoustical analyses.

**Policy NE-1f:** Require development projects that do not include or affect residential uses or other noise sensitive uses to include noise mitigation measures where necessary to maintain noise levels compatible with activities planned for the project site and vicinity.

**Policy NE-1g:** Enforce the State Noise Insulation Standards (Title 24, Part 2, California Administrative Code and Appendix Chapter 12 of the California Building Code) concerning new multiple occupancy dwellings.

**Policy NE-1h:** Prepare and consider a noise control ordinance to regulate existing noise sources as follows:

(1) The draft ordinance shall be prepared by County Counsel with the assistance of the Public Health Department, the Sheriff's Department, and PRMD.
(2) Consider ONC guidelines and ordinances of other counties.
(3) The intent of the ordinance shall be to protect persons from existing or future excessive levels of noise which interfere with sleep, communication, relaxation, health or legally permitted use of property.
(4) Excessive levels of noise shall be defined as levels which exceed the standards of Table NE-2 and other policies of the Noise Element.
(5) In unincorporated areas of the County, it shall be unlawful to create noise which exceeds the standards of Table 2, as measured at the exterior of any noise sensitive use.
(6) The noise ordinance may contain maximum allowable levels of interior noise created by exterior sources.
(7) The ordinance may exempt or modify noise requirements for agricultural uses, construction activities, school functions, property maintenance, heating and cooling equipment, utility facilities, waste collection and other sources.

(8) The ordinance shall include responsibilities and procedures for enforcement, abatement and variances.

**Policy NE-1i:** County equipment and vehicles shall comply with adopted noise level performance standards consistent with the best available noise reduction technology.

**Policy NE-1j:** Encourage the California Highway Patrol to actively enforce sections of the California Vehicle Code relating to adequate vehicle mufflers and modified exhaust systems.

**Policy NE-1k:** Incorporate into the Development Code the standards and policies of the Noise Element, where appropriate.

**Policy NE-1l:** Review and update the Noise Element to ensure that noise information and policies are consistent with regulations and conditions within the community.

**Policy NE-1m:** Consider requiring the monitoring of noise levels for discretionary projects to determine if noise levels are in compliance with required standards. The cost of monitoring shall be the responsibility of the applicant.

## Town of Windsor 2040 General Plan

The following policies from the Town of Windsor 2040 General Plan Health and Safety Element may be applicable to the project:

**Policy PHS-8.1:** Ambient Sound Levels for New Development. The Town shall encourage new development to maintain the current ambient sound environment as much as possible. All noise sources that cause the ambient sound levels to rise by more than 5 dBA should be required to incorporate conditions or design modifications to reduce the potential increase in the noise environment.

**Policy PHS-8.2:** Exterior Noise Standards for New Development. The Town shall require new development to meet exterior noise level standards as established in the noise and land use compatibility guidelines contained in General Plan Figure PHS-4 (reproduced as **Table 9**). For residential areas, these exterior noise guidelines apply to the primary usable outdoor area.

**Policy PHS-8.3:** Interior Noise Threshold for New Residential. The Town shall require new residential projects to provide for an interior CNEL of 45 dB or less due to exterior noise sources. To accomplish this, all residential and other noise sensitive land uses within the 60 dB contours or greater as defined in General Plan Figure PHS-5 should be reviewed to ensure that adequate noise attenuation has been incorporated into the design of the project.

**Policy PHS-8.5:** Noise Attenuation Techniques. The Town shall encourage new development to identify alternatives to the use of sound walls to attenuate noise impacts. Other techniques that would be viewed more favorably by the Town include:

a. Modifications to site planning such as incorporating setbacks; and
b. Revisions to the architectural layout such as changing building orientation, providing noise attenuation for portions of outdoor yards, and construction modification (e.g., noise attenuating windows).

In the event that sound walls are the only practicable alternative, such walls shall be subject to development review to ensure that they are designed to be as aesthetically pleasing as possible, incorporating landscaping, variations in color and patterns, and/or changes in texture or building materials.

**Table 9: Maximum Noise Level by Receiving Land Use (Figure PHS-4)**

| Type of Land Use | Maximum Allowable Noise Levels | | |
|---|---|---|---|
| | **Time Interval** | **Exterior Noise dB(A)** | **Interior Noise dB(A)** |
| Single- or multi- family residential | 7 a.m. – 10 p.m. | 55 | 35 |
| | 10 p.m. to 7 a.m. | 50 | 45 |
| Commercial | 7 a.m. – 10 p.m. | 65 | 50 |
| | 10 p.m. to 7 a.m. | 55 | |
| Industrial or manufacturing | Any time | 70 | 55 |
| Public parks, public open space, and Civic Center | 7 a.m. – 10 p.m. | 55 | N/A |
| | 10 p.m. to 7 a.m. | 50 | |

Notes:

(1) Each of the noise limits specified above shall be reduced by 5 dBA for impulse or simple tone noises, or for consisting of speech or music. If the ambient noise level exceeds the resulting standard, the ambient noise level shall be the standard.

(2) It shall be unlawful for any person within a residentially zoned area of the town to operate any noise amplification device (e.g., bull horns, microphones, musical instruments, speakers, etc.), that exceeds a noise level of 45 dBA measured at the property line or cause loud excessive noise which disturbs the peace of the neighborhood.

(3) In addition, Section 7-1-190 of the Town of Windsor Municipal Code restricts the timing of construction act authorized by a Town permit to the hours of 7 a.m. to 7 p.m. Monday through Friday and 8 a.m. to 7 p.m. on Saturday.

Source: **Appendix L**

**Policy PHS-8.6:** Acoustical Reports. The Town shall require that applications for development of residential or other noise-sensitive land uses in projected noise-impacted areas (greater than 55 dB CNEL) shall require an acoustical analysis, prepared at the applicant's expense. Recommendations contained in the acoustical reports shall be incorporated as conditions of any approval.

**Policy PHS-8.7:** Non-Vehicular Noise. The Town shall continue to regulate non-vehicular noise sources that are not preempted by State and Federal regulations, to minimize disturbances to adjoining uses through the noise ordinance.

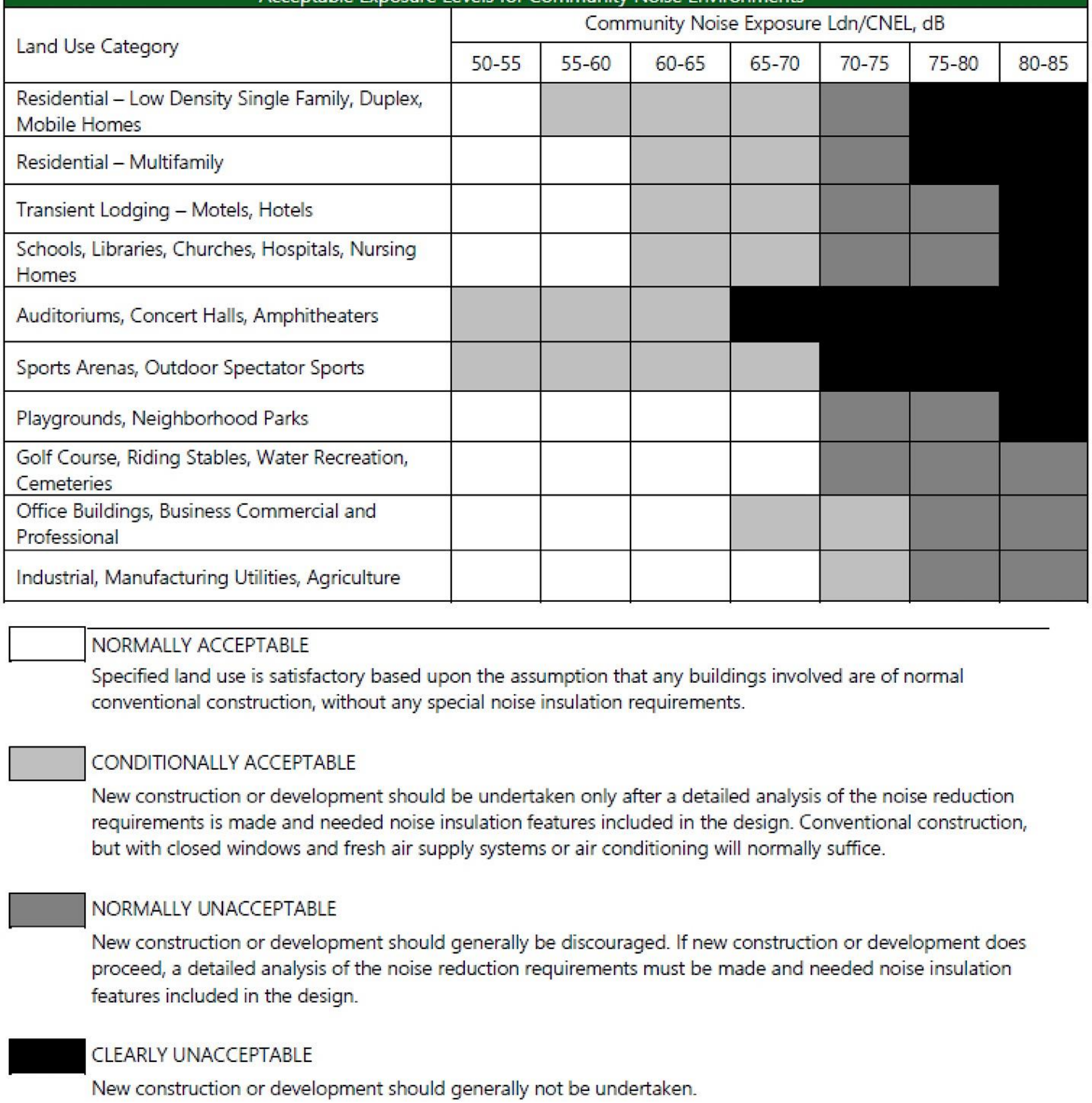
**Policy PHS-8.10**: Construction Site Noise Restrictions. The Town shall restrict construction working hours as designated in the Municipal Code, Title VII Building and Housing Section, to allow efficient construction mobilization and activities, while also protecting the noise environment of noise sensitive land uses.

**Policy PHS-8.15:** Noise Enforcement of State and Federal Standards. The Town shall continue to enforce State and Federal noise regulations regarding vehicle operation, equipment, and building insulation.

**Policy PHS-8.16:** Applicable Standards in the Building Code. The Town shall continue to incorporate the most recent noise standards contained in Title 24 of the California Code of Regulations in Uniform Building Code into its own building code.

**Policy PHS-8.17:** Project and Environmental Review for Noise. The Town shall consider as part of its discretionary review of proposed new development the potential for a proposed project to either generate significant new noise sources or be significantly impacted by existing noise sources as shown in Figure PHS-7. If the Town determines there may be a potential for significant noise effects related to a proposed new development, the Town shall require an acoustical study be conducted by a qualified acoustician and include appropriate mitigation measures for the proposed development based on that study.

Figure PHS-7
Acceptable Exposure Levels for Community Noise Environments




## Acoustical Background and Terminology

Noise is often described as unwanted sound. Sound is defined as any pressure variation in air that the human ear can detect. If the pressure variations occur frequently enough (at least 20 times per second), they can be heard and are designated as sound. The number of pressure variations per second is called the frequency of sound and is expressed as cycles per second, or Hertz (Hz). Definitions of acoustical terminology are provided in Appendix A of **Appendix L**.

Measuring sound directly in terms of pressure would require a very large and awkward range of numbers. To avoid this, the decibel scale was devised. The decibel scale uses the hearing threshold (20 micropascals of pressure) as a point of reference, defined as 0 decibel (dB). Other sound pressures are then compared to the reference pressure, and the logarithm is taken to keep the numbers in a practical range. The decibel scale allows a million-fold increase in pressure to be expressed as 120 dB. Another useful aspect of the decibel scale is that changes in decibel levels correspond closely to human perception of relative loudness. Noise levels associated with common noise sources are provided in **Table 10** (**Appendix L**).

**Table 10: Typical Noise Levels**

| Common Outdoor Activities | Noise Level (dBA) | Common Indoor Activities |
|---|---|---|
| | 110 | Rock Band |
| Jet Fly-over at 300 m (1,000 ft.) | 100 | |
| Gas Lawn Mower at 1 m (3 ft.) | 90 | |
| Diesel Truck at 15 m (50 ft.), at 80 km/hr. (50 mph) | 80 | Food Blender at 1 m (3 ft.) Garbage Disposal at 1 m (3 ft.) |
| Noisy Urban Area, Daytime Gas Lawn Mower, 30 m (100 ft.) | 70 | Vacuum Cleaner at 3 m (10 ft.) |
| Commercial Area Heavy Traffic at 90 m (300 ft.) | 60 | Normal Speech at 1 m (3 ft.) |
| Quiet Urban Daytime | 50 | Large Business Office Dishwasher in Next Room |
| Quiet Urban Nighttime | 40 | Theater, Large Conference Room (Background) |
| Quiet Suburban Nighttime | 30 | Library |
| Quiet Rural Nighttime | 20 | Bedroom at Night, Concert Hall (Background) |
| | 10 | Broadcast/Recording Studio |
| Lowest Threshold of Human Hearing | 0 | Lowest Threshold of Human Hearing |

Source: Caltrans, 2013

The perceived loudness of sounds is dependent upon many factors, including sound pressure level and frequency content. However, within the usual range of environmental noise levels, perception of loudness is relatively predictable and can be approximated by filtering the frequency response of a sound level meter by means of the standardized A-weighting network. There is a strong correlation between A-weighted sound levels (expressed as dBA) and community response to noise. For this reason, the A-weighted sound level has become the standard tool of environmental noise assessment. All noise levels presented in this evaluation are in terms of A-weighted levels (**Appendix L**).

Community noise is commonly described in terms of the ambient noise level, which is defined as the all-encompassing noise level associated with a given noise environment. A common statistical tool to measure the ambient noise level is the average, or equivalent, sound level ($L_{eq}$). The $L_{eq}$ is the foundation of the day-night average noise descriptor, DNL (or $L_{dn}$), and shows very good correlation with community response to noise. DNL is based on the average noise level over a 24-hour day, with a +10-decibel weighting applied to noise occurring during nighttime (10:00 PM to 7:00 AM) hours. The nighttime penalty is based on the assumption that people react to nighttime noise exposures as though they were twice as loud as daytime exposures. Because DNL represents a 24-hour average, it tends to disguise short-term variations in the noise environment (**Appendix L**).

The effects of noise on people can be divided into three categories:

- Subjective effects of annoyance, nuisance, dissatisfaction;
- Interference with activities such as speech, sleep, and learning; and
- Physiological effects such as hearing loss or sudden startling.

Environmental noise typically produces effects in the first two categories. Workers in industrial plants can experience noise in the third category. There is no completely satisfactory way to measure the subjective effects of noise, or the corresponding reactions of annoyance and dissatisfaction. A wide variation in individual thresholds of annoyance exists, and different tolerances to noise tend to develop based on an individual’s past experiences with noise. Human reaction to a new noise can be estimated through comparison of the new noise to the existing ambient noise level within a given environment. In general, the more a new noise exceeds the previously existing ambient noise level, the less acceptable the new noise will likely be judged by the recipients. With regard to increases in dBA noise levels, the following relationships occur:

- Except in carefully controlled laboratory experiments, a change of 1 dBA cannot be perceived.
- Outside of the laboratory, a 3-dBA change is considered a just-perceivable difference.
- A change in level of at least 5 dBA is required before any noticeable change in human response would be expected.
- A 10-dBA change is subjectively heard as approximately a doubling in loudness and can cause adverse response.

Noise effects on humans can be physical or behavioral in nature. The mechanism for chronic exposure to noise leading to hearing loss is well established. The elevated sound levels cause trauma to the cochlear structure in the inner ear, which gives rise to irreversible hearing loss. Though not considered a health effect similar to those noted above, noise pollution also constitutes a significant factor of annoyance and distraction in modern artificial environments:

- The meaning listeners attribute to the sound influences annoyance; if listeners dislike the noise content, they are annoyed.
- If the sound causes activity interference (for example, sleep disturbance), it is more likely to annoy.
- If listeners feel they can control the noise source, it less likely to be perceived as annoying.

- If listeners believe that the noise is subject to third party control, including police, but control has failed, they are more annoyed.

Generally, most noise is generated by transportation systems, principally motor vehicle noise, but also including aircraft noise and rail noise. The level of traffic noise depends on three things: l) the volume of the traffic, 2) the speed of the traffic, and 3) the number of trucks in the flow of the traffic. Because noise is measured on a logarithmic scale, 70 dBA plus 70 dBA does not equal 140 dBA. Instead, two sources of equal noise added together have been found to result in an increase of 3 dBA. That is, if a certain volume of traffic results in a noise level of 70 dBA the addition of the same volume of traffic, or doubling, would result in a noise level of 73 dBA. As stated above, 3 dBA is just audible; therefore, if a project doubles the traffic volume there would be an audible increase in the ambient noise level (**Appendix L**).

Stationary points of noise attenuate (lessen) at a rate of 6 to 9 dBA per doubling of distance from the source, depending on environmental conditions (i.e., atmospheric conditions and noise barriers, vegetative or manufactured, etc.). Widely distributed noises, such as a large industrial facility or a street with moving vehicles would typically attenuate at a lower rate, approximately 4 to 6 dBA per doubling of distance (**Appendix L**).

## Vibration Background and Terminology

Vibration is like noise in that it involves a source, a transmission path, and a receiver. While vibration is related to noise, it differs in that noise is generally considered to be pressure waves transmitted through air, while vibration is usually associated with transmission through the ground or structures. As with noise, vibration consists of an amplitude and frequency. A person's response to vibration will depend on their individual sensitivity as well as the amplitude and frequency of the source (**Appendix L**).

Vibration can be described in terms of acceleration, velocity, or displacement. A common practice is to monitor vibration in terms of velocity in inches per second peak particle velocity (IPS, PPV) or root-mean-square velocity in decibels (VdB, RMS). Standards pertaining to perception as well as damage to structures have been developed for vibration in terms of peak particle velocity as well as RMS velocities. In terms of RMS velocities, vibration levels below approximately 65 VdB are typically considered to be below the threshold of perception (**Appendix L**).

As vibrations travel outward from the source, they excite the particles of rock and soil through which they pass and cause them to oscillate. Differences in subsurface geologic conditions and distance from the source of vibration will result in different vibration levels characterized by different frequencies and intensities. In all cases, vibration amplitudes will decrease with increasing distance. At high enough amplitudes, ground vibration has the potential to damage structures and/or cause cosmetic damage. Ground vibration can also be a source of annoyance to individuals who live or work close to vibration-generating activities. However, traffic, rarely generates vibration amplitudes high enough to cause structural or cosmetic damage (**Appendix L**).

# HAZARDOUS MATERIALS AND HAZARDS– SECTION 3.12 OF THE EIS

## Federal

### Resource Conservation and Recovery Act

The Resource Conservation and Recovery Act (RCRA) regulates the land disposal of hazardous materials from cradle-to-grave. This means establishing a regulatory framework for the generation, transport, treatment, storage and disposal of hazardous waste. Specifically, Subtitle D of RCRA pertains to non-hazardous solid waste and Subtitle C focuses on hazardous solid waste. A solid waste can consist of solids, liquids and gases, but these must be discarded in order to be considered waste. Additionally, the USEPA has developed regulations to set minimum national technical standards for how disposal facilities should be designed and operated. States issue permits to ensure compliance with USEPA and state regulations. The regulated community is comprised of a diverse group that must comprehend and adhere to RCRA regulations. These groups can consist of hazardous waste generators, government agencies, small businesses, and gas stations with underground petroleum tanks.

### Food, Drug, and Cosmetic Act

Under the federal Food, Drug, and Cosmetic Act, the USEPA sets maximum residue limits, or tolerances, for pesticides residues on food. When the USEPA sets a tolerance level for a food, this is the level deemed safe. In defining safe, this means that, “reasonable certainty that no harm will result from aggregate exposure to the pesticide residue.” When determining a safety finding for a tolerance level, the USEPA considers the toxicity of the pesticide and its break-down products, aggregate exposure to the pesticide in foods and from other sources of exposure if applicable, and any special risks specific to infants and children. If a tolerance is not set for a pesticide residue, a food containing that pesticide residue will be subject to government seizure if deemed appropriate. However, once a tolerance has been established for a pesticide residue, then residue levels below the tolerance will not trigger enforcement actions. If the residue level is detected above that tolerance, then the commodity will be subject to seizure. Some pesticides do not have a set tolerance level as the USEPA may grant exemptions in the cases where the pesticide residue does not pose, under foreseeable situations, a significant dietary risk.

### Insecticide, Fungicide, and Rodenticide Act

The federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) addresses the sale, distribution, and labeling of pesticides, as well as the certification and training of pesticide applicators. FIFRA establishes recordkeeping and reporting requirements on certified applicators of restricted use pesticides. Furthermore, FIFRA imposes storage, disposal, and transportation requirements on registrants and applicants for the registration of pesticides. Pesticide use is regulated through requirements to apply pesticides in a manner consistent with the label. The labeling requirement includes directions for use, warnings, and cautions along with the uses for which the pesticide is registered (e.g., pests and appropriate applications). This includes the specific conditions for the application, mixture, and storage of the pesticide. Additionally, the label must specify a time period for re-entry into an area after the pesticide has been applied, and when crops may be harvested after the application of the pesticide. If a pesticide is used in a manner contrary to specifics on its label, then the use constitutes a violation of the FIFRA.

## Hazardous Communication Standard

The Occupational Safety and Health Administration helps ensure employee safety by regulating the handling and use of chemicals in the workplace. For instance, it administers the Hazard Communication Standard (HCS). The HCS ensures safety in the workplace concerning chemicals through requiring information to be provided and understood by workers about the identity and hazards associated with chemicals they may work with. This also requires that chemical manufactures and importers evaluate the hazards associated with the chemicals they create or import, and that these chemicals have proper labels and material safety data sheets concerning their hazards to others (e.g., customers). Downstream of the production, employers who utilize these hazardous chemicals in their workplaces are obligated to have labels and safety data sheets for their workers and to train them on the proper handling of these chemicals.

## Hazardous Substances Act

The Consumer Product Safety Commission has a limited role in regulating hazardous substances; it primarily deals with the labeling of consumer products through the federal Hazardous Substances Act (HSA). HSA only requires products that may at some point be in the presence of people's dwellings to be labeled, including during purchase, storage, or use. These labels must alert consumers of the potential hazards that the product may pose. However, in order for a product to be required for labelling, the product must be toxic, corrosive, flammable/combustible, an irritant, a strong sensitizer, or have the ability to generate pressure through decomposition, heat, or other means. Furthermore, the product must possess the ability to cause severe personal injury or substantial illness during or as a result of any customary or reasonably predictable handling or use, including reasonably foreseeable ingestion by children.

## Toxic Substances Control Act

The federal Toxic Substances Control Act (TSCA), as amended by the Frank R. Lautenberg Chemical Safety for the 21$^{st}$ Century Act, permits the USEPA to evaluate the potential risk from novel and existing chemicals and address unacceptable risks chemicals may have on human health and the environment. The USEPA oversees the production, importation, use, and disposal of certain chemicals. This includes the USEPA having the authority to require record keeping, reporting, and test requirements and restrictions associated with certain chemical substances and/or mixtures. However, certain groups of chemicals are excluded from TSCA consideration, including—but not limited to—food, drugs, cosmetics and pesticides. Examples of chemicals included in TSCA consideration are lead paint, asbestos, mercury, formaldehyde, and polychlorinated biphenyls.

## Emergency Planning and Community Right-to-Know Act

The federal Emergency Planning and Community Right-to-Know Act (EPCRA) is designed to assist local communities protect public health, safety, and the environment from chemical hazards. The Community Right-to-Know provisions help increase the public's knowledge and access to information on chemicals at individual facilities, their uses, and releases into the environment. The EPCRA also requires industry to report on the storage, usage, and releases of hazardous substances to federal, state, and local governments, and states and communities can use the information gained to improve chemical safety and protect public health and the environment.

## National Fire Protection Association Codes and Standards

The National Fire Protection Association (NFPA) publishes more than 300 consensus codes and standards intended to minimize the possibility and effects of fire and other risks, including, but not limited to (NFPA, 2022):

- NFPA 13 Standard for the Installation of Sprinkler Systems
- NFPA 72 National Fire Alarm and Signaling Code
- NFPA 88A Standard for Parking Structures
- NFPA 1660 Standard for Emergency, Continuity, and Crisis Management: Preparedness, Response, and Recovery
- NFPA 1140 Standard for Wildland Fire Protection

## State and Local

### California Building Code

The California Building Code (CBC) includes Fire Code Elements to reduce wildfire impacts including, but not limited to:

**CBC Chapter 7A**: This chapter applies specifically to building materials, systems and/or assemblies used in the exterior design and construction of new buildings located within a Wildland-Urban Interface Fire Area as defined in Section 702A. The Shiloh Resort and Casino Project lies within the Wildland-Urban Interface area described in the code. These are the minimum code standards that buildings will be built to provide an increased level of resiliency from wildfire impacts.

**CBC Section 703A.7**: Standards of Quality. The State Fire Marshal standards for exterior wildfire exposure protection listed below and as referenced in this chapter are located in the California Referenced Standards Code, Part 12 and Chapter 35 of this code.

> **SFM Standard 12-7A-1**: Exterior Wall Siding and Sheathing. A fire resistance test standard consisting of a 150-kW intensity direct flame exposure for a 10-minute duration.
>
> **SFM Standard 12-7A-2**: Exterior Windows. A fire resistance test standard consisting of a 150-kW intensity direct flame exposure for an 8-minute duration.
>
> **SFM Standard 12-7A-3**: Horizontal Projection Underside A fire resistance test standard consisting of a 300-kW intensity direct flame exposure for a 10-minute duration.
>
> **SFM Standard 12-7A-5**: Ignition-resistant Material. A generic building material surface burning flame spread test standard consisting of an extended 30-minute ASTM E84 or UL 723 test method as is used for fire-retardant-treated wood.

### Sonoma County General Plan Public Safety Element

The Sonoma County General Plan Public Safety Element contains goals, objectives, and policies to provide protection from wildland fire hazards including:

**GOAL PS-3:** Prevent unnecessary exposure of people and property to risks of damage or injury from wildland and structural fires.

> **Objective PS-3.2:** Regulate new development to reduce the risks of damage and injury from known fire hazards to acceptable levels.

**Policy PS-3k:** Work with the California Department of Forestry and Fire Protection (CalFire) to identify areas of high fire fuel loads and take advantage of opportunities to reduce those fuel loads, particularly in Very High or High Fire Hazard Severity Zones.

**Policy PS-3l:** Require automatic fire sprinkler systems or other on-site fire detection and suppression systems in all new residential and commercial structures, with exceptions for detached utility buildings, garages, and agricultural exempt buildings.

The Sonoma County Multijurisdictional Hazard Mitigation Plan (MHMP) was last updated in 2021 and defines measures to reduce risks from natural disasters, including wildfire, in the Sonoma County Operational Area. The Sonoma County Operation Area consists of the entire County, including unincorporated areas, incorporated cities, and special purpose districts. The plan complies with federal and state hazard mitigation planning requirements to establish eligibility for funding under Federal Emergency Management Agency (FEMA) grant programs for all planning partners.

The MHMP identifies that home loss in wildland fires is primarily driven by two equally important factors: 1) the vulnerability of buildings that make them prone to ignition, and 2) The vegetative fuels within 100 feet of structures (the area referred to as defensible space). Mitigating large-scale loss of life and property can be achieved through using relatively well-established techniques of home hardening, defensible space, and vegetation management at the scale of whole communities and the natural landscapes that surround them.

## Sonoma County Emergency Operations Plan

The Sonoma County Emergency Operations Plan (EOP; Sonoma County, 2022) is intended to facilitate coordination between agencies and jurisdictions within Sonoma County while ensuring the protection of life, property, and the environment during disasters. In accordance with California's Standardized Emergency Management System (SEMS), this Plan provides the framework for a coordinated effort between partners and provides stability and coordination during a disaster. Operational Area emergency response operations will be led by hazard and/ or sector-specific Standard Operating Procedures (SOPs), developed and maintained by partner agencies that would normally lead that specific emergency operation. As a part of the shared responsibility in leading with current hazard-specific hazard plans, these SOPs, sometimes in the form of an annex, will be regularly updated by the responsible departments and agencies. These annexes include, but are not limited to:

- Evacuation Annex that outlines the strategies, procedures, and organizational structures to be used in managing coordinated, large-scale evacuations in the Sonoma County Operational Area (Sonoma County Department of Emergency Management, 2021a); and
- Community Alert and Warning Annex that establishes general and specific policies, procedures, and protocols for the use of Alert and Warning systems in the Sonoma County Operational Area during actual or potential emergencies that pose a significant threat to life or property (Sonoma County Department of Emergency Management, 2021b).

## Town of Windsor General Plan

The Town of Windsor General Plan Public Health and Safety Element contains goals and policies to provide protection from fire hazards including:

**Goal PHS-4:** Fire Hazards: Minimize the risks to lives and properties due to wildland fire hazards through education and an understanding of the natural environment

**Policy PHS-4.1 Fire Protection Design for New Development:** New development adjacent to heavily grassed and semi-arid hillsides shall be designed to minimize fire hazards to life and property, including the use of fire preventive site design (i.e., defensible space), landscaping and building materials, and fire suppression techniques

**Policy PHS-4.6 Project Review for Proposals in Fire Hazard Areas:** The Town shall require that fire hazards be identified during project review by comparing the project site against the fire hazard maps prepared by Cal Fire. Project sites that lie within the moderate to high hazard areas shall be subject to design modifications and conditions to minimize potential exposure to wildland fire.

## Town of Windsor Riparian Corridor Wildfire Fuel Management Plan

The Riparian Corridor Fuel Reduction Plan (Plan; Town of Windsor, 2020) was developed in response to the 2019 Kincade Fire, to set priorities for riparian corridor fuel reduction, and to provide decisionmakers and the public with a plan for managing fire hazards in riparian corridors in Windsor. The Plan describes the Town's approach to managing riparian corridor vegetation on Town-owned property to reduce the probability of wildfire ignition and reduce the intensity and rate of spread of wildfires. Three fuel reduction zones were delineated based on riparian corridor proximity to the wildland-urban interface (WUI), identified ember cast zones, and density of residential development.

- Zone 1 - High Priority = Residential areas and critical facilities adjacent to the WUI and Ember Cast Zone
- Zone 2 - Medium Priority = Residential areas and critical facilities NOT adjacent to the WUI and Ember Cast Zone
- Zone 3 - Low Priority = Areas adjacent to open space or other non-critical/non-residential use

Includes creek and storm ditech fuel reduction treatment that consists of:

- Reducing fuel load, consistent with resource agency restriction.
- Evaluating the need for fuel reduction in all creeks in Town.
- Removing fallen trees only if they will cause an obstruction.
- Trimming trees only if a canopy can be maintained.
- Avoiding disturbance of any creek beds.
- Providing photo-documentation (before and after photos of all work).

Sets forth the following best management practices for fuel reduction:

- Vegetation management is prohibited in the wetted channel (we wait until streams are dry to perform work)
- Vegetation removal is with hand tools; if a chain saw is needed to perform work, a tarp is used to contain any wood chips/debris
- No motorized vehicles are allowed in the channel
- Vegetation should not be removed from channel banks
- Large woody debris (downed logs and root wads) in the channel and banks should remain in place
- Debris jams (fallen trees) that block the channel causing obstruction are removed
- Vegetation management should be conducted in a manner that protects riparian habitat and water quality, including tree canopies that provide shade to the channel
- Vegetation removal is either conducted outside the bird nesting season (February 1 to August 15) or protection for nesting birds is provided

- Nesting bird mitigation consists of a field survey for bird nests by a qualified biologist prior to starting work and implementing appropriate avoidance buffers

# VISUAL RESOURCES – SECTION 3.13 OF THE EIS

## State and Local

### *Sonoma County General Plan*

As described in the Open Space and Resource Conservation Element of the Sonoma County General Plan, community Separators are rural open space and agricultural and resource lands that separate cities and other communities, prevent sprawl, protect natural resources, and provide city and community identity by providing visual relief from continuous urbanization. The Project Site is within the Windsor-Larkfield-Santa Rosa Community Separator.

The Sonoma County General Plan Open Space and Resource Conservation Element contains goals, objectives, and policies to guide development within the County.

**GOAL OSRC-1:** Preserve the visual identities of communities by maintaining open space areas between cities and communities.

> **Objective OSRC-1.1:** Preserve important open space areas in the Community Separators shown on Figures OSRC-5a through OSRC-5i of the Open Space and Resource Conservation Element.
>
> **Objective OSRC-1.2:** Retain a rural character and promote low intensities of development in Community Separators. Avoid their inclusion in City Urban Growth Boundaries or Spheres of Influence. Avoid their inclusion within Urbans Service Areas for unincorporated communities.
>
> **Objective OSRC-1.3:** Preserve existing groundwater recharge and stormwater detention areas within Community Separators.
>
> **Objective OSRC-1.4:** Preserve existing specimen trees and tree stands within Community Separators.
>
> > **Policy OSRC-1b:** Avoid commercial or industrial uses in Community Separators other than those that are permitted by the agricultural or resource land use categories.
> >
> > **Policy OSRC-1f:** Unless there are existing design guidelines that have been adopted for the affected area, require that new structures within Community Separators meet the following criteria:
> >
> > - Site and design structures to take maximum advantage of existing topography and vegetation in order to substantially screen them from view from public roads. Minimize cuts and fills on hills and ridges;
> > - Minimize the removal of trees and other mature vegetation; avoid removal of specimen trees, tree groupings, and windbreaks;
> > - Where existing topography and vegetation would not screen structures from view from public roads, install landscaping consisting of native vegetation in natural groupings that fits with the character of the area in order to substantially screen structures from view. Screening with native, fire-retardant plants may be required;

- Design structures to use building materials and color schemes that blend with the natural landscape and vegetation;
- To the extent feasible, cluster structures on each parcel within existing built areas, and near existing natural features such as tree groupings;
- Utilities are underground where economically practical.;
- On hills and ridges, avoid structures that project above the silhouette of the hill or ridge against the sky as viewed from public roads, and substantially screen driveways from view where practical; and
- Minimize impervious surfaces and encourage groundwater recharge with effective design features and materials that allow stormwater infiltration and detention.

**GOAL OSRC-6:** Preserve the unique rural and natural character of Sonoma County for residents, businesses, visitors, and future generations.

**Objective OSRC-6.2:** Establish Rural Character as a primary criterion for review of discretionary projects, but not including administrative design review for single family homes on existing lots.

**Policy OSRC-6a:** Develop design guidelines for discretionary projects in rural areas, but not including administrative design review for single family homes on existing lots, that protect and reflect the rural character of Sonoma County. Use the following general design principles until these Design Guidelines are adopted, while assuring that Design Guidelines for agricultural support uses on agricultural lands are consistent with Policy AR-9h of the Agricultural Resources Element.

- New structures blend into the surrounding landscape, rather than stand out.
- Landscaping is included and is designed to blend in with the character of the area.
- Paved areas are minimized and allow for informal parking areas.
- Adequate space is provided for natural site amenities.
- Exterior lighting and signage are minimized.

### *Sonoma County Code of Ordinances*

The Sonoma County Code of Ordinances contains development criteria for new construction within the County. The Code of Ordinances includes specific development criteria for Community separators and scenic landscape units (Ord. No. 6252, § II (Exh. C), 12-4-2018; Ord. No. 5132 § 2, 1999: Ord. No. 4985 § 1(d), 1996; Ord. No. 4973 § 12(a), 1996; Ord. No. 4643, 1993). The Project Site is within a community separator. These development criteria include encourage the siting of new construction in inconspicuous areas, as well as the use of vegetation and natural landforms for visual screening. Additionally, the development criteria include clustering buildings, height limitations, and limited cut and fill.

Additionally, the Sonoma County Code of Ordinances contains general sign provisions. These provisions are intended to insure the stability and safeguarding of property values; to protect the investments, both public and private, in buildings and land; to preserve and improve the appearance of the county as a place to live and work; to encourage sound signing practices as an aid to business and for the information of the public; to prevent excessive and abusive signing; to reduce hazards and confusion to motorists and pedestrians; and to promote the public health, safety and general welfare (Ord. No. 4643, 1993).

### *Dark-Sky Association's Model Lighting Ordinance*

The International Dark-Sky Association and the Illuminating Engineering Society of North America have developed a Model Lighting Ordinance to address the need for strong, consistent outdoor lighting regulation in

North America (IDA, 2011). The purpose of the Model Lighting Ordinance is to provide regulations for outdoor lighting that will:

- Permit the use of outdoor lighting that does not exceed the minimum levels specified in Illuminating Engineering Society recommended practices for night-time safety, utility, security, productivity, enjoyment, and commerce;
- Minimize adverse offsite impacts of lighting such as light trespass, and obtrusive light;
- Curtail light pollution, reduce skyglow and improve the nighttime environment for astronomy;
- Help protect the natural environment from the adverse effects of night lighting from gas or electric sources; and
- Conserve energy and resources to the greatest extent possible.

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