APPENDIX K

EVALUATION OF GROUNDWATER SUPPLY FEASIBILITY AND POTENTIAL IMPACTS TO WATER QUALITY AND RESOURCES

EVALUATION OF GROUNDWATER SUPPLY FEASIBILITY AND POTENTIAL IMPACTS TO WATER QUALITY AND RESOURCES

PROJECT:

WILTON RANCHERIA FEE-TO-TRUST AND CASINO PROJECT

TWIN CITIES SITE

APN: 148-0010-060, 148-0010-018, 148-0031-007,
148-0041-001, 148-0041-004, AND 148-0041-006
HWY 99 AND TWIN CITIES ROAD, GALT, SACRAMENTO COUNTY, CALIFORNIA

HISTORIC RANCHERIA SITE

APN: 126-0210-025, 126-0210-024, 126-0230-001, AND 126-0230-002
GREEN ROAD AND RANDOLPH ROAD, WILTON,
SACRAMENTO COUNTY, CALIFORNIA

PREPARED FOR:

ANALYTICAL ENVIRONMENTAL SERVICES

1801 7TH STREET, SUITE 100
SACRAMENTO, CALIFORNIA 95811

PREPARED BY:

APPLIED ENGINEERING AND GEOLOGY, INC.
Engineers • Environmental Assessors • Geologists

578 E STREET • POST OFFICE BOX 247
LINCOLN, CALIFORNIA 95648
OFFICE 916.645.6014 • FAX 916.645.6098 • Email aeg@aegEngineers.com

JULY 1, 2015

TABLE OF CONTENTS

1.0 SUMMARY 1
1.1 Twin Cities Site Summary 1
1.2 Historic Rancheria Site Summary 1

2.0 INTRODUCTION 2

3.0 PROJECT DESCRIPTION 2

4.0 PREVIOUS GROUNDWATER USE STUDIES 4

5.0 TWIN CITIES SITE 5
5.1 Site Description 5
5.1.1 General Site Information 5
5.1.2 Geology and Hydrogeology 5
5.2 Groundwater Supply Feasibility Evaluation 8
5.2.1 Water Supply 8
5.2.2 Water Quality 11
5.2.3 Water Demand 12
5.2.4 Groundwater Use Impacts 12
5.2.5 Summary of Major Evaluation Findings on the Twin Cities Site . . . 16
5.2.6 Recommendations 17

6.0 HISTORIC RANCHERIA SITE 17
6.1 Site Description 17
6.1.1 General Site Information 17
6.1.2 Geology and Hydrogeology 17
6.2 Groundwater Supply Feasibility Evaluation 19
6.2.1 Water Supply 19
6.2.2 Water Quality 21
6.2.3 Water Demand 21
6.2.4 Groundwater Use Impacts 22
6.2.5 Summary of Major Evaluation Findings on the Historic Rancheria Site 27
6.2.6 Recommendations 27

7.0 REFERENCES 27

8.0 STATEMENT OF LIABILITY 30

LIST OF TABLES

3-1 Project Alternatives 3
5-1 Water Demand Estimates for Twin Cities Site 12
5-2 Groundwater Drawdown Calculation Results Summary for Twin Cities Site 15
6-1 Water Demand Estimates for Historic Rancheria Site 22
6-2 Groundwater Drawdown Calculation Results Summary for Historic Rancheria Site 25
6-3 Net Groundwater Drawdown Calculation Results Summary for Historic Rancheria Site 26

LIST OF FIGURES

1 Twin Cities Site Vicinity Map . . . . . Appendix A
2 Twin Cities Site Generalized Map . . . . . Appendix A
3 Historic Rancheria Site Vicinity Map . . . . . Appendix A
4 Historic Rancheria Site Generalized Map . . . . . Appendix A

LIST OF APPENDICES

Appendix A Figures
Appendix B Drawdown Calculations
Appendix C Groundwater Elevation Figures and Hydrographs

LIST OF ABBREVIATIONS

ac	Acre
acft	Acre-feet
ac-ft	Acre-feet
AEG	Applied Engineering and Geology, Inc.
AES	Analytical Environmental Services
AFY	Acre-feet per year
ag	Agricultural
bgs	Below ground surface
CEDEN	California Environmental Data Exchange Network
DOI	Department of the Interior
DWR	California Department of Water Resources
EIS	Environmental Impact Study
ex	Example
ft	Feet
gpm	Gallons per minute
gpd	Gallons per day
gpy	Gallons per year
H_2O	Water
HR Site	Historic Rancheria Site
in	Inch
MCL	Maximum Contaminant Level
TC Site	Twin Cities Site
Theis Solution	Theis Non-leaky Aquifer Solution
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
WWTP	Waste water treatment plant

1.0 SUMMARY

AEG has conducted an evaluation of groundwater supply feasibility and potential impacts to surface and groundwater resources and quality resulting from the proposed construction and operation of the Wilton Rancheria Casino. A summary of the major findings of the evaluation and recommended mitigation measures is shown below.

1.1 Twin Cities Site Summary

There is localized groundwater drawdown in the vicinity of the TC Site (drawdown area related to the City of Galt); however, the Cosumnes Subbasin as a whole is not considered to be in a state of overdraft. The groundwater resources in the vicinity of the TC Site are adequate to support each of the proposed project alternatives; however, groundwater beneath the TC Site may require treatment for iron, manganese, and/or arsenic prior to public supply use.

Construction of the proposed project alternatives would not only cause no additional negative impacts to the groundwater resources, but would lessen the current impact the TC Site has on groundwater resources. Therefore, the EIS proposed development would lessen the magnitude of the localized groundwater drawdown.

If new wells are to be installed on the TC Site, care should be taken when positioning the new wells so as not to create a new negative impact on existing wells and surface water features in the vicinity of the Site.

1.2 Historic Rancheria Site Summary

There is no localized groundwater drawdown in the vicinity of the HR Site and the Cosumnes Subbasin as a whole is not considered to be in a state of overdraft. The groundwater resources in the vicinity of the HR Site are adequate to support each of the proposed project alternatives and groundwater beneath the HR Site is likely suitable for public supply use without treatment from a water quality perspective.

Construction of the proposed development will cause less negative impacts than if the HR Site resumes agricultural irrigation.

The additional groundwater use would not create an overdraft effect in the Cosumnes Subbasin, due to the relatively low water use rates (when compared to historical irrigation water use).

Existing wells within 635 feet of the proposed development water supply well and the Cosumnes River may experience significant water level drops due to casino well pumping.

Recommendations include: assessing methods for offsetting the groundwater drawdown effects prior to construction, assessing onsite features for inclusion in the project design to lessen or eliminate the effects of groundwater drawdown on the Cosumnes River, and evaluating additional water conservation measures to be incorporated into the project design.

2.0 INTRODUCTION

Applied Engineering and Geology, Inc (AEG) was contracted by Analytical Environmental Services (AES) to conduct an evaluation of groundwater supply feasibility and potential impacts to surface and groundwater resources and quality resulting from the proposed construction of the Wilton Rancheria Casino.

The evaluation of groundwater included potential on-site and off-site impacts to groundwater resources resulting from additional on-site extraction of groundwater necessary to accommodate the proposed development. AEG also evaluated the potential off-site impacts to surface water ways in the vicinity of the sites. The surface water ways included in the evaluation were Laguna Creek and Skunk Creek for the TC Site and the Cosumnes River for the HR Site.

There were a number of instances where AEG was not able to obtain site specific data for the analysis performed in this Report. In these instances, AEG utilized indirect methods to estimate likely values for the missing data, or used regional or generalized data to fill in the gaps.

3.0 PROJECT DESCRIPTION

The EIS project alternatives consist of constructing a casino and associated facilities, or a retail facility at one of three possible sites, with up to three possible alternative configurations at each site. A summary of the alternatives is as follows:

- Proposed Casino at Twin Cities Site
- Reduced Intensity Casino at Twin Cities Site
- Retail at Twin Cities Site
- Casino at Historic Rancheria Site
- Reduced Intensity Casino at Historic Rancheria Site
- Casino at Mall Site (not evaluated in this document)

A detailed breakdown of the alternatives is shown in **Table 3-1**.

TABLE 3-1
Project Alternatives

	Twin Cities Site			Historic Rancheria Site		Mall Site
EIS Alternative	A	B	C	D	E	F
Description	Proposed Casino Project	Reduced Intensity Casino	Retail Development	Casino	Reduced Intensity Casino	Casino
Jurisdiction	City of Galt Sphere of Influence / Sacramento County			Sacramento County		City of Elk Grove
Fee-to-Trust Acreage (approximate)	282			75		28
Total Building Size - not including hotel (approximate square feet)	376,500	293,000	686,000	376,500	293,000	381,000
Hotel Size / Rooms (approximate)	230,000 sf 302 rooms	0	0	230,000 sf 302 rooms	0	230,000 sf 307 rooms
Restaurants - total (approximate square feet)	44,500	42,300	23,000	44,500	42,300	46,375
Convention Area (approximate square feet)	48,150	0	0	48,150	0	48,150
Parking Spaces (approximate)	3,500	3,500	3,320	3,500	3,500	1,790
Existing Land Use	Agricultural Cropland			General Agriculture		Commercial
Zoning	Agriculture - 80 acres			Agriculture - 80 acres		Lent Ranch Special Planning Area

Source: Ref B - Analytical, Table 2-1, Ref P - David, Email, and Ref T - Katherine, Email

4.0 PREVIOUS GROUNDWATER USE STUDIES

Many previous groundwater use studies have been performed in the region discussed in this document. In this section, AEG has summarized the scope of the groundwater use studies, and several water management documents, found to be relevant to the TC Site and HR Site.

Ground-Water Flow in the Central Valley, California (USGS Professional Paper 1401-D): This study was part of the Regional Aquifer-System Analysis (RASA) Program started in 1978. The purpose of this study was to evaluate the aquifer system on a regional basis, model the aquifer system before and after development, and identify changes to the aquifer system resulting from development. This evaluation included geology, hydrology, and land subsidence. (Ref A - Alex, Page D2)

Evaluation of Ground Water Resources: Sacramento County (California Bulletin No. 118-3): The purpose of this study was to evaluate the ways the groundwater basin could be used to satisfy the future water needs of the region. This study was performed as the first part of a larger two part study and has been incorporated into many subsequent studies. (Ref G - California, Page 1)

San Joaquin Valley Groundwater Basin, Cosumnes Subbasin (California's Groundwater Bulletin 118): This bulletin was prepared by the California Department of Water Resources and provides general geology, hydrology, and water quality information for the Cosumnes Subbasin. (Ref D - California, Page 1)

Sacramento Central Groundwater Authority Basin Management Report 2009-2010: This report was prepared to document hydrologic conditions and groundwater management activities in the Sacramento Region. This report provides groundwater basin conditions, a discussion of basin management activities occurring during the reporting period, and conclusions and recommendations. (Ref V - Sacramento, Page 1)

Groundwater Availability of the Central Valley Aquifer, California (USGS Professional Paper 1766): The purpose of this report was to describe groundwater availability in the California Central Valley using modeling and a review of existing data and literature. This report includes a significant amount of historical and background data, an evaluation of the Central Valley, and detailed modeling of the Central Valley. (Ref AA - U.S., Page 4)

City of Galt, 2010 Urban Water Management Plan, Public Review Version: The purpose of this document is to maintain efficient use of water supplies, promote water conservation, ensure sufficient water supplies remain available, and provide responses for droughts. This document includes a description of the City's water system and the water resources available to the City. (Ref K - Carollo, Page 1-1)

Central Sacramento County Groundwater Management Plan: The purpose of this document is to outline groundwater management practices and assist water providers with planning. This document discusses the condition of the groundwater resources in central Sacramento County and the plans for future use and management of these resources. This document includes information on regional geology, hydrology, and groundwater surface elevations. (Ref L - Central, ES-2)

Draft Environmental Impact Report for the 2030 Galt General Plan: The purpose of this document is to comply with CEQA requirements and provide environmental impact information to the City of Galt. This document includes evaluations of water supply, geology, and hydrology associated with the Galt 2030 General Plan. (Ref R - Draft, 1-1)

Final Environmental Impact Report, Sacramento County General Plan Update, April 2010: The purpose of this document is to comply with CEQA requirements and provide environmental impact information to Sacramento County. This document includes evaluations of water supply, hydrology, and water quality associated with the Sacramento County General Plan Update. (Ref W - Sacramento, 2-1)

5.0 TWIN CITIES SITE

5.1 Site Description

5.1.1 General Site Information

The Twin Cities Site (TC Site) is located adjacent to the northern edge of the City of Galt, immediately west of Highway 99, the TC Site consists of approximately 282 acres of land, comprised of six separate parcels, which is currently used for agriculture (primarily row crops) and rural residential development. The proposed development area would be located on the northern third of this property. The TC Site is bounded by Stockton Boulevard and Highway 99 on the east, Twin Cities Road and private properties on the south, a Union Pacific Railroad on the west, and private property and Laguna Creek on the north (see **Figures 1** and **2**). The TC Site is at an elevation ranging from approximately 35 to 50 feet above mean sea level. Skunk Creek begins approximately 2,000 feet west of the TC Site, at the City of Galt WWTP, with another water way also called Skunk Creek located approximately 1,800 feet east of the TC Site.

5.1.2 Geology and Hydrogeology

The TC Site is located in the Sacramento Valley, between the Sierra Nevada Mountain Range (to the east) and the Coast Ranges (to the west). The aquifers beneath the TC Site is part of the San Joaquin Valley Groundwater Basin, Cosumnes Subbasin. (Ref D - California, Page 1)

The water-bearing formations of the Cosumnes Subbasin are described below.

"The Cosumnes subbasin aquifer system is comprised of continental deposits of Late Tertiary to Quaternary age. These deposits include Younger Alluvium, Older Alluvium, and Miocene/Pliocene Volcanics. The cumulative thickness of these deposits increases from a few hundred feet near the Sierra Nevada foothills on the east to over 2,500 feet along the western margin of the subbasin.

Younger Alluvium: *This unit includes Recent stream channel deposits and dredge tailings. The maximum combined thickness of all the younger alluvial units is about 100 feet. Calculated specific yield values range from about 6 percent in the alluvial deposits to about 12 percent in the stream channel deposits.*

Minor exposures of dredge tailings are present along the Cosumnes and Mokelumne Rivers at the eastern margin of the subbasin. They consist of windrows of gravel, cobbles, boulders, sand, and silt resulting from gold dredging operations. The tailings are highly permeable, but well construction is complicated by the presence of cobbles and boulders.

The stream channel deposits include sediments deposited in the channels of active streams as well as overbank deposits and terraces of those streams. They occur along the Sacramento, Cosumnes, and Mokelumne Rivers and their major tributaries and consist primarily of unconsolidated silt, fine- to medium-grained sand, and gravel. Sand and gravel zones in the younger alluvium are highly permeable and yield significant quantities of water to wells.

Older Alluvium: *This unit consists of loosely to moderately compacted sand, silt, and gravel deposited in alluvial fans during the Pliocene and Pleistocene. A number of formational names have been assigned to the older alluvium, including the Modesto and Riverbank Formations, Victor Formation and Laguna Formation, and Victor Formation, Laguna Formation, Arroyo Seco Gravels, South Fork Gravels, and Fair Oaks Formation. The older alluvial units are widely exposed between the Sierra Nevada foothills and overlying younger alluvial units near the axis of the Sacramento Valley. Thickness of the older alluvium is about 100 to 650 feet. It is moderately permeable. The calculated specific yield of these deposits is approximately 6 to 7 percent.*

Miocene/Pliocene Volcanics: *This unit consists of the Mehrten Formation, a sequence of fragmental volcanic rocks, which crops out in a discontinuous band along the eastern margin of the basin. It is composed of intervals of "black sands," stream gravels, silt, and clay interbedded with intervals of dense tuff breccia. The sand and gravel intervals are highly permeable and wells completed in them can have high yields. The tuff breccia intervals act as confining layers. Thickness of the unit is between 200 and 1,200 feet. Specific yields for this unit range from about 6 to 12 percent."* (Ref D - California, Page 1)

Based on the well completion reports for wells near the TC Site reviewed by AEG, the shallow aquifer (a few hundred feet deep) beneath the TC Site is comprised of alternating layers of fine and coarse materials, with the water bearing layers being composed of sand and/or gravel that range from five to 20 feet thick. Several of the wells around the TC Site, which had depths between 200 and 300 feet, were reported to yield 80 gpm.

The deeper aquifer (Mehrten Formation - extends to over 1,500 feet deep) beneath the TC Site is comprised of alternating layers of fine materials, coarse materials, and rock, with the water bearing layers being composed of sand and/or gravel. Several City of Galt wells that are between 600 and 750 feet deep were reported to produce between 400 and 650 gpm; one 1,000 feet deep well (Industrial Park) was reported to produce 1,900 gpm; and one 1,539 feet deep well was reported to produce 1,900 gpm. (Ref K - Carollo, Page 4-2)

Groundwater elevation data from the California Department of Water Resources Water Data Library show the groundwater elevation in the vicinity of the north and south sides of the TC Site was -26.49 and -42.1 feet (State well numbers 383237N1213272W001 and 05N06E10P001M), respectively, on January 24, 2014. The northern well is located approximately 7,400 feet north of the northern boundary of the TC Site and the southern well is located approximately 700 feet south of the southern boundary of the TC Site Since the 1960's, groundwater elevations in State well numbers 06N06E33L001M and 05N06E10P001M have ranged from -4.8 to -47.9 feet (north of TC Site) and -22.6 to -58.4 feet (south of TC Site). (Ref H - California, Website)

A groundwater elevation contour map of Sacramento County prepared by the Sacramento Central Groundwater Authority for fall of 2010 shows the direction of groundwater flow in the vicinity of the TC Site to be to the northwest, generally toward a cone of depression near the City of Elk Grove. (Ref V - Sacramento, Page 17) A groundwater elevation contour map prepared for the City of Galt WWTP (located immediately west of the TC Site) using October 15, 2013 data shows the direction of groundwater flow on the northern half of the TC Site to range from east to southeast. (Ref S - Dunn, Figure 5) It should be noted, these two groundwater contour maps use data sets of significantly different scales (regional versus site specific), so the difference in direction of groundwater flows does not necessarily indicate errors in the data or data interpretation. It is likely the WWTP groundwater contours are being influenced by local influences that would not necessarily be incorporated into the regional groundwater contours; therefore, they are more likely to be an accurate representation of conditions present at the TC Site.

It should also be noted, a groundwater elevation contour map prepared by the County of Sacramento Department of Water Resources for spring 2007 shows a cone of depression to the east of the TC Site that is outside the boundary of the 2010 map contours. (Ref X - Sacramento, Website) Additionally, the groundwater elevation data in the vicinity of the southern boundary of the TC Site from January 24, 2014 (State well number 05N06E10P001M) shows groundwater elevations at approximately 25 feet below those shown in the 2010 map. (Ref H - California, Website) Based on this, and the historical groundwater elevation contour maps showing significant changes over the years, AEG believes it is unlikely the 2010 map shows the same conditions as were present in January 2014.

To demonstrate the significant fluctuation of groundwater elevations and direction of groundwater flow at various points in time and location in the basin, copies of several groundwater elevation figures and hydrographs, prepared by others, are included in **Appendix C**.

Surface water features that occur adjacent to the TC Site include Laguna Creek, which travels westward along the north boundary of the TC Site, Skunk Creek, which flows northwest, from the WWTP located immediately west of the TC Site, into Laguna Creek, and another water way also called Skunk creek which flow northwest into Laguna Creek to the east of the TC Site. (Ref C - Ascent, Exhibit 3-2) In addition to these features, there are numerous seasonal water ways in the vicinity of the TC Site.

Stormwater runoff in the vicinity of the TC Site generally flows to the west; however, there are numerous man made features (primarily agricultural fields and roads) that alter the stormwater flow direction on a smaller scale.

5.2 Groundwater Supply Feasibility Evaluation

There are currently three agricultural/irrigation wells (AG-3, AG-4, and AG-5), one domestic well (DW-1), and two agricultural/irrigation sumps (AG-1 and AG-2) on the TC Site. The locations of these wells are shown on **Figure 2**. The ag wells are primarily used to supply irrigation water for crops during the dry season, the domestic well is used to supply a residence on the TC Site, and the sumps are used to move water around the TC Site. The wells have been reported to supply the following yields: 400 gpm (AG-3 and AG-5), 1,100 gpm (AG-4), and 50 gpm (DW-1). (Ref Y - Tom, Email Attachment)

The TC Site has been reported to have no water supply other than groundwater. (Ref Y - Tom, Email Attachment)

5.2.1 Water Supply

The four production wells located on the TC Site extract groundwater from the San Joaquin Valley Groundwater Basin, Cosumnes Subbasin, which underlies the entire TC Site and vicinity. The estimated groundwater storage capacity of the basin is on the order of 6,000,000 ac-ft. (Ref D - California, Page 2) Pre-development aquifer recharge characteristics of the California Central Valley aquifer have been described as follows.

"Prior to development, groundwater in both the confined and unconfined aquifers of the aquifer system generally moved from recharge areas in the upland areas surrounding the Central Valley toward discharge areas in the lowlands along the valleys axes and the Delta. Groundwater flowed largely toward the Sacramento or San Joaquin Rivers or Tulare Lake. Areal recharge from precipitation provided about 75 percent of recharge, and seepage from stream channels provided the remaining recharge. The eastern-valley streams carrying runoff from the Sierra Nevada and the Klamath Mountains provided the bulk of the recharge derived from streams. Most of this occurred as mountain-front recharge in the coarse-grained upper alluvial fans where streams enter the basin." (Ref AA - U.S., Page 48)

Post-development aquifer recharge characteristics of the California Central Valley aquifer have been described as follows.

"Delivery of surface water for irrigation, combined with pumping for irrigation and public supply, has greatly altered the amount and distribution of recharge to, and discharge from, the groundwater system. Recharge rates from precipitation have not changed significantly from predevelopment times. Prior to development, natural recharge to, and discharge from, the system was in a dynamic steady state, with an estimated 2 million acre-ft/yr moving through the system. Soon after irrigated agriculture began in the late 1800s, water pumped for irrigation exceeded the amount of natural recharge. Recharge to the groundwater system comes from two main sources: percolation of water past the root zone, and stream losses. Prior to development, the source of percolating water was infiltration of precipitation.

During the period between 1962 and 2003, an average of 18.9 million acre-ft of water was required annually for irrigation, supplied in approximately equal proportions from groundwater and surface water. Part of this irrigation water was consumed by crops. However, it is important to recognize that not all irrigation water is consumed: some runs off and some returns to the groundwater system by deep percolation, canal leakage, and other mechanisms.

The primary source of recharge has become deep percolation of irrigation water past crop roots, sometimes referred to as recharge from excess applied irrigation water. Of the average 13.3 million acre-ft of groundwater recharged annually from 1962 to 2003, less than 1 percent was from infiltration from the Delta, 19 percent was from streams by way of stream-flow leakage, and 79 percent was from the landscape processes, which include recharge from excess applied irrigation water and from precipitation. Average annual groundwater recharge varies between typical, dry, and wet years; 12.1, 7.5, and 25.6 million acre-ft, respectively. During dry years, recharge is reduced to a little more than one-half the average recharge; recharge during wet years is almost double the average. In typical and dry years, the contribution from stream-flow leakage was about 15 percent. However, during wet years, the streams generally flow at higher rates for longer periods of time and the simulated contribution from stream-flow leakage increases to 24 percent.

Groundwater pumpage and ET from crops has replaced natural ET as the primary mechanism of discharge from the groundwater system. Groundwater flow out the Delta relatively is negligible. ET varies annually, but the total ET does not vary much from the average annual rate of 25.6 million acre-ft/yr. Roughly 15 percent of the ET is met directly from the uptake of shallow groundwater." (Ref AA - U.S., Page 66)

The major users of groundwater in the immediate vicinity of the TC Site are the City of Galt (for municipal and domestic use), agricultural properties (primarily for irrigation), and domestic wells (for residential supply). At longer distances from the TC Site, two additional major groundwater users are the City of Elk Grove (for municipal and domestic use) and an unknown source of a large historic groundwater drawdown area located approximately five miles east of the TC Site (AEG could not identify a specific source of this drawdown area, but it could be the result of heavy agricultural pumping).

The City of Galt addressed the issue of groundwater basin overdraft in it's 2010 Urban Water Management Plan (Ref K - Carollo, Page 4-4), an excerpt of which is provided below.

"Based upon the water balance provided in Bulletin 118 (Ref D - California, Page 2)*, groundwater outflows exceed groundwater inflows by approximately 4,300 acre-feet per year (AFY), suggesting a basin overdraft situation may exist. However, assuming a +/- 5 percent error, the water balance deficit of 4,300 AFY is potentially inconclusive with regard to the overall health of the basin.*

Furthermore, DWR has continuously monitored the groundwater level at the City's Gateway Well since 1961. Over the period of record, there are two distinctive periods of declining ground water levels (first period is from 1963 to 1980 and the second is from 1984 to 1992). In each instance, over time, the groundwater levels have recovered such that the depth to groundwater either met or exceeded the groundwater level at the beginning of the period of decline."

Based on the above discussion, there is localized groundwater drawdown in the vicinity of the TC Site (drawdown area related to the City of Galt); however, the Cosumnes Subbasin as a whole is not considered to be in a state of overdraft.

AEG was not able to obtain any water usage data for the TC Site; however, AEG was informed of the crops typically grown on the TC Site and the typical duration of irrigation activities each year. Using this data, well pump rates, and crop water consumption data, AEG estimated the irrigation water usage per year, which is summarized below.

TC Site area: 282 acres
Crops: corn and alfalfa (Ref Y - Tom, Email Attachment)
(assuming half of TC Site is used for each crop)
Irrigation period: June through September (Ref Y - Tom, Email Attachment)
Corn crop water use: 25.5 inches for June through September (Ref E - California, Table J-4)
Alfalfa water use: 38.1 inches for June through September (Ref E - California, Table J-4)

$$141ac * 25.5inH_2O * 1ft/12in + 141ac * 38.1inH_2O * 1ft/12in = 747acft$$

This estimate shows the TC Site currently uses approximately 747 ac-ft ($2.43E^8$ gallons) of water per year for irrigation. If averaged over the four months (June through September) irrigation is used, this translates to a flow rate of 1,380 gpm for the TC Site, and if averaged over one year, this translates to a flow rate of 461 gpm for the TC Site. Please note: this estimate, and all subsequent calculations based on it, was performed using very rough numbers, has a large margin for error, and is only intended for impact analysis and general planning purposes. For discussion purposes, AEG is considering the TC Site to use groundwater on the orders of 1,400 gpm per year for irrigation (over four months) or 450 gpm averaged over one year.

As one third of the TC Site has been proposed to remain in use as agricultural land after the proposed development, two thirds of the above irrigation water would no longer be used following the construction. (Ref O - David, Email) This would translate to a reduction in agricultural water use at the TC Site of 498 ac-ft ($1.62E^8$ gallons) per year, 933 gpm averaged over four months, or 300 gpm averaged over one year.

There is also a domestic well on the TC Site that supplies water to a residence; however, since a typical residence in this region uses only 160,000 gallons of water per year, this domestic well was not considered to have a significant impact on the overall water usage of the TC Site. (Ref CC - William, Table 23)

5.2.2 Water Quality

The current property owner of the TC Site stated the well water does not have an unappealing odor or taste, but does cause mineral buildup, and that he did not have any laboratory data for the wells. AEG did not discover any groundwater quality laboratory data for the wells on the TC Site during this evaluation. (Ref Y - Tom, Email Attachment)

The City of Galt maintains several groundwater supply wells in the vicinity of the TC Site, the closest of which is located approximately 5,000 feet southeast of the TC Site (Golden Heights well #17). Based on 2012 and 2013 City of Galt documents, the City treats the extracted groundwater from some of it's wells for iron, manganese, and/or arsenic. The City's Annual Drinking Water Quality Report - 2012 states "The water is treated to remove iron and manganese to improve taste and reduce odor." One of the City's wells (Emerald Oaks well #9) was out of service in 2010 due to elevated nitrate levels and at least one of the City's wells exceeded the MCL for arsenic prior to treatment in 2012. (Ref N - City, Page 2 and Ref K - Carollo, Page 4-2)

It should be noted, there appears to be a groundwater aquifer at a greater depth than most of the City's wells that has lower arsenic concentrations.

"Galt's groundwater wells were historically drilled to a depth of approximately 1,000 feet. At these depths, the groundwater quality in the City typically requires treatment for manganese and arsenic. In recent years, City staff learned that the City of Elk Grove drilled a well to a new aquifer at a depth of approximately 1,700 feet. This deeper aquifer (Mehrten Formation) has low arsenic levels and has also been producing a higher water flow yield.

The City installed the Kost Road Monitoring Well in the same lower aquifer and found no detectable arsenic levels. For this reason, the City constructed a deep well at the Golden Heights location." (Ref K - Carollo, Page 4-4)

Based on the above discussion, the groundwater beneath the TC Site may require treatment for iron, manganese, and/or arsenic prior to public supply use. This can be confirmed/denied by laboratory analysis of water from the onsite wells.

5.2.3 Water Demand

Summit Engineering, Inc. has estimated the average daily demand for each of the project alternatives (see **Table 5-1** for the estimated Twin Cities TC Site water demand).

TABLE 5-1
Water Demand Estimates for Twin Cities Site

	Project Alternative		
	A	B	C
Description	Proposed Casino Project	Reduced Intensity Casino	Retail Development
Calculated Flow Rate (gpm)	205	158	110
Avg. Daily Demand (gpd)	295,000	227,000	158,000
Calculated Flow Rate (gpy)	$1.08E^{8}$	$8.29E^{7}$	$5.77E^{7}$

gpm = gallons per minute gpd = gallons per day gpy = gallons per year
Source: Ref Q - David, Email and Ref T - Katherine, Email
Note: Flows were provided to AEG in units of gpd; gpm and gpy values were calculated by AEG.

5.2.4 Groundwater Use Impacts

Groundwater resource impacts as a result of increased pumping of wells on the TC Site could be caused by lowering the aquifer surface in the vicinity of offsite wells, surface water bodies, and habitat that is reliant on existing groundwater conditions. In order to evaluate the potential for negative groundwater resource impacts as a result of the proposed development on the TC Site, AEG has calculated the drop in groundwater surface at the following locations:

- The nearest site boundary
- The nearest offsite well located in this investigation
- The nearest point on Laguna Creek (closest surface water way to onsite pumping wells)

To determine the location of the nearest offsite well, AEG requested logs of nearby wells from the DWR and reviewed online databases with well location information. AEG received logs for numerous domestic, agricultural/irrigation, public supply, and monitoring/observation wells in the vicinity of the TC Site and reviewed the logs of wells found to be within approximately one mile of the TC Site. The majority of the wells are located to the south and east of the TC Site, with a cluster of monitoring/public supply wells associated with the City of Galt WWTP located immediately west of the TC Site. The wells identified to the south of the TC Site are primarily domestic wells, while the wells identified to the east of the TC Site are roughly half domestic and half agricultural/irrigation wells. Public supply wells were identified to the west, southwest, south, and southeast of the TC Site.

According to the logs received by AEG and wells observed during a site inspection, there are wells

within 200 feet of the western and southern TC Site boundaries, and within 500 feet of the eastern Site boundary. To the north of the TC Site, the closest well identified is approximately 2,500 feet from the Site boundary; however, it is likely there is a well located within 1,000 feet of this boundary based on structures (cattle lot) shown in aerial/satellite photos.

Based on the wells AEG was able to identify, and the documents AEG reviewed, it is likely that all of the residences, and most of the structures, outside the Galt city limits are supplied by private wells.

AEG has used the following assumed locations to evaluate possible groundwater resource impacts.

- Existing well AG-3 (most likely existing well to be used as water supply well)
- A location (SoC Well) on the south edge of the proposed development area in the middle (east-west) of the TC Site (likely location of possible new water supply well)

Shown below are the distances AEG used while evaluating groundwater resource impacts.

- AG-3 to Site boundary: 25 feet
- AG-3 to nearest offsite production well (DWR #87597): 650 feet
- AG-3 to Laguna Creek: 2,000 feet
- SoC Well to Site boundary: 850 feet
- SoC Well to nearest offsite production well (DWR #87597): 1,450 feet
- SoC Well to Laguna Creek: 2,700 feet

AEG utilized the Theis Solution to calculate an approximate drawdown (Ref M - Charles, Page 215) at the locations discussed above (see **Eq. 5.1**).

$$s = \frac{114.6Q}{KY} W(u) \quad (5.1)$$

Where:

s = Drawdown at the point of measurement (ft)
Y = Average aquifer thickness (ft)
Q = Pumping rate (gpm)
K = Average permeability of Aquifer (gpd/ft^2)
W(u) = Well function, based on the value of u

The term u is a unitless parameter defined by **Equation 5.2**.

$$u = \frac{1.87r^2S}{KYt} \quad (5.2)$$

Where:

r = Distance from the pumped well to the point of observation (ft)
S = Average specific yield of aquifer
t = Time since pumping started (days)

For the drawdown calculations, AEG estimated the values of aquifer thickness, specific yield, time, and permeability based on reference documents that provided generalized regional values.

- Average aquifer thickness (Y) was estimated to be 700 feet based on common well depths in the vicinity of the TC Site and corroborated using the USGS Ground-Water Flow in the Central Valley, California (Ref A - Alex, Page D114). Because the depth of the water bearing strata is significantly deeper than wells in the vicinity of the TC Site, AEG used a thickness that corresponds to the zone commonly accessed by wells, rather than the total depth of the aquifer (which causes the calculation to be more conservative). For domestic and agricultural/irrigation wells, a thickness of 700 feet was used (most wells identified by AEG ranged from 100 feet to 800 feet deep). For shallower public supply wells, a thickness of 1,000 feet was used (common depth of City of Galt wells). For deeper public supply wells, a thickness of 1,700 feet was used (depth of newer City of Galt Golden Heights well #17).

- Average specific yield of aquifer (S) was estimated to be 0.07 (7%) based on California's Groundwater Bulletin 118 (Ref D - California, Page 2) and the USGS Ground-Water Flow in the Central Valley, California (Ref A - Alex, Page D114). Additionally, 0.07 falls within the typical range of S values for sandy clay.

- Time (t) was estimated to be three years (1095 days) based on Drought in California (Ref F - California, Page, 4) and a review of precipitation data collected at the Sacramento FAA Airport (Ref BB - Western, Website). This three year period is based on the average drought duration found in the vicinity of the TC Site.

- Average permeability of aquifer (K) was estimated to be 2.6 ft/d ($9.2E^{-4}$ cm/s or 20 gpd/ft^2) for wells 1,000 feet deep or less and 1.3 ft/d ($4.6E^{-4}$ cm/s or 10 gpd/ft^2) for wells more than 1,000 feet deep based on the USGS Ground-Water Flow in the Central Valley, California (Ref A - Alex, Page D114). Due to the high number of alternating layers of fine and coarse grain materials beneath the TC Site, these permeability values were estimated to represent the composite material making up the aquifer, rather than representing a specific layer(s) within the aquifer.

Due to the relatively small water requirements of the proposed development, AEG assumed deep wells (deeper than 700 feet) will not be utilized by the development. Additionally, AEG assumed all of the proposed development's water would be supplied by a single well, which provides for a more conservative analysis.

The Theis Solution makes several assumptions not met by the TC Site for this evaluation; however, according to U.S. Department of the Interior Bureau of Reclamation (DOI) *Ground Water Manual* (Ref Z - U.S., Page 145), the errors introduced by the Theis Solution, when assumptions are not met, are minor when the pumped well's drawdown is less than 25% of the aquifer thickness. To determine if the proposed increase in pumping would increase the drawdown to greater than 25% of the aquifer thickness and thus make the use of the Theis Solution invalid, AEG calculated the drawdown using the highest flow rate estimated for the TC Site project alternatives (205 gpm from Alternative A). For 205 gpm, a total drawdown of approximately 32.5 feet (or approximately 5% of the average aquifer thickness of 700 ft used in the calculations) is calculated at the pumped well.

During this evaluation, AEG calculated the drawdown at the closest Site boundary, closest offsite well, and Laguna Creek relative to the pumping location. Additionally, AEG calculated the distance to three feet of drawdown. A summary of the drawdown calculation results is shown in **Table 5-2** and copies of the drawdown calculations are included in **Appendix B**. For this evaluation, AEG considered any additional drawdown greater than three feet to be a significant impact.

TABLE 5-2
Groundwater Drawdown Calculation Results Summary for Twin Cities Site

		Project Alternative		
		A	B	C
Description	Current Estimated Water Use	Proposed Casino Project	Reduced Intensity Casino	Retail Development
Flow Rate Input (gpm)	300	205	158	110
Distance to 3' of Drawdown (feet)	4,840	3,490	2,620	1,550
Pumping and Reference Locations	Drawdown at Reference Location (feet)			
Drawdown at Pumped Well	47.6	32.5	25.1	17.5
AG-3 to Closest Site Boundary	28.4	19.4	15.0	10.4
AG-3 to Closest Domestic Well	12.4	8.5	6.5	4.6
AG-3 to Laguna Creek	7.0	4.8	3.7	2.6
SoC to Closest Site Boundary	11.1	7.6	5.8	4.1
SoC to Closest Domestic Well	8.5	5.8	4.5	3.1
SoC to Laguna Creek	5.6	3.8	2.9	2.0

Based on the results shown in **Table 5-2**, the estimated water use for all three project alternatives for the TC Site will cause groundwater drawdown in all of the pumping and reference locations evaluated; however, none of these project alternatives use as much water as is currently being used by agricultural irrigation at the TC Site. As discussed in **Section 5.2.1**, the portion of the TC Site the development is proposed to be built on is estimated to currently use water at a rate of 300 gpm for irrigation. This higher rate of current water use creates a larger drawdown than the proposed development would, resulting in a net reduction in groundwater drawdown as a result of the construction of the proposed development.

Additionally, while the proposed development has been estimated to use 205 gpm (Alternative A) or less year round, the current irrigation water use is at an estimated rate of 933 gpm during the dry season (June through September). Therefore, the construction of the proposed development would also significantly reduce the amount of water extracted from the aquifer during the dry season, when aquifer recharge is traditionally lowest.

Lastly, most (80% is not uncommon) of the water used by the proposed development will be treated at an onsite WWTP, or at the Galt WWTP located adjacent to the TC Site, and returned to the aquifer or nearby surface water ways. Treated water from the City of Galt WWTP is discharged to Laguna Creek downstream of the TC Site. And while a percentage of agricultural irrigation water does typically return to the aquifer by percolating past the crop roots, this percentage is intentionally kept low to increase the efficiency of growing the crop. Therefore, the net use of water resources by the proposed development would be even smaller than the estimated water use, and have that much less of an effect on water resources.

Based on the above discussion, the construction of the proposed EIS alternatives on the TC Site would not only cause no additional negative impacts to the groundwater resources, but would lessen the impact the existing land use has on groundwater resources, which would include lessening the magnitude of the groundwater drawdown beneath the TC Site. In other words, implementation of any of the TC Site project alternative would have a beneficial effect on groundwater resources.

5.2.5 Summary of Major Evaluation Findings on the Twin Cities Site

- There is localized groundwater drawdown in the vicinity of the TC Site (drawdown area related to the City of Galt); however, the Cosumnes Subbasin as a whole is not considered to be in a state of overdraft.
- Groundwater beneath the TC Site may require treatment for iron, manganese, and/or arsenic prior to public supply use.
- The groundwater resources in the vicinity of the TC Site are adequate to support each of the proposed project alternatives.
- Construction of the proposed project alternatives would not only cause no additional negative impacts to the groundwater resources, but would lessen the current impact the TC Site has on groundwater resources.

5.2.6 Recommendations

If new wells are to be installed on the TC Site, wells should be positioned so as not to create a new negative impact on existing wells and surface water features in the vicinity of the TC Site. An example of this would be installing a new production well along the Site boundary adjacent to an existing offsite well or Laguna Creek. While the existing wells, or a new well placed a reasonable distance from existing features, should not cause additional negative impacts to surrounding features, if a new production well was installed close to an existing feature, the negative impacts on that feature could be significant.

6.0 HISTORIC RANCHERIA SITE

6.1 Site Description

6.1.1 General Site Information

The Historic Rancheria Site (HR Site) is located in Wilton, east of Wilton Road and immediately north of Green Road. The HR Site consists of approximately 75 acres of land, comprised of four separate parcels, which is currently used for residences and grazing land. The proposed development alternatives would be located in the center of this property. The HR Site is bounded by residential and agricultural properties on the east, Green Road on the south, residential and agricultural properties on the west, and agricultural property and the Cosumnes River on the north (see **Figures 3** and **4**). The HR Site is at an elevation ranging from approximately 70 to 85 feet above mean sea level. The Cosumnes River, which starts in the Sierra Nevada Mountain Range and ends in the Sacramento–San Joaquin River Delta, flows to the southwest in the vicinity of the HR Site and lies along approximately 900 feet of the HR Site's northern boundary.

6.1.2 Geology and Hydrogeology

The HR Site is located in the Sacramento Valley, between the Sierra Nevada Mountain Range (to the east) and the Coast Ranges (to the west). The aquifer beneath the HR Site is part of the San Joaquin Valley Groundwater Basin, Cosumnes Subbasin. (Ref D - California, Page 1)

The water bearing formations of the Cosumnes Subbasin are described in **Section 5.1.2**.

Based on the well completion reports for wells near the HR Site reviewed by AEG, the shallow aquifer (a few hundred feet deep) beneath the HR Site is comprised of alternating layers of fine and coarse materials, with the water bearing layers being composed of sand and/or gravel that range from two to five feet thick. Several of the wells around the HR Site, which had depths between 200 and 300 feet, were reported to yield between 40 and 70 gpm.

Groundwater elevation data from the California Department of Water Resources Water Data Library show the groundwater elevation in the vicinity of the HR Site (well located approximately ¾ of a mile south of HR Site) was -23.83 feet (State well number 06N06E01G001M) on January 31, 2014. Since 1990, groundwater elevations in this well have ranged from -2.1 to -26.9 feet. (Ref H - California, Website) It should be noted, groundwater beneath the HR Site is likely at a higher elevation than indicated by this well due to the HR Site's location adjacent to the Cosumnes River.

A groundwater elevation contour map prepared by the Sacramento Central Groundwater Authority for fall of 2010 shows the direction of groundwater flow in the vicinity of the HR Site to be to the west-northwest, generally toward a groundwater drawdown area near the City of Elk Grove. (Ref V - Sacramento, Page 17) No groundwater elevation contour maps more recent than 2010 were found. It should be noted, a groundwater elevation contour map prepared by the County of Sacramento Department of Water Resources for spring 2007 shows a cone of depression to the south of the HR Site that is outside the boundary of the 2010 map contours. (Ref X - Sacramento, Website) The groundwater elevation data in the vicinity of the HR Site from January 31, 2014 (State well number 06N06E01G001M) reported groundwater elevations that approximately match those shown in the 2010 map. (Ref H - California, Website) Therefore, it is possible the 2010 map shows the same conditions as are present in January 2014.

To demonstrate the significant fluctuations of groundwater elevations and direction of groundwater flow at various points in time and location in the basin, copies of several groundwater elevation figures and hydrographs, prepared by others, are included in **Appendix C**.

The only major surface water features adjacent to the HR Site is the Cosumnes River, which travels southwest along the north boundary of the HR Site. In addition to this feature, there are numerous seasonal water ways in the vicinity of the HR Site.

Stormwater runoff in the vicinity of the HR Site generally flows to the southwest, in the direction of the Cosumnes River; however, there are numerous man made features that alter the stormwater flow direction on a smaller scale. One of these man made features is a levy located along the southern bank of the Cosumnes River within the HR Site.

6.2 Groundwater Supply Feasibility Evaluation

There are currently two agricultural/irrigation wells (AG-1 and AG-2) and one domestic well (DW-1) on the HR Site that AEG has confirmed the presence of. Additionally, there appear (based on aerial/satellite photos) to be two more wells on the southwest portion of the HR Site, the current use of which are unknown. The locations of these wells are shown on **Figure 4**. Based on a conversation with the current Property Owner of the majority of the HR Site (Michael Coffey - Ref U - Michael, Interview), DW-1 is used to provide water to the residence, minor landscaping irrigation, and animals that live on the property; AG-1 has not been used in several years and was previously used for irrigation; and AG-2 is currently used for irrigation, though only for a few days each year. During the interview, Mr. Coffey stated the property hasn't been regularly irrigated during the past two years.

Per Mr. Coffey, his property has rights to water from the Cosumnes River, in addition to groundwater rights. (Ref U - Michael, Interview)

AEG has not been able to obtain any well yield or well construction data for any of the wells on the HR Site. During the interview, Mr. Coffey informed AEG that he floods the lower fields on the property (northwest portion of HR Site, AEG estimated approximately 16 acres) to approximately two inches of water by pumping from AG-2 for three days (approximately 2.67 ac-ft or 870,000 gallons of water based on volume filled - does not account for infiltration or evaporation). This would correspond to a flow rate of approximately 200 gpm, which could be limited by the pump, rather than the well. (Ref U - Michael, Interview) The actual production rate of this well is likely higher than this due to the size of the pump/piping AEG observed during the HR Site visit and the effects of water infiltration that were not considered in the above estimate.

6.2.1 Water Supply

The three production wells known to be located on the HR Site extract groundwater from the San Joaquin Valley Groundwater Basin, Cosumnes Subbasin, which underlies the entire HR Site. The estimated groundwater storage capacity of the basin is on the order of 6,000,000 ac-ft. (Ref D - California, Page 2) Pre-development aquifer recharge characteristics of the California Central Valley aquifer are described in **Section 5.2.1**.

The major users of groundwater in the immediate vicinity of the HR Site are agricultural properties (primarily for irrigation) and domestic wells (for residential supply). At longer distances from the HR Site, three additional major groundwater users are the City of Elk Grove (for municipal and domestic use), the City of Galt (for municipal and domestic use), and an unknown source of a large historic groundwater drawdown area located approximately eight miles south of the HR Site (AEG could not identify a specific source of this drawdown area, but it could be the result of heavy agricultural pumping).

Based on the 2010 Urban Water Management Plan (Ref K - Carollo, Page 4-4), the is no large scale groundwater drawdown in the vicinity of the HR Site (although the HR Site is at the edge of the drawdown area related to the City of Elk Grove) and the Cosumnes Subbasin as a whole is not considered to be in a state of overdraft.

If it is assumed the lower pastures are flooded twice per year, the estimated water use would be 5.34 ac-ft. Additionally, a typical residence in this region (two of which are currently on the HR Site) uses approximately 160,000 gallons (0.5 ac-ft) of water per year, which would likely underestimate the domestic water use on the HR Site due to the animals (including a number of horses) that are also supplied from these wells and the large parcel sizes. (Ref CC - William, Table 23) Based on the above discussion, the HR Site is estimated to currently use 6.34 ac-ft ($2.07E^6$ gallons) of water per year. If this estimate is averaged over one year, this translates to a flow rate of 3.9 gpm for the HR Site. Please note: this estimate, and all subsequent calculations based on this estimate, was performed using very rough numbers, has a large margin for error, and is only intended for impact analysis and general planning purposes. For discussion purposes, AEG is considering the HR Site to use groundwater on the orders of 4 gpm averaged over one year.

While the HR Site has not used groundwater resources heavily in the last couple years, this should not be taken to indicate the HR Site does not have access to significant groundwater supplies. Based on the interview with Mr. Coffey, the property owner of a number of the HR Site parcels, and a review of historic aerial/satellite photos, the HR Site has been irrigated in the past and does possess adequate water resources to do so again. Based on California Department of Water Resources Well Completion Reports, a domestic well located approximately 1,500 feet south of the HR Site (263 feet deep and believed to have a 8 inches diameter casing) was reported to have a yield of 70 gpm and a public supply well located approximately 5,000 feet southeast of the HR Site (595 feet deep with a 16 inches diameter casing) was reported to have a yield of 750 gpm. It should be noted, both of these wells are significantly further from the Consumnes River than the HR Site and likely have slower/less localized groundwater recharge than the wells on the HR Site.

Based on the well yields discussed in the above paragraph, and the estimate of the flow rate pumped from AG-2 while flooding the lower fields of the HR Site (200 gpm), AEG has estimated the three confirmed wells on the HR Site (one domestic and two agricultural/irrigation) can produce a total of 470 gpm. For discussion purposes, AEG is considering the wells on the HR Site to have a combined groundwater pumping capacity on the order of 500 gpm.

Since the HR Site was actively irrigated as little as three years ago, AEG estimated the irrigation water use of the HR Site for agricultural purposes. During the interview, Mr. Coffey stated that much of the HR Site was used as grazing land. (Ref U - Michael, Interview) Based on aerial/satellite photos, approximately 60 acres of the HR Site is setup for grazing use (fenced in grass fields). Using this data, and crop water consumption data, AEG estimated the HR Site's historic irrigation water usage per year, as is summarized below.

Irrigated area: 60 acres
Crops: grass (Ref U - Michael, Interview)
Irrigation period: March through October (growing period per Ref E - California, Table J-4)
Grass crop water use: 46.1 inches for growing period (Ref E - California, Table J-4)

$$60ac * 46.1inH_2O * 1ft/12in = 230acft$$

This estimate shows the HR Site was using approximately 230 ac-ft ($7.50E^7$ gallons) of water per year for irrigation. If averaged over one year, this translates to a flow rate of 143 gpm for the HR Site. For discussion purposes, the HR Site's historic irrigation water use is considered to be 140 gpm when averaged over a year.

6.2.2 Water Quality

The current property owner of the HR Site, stated the well water does not have an unappealing odor or taste and does cause mineral buildup, and that he did not have any laboratory data for the wells. (Ref U - Michael, Interview) AEG did not discover any groundwater quality laboratory data for the wells on the HR Site during this evaluation. AEG reviewed the Geotracker Gama database for groundwater quality data and found seven wells (in two clusters - one to the northwest and one to the southeast) within 10,000 feet of the HR Site that had relevant data during years 2007 through 2014. AEG did not find any exceedances of the California MCLs during a review of this data. A number of the wells were reported to contain moderate concentrations of nitrates; however, none of the concentrations exceeded 30 mg/L (nitrates MCL = 45 mg/L) and none of the graphed nitrate data showed a strong upward trend in nitrate concentrations. (Ref J - California, Website)

AEG also reviewed the California Environmental Data Exchange Network (CEDEN) for water quality data on the Cosumnes River. While AEG found only limited data on the sampling points shortly upriver of the HR Site, a substantial amount of data was found for the Cosumnes River at Twin Cities Road sampling points (approximately 11 miles southwest of the HR Site). This data did not include analysis for all of the MCL parameters, but did include nitrate results. AEG did not find any exceedances of the California inorganics MCLs during a review of this data (elevated E. coli levels were reported several times).

Based on the above discussion, the groundwater beneath the HR Site is likely suitable for public supply use without treatment from a water quality perspective. This can be confirmed/denied by laboratory analysis of water from the onsite wells.

6.2.3 Water Demand

Summit Engineering, Inc. has estimated the average daily demand for each of the project alternatives (see **Table 6-1** for the estimated HR Site water demand).

TABLE 6-1
Water Demand Estimates for Historic Rancheria Site

	Project Alternative	
	D	E
Description	Casino	Reduced Intensity Casino
Calculated Flow Rate (gpm)	251	184
Avg. Daily Demand (gpd)	362,000	265,000
Calculated Flow Rate (gpy)	$1.32E^{8}$	$9.67E^{7}$

gpm = gallons per minute gpd = gallons per day gpy = gallons per year
Source: Ref T - Katherine, Email
Note: Flows provided to AEG in units of gpd; gpm and gpy values were calculated by AEG.

6.2.4 Groundwater Use Impacts

Groundwater resource impacts as a result of increased pumping of wells on the HR Site could be caused by lowering the aquifer surface in offsite wells, surface water bodies, and habitat that is reliant on existing groundwater conditions. In order to evaluate the potential for negative groundwater resource impacts as a result of the alternatives on the HR Site, AEG has calculated the drop in groundwater surface at the following locations:

- The nearest Site boundary
- The nearest offsite well located in this investigation
- The nearest point on the Cosumnes River (closest surface water way to pumping well)

To determine the location of the nearest offsite well, AEG requested logs of nearby wells from the DWR and reviewed online databases with well location information. AEG received logs for numerous domestic, agricultural/irrigation, and monitoring/observation wells in the vicinity of the HR Site and reviewed the logs of wells found to be within approximately one mile of the HR Site. The majority of the wells are located to the south and east of the HR Site, with a cluster of domestic wells located immediately west of the HR Site. Very few wells were identified to the north of the HR Site, likely due to most of this area being a flood plain. The vast majority of the identified wells were reported to be for domestic use. One public supply well was identified and is located to the southeast of the HR Site.

According to the logs received by AEG, and wells observed during a site inspection, there are wells within 200 feet of the western and eastern HR Site boundaries, and within 600 feet of the southern Site boundary. AEG didn't identify any wells between the northern Site boundary and the Cosumnes River, and the closest well to the north appears (unconfirmed location) to be approximately 1,300 feet from the Site boundary. It is unlikely this well would be effected by groundwater drawdown on the HR Site due to the groundwater recharge caused by the Cosumnes River.

Based on the wells AEG was able to identify, and the documents AEG reviewed, it is likely that all of the residences, and most of the structures, in the vicinity of the HR Site are supplied by private wells.

AEG has used wells AG-1 and AG-2 as the assumed water supply wells for this evaluation. As the proposed development would be located in the center of the HR Site, any new well would likely be installed close to the HR Site's perimeter. Additionally, these two locations provide an analysis of a point further from the river, but closer to nearby domestic wells and a point further from the nearby domestic wells, but closer to the river. Therefore, using these wells will provide a representative evaluation of large areas of the HR Site that could be used for future well installation.

Shown below are the distances AEG used while evaluating groundwater resource impacts.

- AG-1 to Site boundary: 150 feet
- AG-1 to nearest offsite production well (name unknown): 850 feet
- AG-1 to Cosumnes River: 1,600 feet
- AG-2 to Site boundary: 100 feet
- AG-2 to nearest offsite production well (DWR #87669): 1,400 feet
- AG-2 to Cosumnes River: 400 feet

AEG utilized the Theis Solution to calculate an approximate drawdown (Ref M - Charles, Page 215) at the locations discussed above (see **Eq. 6.1**).

$$s = \frac{114.6Q}{KY} W(u) \quad (6.1)$$

Where:

s = Drawdown at the point of measurement (ft)
Y = Average aquifer thickness (ft)
Q = Pumping rate (gpm)
K = Average permeability of Aquifer (gpd/ft^2)
W(u) = Well function, based on the value of u

The term u is a unitless parameter defined by **Equation 6.2**.

$$u = \frac{1.87r^2S}{KYt} \quad (6.2)$$

Where:

r = Distance from the pumped well to the point of observation (ft)
S = Average specific yield of aquifer
t = Time since pumping started (days)

For the drawdown calculations, AEG estimated the values of aquifer thickness, specific yield, time, and permeability based on reference documents that provided generalized regional values.

- Average aquifer thickness (Y) was estimated to be 700 feet based on common well depths in the vicinity of the HR Site and corroborated using the USGS Ground-Water Flow in the Central Valley, California (Ref A - Alex, Page D114). Because the depth of the water bearing strata is significantly deeper than wells in the vicinity of the HR Site, AEG used a thickness that corresponds to the zone commonly accessed by wells, rather than the total depth of the aquifer (which causes the calculation to be more conservative). Domestic and agricultural/irrigation wells typically have total depths in the 150 to 350 feet range, with a few wells identified with depths around 450 feet. The public supply well identified by AEG has a total depth of 595 feet.

- Average specific yield of aquifer (S) was estimated to be 0.07 (7%) based on California's Groundwater Bulletin 118 (Ref D - California, Page 2) and the USGS Ground-Water Flow in the Central Valley, California (Ref A - Alex, Page D114). Additionally, 0.07 falls within the typical range of S values for sandy clay.

- Time (t) was estimated to be three years (1095 days) based on Drought in California (Ref F - California, Page, 4) and a review of precipitation data collected at the Sacramento FAA Airport (Ref BB - Western, Website). This three year period is based on the average drought duration found in the vicinity of the HR Site.

- Average permeability of aquifer (K) was estimated to be 1.8 ft/d ($6.4E^{-4}$ cm/s or 13 gpd/ft^2) for wells 1,000 feet deep based on the USGS Ground-Water Flow in the Central Valley, California (Ref A - Alex, Page D114). Due to the high number of alternating layers of fine and coarse grain materials beneath the HR Site, these permeability values were estimated to represent the composite material making up the aquifer, rather than representing a specific layer(s) within the aquifer.

AEG assumed all of the proposed development's water would be supplied by a single well, which provides for a more conservative analysis.

It should be noted, the effects of the change in groundwater elevation across the HR Site due to the Cosumnes River were not accounted for in these calculations; therefore, it is possible a water supply well located near the Cosumnes River will behave differently than these calculation have predicted. An extensive field investigation would be required to properly model groundwater conditions at the HR Site to account for the effects of the Cosumnes River.

The Theis Solution makes several assumptions not met by the HR Site for this evaluation; however, according to U.S. Department of the Interior Bureau of Reclamation (DOI) *Ground Water Manual* (Ref Z - U.S., Page 145), the errors introduced by the Theis Solution, when assumptions are not met, are minor when the pumped well's drawdown is less than 25% of the aquifer thickness. To determine if the proposed increase in pumping would increase the drawdown to greater than 25% of the aquifer thickness and thus make the use of the Theis Solution invalid, AEG calculated the drawdown using the highest flow rate estimated for the HR Site project alternatives (251 gpm from Alternative D). For 251 gpm, a total drawdown of approximately 59.9 feet (or approximately 9% of the average aquifer thickness of 700 ft used in the calculations) is calculated at the pumped well.

During this evaluation, AEG calculated the drawdown at the closest Site boundary, closest offsite well, and the Cosumnes River relative to the pumping location. Additionally, AEG calculated the distance to three feet of drawdown. A summary of the drawdown calculation results is shown in **Table 6-2** and copies of the drawdown calculations are included in **Appendix B**. For this evaluation, AEG considered any additional drawdown greater than three feet to be a significant impact.

TABLE 6-2
Groundwater Drawdown Calculation Results Summary for Historic Rancheria Site

	Project Alternative	
	D	E
Description	Casino	Reduced Intensity Casino
Flow Rate Input (gpm)	251	184
Distance to 3' of Drawdown (feet)	4,640	3,740
Pumping and Reference Locations		
Drawdown at Pumped Well	59.9	43.9
AG-1 to Closest Site Boundary	23.9	17.5
AG-1 to Closest Domestic Well	12.9	9.5
AG-1 to Cosumnes River	9.0	6.6
AG-2 to Closest Site Boundary	26.4	19.4
AG-2 to Closest Domestic Well	9.8	7.2
AG-2 to Cosumnes River	17.7	13.0

Based on the results shown in **Table 6-2**, the estimated water use for both project alternatives for the HR Site will cause significant groundwater drawdown in each of the pumping and reference locations evaluated.

As a onsite WWTP will likely be required for the proposed development, AEG has assumed that a significant portion of the groundwater used by the proposed development will be treated onsite and returned to the aquifer or a surface water channel. By assuming 80% of the groundwater used by the proposed development is returned to the natural water system, net water use rates of 51 gpm and 37 gpm can be calculated for project alternatives D and E, respectively. A summary of the drawdown calculation results using these flow rate inputs is shown in **Table 6-3**.

TABLE 6-3
Net Groundwater Drawdown Calculation Results Summary for Historic Rancheria Site

	Project Alternative	
	D	E
Description	Casino	Reduced Intensity Casino
Net Flow Rate Input (gpm)	51	37
Distance to 3' of Drawdown (feet)	635	262
Pumping and Reference Locations	Drawdown at Reference Location (feet)	
AG-1 to Closest Site Boundary	4.9	3.5
AG-1 to Closest Domestic Well	2.6	1.9
AG-1 to Cosumnes River	1.8	1.3
AG-2 to Closest Site Boundary	5.4	3.9
AG-2 to Closest Domestic Well	2.0	1.5
AG-2 to Cosumnes River	3.6	2.6

Note: These drawdown values are based on the assumption that the treated water would be returned to the aquifer in the same location as groundwater is being pumped from the aquifer, which is very unlikely to happen. It is much more likely that groundwater will be pumped from one side of the HR Site and treated water will be returned to the other side of the HR Site. Therefore, these values are less likely to accurately represent conditions that would exist on the HR Site than other drawdown values included in this evaluation. The values in this table are meant to be used as a comparative reference, not as an accurate representation of what Site conditions would likely be.

Based on the results shown in **Table 6-3**, the net estimated water use for both project alternatives for the HR Site will still cause significant groundwater drawdown in at least one of the pumping and reference locations evaluated; however, these effects will be significantly less than those caused by the full estimated water use rates.

When compared to the estimated current water use of the HR Site (4 gpm), the net water use of the proposed development is significantly higher; however, when compared to the estimated historic irrigation water use (140 gpm), the net water use of the proposed development is significantly lower. Based on the above discussion, the construction of the proposed development would cause more negative impacts to wells and surface water ways in the vicinity of the HR Site than the current residential water use at the HR Site, but less negative impacts to than if the HR Site resumes agricultural irrigation.

While the net water use of the proposed development would cause negative impacts to wells and surface water ways in the vicinity of the HR Site, the additional groundwater use would not create an overdraft effect, due to the relatively low water use rates. Based on the historical irrigation of the HR Site, which did not cause overdraft effects, historical pumping rates in the onsite wells that exceeded the net water use of the proposed development, did not cause overdraft of the Cosumnes Subbasin.

6.2.5 Summary of Major Evaluation Findings on the Historic Rancheria Site

- There is no localized groundwater drawdown in the vicinity of the HR Site (although the HR Site is at the edge of the drawdown area related to the City of Elk Grove) and the Cosumnes Subbasin as a whole is not considered to be in a state of overdraft.
- Groundwater beneath the HR Site is likely suitable for public supply use without treatment from a water quality perspective.
- The groundwater resources in the vicinity of the HR Site are adequate to support each of the proposed project alternatives.
- Construction of the proposed development will cause more negative impacts to wells and surface water ways in the vicinity of the HR Site than the current residential water use at the HR Site, but less negative impacts than if the HR Site resumes agricultural irrigation.
- The additional groundwater use would not create an overdraft effect in the Cosumnes Subbasin, due to the relatively low water use rates (when compared to historical irrigation water use).

6.2.6 Recommendations

In an effort to mitigate the impact to wells within 635 feet of the HR Site and the Cosumnes River, AEG recommends offsetting the groundwater drawdown effect prior to the construction of the proposed development to the extent feasible (ex. start a groundwater recharge program associated with the development). Additionally, AEG recommends onsite features be implemented in the development design to lessen or eliminate the effects of groundwater drawdown on the Cosumnes River (ex. placing the development supply well on the south side of the HR Site and discharging the WWTP effluent on the north side of the HR Site).

As any reduction in water use at the HR Site will reduce the range and magnitude of the drawdown effects, AEG recommends additional water conservation methods be implemented to the extent feasible.

7.0 REFERENCES

A. Alex Williamson, David Prudic, and Lindsay Swain. Ground-Water Flow in the Central Valley, California U.S. Geological Survey Professional Paper 1401-D, 1989.

B. Analytical Environmental Services. EIS Scoping Report, Wilton Rancheria, Fee-to-Trust and Casino Project February 2014.

C. Ascent Environmental Inc. City of Galt Wastewater Treatment Plant Facilities Master Plan and Immediate Improvements Project May 1, 2013.

D. California Department of Water Resources. California's Groundwater Bulletin 118, San Joaquin Valley Groundwater Basin, Cosumnes Subbasin February 3, 2006.

E. California Department of Water Resources. Crop Water Use in California Bulletin 113-4, April 1986.

F. California Department of Water Resources. Drought in California Fall 2012.

G. California Department of Water Resources. Evaluation of Ground Water Resources: Sacramento County, Bulletin No. 118-3 July 1974 (reprinted April 1980).

H. California Department of Water Resources. Water Data Library Online Database, Accessed February 28, 2014, http://www.water.ca.gov/waterdatalibrary/.

I. California Envioronmental Data Exchange Network (CEDEN) Online Database, Accessed March 3, 2014, http://www.ceden.us/AdvancedQueryTool.

J. California State Water Resources Control Board. Geotracker Gama Online Database, Accessed March 17,2014, http://geotracker.waterboards.ca.gov/gama/gamamap/public/?CMD=runreport&myaddress=wilton%2Cca.

K. Carollo Engineers. City of Galt 2010 Urban Water Management Plan February 2013.

L. Central Sacramento County Groundwater Management Plan February 2006.

M. Charles R. Fitts. Groundwater Science New York: Academic Press, 2002.

N. City of Galt, Public Works Department. Annual Drinking Water Quality Report - 2012 June 2013.

O. David Sawyer. RE: Wilton Rancheria Casino - Additional Questions Analytical Environmental Services, Email, March 20, 2014.

P. David Sawyer. Wilton Rancheria EIS - Hotel Room #s Analytical Environmental Services, Email, May 28, 2014.

Q. David Zweig. Wilton Water Analytical Environmental Services, Email, February 27, 2015.

R. Draft Environmental Impact Report for the 2030 Galt General Plan July 2008.

S. Dunn Environmental, Inc. Fourth Quarter 2013 Ground Water Monitoring and Ground Water Quality Assessment Report for the City of Galt Wastewater Treatment Plant and Reclamation Facility, Revision 0 January 2014.

T. Katherine Green. RE: Wilton Rancheria - ADEIS Comments Analytical Environmental Services, Email, June 12, 2015.

U. Michael Coffey, Property Owner. Personal Interview. February 25, 2014.

V. Sacramento Central Groundwater Authority. 2009-2010 Basin Management Report.

W. Sacramento County, Department of Environmental Review and Assessment. Final Environmental Impact Report, Sacramento County General Plan Update April 2010

X. Sacramento County, Department of Water Resources, Ground Water Elevation Contour Maps. Sacramento County, California Groundwater Elevations Spring 2007 Accessed February 28, 2014, http://www.waterresources.saccounty.net/Pages/ContourMaps.aspx.

Y. Tom Farrell. Email with Questions and Answers Asked of Jim Pellandini February 21, 2014.

Z. U.S. Department of the Interior Bureau of Reclamation. Ground Water Manual, A Water Resources Technical Publication New York: Wiley-Interscience Publication, 1977 (Second Edition 1995).

AA. U.S. Geological Survey. Groundwater Availability of the Central Valley Aquifer, California Professional Paper 1766, 2009.

BB. Western Regional Climate Center. Sacramento FAA Arpt, California Monthly Total Precipitation (inches) Online Database, http://www.wrcc.dri.edu/cgi-bin/cliMONtpre.pl?ca7630 Accessed March 18, 2014.

CC. William DeOreo and others. California Single-Family Water Use Efficiency Study Aquacraft Water Engineering & Management, June 1, 2011.

8.0 STATEMENT OF LIABILITY

This *Evaluation of Groundwater Supply Feasibility and Potential Impacts to Groundwater Quality and Resources* (Evaluation) was prepared by Applied Engineering and Geology, Inc. (AEG), at the request of Analytical Environmental Services (Client). This Evaluation was prepared using the degree of care and skill ordinarily exercised, under similar circumstances, by reputable engineers, geologists, and scientists practicing in this or similar localities in California at the time this Evaluation was prepared.

No other warranty, expressed or implied, is made as to the information and professional advice included in this Evaluation. Any reliance on this Evaluation by third parties shall be at such parties' sole risk.

AEG's Evaluation is based on factual information obtained from AES, Federal, Tribal, State, and local agencies, and others that has been assumed to be correct, accurate, and complete. Applied Engineering and Geology, Inc., does not guarantee the correctness, accuracy, or completeness of those data.

There were a number of instances where AEG was not able to obtain site specific data for the analysis performed in this Report. In these instances, AEG utilized indirect methods to estimate likely values for the missing data, or used regional or generalized data to fill in the gaps. AEG's analysis, findings, and recommendations are based on these estimated, regional, and generalized data and may not reflect actual conditions at the TC Site and HR Site.

All work performed by AEG was performed under the direct supervision of the engineer, registered with the State of California, whose signature appears at the end of this document.

Should you have any questions regarding the content of this Evaluation, please contact the undersigned at 916.645.6014.

Sincerely,

APPLIED ENGINEERING AND GEOLOGY, INC.

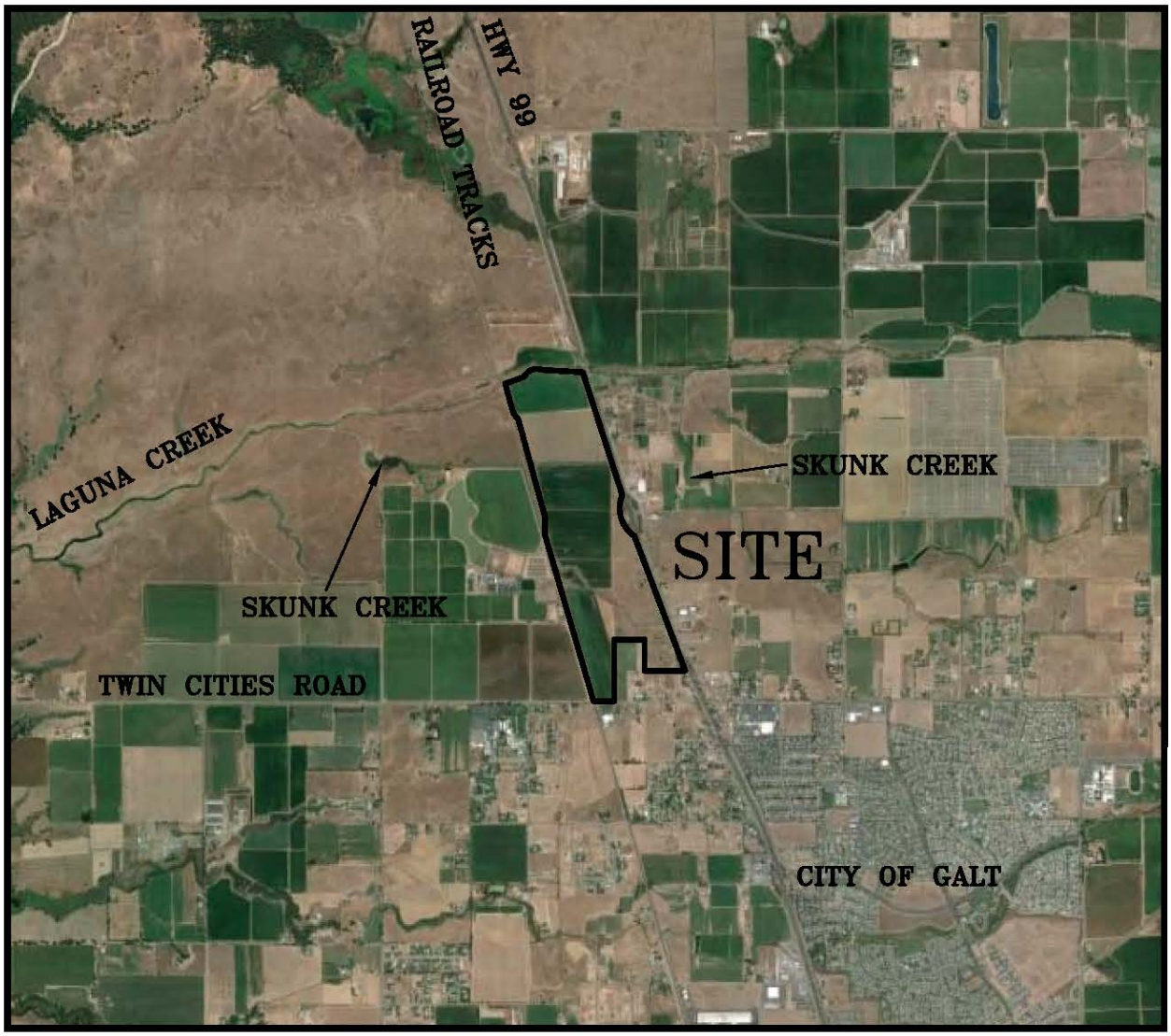
Dane Frank
Project Manager

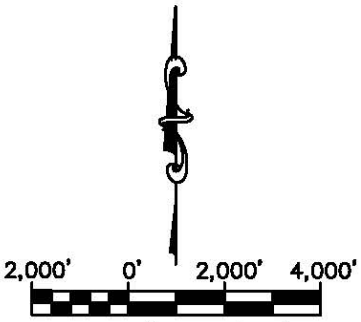
Earl R. Stephens, RCE 45335
Principal Engineer

N:\Everyone\AEG Documents\Wilton Rancheria\R - Wilton Rancheria Water Use Evaluation (6th draft).wpd

Appendix A

Figures





SCALE 1"=4,000' +/-
FEBRUARY 26, 2014

NOT TO SCALE

N:\EVERYONE\AEG DOCUMENTS\WILTON RANCHERIA\FIGURE - TWIN CITIES VICINITY MAP.DWG (61)

APPLIED ENGINEERING AND GEOLOGY, INC.
Engineers • Environmental Assessors • Geologists
P.O. BOX 247 LINCOLN, CA 95648
P: (916) 645.6014 aegEngineers.com

TWIN CITIES SITE VICINITY MAP
WILTON RANCHERIA CASINO PROJECT
TWIN CITIES ROAD AND HIGHWAY 99
GALT, SACRAMENTO COUNTY, CALIFORNIA

APPROVAL	DATE

FIGURE 1

500' 0' 500' 1000'

SCALE 1"=1,000'

LEGEND

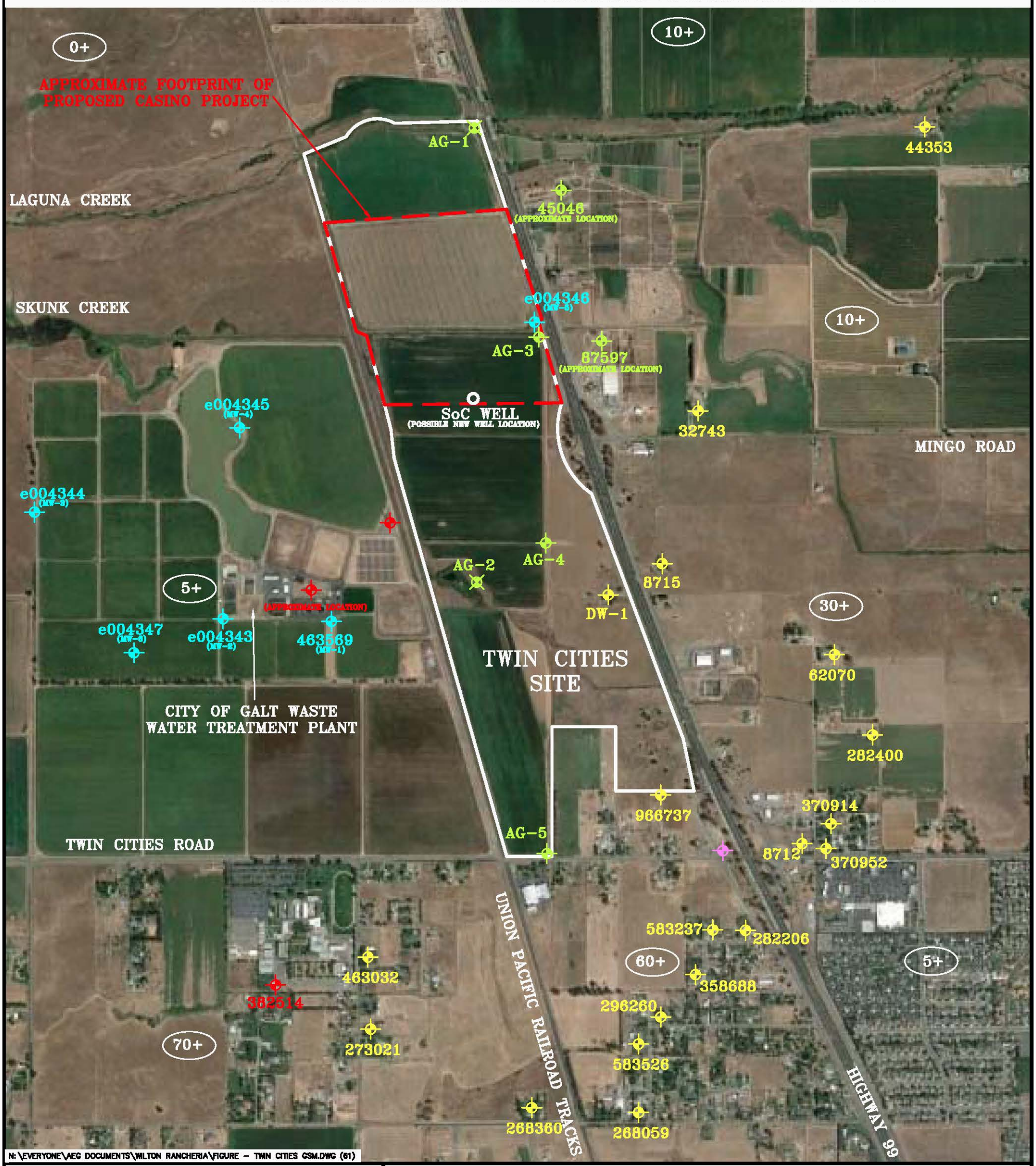
APPROXIMATE LOCATION OF WELL LOCATED BY AEG, PINK = UNKNOWN USE, BLUE = MONITORING WELL, GREEN = AGRICULTURAL/IRRIGATION USE, YELLOW = RESIDENTIAL USE, RED = PUBLIC USE, NUMERICAL WELL NAMES ARE FROM THE CALIFORNIA DEPARTMENT OF WATER RESOURCES WELL COMPLETION REPORTS, NON-NUMERICAL WELLS NAMES WERE CREATED BY AEG, WELL NAMES IN PARENTHESIS ARE ADDITIONAL NAMES A WELL IS KNOWN BY, SOME WELLS ARE NOT NAMED BECAUSE AEG COULD NOT IDENTIFY A NAME OR WAS UNABLE TO CONFIRM THE CORRECT NAME.

APPROXIMATE LOCATION OF AGRICULTURAL SUMP LOCATED BY AEG, NAMES WERE CREATED BY AEG

##+ APPROXIMATE SCALE OF NUMBER OF WELLS IN THE AREA AROUND THE ICON. THIS NUMBER IS NOT MEANT TO REPRESENT THE ACTUAL NUMBER OF WELLS IDENTIFIED IN AN AREA, BUT TO PROVIDE A ROUGH ESTIMATE TO THE NUMBER OF WELLS LIKELY TO EXIST IN AN AREA.

NOTES

1. THE BACKGROUND IMAGE IS DATED AUGUST 13, 2013 AND MAY NOT REPRESENT CURRENT SITE CONDITIONS.
2. ALL FEATURE LOCATIONS ARE APPROXIMATE.
3. ONLY SELECT WELLS ARE SHOWN.
4. SEVERAL WELLS COULD ONLY BE LOCATED TO BE ON A SPECIFIC PROPERTY, RATHER THAN AT A SPECIFIC LOCATION. WHEN THIS OCCURRED, AEG SHOWED THE WELL LOCATION AS THE CENTER OF THE LARGEST BUILDING ON THE PROPERTY OR LABELED THE WELL LOCATION AS APPROXIMATE.
5. AEG HAS NOT IDENTIFIED (OR SHOWN) ALL OF THE WELLS IN THE VICINITY OF THE SITE. BASED ON THE WELLS AEG HAS IDENTIFIED AND THE DOCUMENTS REVIEWED, IT IS LIKELY THAT EVERY RESIDENCE, AND MOST STRUCTURES, OUTSIDE THE GALT CITY LIMITS IS SUPPLIED BY A PRIVATE WELL.



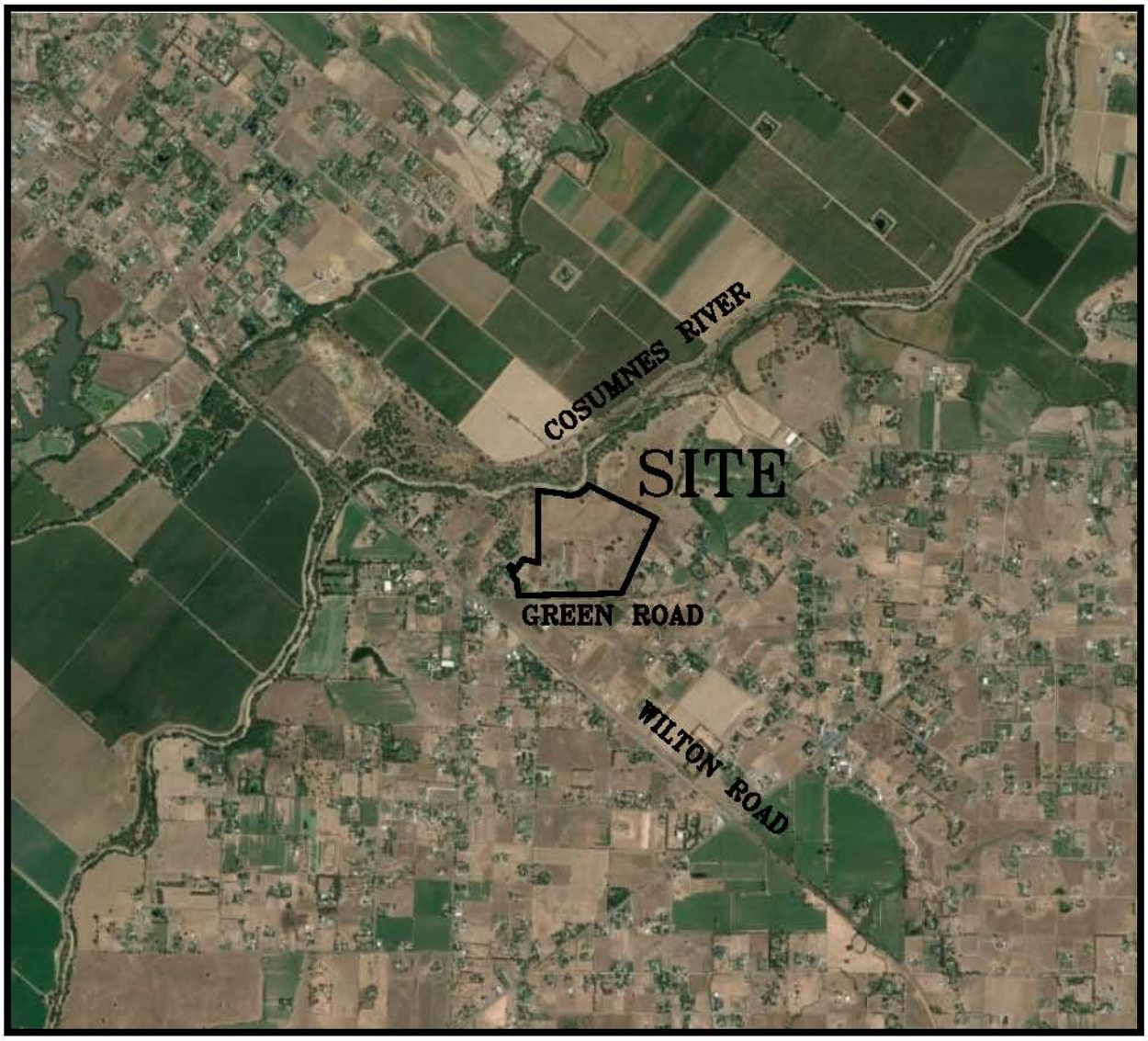
APPLIED ENGINEERING AND GEOLOGY, INC.
Engineers • Environmental Assessors • Geologists
P.O. BOX 247 LINCOLN, CA 95648
P: (916) 645.6014 aegEngineers.com

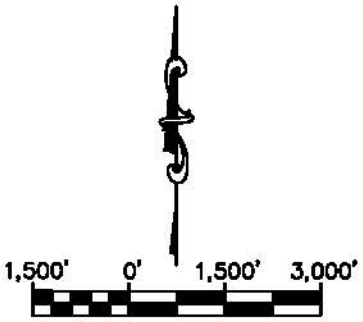
TWIN CITIES SITE GENERALIZED MAP
WILTON RANCHERIA CASINO PROJECT

TWIN CITIES ROAD AND HIGHWAY 99
GALT, SACRAMENTO COUNTY, CALIFORNIA

APPROVAL	DATE

FIGURE 2





SCALE 1" 3,000' +/-
FEBRUARY 26, 2014

NOT TO SCALE

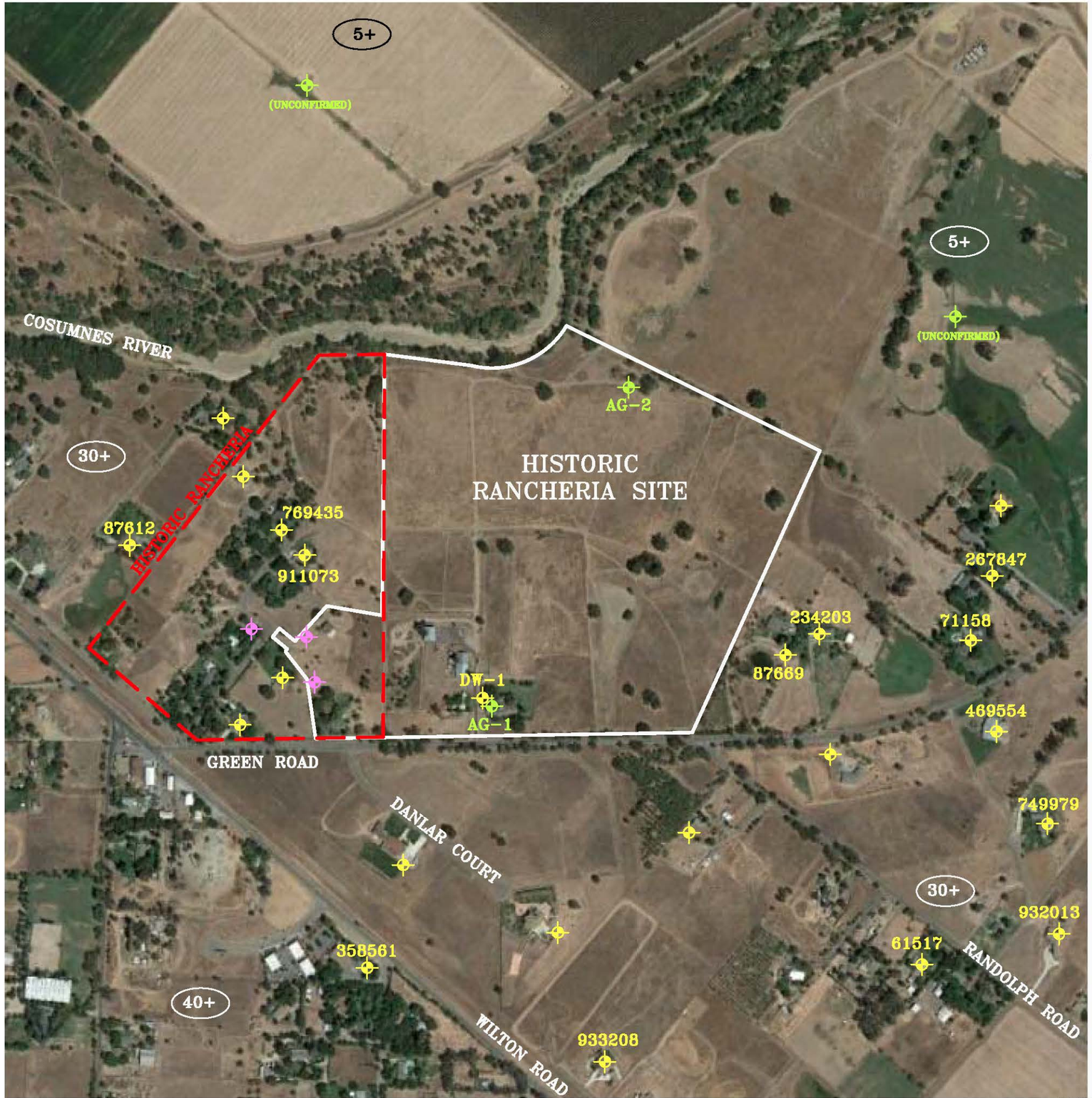
N:\EVERYONE\AEG DOCUMENTS\WILTON RANCHERIA\FIGURE - HISTORIC RANCHERIA VICINITY MAP.DWG (61)

APPLIED ENGINEERING AND GEOLOGY, INC.
Engineers • Environmental Assessors • Geologists
P.O. BOX 247 LINCOLN, CA 95648
P: (916) 645.6014 aegEngineers.com

HISTORIC RANCHERIA SITE VICINITY MAP
WILTON RANCHERIA CASINO PROJECT
WILTON ROAD AND GREEN ROAD
WILTON, SACRAMENTO COUNTY, CALIFORNIA

APPROVAL	DATE

FIGURE 3



LEGEND

APPROXIMATE LOCATION OF WELL LOCATED BY AEG, PINK = UNKNOWN USE, BLUE = MONITORING WELL, GREEN = AGRICULTURAL/IRRIGATION USE, YELLOW = RESIDENTIAL USE, RED = PUBLIC USE, NUMERICAL WELL NAMES ARE FROM THE CALIFORNIA DEPARTMENT OF WATER RESOURCES WELL COMPLETION REPORTS, NON-NUMERICAL WELLS NAMES WERE CREATED BY AEG, WELL NAMES IN PARENTHESIS ARE ADDITIONAL NAMES A WELL IS KNOWN BY, SOME WELLS ARE NOT NAMED BECAUSE AEG COULD NOT IDENTIFY A NAME OR WAS UNABLE TO CONFIRM THE CORRECT NAME.

##+ APPROXIMATE SCALE OF NUMBER OF WELLS IN THE AREA AROUND THE ICON. THIS NUMBER IS NOT MEANT TO REPRESENT THE ACTUAL NUMBER OF WELLS IDENTIFIED IN AN AREA, BUT TO PROVIDE A ROUGH ESTIMATE TO THE NUMBER OF WELLS LIKELY TO EXIST IN AN AREA.

NOTES

1. THE BACKGROUND IMAGE IS DATED AUGUST 10, 2013 AND MAY NOT REPRESENT CURRENT SITE CONDITIONS.
2. ALL FEATURE LOCATIONS ARE APPROXIMATE.
3. ONLY SELECT WELLS ARE SHOWN.
4. SEVERAL WELLS COULD ONLY BE LOCATED TO BE ON A SPECIFIC PROPERTY, RATHER THAN AT A SPECIFIC LOCATION. WHEN THIS OCCURRED, AEG SHOWED THE WELL LOCATION AS THE CENTER OF THE LARGEST BUILDING ON THE PROPERTY.
5. AEG HAS NOT IDENTIFIED (OR SHOWN) ALL OF THE WELLS IN THE VICINITY OF THE SITE. BASED ON THE WELLS AEG HAS IDENTIFIED AND THE DOCUMENTS REVIEWED, IT IS LIKELY THAT EVERY RESIDENCE, AND MOST STRUCTURES, IN THE VICINITY OF THE SITE IS SUPPLIED BY A PRIVATE WELL.

250' 0' 250' 500'

SCALE 1"=500'

N:\EVERYONE\AEG DOCUMENTS\WILTON RANCHERIA\FIGURE - HISTORIC RANCHERIA GSM.DWG (61)

HISTORIC RANCHERIA SITE GENERALIZED MAP
WILTON RANCHERIA CASINO PROJECT
WILTON ROAD AND GREEN ROAD
WILTON, SACRAMENTO COUNTY, CALIFORNIA

APPROVAL	DATE

FIGURE 4

APPLIED ENGINEERING AND GEOLOGY, INC.
Engineers • Environmental Assessors • Geologists
P.O. BOX 247 LINCOLN, CA 95648
P: (916) 645.6014 aegEngineers.com

Appendix B

Drawdown Calculations

Wilton Rancheria - Twin Cities Site

Dane Frank

7/1/2015

Casino Water Demand (values are working estimates)

Based on Data from Katherine Green's (AES) Email, RE: Wilton Rancheria - ADEIS, dated June 12, 2015

Twin Cities Site Alternatives (A, B, and C)

Alternative	Gallons per Minute (gpm)	Gallons per Day (gpd)	Gallons per Week (gpw)	Gallons per Month (gpM)	Gallons per Year (gpY)
A - Full Casino	205	295,000	2.07E+06	8.85E+06	1.08E+08
B - Reduced Casino	158	227,000	1.59E+06	6.81E+06	8.29E+07
C - Retail Development	110	158,000	1.11E+06	4.74E+06	5.77E+07

= provided to AEG

= calculated by AEG

N:\Everyone\AEG Documents\Wilton Rancheria\SS - Wilton Rancheria Twin Cities Site Drawdown Calcs.xls

Wilton Rancheria - Twin Cities Site
Drawdown Calculations - References
Dane Frank
3/18/2014

Notes: Using generalized parameters from Cosumnes Subbasin and California Central Valley
Wells in vicinity of Site show many alternating layers of fine and coarse materials, modeling soils as a single composite material, rather than using individual layers
Depth to bedrock is unknown and very deep, aquifer thickness/saturated thickness is based on common well depth in the vicinity of the Site
Assuming well AG-3 or new well will be used for the Casino water supply

K =	gpd/ft^2	Average Permeability (aka hydraulic conductivity)
Y =	feet	Saturated Thickness
r =	feet	distance to point of drawdown measurement
S =	NA	Specific Yield
t =	days	time since pumping started

K: For wells of 1000' and less, K = 2.6 ft/d = 9.2×10^{-4} cm/s = 20 gpd/ft^2
For wells of more than 1000', K = 1.3 ft/d = 4.6×10^{-4} cm/s = 10 gpd/ft^2

Y: For domestic/agricultural/irrigation wells, Y = 700' (most wells range from 100' to 800' deep)
For shallow public supply wells, Y = 1000' (based on City of Galt wells)
For deep public supply wells, Y = 1700' (based on City of Galt wells)

r: (from AG-3) Site boundary is ~25' from AG-3 (exact location of property line unknown, measuring to edge of asphalt)
DWR #87597 is ~ 650' from AG-3 (best guess location of 87597)
Laguna Creek is ~2000' from AG-3
Distances are based on DWR log locations (approximate) that were plotted on Google Earth
Site boundary is ~850'

r: (from south center edge of proposed casino) DWR #87597 is ~ 1450' (best guess location of 87597)
Laguna Creek is ~2700'
Distances are based on DWR log locations (approximate) that were plotted on Google Earth

S: Using value of 0.07 (7%) based on Ground-Water Flow in the Central Valley, California (USGS) and California's Groundwater Bulletin 118, Cosumnes Subbasin . 0.07 falls within the typical range of S values for sandy clay.

t: Using 3 years (1095 days), based on Drought in California (CA DWR) and Sacramento Region yearly precipitation data review. Drought durations found from 1 to 7 years, with 2 to 3 years being the average durations (drought year = year with below average precipitation).

N:\Everyone\AEG Documents\Wilton Rancheria\SS - Wilton Rancheria Twin Cities Site Drawdown Calcs.xls

Wilton Rancheria - Twin Cities Site								
Drawdown Calculations - Closest Site Boundary to AG-3								
Dane Frank								
3/18/2014								
Eastern Site boundary								
Note: exact location of property line is unknown, meauring to edge of asphalt								
		Theis Non-leaky Aquifer Solution						
s = W(u) (114.6Q / KY)			**Symbol**	**Units**	**Description**			
			s =	feet	Drawdown			
Symbol	**Value**	**Units**	Q =	gpm	Flowrate			
s =	28.40	feet	K =	gpd/ft^2	Average Permeability			
Q =	300	gpm	Y =	feet	Saturated Thickness			
n =	0.04	NA	W(u) =	NA	Well Function			
			r =	feet	distance to point of drawdown measurement			
			S =	NA	Specific Yield			
			t =	days	time since pumping started			
			n =	NA	Drawdown / Aquifer Thickness			
W(u) = -0.5772 - ln(u) + (u^1 / 1*1!) - (u^2 / 2*2!) + (u^3 / 3*3!) - (u^4 / 4*4!)...								
X	**(u^x / x*x!)**			**u = 1.87r^{2}S / Kmt**		**Units**		
1	5.33676E-06							
2	7.12025E-12		K =	20		gpd/ft^2		
3	8.44423E-18		Y =	700		feet		
4	8.44965E-24		r =	25		feet		
5	7.215E-30		S =	0.07		NA		
6	5.34788E-36		t =	1095		days		
7	3.49473E-42		u =	5.33676E-06		NA		
8	2.0399E-48		ln(u) =	-12.1408922		NA		
9	1.07521E-54		W(u) =	11.56369754		NA		
10	5.16431E-61							
11	2.27774E-67							
12	9.28564E-74							
13	3.51871E-80		N:\Everyone\AEG Documents\Wilton Rancheria\SS - Wilton Rancheria Twin Cities Site Drawsown Calcs.xls					
14	1.24551E-86							
15	4.13592E-93			= input		= output		

Wilton Rancheria - Twin Cities Site								
Drawdown Calculations - Closest Off-Site Domestic Well to AG-3								
Dane Frank								
3/18/2014								
Well: DWR #87597 - East of AG-3								
Note: Location of well (and distance to well) is approximate								
		Theis Non-leaky Aquifer Solution						
s = W(u) (114.6Q / KY)			**Symbol**	**Units**	**Description**			
			s =	feet	Drawdown			
Symbol	**Value**	**Units**	Q =	gpm	Flowrate			
s =	12.40	feet	K =	gpd/ft^2	Average Permeability			
Q =	300	gpm	Y =	feet	Saturated Thickness			
n =	0.02	NA	W(u) =	NA	Well Function			
			r =	feet	distance to point of drawdown measurement			
			S =	NA	Specific Yield			
			t =	days	time since pumping started			
			n =	NA	Drawdown / Aquifer Thickness			
W(u) = -0.5772 - ln(u) + (u^1 / 1*1!) - (u^2 / 2*2!) + (u^3 / 3*3!) - (u^4 / 4*4!)...								
X	**(u^x / x*x!)**			**u = 1.87r^{2}S / Kmt**		**Units**		
1	0.003607648							
2	3.25378E-06		K =	20		gpd/ft^2		
3	2.60856E-09		Y =	700		feet		
4	1.76452E-12		r =	650		feet		
5	1.01852E-15		S =	0.07		NA		
6	5.10342E-19		t =	1095		days		
7	2.25445E-22		u =	0.003607648		NA		
8	8.89576E-26		ln(u) =	-5.62469913		NA		
9	3.16966E-29		W(u) =	5.051103528		NA		
10	1.02915E-32							
11	3.06844E-36							
12	8.45614E-40							
13	2.16616E-43		N:\Everyone\AEG Documents\Wilton Rancheria\SS - Wilton Rancheria Twin Cities Site Drawsown Calcs.xls					
14	5.18325E-47							
15	1.16352E-50			= input		= output		

Wilton Rancheria - Twin Cities Site								
Drawdown Calculations - Laguna Creek from AG-3								
Dane Frank								
3/18/2014								
		Theis Non-leaky Aquifer Solution						
s = W(u) (114.6Q / KY)			**Symbol**	**Units**	**Description**			
			s =	feet	Drawdown			
Symbol	**Value**	**Units**	Q =	gpm	Flowrate			
s =	6.96	feet	K =	gpd/ft^2	Average Permeability			
Q =	300	gpm	Y =	feet	Saturated Thickness			
n =	0.01	NA	W(u) =	NA	Well Function			
			r =	feet	distance to point of drawdown measurement			
			S =	NA	Specific Yield			
			t =	days	time since pumping started			
			n =	NA	Drawdown / Aquifer Thickness			
W(u) = -0.5772 - ln(u) + (u^1 / 1*1!) - (u^2 / 2*2!) + (u^3 / 3*3!) - (u^4 / 4*4!)...								
X	**(u^x / x*x!)**			**u = 1.87r^{2}S / Kmt**		**Units**		
1	0.034155251							
2	0.000291645		K =	20		gpd/ft^2		
3	2.2136E-06		Y =	700		feet		
4	1.41762E-08		r =	2000		feet		
5	7.74705E-11		S =	0.07		NA		
6	3.67503E-13		t =	1095		days		
7	1.537E-15		u =	0.034155251		NA		
8	5.74182E-18		ln(u) =	-3.37683894		NA		
9	1.93692E-20		W(u) =	2.833504743		NA		
10	5.95404E-23							
11	1.68068E-25							
12	4.38502E-28							
13	1.06347E-30		N:\Everyone\AEG Documents\Wilton Rancheria\SS - Wilton Rancheria Twin Cities Site Drawsown Calcs.xls					
14	2.40918E-33							
15	5.12002E-36			= input		= output		

Wilton Rancheria - Twin Cities Site								
Drawdown Calculations - Closest Site Boundary to South Center of Proposed Casino								
Dane Frank								
3/18/2014								
Eastern Site boundary								
Note: exact location of property line is unknown, meauring to edge of asphalt								
		Theis Non-leaky Aquifer Solution						
s = W(u) (114.6Q / KY)			**Symbol**	**Units**	**Description**			
			s =	feet	Drawdown			
Symbol	**Value**	**Units**	Q =	gpm	Flowrate			
s =	11.09	feet	K =	gpd/ft^2	Average Permeability			
Q =	300	gpm	Y =	feet	Saturated Thickness			
n =	0.02	NA	W(u) =	NA	Well Function			
			r =	feet	distance to point of drawdown measurement			
			S =	NA	Specific Yield			
			t =	days	time since pumping started			
			n =	NA	Drawdown / Aquifer Thickness			
W(u) = -0.5772 - ln(u) + (u^1 / 1*1!) - (u^2 / 2*2!) + (u^3 / 3*3!) - (u^4 / 4*4!)...								
X	**(u^x / x*x!)**			**u = 1.87r^{2}S / Kmt**		**Units**		
1	0.006169292							
2	9.51504E-06		K =	20		gpd/ft^2		
3	1.30447E-08		Y =	700		feet		
4	1.50893E-11		r =	850		feet		
5	1.48945E-14		S =	0.07		NA		
6	1.27623E-17		t =	1095		days		
7	9.64093E-21		u =	0.006169292		NA		
8	6.50537E-24		ln(u) =	-5.08817116		NA		
9	3.96381E-27		W(u) =	4.517130948		NA		
10	2.20085E-30							
11	1.12212E-33							
12	5.28818E-37							
13	2.31652E-40		N:\Everyone\AEG Documents\Wilton Rancheria\SS - Wilton Rancheria Twin Cities Site Drawsown Calcs.xls					
14	9.47891E-44							
15	3.63864E-47			= input		= output		

Wilton Rancheria - Twin Cities Site								
Drawdown Calculations - Closest Off-Site Domestic Well to South Center of Proposed Casino								
Dane Frank								
3/18/2014								
Well: DWR #87597 - East of south center of proposed casino								
Note: Location of well (and distance to well) is approximate								
		Theis Non-leaky Aquifer Solution						
s = W(u) (114.6Q / KY)			**Symbol**	**Units**	**Description**			
			s =	feet	Drawdown			
Symbol	**Value**	**Units**	Q =	gpm	Flowrate			
s =	8.50	feet	K =	gpd/ft^2	Average Permeability			
Q =	300	gpm	Y =	feet	Saturated Thickness			
n =	0.01	NA	W(u) =	NA	Well Function			
			r =	feet	distance to point of drawdown measurement			
			S =	NA	Specific Yield			
			t =	days	time since pumping started			
			n =	NA	Drawdown / Aquifer Thickness			
W(u) = -0.5772 - ln(u) + (u^1 / 1*1!) - (u^2 / 2*2!) + (u^3 / 3*3!) - (u^4 / 4*4!)...								
X	**(u^x / x*x!)**			**u = 1.87r^{2}S / Kmt**		**Units**		
1	0.017952854							
2	8.05762E-05		K =	20		gpd/ft^2		
3	3.21461E-07		Y =	700		feet		
4	1.08209E-09		r =	1450		feet		
5	3.10825E-12		S =	0.07		NA		
6	7.75028E-15		t =	1095		days		
7	1.70375E-17		u =	0.017952854		NA		
8	3.34547E-20		ln(u) =	-4.02000619		NA		
9	5.93193E-23		W(u) =	3.460678784		NA		
10	9.58455E-26							
11	1.42207E-28							
12	1.95022E-31							
13	2.48606E-34		N:\Everyone\AEG Documents\Wilton Rancheria\SS - Wilton Rancheria Twin Cities Site Drawsown Calcs.xls					
14	2.96028E-37							
15	3.30683E-40			= input		= output		

Wilton Rancheria - Twin Cities Site								
Drawdown Calculations - Laguna Creek from South Center of Proposed Casino								
Dane Frank								
3/18/2014								
		Theis Non-leaky Aquifer Solution						
s =	**W(u) (114.6Q / KY)**		**Symbol**	**Units**	**Description**			
			s =	feet	Drawdown			
Symbol	**Value**	**Units**	Q =	gpm	Flowrate			
s =	5.55	feet	K =	gpd/ft^2	Average Permeability			
Q =	300	gpm	Y =	feet	Saturated Thickness			
n =	0.01	NA	W(u) =	NA	Well Function			
			r =	feet	distance to point of drawdown measurement			
			S =	NA	Specific Yield			
			t =	days	time since pumping started			
			n =	NA	Drawdown / Aquifer Thickness			
W(u) = -0.5772 - ln(u) + (u^1 / 1*1!) - (u^2 / 2*2!) + (u^3 / 3*3!) - (u^4 / 4*4!)...								
X	**(u^x / x*x!)**			**u = 1.87r^{2}S / Kmt**		**Units**		
1	0.062247945							
2	0.000968702		K =	20		gpd/ft^2		
3	1.33999E-05		Y =	700		feet		
4	1.56397E-07		r =	2700		feet		
5	1.55766E-09		S =	0.07		NA		
6	1.34669E-11		t =	1095		days		
7	1.02647E-13		u =	0.062247945		NA		
8	6.98859E-16		ln(u) =	-2.77662975		NA		
9	4.29655E-18		W(u) =	2.260722242		NA		
10	2.40706E-20							
11	1.2383E-22							
12	5.88819E-25							
13	2.60257E-27		N:\Everyone\AEG Documents\Wilton Rancheria\SS - Wilton Rancheria Twin Cities Site Drawsown Calcs.xls					
14	1.07452E-29							
15	4.16183E-32			= input		= output		

Wilton Rancheria - Twin Cities Site							
Drawdown Calculations - At Extraction Well							
Dane Frank							
3/18/2014							
		Theis Non-leaky Aquifer Solution					
s = W(u) (114.6Q / KY)			**Symbol**	**Units**	**Description**		
			s =	feet	Drawdown at point of measureme		
Symbol	**Value**	**Units**	Q =	gpm	Flowrate		
s =	47.61	feet	K =	gpd/ft^2	Average Permeability		
Q =	300	gpm	Y =	feet	Saturated Thickness		
n =	0.07	NA	W(u) =	NA	Well Function		
			r =	feet	Radius of Well		
			S =	NA	Specific Yield		
			t =	days	time since pumping started		
			n =	NA	Drawdown / Aquifer Thickness		
W(u) = -0.5772 - ln(u) + (u^1 / 1*1!) - (u^2 / 2*2!) + (u^3 / 3*3!) - (u^4 / 4*4!)...							
X	**(u^x / x*x!)**			**u = 1.87r^{2}S / Kmt**		**Units**	
1	2.1347E-09						
2	1.13924E-18		K =	20		gpd/ft^2	
3	5.40431E-28		Y =	700		feet	
4	2.16311E-37		r =	0.5		feet	
5	7.38816E-47		S =	0.07		NA	
6	2.19049E-56		t =	1095		days	
7	5.72577E-66		u =	2.13E-09		NA	
8	1.33687E-75		ln(u) =	-19.96494		NA	
9	2.81859E-85		W(u) =	19.38774		NA	
10	5.41517E-95						
11	9.5535E-105						
12	1.5579E-114						
13	2.3614E-124		N:\Everyone\AEG Documents\Wilton Rancheria\SS - Wilton Rancheria Twin Cities Site Drawsown Calcs.xls				
14	3.3434E-134						
15	4.4409E-144			= input		= output	

Wilton Rancheria - Twin Cities Site									
Drawdown Calculations - Distance to Three Feet of Drawdown									
Dane Frank									
7/10/2014									
			Theis Non-leaky Aquifer Solution						
s = W(u) (114.6Q / KY)			**Symbol**	**Units**	**Description**				
			s =	feet	Drawdown at point of measurement				
Symbol	**Value**	**Units**	Q =	gpm	Flowrate				
s =	3.00	feet	K =	gpd/ft^2	Average Permeability				
Q =	300	gpm	Y =	feet	Saturated Thickness				
n =	0.00	NA	W(u) =	NA	Well Function				
			r =	feet	distance from the well to point of drawdown measurement				
			S =	NA	Specific Yield				
			t =	days	time since pumping started				
			n =	NA	Drawdown / Aquifer Thickness				
W(u) = -0.5772 - ln(u) + (u^1 / 1*1!) - (u^2 / 2*2!) + (u^3 / 3*3!) - (u^4 / 4*4!)...									
X	**(u^x / x*x!)**			**u = 1.87r^{2}S / Kmt**		**Units**			
1	0.200026813								
2	0.010002681		K =	20		gpd/ft^2			
3	0.000444623		Y =	700		feet			
4	1.66756E-05		r =	4840		feet			
5	5.33691E-07		S =	0.07		NA			
6	1.48267E-08		t =	1095		days			
7	3.63152E-10		u =	0.20002681		NA			
8	7.94502E-12		ln(u) =	-1.6093039		NA			
9	1.5696E-13		W(u) =	1.22255646		NA			
10	2.82565E-15								
11	4.67113E-17								
12	7.13741E-19								
13	1.01373E-20		N:\Everyone\AEG Documents\Wilton Rancheria\SS - Wilton Rancheria Twin Cities Site Drawsown Calcs.xls						
14	1.34493E-22								
15	1.67391E-24			= input		= output			

Wilton Rancheria - Twin Cities Site								
Drawdown Calculations - Closest Site Boundary to AG-3								
Dane Frank								
7/1/2015								
Eastern Site boundary								
Note: exact location of property line is unknown, meauring to edge of asphalt								
			Theis Non-leaky Aquifer Solution					
s = W(u) (114.6Q / KY)			**Symbol**	**Units**	**Description**			
			s =	feet	Drawdown			
Symbol	**Value**	**Units**	Q =	gpm	Flowrate			
s =	19.40	feet	K =	gpd/ft^2	Average Permeability			
Q =	205	gpm	Y =	feet	Saturated Thickness			
n =	0.03	NA	W(u) =	NA	Well Function			
			r =	feet	distance to point of drawdown measurement			
			S =	NA	Specific Yield			
			t =	days	time since pumping started			
			n =	NA	Drawdown / Aquifer Thickness			
W(u) = -0.5772 - ln(u) + (u^1 / 1*1!) - (u^2 / 2*2!) + (u^3 / 3*3!) - (u^4 / 4*4!)...								
X	**(u^x / x*x!)**			**u = 1.87r^{2}S / Kmt**		**Units**		
1	5.33676E-06							
2	7.12025E-12		K =	20		gpd/ft^2		
3	8.44423E-18		Y =	700		feet		
4	8.44965E-24		r =	25		feet		
5	7.215E-30		S =	0.07		NA		
6	5.34788E-36		t =	1095		days		
7	3.49473E-42		u =	5.33676E-06		NA		
8	2.0399E-48		ln(u) =	-12.1408922		NA		
9	1.07521E-54		W(u) =	11.56369754		NA		
10	5.16431E-61							
11	2.27774E-67							
12	9.28564E-74							
13	3.51871E-80		N:\Everyone\AEG Documents\Wilton Rancheria\SS - Wilton Rancheria Twin Cities Site Drawsown Calcs.xls					
14	1.24551E-86							
15	4.13592E-93			= input		= output		

Wilton Rancheria - Twin Cities Site								
Drawdown Calculations - Closest Off-Site Domestic Well to AG-3								
Dane Frank								
7/1/2015								
Well: DWR #87597 - East of AG-3								
Note: Location of well (and distance to well) is approximate								
		Theis Non-leaky Aquifer Solution						
s = W(u) (114.6Q / KY)			**Symbol**	**Units**	**Description**			
			s =	feet	Drawdown			
Symbol	**Value**	**Units**	Q =	gpm	Flowrate			
s =	8.48	feet	K =	gpd/ft^2	Average Permeability			
Q =	205	gpm	Y =	feet	Saturated Thickness			
n =	0.01	NA	W(u) =	NA	Well Function			
			r =	feet	distance to point of drawdown measurement			
			S =	NA	Specific Yield			
			t =	days	time since pumping started			
			n =	NA	Drawdown / Aquifer Thickness			
W(u) = -0.5772 - ln(u) + (u^1 / 1*1!) - (u^2 / 2*2!) + (u^3 / 3*3!) - (u^4 / 4*4!)...								
X	**(u^x / x*x!)**			**u = 1.87r^{2}S / Kmt**		**Units**		
1	0.003607648							
2	3.25378E-06		K =	20		gpd/ft^2		
3	2.60856E-09		Y =	700		feet		
4	1.76452E-12		r =	650		feet		
5	1.01852E-15		S =	0.07		NA		
6	5.10342E-19		t =	1095		days		
7	2.25445E-22		u =	0.003607648		NA		
8	8.89576E-26		ln(u) =	-5.62469913		NA		
9	3.16966E-29		W(u) =	5.051103528		NA		
10	1.02915E-32							
11	3.06844E-36							
12	8.45614E-40							
13	2.16616E-43		N:\Everyone\AEG Documents\Wilton Rancheria\SS - Wilton Rancheria Twin Cities Site Drawsown Calcs.xls					
14	5.18325E-47							
15	1.16352E-50			= input		= output		

Wilton Rancheria - Twin Cities Site								
Drawdown Calculations - Laguna Creek from AG-3								
Dane Frank								
7/1/2015								
		Theis Non-leaky Aquifer Solution						
s = W(u) (114.6Q / KY)			**Symbol**	**Units**	**Description**			
			s =	feet	Drawdown			
Symbol	**Value**	**Units**	Q =	gpm	Flowrate			
s =	4.75	feet	K =	gpd/ft^2	Average Permeability			
Q =	205	gpm	Y =	feet	Saturated Thickness			
n =	0.01	NA	W(u) =	NA	Well Function			
			r =	feet	distance to point of drawdown measurement			
			S =	NA	Specific Yield			
			t =	days	time since pumping started			
			n =	NA	Drawdown / Aquifer Thickness			
W(u) = -0.5772 - ln(u) + (u^1 / 1*1!) - (u^2 / 2*2!) + (u^3 / 3*3!) - (u^4 / 4*4!)...								
X	**(u^x / x*x!)**			**u = 1.87r^{2}S / Kmt**		**Units**		
1	0.034155251							
2	0.000291645		K =	20		gpd/ft^2		
3	2.2136E-06		Y =	700		feet		
4	1.41762E-08		r =	2000		feet		
5	7.74705E-11		S =	0.07		NA		
6	3.67503E-13		t =	1095		days		
7	1.537E-15		u =	0.034155251		NA		
8	5.74182E-18		ln(u) =	-3.37683894		NA		
9	1.93692E-20		W(u) =	2.833504743		NA		
10	5.95404E-23							
11	1.68068E-25							
12	4.38502E-28							
13	1.06347E-30		N:\Everyone\AEG Documents\Wilton Rancheria\SS - Wilton Rancheria Twin Cities Site Drawsown Calcs.xls					
14	2.40918E-33							
15	5.12002E-36			= input		= output		

Wilton Rancheria - Twin Cities Site								
Drawdown Calculations - Closest Site Boundary to South Center of Proposed Casino								
Dane Frank								
7/1/2015								
Eastern Site boundary								
Note: exact location of property line is unknown, meauring to edge of asphalt								
		Theis Non-leaky Aquifer Solution						
s = W(u) (114.6Q / KY)			**Symbol**	**Units**	**Description**			
			s =	feet	Drawdown			
Symbol	**Value**	**Units**	Q =	gpm	Flowrate			
s =	7.58	feet	K =	gpd/ft^2	Average Permeability			
Q =	205	gpm	Y =	feet	Saturated Thickness			
n =	0.01	NA	W(u) =	NA	Well Function			
			r =	feet	distance to point of drawdown measurement			
			S =	NA	Specific Yield			
			t =	days	time since pumping started			
			n =	NA	Drawdown / Aquifer Thickness			
W(u) = -0.5772 - ln(u) + (u^1 / 1*1!) - (u^2 / 2*2!) + (u^3 / 3*3!) - (u^4 / 4*4!)...								
X	**(u^x / x*x!)**			**u = 1.87r^{2}S / Kmt**		**Units**		
1	0.006169292							
2	9.51504E-06		K =	20		gpd/ft^2		
3	1.30447E-08		Y =	700		feet		
4	1.50893E-11		r =	850		feet		
5	1.48945E-14		S =	0.07		NA		
6	1.27623E-17		t =	1095		days		
7	9.64093E-21		u =	0.006169292		NA		
8	6.50537E-24		ln(u) =	-5.08817116		NA		
9	3.96381E-27		W(u) =	4.517130948		NA		
10	2.20085E-30							
11	1.12212E-33							
12	5.28818E-37							
13	2.31652E-40		N:\Everyone\AEG Documents\Wilton Rancheria\SS - Wilton Rancheria Twin Cities Site Drawsown Calcs.xls					
14	9.47891E-44							
15	3.63864E-47			= input		= output		

Wilton Rancheria - Twin Cities Site								
Drawdown Calculations - Closest Off-Site Domestic Well to South Center of Proposed Casino								
Dane Frank								
7/1/2015								
Well: DWR #87597 - East of south center of proposed casino								
Note: Location of well (and distance to well) is approximate								
		Theis Non-leaky Aquifer Solution						
s = W(u) (114.6Q / KY)			**Symbol**	**Units**	**Description**			
			s =	feet	Drawdown			
Symbol	**Value**	**Units**	Q =	gpm	Flowrate			
s =	5.81	feet	K =	gpd/ft^2	Average Permeability			
Q =	205	gpm	Y =	feet	Saturated Thickness			
n =	0.01	NA	W(u) =	NA	Well Function			
			r =	feet	distance to point of drawdown measurement			
			S =	NA	Specific Yield			
			t =	days	time since pumping started			
			n =	NA	Drawdown / Aquifer Thickness			
W(u) = -0.5772 - ln(u) + (u^1 / 1*1!) - (u^2 / 2*2!) + (u^3 / 3*3!) - (u^4 / 4*4!)...								
X	**(u^x / x*x!)**			**u = 1.87r^{2}S / Kmt**		**Units**		
1	0.017952854							
2	8.05762E-05		K =	20		gpd/ft^2		
3	3.21461E-07		Y =	700		feet		
4	1.08209E-09		r =	1450		feet		
5	3.10825E-12		S =	0.07		NA		
6	7.75028E-15		t =	1095		days		
7	1.70375E-17		u =	0.017952854		NA		
8	3.34547E-20		ln(u) =	-4.02000619		NA		
9	5.93193E-23		W(u) =	3.460678784		NA		
10	9.58455E-26							
11	1.42207E-28							
12	1.95022E-31							
13	2.48606E-34		N:\Everyone\AEG Documents\Wilton Rancheria\SS - Wilton Rancheria Twin Cities Site Drawsown Calcs.xls					
14	2.96028E-37							
15	3.30683E-40			= input		= output		

Wilton Rancheria - Twin Cities Site								
Drawdown Calculations - Laguna Creek from South Center of Proposed Casino								
Dane Frank								
7/1/2015								
		Theis Non-leaky Aquifer Solution						
s =	**W(u) (114.6Q / KY)**		**Symbol**	**Units**	**Description**			
			s =	feet	Drawdown			
Symbol	**Value**	**Units**	Q =	gpm	Flowrate			
s =	3.79	feet	K =	gpd/ft^2	Average Permeability			
Q =	205	gpm	Y =	feet	Saturated Thickness			
n =	0.01	NA	W(u) =	NA	Well Function			
			r =	feet	distance to point of drawdown measurement			
			S =	NA	Specific Yield			
			t =	days	time since pumping started			
			n =	NA	Drawdown / Aquifer Thickness			
W(u) = -0.5772 - ln(u) + (u^1 / 1*1!) - (u^2 / 2*2!) + (u^3 / 3*3!) - (u^4 / 4*4!)...								
X	**(u^x / x*x!)**			**u = 1.87r^{2}S / Kmt**		**Units**		
1	0.062247945							
2	0.000968702		K =	20		gpd/ft^2		
3	1.33999E-05		Y =	700		feet		
4	1.56397E-07		r =	2700		feet		
5	1.55766E-09		S =	0.07		NA		
6	1.34669E-11		t =	1095		days		
7	1.02647E-13		u =	0.062247945		NA		
8	6.98859E-16		ln(u) =	-2.77662975		NA		
9	4.29655E-18		W(u) =	2.260722242		NA		
10	2.40706E-20							
11	1.2383E-22							
12	5.88819E-25							
13	2.60257E-27		N:\Everyone\AEG Documents\Wilton Rancheria\SS - Wilton Rancheria Twin Cities Site Drawsown Calcs.xls					
14	1.07452E-29							
15	4.16183E-32			= input		= output		

Wilton Rancheria - Twin Cities Site									
Drawdown Calculations - At Extraction Well									
Dane Frank									
7/1/2015									
		Theis Non-leaky Aquifer Solution							
s =	**W(u) (114.6Q / KY)**		**Symbol**	**Units**	**Description**				
			s =	feet	Drawdown at point of measurement				
Symbol	**Value**	**Units**	Q =	gpm	Flowrate				
s =	32.53	feet	K =	gpd/ft^2	Average Permeability				
Q =	205	gpm	Y =	feet	Saturated Thickness				
n =	0.05	NA	W(u) =	NA	Well Function				
			r =	feet	Radius of Well				
			S =	NA	Specific Yield				
			t =	days	time since pumping started				
			n =	NA	Drawdown / Aquifer Thickness				
W(u) = -0.5772 - ln(u) + (u^1 / 1*1!) - (u^2 / 2*2!) + (u^3 / 3*3!) - (u^4 / 4*4!)...									
X	**(u^x / x*x!)**			**u = 1.87r^{2}S / Kmt**		**Units**			
1	2.1347E-09								
2	1.13924E-18		K =	20		gpd/ft^2			
3	5.40431E-28		Y =	700		feet			
4	2.16311E-37		r =	0.5		feet			
5	7.38816E-47		S =	0.07		NA			
6	2.19049E-56		t =	1095		days			
7	5.72577E-66		u =	2.1347E-09		NA			
8	1.33687E-75		ln(u) =	-19.96493822		NA			
9	2.81859E-85		W(u) =	19.38773822		NA			
10	5.41517E-95								
11	9.5535E-105								
12	1.5579E-114								
13	2.3614E-124		N:\Everyone\AEG Documents\Wilton Rancheria\SS - Wilton Rancheria Twin Cities Site Drawsown Calcs.xls						
14	3.3434E-134								
15	4.4409E-144			= input		= output			

Wilton Rancheria - Twin Cities Site									
Drawdown Calculations - Distance to Three Feet of Drawdown									
Dane Frank									
7/1/2015									
Theis Non-leaky Aquifer Solution									
s = W(u) (114.6Q / KY)			**Symbol**	**Units**	**Description**				
			s =	feet	Drawdown at point of measurement				
Symbol	**Value**	**Units**	Q =	gpm	Flowrate				
s =	3.00	feet	K =	gpd/ft^2	Average Permeability				
Q =	205	gpm	Y =	feet	Saturated Thickness				
n =	0.00	NA	W(u) =	NA	Well Function				
			r =	feet	distance from the well to point of drawdown measurement				
			S =	NA	Specific Yield				
			t =	days	time since pumping started				
			n =	NA	Drawdown / Aquifer Thickness				
W(u) = -0.5772 - ln(u) + (u^1 / 1*1!) - (u^2 / 2*2!) + (u^3 / 3*3!) - (u^4 / 4*4!)...									
X	**(u^x / x*x!)**			**u = 1.87r^{2}S / Kmt**		**Units**			
1	0.104003594								
2	0.002704187		K =	20		gpd/ft^2			
3	6.24989E-05		Y =	700		feet			
4	1.21877E-06		r =	3490		feet			
5	2.02811E-08		S =	0.07		NA			
6	2.92959E-10		t =	1095		days			
7	3.73087E-12		u =	0.10400359		NA			
8	4.24401E-14		ln(u) =	-2.2633298		NA			
9	4.35943E-16		W(u) =	1.78749053		NA			
10	4.08057E-18								
11	3.50738E-20								
12	2.78652E-22								
13	2.05781E-24		N:\Everyone\AEG Documents\Wilton Rancheria\SS - Wilton Rancheria Twin Cities Site Drawsown Calcs.xls						
14	1.41952E-26								
15	9.18617E-29			= input		= output			

Wilton Rancheria - Twin Cities Site								
Drawdown Calculations - Closest Site Boundary to AG-3								
Dane Frank								
7/1/2015								
Eastern Site boundary								
Note: exact location of property line is unknown, meauring to edge of asphalt								
		Theis Non-leaky Aquifer Solution						
s = W(u) (114.6Q / KY)			**Symbol**	**Units**	**Description**			
			s =	feet	Drawdown			
Symbol	**Value**	**Units**	Q =	gpm	Flowrate			
s =	14.96	feet	K =	gpd/ft^2	Average Permeability			
Q =	158	gpm	Y =	feet	Saturated Thickness			
n =	0.02	NA	W(u) =	NA	Well Function			
			r =	feet	distance to point of drawdown measurement			
			S =	NA	Specific Yield			
			t =	days	time since pumping started			
			n =	NA	Drawdown / Aquifer Thickness			
W(u) = -0.5772 - ln(u) + (u^1 / 1*1!) - (u^2 / 2*2!) + (u^3 / 3*3!) - (u^4 / 4*4!)...								
X	**(u^x / x*x!)**			**u = 1.87r^{2}S / Kmt**		**Units**		
1	5.33676E-06							
2	7.12025E-12		K =	20		gpd/ft^2		
3	8.44423E-18		Y =	700		feet		
4	8.44965E-24		r =	25		feet		
5	7.215E-30		S =	0.07		NA		
6	5.34788E-36		t =	1095		days		
7	3.49473E-42		u =	5.33676E-06		NA		
8	2.0399E-48		ln(u) =	-12.1408922		NA		
9	1.07521E-54		W(u) =	11.56369754		NA		
10	5.16431E-61							
11	2.27774E-67							
12	9.28564E-74							
13	3.51871E-80		N:\Everyone\AEG Documents\Wilton Rancheria\SS - Wilton Rancheria Twin Cities Site Drawsown Calcs.xls					
14	1.24551E-86							
15	4.13592E-93			= input		= output		

Wilton Rancheria - Twin Cities Site								
Drawdown Calculations - Closest Off-Site Domestic Well to AG-3								
Dane Frank								
7/1/2015								
Well: DWR #87597 - East of AG-3								
Note: Location of well (and distance to well) is approximate								
		Theis Non-leaky Aquifer Solution						
s = W(u) (114.6Q / KY)			**Symbol**	**Units**	**Description**			
			s =	feet	Drawdown			
Symbol	**Value**	**Units**	Q =	gpm	Flowrate			
s =	6.53	feet	K =	gpd/ft^2	Average Permeability			
Q =	158	gpm	Y =	feet	Saturated Thickness			
n =	0.01	NA	W(u) =	NA	Well Function			
			r =	feet	distance to point of drawdown measurement			
			S =	NA	Specific Yield			
			t =	days	time since pumping started			
			n =	NA	Drawdown / Aquifer Thickness			
W(u) = -0.5772 - ln(u) + (u^1 / 1*1!) - (u^2 / 2*2!) + (u^3 / 3*3!) - (u^4 / 4*4!)...								
X	**(u^x / x*x!)**			**u = 1.87r^{2}S / Kmt**		**Units**		
1	0.003607648							
2	3.25378E-06		K =	20		gpd/ft^2		
3	2.60856E-09		Y =	700		feet		
4	1.76452E-12		r =	650		feet		
5	1.01852E-15		S =	0.07		NA		
6	5.10342E-19		t =	1095		days		
7	2.25445E-22		u =	0.003607648		NA		
8	8.89576E-26		ln(u) =	-5.62469913		NA		
9	3.16966E-29		W(u) =	5.051103528		NA		
10	1.02915E-32							
11	3.06844E-36							
12	8.45614E-40							
13	2.16616E-43		N:\Everyone\AEG Documents\Wilton Rancheria\SS - Wilton Rancheria Twin Cities Site Drawsown Calcs.xls					
14	5.18325E-47							
15	1.16352E-50			= input		= output		

Wilton Rancheria - Twin Cities Site								
Drawdown Calculations - Laguna Creek from AG-3								
Dane Frank								
7/1/2015								
		Theis Non-leaky Aquifer Solution						
s = W(u) (114.6Q / KY)			**Symbol**	**Units**	**Description**			
			s =	feet	Drawdown			
Symbol	**Value**	**Units**	Q =	gpm	Flowrate			
s =	3.66	feet	K =	gpd/ft^2	Average Permeability			
Q =	158	gpm	Y =	feet	Saturated Thickness			
n =	0.01	NA	W(u) =	NA	Well Function			
			r =	feet	distance to point of drawdown measurement			
			S =	NA	Specific Yield			
			t =	days	time since pumping started			
			n =	NA	Drawdown / Aquifer Thickness			
W(u) = -0.5772 - ln(u) + (u^1 / 1*1!) - (u^2 / 2*2!) + (u^3 / 3*3!) - (u^4 / 4*4!)...								
X	**(u^x / x*x!)**			**u = 1.87r^{2}S / Kmt**		**Units**		
1	0.034155251							
2	0.000291645		K =	20		gpd/ft^2		
3	2.2136E-06		Y =	700		feet		
4	1.41762E-08		r =	2000		feet		
5	7.74705E-11		S =	0.07		NA		
6	3.67503E-13		t =	1095		days		
7	1.537E-15		u =	0.034155251		NA		
8	5.74182E-18		ln(u) =	-3.37683894		NA		
9	1.93692E-20		W(u) =	2.833504743		NA		
10	5.95404E-23							
11	1.68068E-25							
12	4.38502E-28							
13	1.06347E-30		N:\Everyone\AEG Documents\Wilton Rancheria\SS - Wilton Rancheria Twin Cities Site Drawsown Calcs.xls					
14	2.40918E-33							
15	5.12002E-36			= input		= output		

Wilton Rancheria - Twin Cities Site								
Drawdown Calculations - Closest Site Boundary to South Center of Proposed Casino								
Dane Frank								
7/1/2015								
Eastern Site boundary								
Note: exact location of property line is unknown, meauring to edge of asphalt								
		Theis Non-leaky Aquifer Solution						
s = W(u) (114.6Q / KY)			**Symbol**	**Units**	**Description**			
			s =	feet	Drawdown			
Symbol	**Value**	**Units**	Q =	gpm	Flowrate			
s =	5.84	feet	K =	gpd/ft^2	Average Permeability			
Q =	158	gpm	Y =	feet	Saturated Thickness			
n =	0.01	NA	W(u) =	NA	Well Function			
			r =	feet	distance to point of drawdown measurement			
			S =	NA	Specific Yield			
			t =	days	time since pumping started			
			n =	NA	Drawdown / Aquifer Thickness			
W(u) = -0.5772 - ln(u) + (u^1 / 1*1!) - (u^2 / 2*2!) + (u^3 / 3*3!) - (u^4 / 4*4!)...								
X	**(u^x / x*x!)**			**u = 1.87r^{2}S / Kmt**		**Units**		
1	0.006169292							
2	9.51504E-06		K =	20		gpd/ft^2		
3	1.30447E-08		Y =	700		feet		
4	1.50893E-11		r =	850		feet		
5	1.48945E-14		S =	0.07		NA		
6	1.27623E-17		t =	1095		days		
7	9.64093E-21		u =	0.006169292		NA		
8	6.50537E-24		ln(u) =	-5.08817116		NA		
9	3.96381E-27		W(u) =	4.517130948		NA		
10	2.20085E-30							
11	1.12212E-33							
12	5.28818E-37							
13	2.31652E-40		N:\Everyone\AEG Documents\Wilton Rancheria\SS - Wilton Rancheria Twin Cities Site Drawsown Calcs.xls					
14	9.47891E-44							
15	3.63864E-47			= input		= output		

Wilton Rancheria - Twin Cities Site								
Drawdown Calculations - Closest Off-Site Domestic Well to South Center of Proposed Casino								
Dane Frank								
7/1/2015								
Well: DWR #87597 - East of south center of proposed casino								
Note: Location of well (and distance to well) is approximate								
		Theis Non-leaky Aquifer Solution						
s = W(u) (114.6Q / KY)			**Symbol**	**Units**	**Description**			
			s =	feet	Drawdown			
Symbol	**Value**	**Units**	Q =	gpm	Flowrate			
s =	4.48	feet	K =	gpd/ft^2	Average Permeability			
Q =	158	gpm	Y =	feet	Saturated Thickness			
n =	0.01	NA	W(u) =	NA	Well Function			
			r =	feet	distance to point of drawdown measurement			
			S =	NA	Specific Yield			
			t =	days	time since pumping started			
			n =	NA	Drawdown / Aquifer Thickness			
W(u) = -0.5772 - ln(u) + (u^1 / 1*1!) - (u^2 / 2*2!) + (u^3 / 3*3!) - (u^4 / 4*4!)...								
X	**(u^x / x*x!)**			**u = 1.87r^{2}S / Kmt**		**Units**		
1	0.017952854							
2	8.05762E-05		K =	20		gpd/ft^2		
3	3.21461E-07		Y =	700		feet		
4	1.08209E-09		r =	1450		feet		
5	3.10825E-12		S =	0.07		NA		
6	7.75028E-15		t =	1095		days		
7	1.70375E-17		u =	0.017952854		NA		
8	3.34547E-20		ln(u) =	-4.02000619		NA		
9	5.93193E-23		W(u) =	3.460678784		NA		
10	9.58455E-26							
11	1.42207E-28							
12	1.95022E-31							
13	2.48606E-34		N:\Everyone\AEG Documents\Wilton Rancheria\SS - Wilton Rancheria Twin Cities Site Drawsown Calcs.xls					
14	2.96028E-37							
15	3.30683E-40			= input		= output		

Wilton Rancheria - Twin Cities Site								
Drawdown Calculations - Laguna Creek from South Center of Proposed Casino								
Dane Frank								
7/1/2015								
		Theis Non-leaky Aquifer Solution						
s = W(u) (114.6Q / KY)			**Symbol**	**Units**	**Description**			
			s =	feet	Drawdown			
Symbol	**Value**	**Units**	Q =	gpm	Flowrate			
s =	2.92	feet	K =	gpd/ft^2	Average Permeability			
Q =	158	gpm	Y =	feet	Saturated Thickness			
n =	0.00	NA	W(u) =	NA	Well Function			
			r =	feet	distance to point of drawdown measurement			
			S =	NA	Specific Yield			
			t =	days	time since pumping started			
			n =	NA	Drawdown / Aquifer Thickness			
W(u) = -0.5772 - ln(u) + (u^1 / 1*1!) - (u^2 / 2*2!) + (u^3 / 3*3!) - (u^4 / 4*4!)...								
X	**(u^x / x*x!)**			**u = 1.87r^{2}S / Kmt**		**Units**		
1	0.062247945							
2	0.000968702		K =	20		gpd/ft^2		
3	1.33999E-05		Y =	700		feet		
4	1.56397E-07		r =	2700		feet		
5	1.55766E-09		S =	0.07		NA		
6	1.34669E-11		t =	1095		days		
7	1.02647E-13		u =	0.062247945		NA		
8	6.98859E-16		ln(u) =	-2.77662975		NA		
9	4.29655E-18		W(u) =	2.260722242		NA		
10	2.40706E-20							
11	1.2383E-22							
12	5.88819E-25							
13	2.60257E-27		N:\Everyone\AEG Documents\Wilton Rancheria\SS - Wilton Rancheria Twin Cities Site Drawsown Calcs.xls					
14	1.07452E-29							
15	4.16183E-32			= input		= output		

Wilton Rancheria - Twin Cities Site									
Drawdown Calculations - At Extraction Well									
Dane Frank									
7/1/2015									
		Theis Non-leaky Aquifer Solution							
s =	**W(u) (114.6Q / KY)**		**Symbol**	**Units**	**Description**				
			s =	feet	Drawdown at point of measurement				
Symbol	**Value**	**Units**	Q =	gpm	Flowrate				
s =	25.07	feet	K =	gpd/ft^2	Average Permeability				
Q =	158	gpm	Y =	feet	Saturated Thickness				
n =	0.04	NA	W(u) =	NA	Well Function				
			r =	feet	Radius of Well				
			S =	NA	Specific Yield				
			t =	days	time since pumping started				
			n =	NA	Drawdown / Aquifer Thickness				
W(u) = -0.5772 - ln(u) + (u^1 / 1*1!) - (u^2 / 2*2!) + (u^3 / 3*3!) - (u^4 / 4*4!)...									
X	**(u^x / x*x!)**			**u = 1.87r^{2}S / Kmt**		**Units**			
1	2.1347E-09								
2	1.13924E-18		K =	20		gpd/ft^2			
3	5.40431E-28		Y =	700		feet			
4	2.16311E-37		r =	0.5		feet			
5	7.38816E-47		S =	0.07		NA			
6	2.19049E-56		t =	1095		days			
7	5.72577E-66		u =	2.1347E-09		NA			
8	1.33687E-75		ln(u) =	-19.96493822		NA			
9	2.81859E-85		W(u) =	19.38773822		NA			
10	5.41517E-95								
11	9.5535E-105								
12	1.5579E-114								
13	2.3614E-124		N:\Everyone\AEG Documents\Wilton Rancheria\SS - Wilton Rancheria Twin Cities Site Drawsown Calcs.xls						
14	3.3434E-134								
15	4.4409E-144			= input		= output			

Wilton Rancheria - Twin Cities Site									
Drawdown Calculations - Distance to Three Feet of Drawdown									
Dane Frank									
7/1/2015									
			Theis Non-leaky Aquifer Solution						
s = W(u) (114.6Q / KY)			**Symbol**	**Units**	**Description**				
			s =	feet	Drawdown at point of measurement				
Symbol	**Value**	**Units**	Q =	gpm	Flowrate				
s =	3.00	feet	K =	gpd/ft^2	Average Permeability				
Q =	158	gpm	Y =	feet	Saturated Thickness				
n =	0.00	NA	W(u) =	NA	Well Function				
			r =	feet	distance from the well to point of drawdown measurement				
			S =	NA	Specific Yield				
			t =	days	time since pumping started				
			n =	NA	Drawdown / Aquifer Thickness				
W(u) = -0.5772 - ln(u) + (u^1 / 1*1!) - (u^2 / 2*2!) + (u^3 / 3*3!) - (u^4 / 4*4!)...									
X	**(u^x / x*x!)**			**u = 1.87r^{2}S / Kmt**		**Units**			
1	0.058613826								
2	0.000858895		K =	20		gpd/ft^2			
3	1.11874E-05		Y =	700		feet			
4	1.2295E-07		r =	2620		feet			
5	1.15305E-09		S =	0.07		NA			
6	9.38678E-12		t =	1095		days			
7	6.73708E-14		u =	0.05861383		NA			
8	4.31907E-16		ln(u) =	-2.8367847		NA			
9	2.50032E-18		W(u) =	2.31735066		NA			
10	1.31898E-20								
11	6.38929E-23								
12	2.86077E-25								
13	1.19063E-27		N:\Everyone\AEG Documents\Wilton Rancheria\SS - Wilton Rancheria Twin Cities Site Drawsown Calcs.xls						
14	4.62876E-30								
15	1.68815E-32			= input		= output			

Wilton Rancheria - Twin Cities Site								
Drawdown Calculations - Closest Site Boundary to AG-3								
Dane Frank								
3/2/2015								
Eastern Site boundary								
Note: exact location of property line is unknown, meauring to edge of asphalt								
		Theis Non-leaky Aquifer Solution						
s = W(u) (114.6Q / KY)			**Symbol**	**Units**	**Description**			
			s =	feet	Drawdown			
Symbol	**Value**	**Units**	Q =	gpm	Flowrate			
s =	10.41	feet	K =	gpd/ft^2	Average Permeability			
Q =	110	gpm	Y =	feet	Saturated Thickness			
n =	0.01	NA	W(u) =	NA	Well Function			
			r =	feet	distance to point of drawdown measurement			
			S =	NA	Specific Yield			
			t =	days	time since pumping started			
			n =	NA	Drawdown / Aquifer Thickness			
W(u) = -0.5772 - ln(u) + (u^1 / 1*1!) - (u^2 / 2*2!) + (u^3 / 3*3!) - (u^4 / 4*4!)...								
X	**(u^x / x*x!)**			**u = 1.87r^{2}S / Kmt**		**Units**		
1	5.33676E-06							
2	7.12025E-12		K =	20		gpd/ft^2		
3	8.44423E-18		Y =	700		feet		
4	8.44965E-24		r =	25		feet		
5	7.215E-30		S =	0.07		NA		
6	5.34788E-36		t =	1095		days		
7	3.49473E-42		u =	5.33676E-06		NA		
8	2.0399E-48		ln(u) =	-12.1408922		NA		
9	1.07521E-54		W(u) =	11.56369754		NA		
10	5.16431E-61							
11	2.27774E-67							
12	9.28564E-74							
13	3.51871E-80		N:\Everyone\AEG Documents\Wilton Rancheria\SS - Wilton Rancheria Twin Cities Site Drawsown Calcs.xls					
14	1.24551E-86							
15	4.13592E-93			= input		= output		

Wilton Rancheria - Twin Cities Site								
Drawdown Calculations - Closest Off-Site Domestic Well to AG-3								
Dane Frank								
3/2/2015								
Well: DWR #87597 - East of AG-3								
Note: Location of well (and distance to well) is approximate								
		Theis Non-leaky Aquifer Solution						
s = W(u) (114.6Q / KY)			**Symbol**	**Units**	**Description**			
			s =	feet	Drawdown			
Symbol	**Value**	**Units**	Q =	gpm	Flowrate			
s =	4.55	feet	K =	gpd/ft^2	Average Permeability			
Q =	110	gpm	Y =	feet	Saturated Thickness			
n =	0.01	NA	W(u) =	NA	Well Function			
			r =	feet	distance to point of drawdown measurement			
			S =	NA	Specific Yield			
			t =	days	time since pumping started			
			n =	NA	Drawdown / Aquifer Thickness			
W(u) = -0.5772 - ln(u) + (u^1 / 1*1!) - (u^2 / 2*2!) + (u^3 / 3*3!) - (u^4 / 4*4!)...								
X	**(u^x / x*x!)**			**u = 1.87r^{2}S / Kmt**		**Units**		
1	0.003607648							
2	3.25378E-06		K =	20		gpd/ft^2		
3	2.60856E-09		Y =	700		feet		
4	1.76452E-12		r =	650		feet		
5	1.01852E-15		S =	0.07		NA		
6	5.10342E-19		t =	1095		days		
7	2.25445E-22		u =	0.003607648		NA		
8	8.89576E-26		ln(u) =	-5.62469913		NA		
9	3.16966E-29		W(u) =	5.051103528		NA		
10	1.02915E-32							
11	3.06844E-36							
12	8.45614E-40							
13	2.16616E-43		N:\Everyone\AEG Documents\Wilton Rancheria\SS - Wilton Rancheria Twin Cities Site Drawsown Calcs.xls					
14	5.18325E-47							
15	1.16352E-50			= input		= output		

Wilton Rancheria - Twin Cities Site								
Drawdown Calculations - Laguna Creek from AG-3								
Dane Frank								
3/2/2015								
		Theis Non-leaky Aquifer Solution						
s = W(u) (114.6Q / KY)			**Symbol**	**Units**	**Description**			
			s =	feet	Drawdown			
Symbol	**Value**	**Units**	Q =	gpm	Flowrate			
s =	2.55	feet	K =	gpd/ft^2	Average Permeability			
Q =	110	gpm	Y =	feet	Saturated Thickness			
n =	0.00	NA	W(u) =	NA	Well Function			
			r =	feet	distance to point of drawdown measurement			
			S =	NA	Specific Yield			
			t =	days	time since pumping started			
			n =	NA	Drawdown / Aquifer Thickness			
W(u) = -0.5772 - ln(u) + (u^1 / 1*1!) - (u^2 / 2*2!) + (u^3 / 3*3!) - (u^4 / 4*4!)...								
X	**(u^x / x*x!)**			**u = 1.87r^{2}S / Kmt**		**Units**		
1	0.034155251							
2	0.000291645		K =	20		gpd/ft^2		
3	2.2136E-06		Y =	700		feet		
4	1.41762E-08		r =	2000		feet		
5	7.74705E-11		S =	0.07		NA		
6	3.67503E-13		t =	1095		days		
7	1.537E-15		u =	0.034155251		NA		
8	5.74182E-18		ln(u) =	-3.37683894		NA		
9	1.93692E-20		W(u) =	2.833504743		NA		
10	5.95404E-23							
11	1.68068E-25							
12	4.38502E-28							
13	1.06347E-30		N:\Everyone\AEG Documents\Wilton Rancheria\SS - Wilton Rancheria Twin Cities Site Drawsown Calcs.xls					
14	2.40918E-33							
15	5.12002E-36			= input		= output		

Wilton Rancheria - Twin Cities Site								
Drawdown Calculations - Closest Site Boundary to South Center of Proposed Casino								
Dane Frank								
3/2/2015								
Eastern Site boundary								
Note: exact location of property line is unknown, meauring to edge of asphalt								
		Theis Non-leaky Aquifer Solution						
s = W(u) (114.6Q / KY)			**Symbol**	**Units**	**Description**			
			s =	feet	Drawdown			
Symbol	**Value**	**Units**	Q =	gpm	Flowrate			
s =	4.07	feet	K =	gpd/ft^2	Average Permeability			
Q =	110	gpm	Y =	feet	Saturated Thickness			
n =	0.01	NA	W(u) =	NA	Well Function			
			r =	feet	distance to point of drawdown measurement			
			S =	NA	Specific Yield			
			t =	days	time since pumping started			
			n =	NA	Drawdown / Aquifer Thickness			
W(u) = -0.5772 - ln(u) + (u^1 / 1*1!) - (u^2 / 2*2!) + (u^3 / 3*3!) - (u^4 / 4*4!)...								
X	**(u^x / x*x!)**			**u = 1.87r^{2}S / Kmt**		**Units**		
1	0.006169292							
2	9.51504E-06		K =	20		gpd/ft^2		
3	1.30447E-08		Y =	700		feet		
4	1.50893E-11		r =	850		feet		
5	1.48945E-14		S =	0.07		NA		
6	1.27623E-17		t =	1095		days		
7	9.64093E-21		u =	0.006169292		NA		
8	6.50537E-24		ln(u) =	-5.08817116		NA		
9	3.96381E-27		W(u) =	4.517130948		NA		
10	2.20085E-30							
11	1.12212E-33							
12	5.28818E-37							
13	2.31652E-40		N:\Everyone\AEG Documents\Wilton Rancheria\SS - Wilton Rancheria Twin Cities Site Drawsown Calcs.xls					
14	9.47891E-44							
15	3.63864E-47			= input		= output		

Wilton Rancheria - Twin Cities Site								
Drawdown Calculations - Closest Off-Site Domestic Well to South Center of Proposed Casino								
Dane Frank								
3/2/2015								
Well: DWR #87597 - East of south center of proposed casino								
Note: Location of well (and distance to well) is approximate								
		Theis Non-leaky Aquifer Solution						
s = W(u) (114.6Q / KY)			**Symbol**	**Units**	**Description**			
			s =	feet	Drawdown			
Symbol	**Value**	**Units**	Q =	gpm	Flowrate			
s =	3.12	feet	K =	gpd/ft^2	Average Permeability			
Q =	110	gpm	Y =	feet	Saturated Thickness			
n =	0.00	NA	W(u) =	NA	Well Function			
			r =	feet	distance to point of drawdown measurement			
			S =	NA	Specific Yield			
			t =	days	time since pumping started			
			n =	NA	Drawdown / Aquifer Thickness			
W(u) = -0.5772 - ln(u) + (u^1 / 1*1!) - (u^2 / 2*2!) + (u^3 / 3*3!) - (u^4 / 4*4!)...								
X	**(u^x / x*x!)**			**u = 1.87r^{2}S / Kmt**		**Units**		
1	0.017952854							
2	8.05762E-05		K =	20		gpd/ft^2		
3	3.21461E-07		Y =	700		feet		
4	1.08209E-09		r =	1450		feet		
5	3.10825E-12		S =	0.07		NA		
6	7.75028E-15		t =	1095		days		
7	1.70375E-17		u =	0.017952854		NA		
8	3.34547E-20		ln(u) =	-4.02000619		NA		
9	5.93193E-23		W(u) =	3.460678784		NA		
10	9.58455E-26							
11	1.42207E-28							
12	1.95022E-31							
13	2.48606E-34		N:\Everyone\AEG Documents\Wilton Rancheria\SS - Wilton Rancheria Twin Cities Site Drawsown Calcs.xls					
14	2.96028E-37							
15	3.30683E-40			= input		= output		

Wilton Rancheria - Twin Cities Site								
Drawdown Calculations - Laguna Creek from South Center of Proposed Casino								
Dane Frank								
3/2/2015								
		Theis Non-leaky Aquifer Solution						
s =	**W(u) (114.6Q / KY)**		**Symbol**	**Units**	**Description**			
			s =	feet	Drawdown			
Symbol	**Value**	**Units**	Q =	gpm	Flowrate			
s =	2.04	feet	K =	gpd/ft^2	Average Permeability			
Q =	110	gpm	Y =	feet	Saturated Thickness			
n =	0.00	NA	W(u) =	NA	Well Function			
			r =	feet	distance to point of drawdown measurement			
			S =	NA	Specific Yield			
			t =	days	time since pumping started			
			n =	NA	Drawdown / Aquifer Thickness			
W(u) = -0.5772 - ln(u) + (u^1 / 1*1!) - (u^2 / 2*2!) + (u^3 / 3*3!) - (u^4 / 4*4!)...								
X	**(u^x / x*x!)**			**u = 1.87r^{2}S / Kmt**		**Units**		
1	0.062247945							
2	0.000968702		K =	20		gpd/ft^2		
3	1.33999E-05		Y =	700		feet		
4	1.56397E-07		r =	2700		feet		
5	1.55766E-09		S =	0.07		NA		
6	1.34669E-11		t =	1095		days		
7	1.02647E-13		u =	0.062247945		NA		
8	6.98859E-16		ln(u) =	-2.77662975		NA		
9	4.29655E-18		W(u) =	2.260722242		NA		
10	2.40706E-20							
11	1.2383E-22							
12	5.88819E-25							
13	2.60257E-27		N:\Everyone\AEG Documents\Wilton Rancheria\SS - Wilton Rancheria Twin Cities Site Drawsown Calcs.xls					
14	1.07452E-29							
15	4.16183E-32			= input		= output		

Wilton Rancheria - Twin Cities Site									
Drawdown Calculations - At Extraction Well									
Dane Frank									
3/2/2015									
		Theis Non-leaky Aquifer Solution							
s =	**W(u) (114.6Q / KY)**		**Symbol**	**Units**	**Description**				
			s =	feet	Drawdown at point of measurement				
Symbol	**Value**	**Units**	Q =	gpm	Flowrate				
s =	17.46	feet	K =	gpd/ft^2	Average Permeability				
Q =	110	gpm	Y =	feet	Saturated Thickness				
n =	0.02	NA	W(u) =	NA	Well Function				
			r =	feet	Radius of Well				
			S =	NA	Specific Yield				
			t =	days	time since pumping started				
			n =	NA	Drawdown / Aquifer Thickness				
W(u) = -0.5772 - ln(u) + (u^1 / 1*1!) - (u^2 / 2*2!) + (u^3 / 3*3!) - (u^4 / 4*4!)...									
X	**(u^x / x*x!)**			**u = 1.87r^{2}S / Kmt**		**Units**			
1	2.1347E-09								
2	1.13924E-18		K =	20		gpd/ft^2			
3	5.40431E-28		Y =	700		feet			
4	2.16311E-37		r =	0.5		feet			
5	7.38816E-47		S =	0.07		NA			
6	2.19049E-56		t =	1095		days			
7	5.72577E-66		u =	2.1347E-09		NA			
8	1.33687E-75		ln(u) =	-19.96493822		NA			
9	2.81859E-85		W(u) =	19.38773822		NA			
10	5.41517E-95								
11	9.5535E-105								
12	1.5579E-114								
13	2.3614E-124		N:\Everyone\AEG Documents\Wilton Rancheria\SS - Wilton Rancheria Twin Cities Site Drawsown Calcs.xls						
14	3.3434E-134								
15	4.4409E-144			= input		= output			

Wilton Rancheria - Twin Cities Site									
Drawdown Calculations - Distance to Three Feet of Drawdown									
Dane Frank									
3/2/2015									
Theis Non-leaky Aquifer Solution									
s = W(u) (114.6Q / KY)			**Symbol**	**Units**	**Description**				
			s =	feet	Drawdown at point of measurement				
Symbol	**Value**	**Units**	Q =	gpm	Flowrate				
s =	3.00	feet	K =	gpd/ft^2	Average Permeability				
Q =	110	gpm	Y =	feet	Saturated Thickness				
n =	0.00	NA	W(u) =	NA	Well Function				
			r =	feet	distance from the well to point of drawdown measurement				
			S =	NA	Specific Yield				
			t =	days	time since pumping started				
			n =	NA	Drawdown / Aquifer Thickness				
W(u) = -0.5772 - ln(u) + (u^1 / 1*1!) - (u^2 / 2*2!) + (u^3 / 3*3!) - (u^4 / 4*4!)...									
X	**(u^x / x*x!)**			**u = 1.87r^{2}S / Kmt**		**Units**			
1	0.020514498								
2	0.000105211		K =	20		gpd/ft^2			
3	4.79634E-07		Y =	700		feet			
4	1.8449E-09		r =	1550		feet			
5	6.05554E-12		S =	0.07		NA			
6	1.72537E-14		t =	1095		days			
7	4.33409E-17		u =	0.0205145		NA			
8	9.72471E-20		ln(u) =	-3.8866234		NA			
9	1.97035E-22		W(u) =	3.3298332		NA			
10	3.63786E-25								
11	6.16767E-28								
12	9.66524E-31								
13	1.40789E-33		N:\Everyone\AEG Documents\Wilton Rancheria\SS - Wilton Rancheria Twin Cities Site Drawsown Calcs.xls						
14	1.91565E-36								
15	2.44525E-39			= input		= output			

Wilton Rancheria - Historic Rancheria Site

Dane Frank

7/1/2015

Casino Water Demand (values are working estimates)

Based on Data from Katherine Green's (AES) Email, RE: Wilton Rancheria - ADEIS, dated June 12, 2015

Historic Rancheria Site Alternatives (D and E)

Alternative	Gallons per Minute (gpm)	Gallons per Day (gpd)	Gallons per Week (gpw)	Gallons per Month (gpM)	Gallons per Year (gpY)
D - Full Casino	251	362,000	2.53E+06	1.09E+07	1.32E+08
E - Reduced Casino	184	265,000	1.86E+06	7.95E+06	9.67E+07

= provided to AEG

= calculated by AEG

N:\Everyone\AEG Documents\Wilton Rancheria\SS - Wilton Rancheria Historic Rancheria Site Drawdown Calcs.xls

Wilton Rancheria - Historic Rancheria Site
Drawdown Calculations - References
Dane Frank
3/18/2014

Notes: Using generalized parameters from Cosumnes Subbasin and California Central Valley
Wells in vicinity of Site show many alternating layers of fine and coarse materials, modeling soils as a single composite material, rather than using individual layers
Depth to bedrock is unknown and very deep, aquifer thickness/saturated thickness is based on common well depth in the vicinity of the Site
Assuming wells AG-1 or AG-2 will be used for the Casino water supply

K =	gpd/ft^2	Average Permeability (aka hydraulic conductivity)
Y =	feet	Saturated Thickness
r =	feet	distance to point of drawdown measurement
S =	NA	Specific Yield
t =	days	time since pumping started

K: K = 1.8 ft/d = 6.4×10^{-4} cm/s = 13 gpd/ft^2

Y: Y = 700' (most wells range from 100' to 600' deep)

r: (from AG-1) Site boundary is ~150' (exact location of property line unknown)
Unknown well name is ~ 800' (well at residence to SSW)
Cosumnes River is ~1600'
Distances are based on DWR log locations (approximate) that were plotted on Google Earth

r: (from AG-2) Site boundary is ~100' (exact location of property line unknown)
DWR #87669 is ~ 1400'
Cosumnes River is ~400'
Distances are based on DWR log locations (approximate) that were plotted on Google Earth

S: Using value of 0.07 (7%) based on Ground-Water Flow in the Central Valley, California (USGS) and California's Groundwater Bulletin 118, Cosumnes Subbasin . 0.07 falls within the typical range of S values for sandy clay.

t: Using 3 years (1095 days), based on Drought in California (CA DWR) and Sacramento Region yearly precipitation data review. Drought durations found from 1 to 7 years, with 2 to 3 years being the average durations (drought year = year with below average precipitation).

Wilton Rancheria - Historic Rancheria Site								
Drawdown Calculations - Closest Site Boundary to AG-1								
Dane Frank								
7/1/2015								
Southern Site boundary								
Note: exact location of property line is unknown, measuring to edge of asphalt								
			Theis Non-leaky Aquifer Solution					
s = W(u) (114.6Q / KY)			**Symbol**	**Units**	**Description**			
			s =	feet	Drawdown			
Symbol	**Value**	**Units**	Q =	gpm	Flowrate			
s =	23.86	feet	K =	gpd/ft^2	Average Permeability			
Q =	251	gpm	Y =	feet	Saturated Thickness			
n =	0.03	NA	W(u) =	NA	Well Function			
			r =	feet	distance to point of drawdown measurement			
			S =	NA	Specific Yield			
			t =	days	time since pumping started			
			n =	NA	Drawdown / Aquifer Thickness			
W(u) = -0.5772 - ln(u) + (u^1 / 1*1!) - (u^2 / 2*2!) + (u^3 / 3*3!) - (u^4 / 4*4!)...								
X	**(u^x / x*x!)**			**u = 1.87r^{2}S / Kmt**		**Units**		
1	0.000295574							
2	2.1841E-08		K =	13		gpd/ft^2		
3	1.43459E-12		Y =	700		feet		
4	7.95052E-17		r =	150		feet		
5	3.75995E-21		S =	0.07		NA		
6	1.54353E-25		t =	1095		days		
7	5.58648E-30		u =	0.000295574		NA		
8	1.80602E-34		ln(u) =	-8.12659035		NA		
9	5.27223E-39		W(u) =	7.549685905		NA		
10	1.4025E-43							
11	3.42598E-48							
12	7.73538E-53							
13	1.62346E-57		N:\Everyone\AEG Documents\Wilton Rancheria\SS - Wilton Rancheria Historic Rancheria Site Drawdown Calcs.xls					
14	3.18271E-62							
15	5.85341E-67			= input		= output		

Wilton Rancheria - Historic Rancheria Site								
Drawdown Calculations - Closest Off-Site Domestic Well to AG-1								
Dane Frank								
7/1/2015								
Well: Unknown well name - at residence south-southwest of AG-1								
Note: Location of well (and distance to well) is approximate								
		Theis Non-leaky Aquifer Solution						
s = W(u) (114.6Q / KY)			**Symbol**	**Units**	**Description**			
			s =	feet	Drawdown			
Symbol	**Value**	**Units**	Q =	gpm	Flowrate			
s =	12.93	feet	K =	gpd/ft^2	Average Permeability			
Q =	251	gpm	Y =	feet	Saturated Thickness			
n =	0.02	NA	W(u) =	NA	Well Function			
			r =	feet	distance to point of drawdown measurement			
			S =	NA	Specific Yield			
			t =	days	time since pumping started			
			n =	NA	Drawdown / Aquifer Thickness			
W(u) = -0.5772 - ln(u) + (u^1 / 1*1!) - (u^2 / 2*2!) + (u^3 / 3*3!) - (u^4 / 4*4!)...								
X	**(u^x / x*x!)**			**u = 1.87r^{2}S / Kmt**		**Units**		
1	0.009491219							
2	2.25208E-05		K =	13		gpd/ft^2		
3	4.75E-08		Y =	700		feet		
4	8.45311E-11		r =	850		feet		
5	1.28369E-13		S =	0.07		NA		
6	1.69219E-16		t =	1095		days		
7	1.96664E-19		u =	0.009491219		NA		
8	2.04158E-22		ln(u) =	-4.65738824		NA		
9	1.91378E-25		W(u) =	4.089656987		NA		
10	1.63477E-28							
11	1.28231E-31							
12	9.29706E-35							
13	6.26559E-38		N:\Everyone\AEG Documents\Wilton Rancheria\SS - Wilton Rancheria Historic Rancheria Site Drawdown Calcs.xls					
14	3.94431E-41							
15	2.32937E-44			= input		= output		

Wilton Rancheria - Historic Rancheria Site								
Drawdown Calculations - Cosumnes River from AG-1								
Dane Frank								
7/1/2015								
			Theis Non-leaky Aquifer Solution					
s =	**W(u) (114.6Q / KY)**		**Symbol**	**Units**	**Description**			
			s =	feet	Drawdown			
Symbol	**Value**	**Units**	Q =	gpm	Flowrate			
s =	9.00	feet	K =	gpd/ft^2	Average Permeability			
Q =	251	gpm	Y =	feet	Saturated Thickness			
n =	0.01	NA	W(u) =	NA	Well Function			
			r =	feet	distance to point of drawdown measurement			
			S =	NA	Specific Yield			
			t =	days	time since pumping started			
			n =	NA	Drawdown / Aquifer Thickness			
W(u) = -0.5772 - ln(u) + (u^1 / 1*1!) - (u^2 / 2*2!) + (u^3 / 3*3!) - (u^4 / 4*4!)...								
X	**(u^x / x*x!)**			**u = 1.87r^{2}S / Kmt**		**Units**		
1	0.033629786							
2	0.000282741		K =	13		gpd/ft^2		
3	2.113E-06		Y =	700		feet		
4	1.33237E-08		r =	1600		feet		
5	7.16918E-11		S =	0.07		NA		
6	3.34858E-13		t =	1095		days		
7	1.37892E-15		u =	0.033629786		NA		
8	5.07204E-18		ln(u) =	-3.39234312		NA		
9	1.68466E-20		W(u) =	2.848492269		NA		
10	5.09892E-23							
11	1.41715E-25							
12	3.64058E-28							
13	8.6934E-31		N:\Everyone\AEG Documents\Wilton Rancheria\SS - Wilton Rancheria Historic Rancheria Site Drawdown Calcs.xls					
14	1.9391E-33							
15	4.05761E-36			= input		= output		

Wilton Rancheria - Historic Rancheria Site								
Drawdown Calculations - Closest Site Boundary to AG-2								
Dane Frank								
7/1/2015								
Northern Site boundary								
Note: exact location of property line is unknown								
		Theis Non-leaky Aquifer Solution						
s = W(u) (114.6Q / KY)			**Symbol**	**Units**	**Description**			
			s =	feet	Drawdown			
Symbol	**Value**	**Units**	Q =	gpm	Flowrate			
s =	26.43	feet	K =	gpd/ft^2	Average Permeability			
Q =	251	gpm	Y =	feet	Saturated Thickness			
n =	0.04	NA	W(u) =	NA	Well Function			
			r =	feet	distance to point of drawdown measurement			
			S =	NA	Specific Yield			
			t =	days	time since pumping started			
			n =	NA	Drawdown / Aquifer Thickness			
W(u) = -0.5772 - ln(u) + (u^1 / 1*1!) - (u^2 / 2*2!) + (u^3 / 3*3!) - (u^4 / 4*4!)...								
X	**(u^x / x*x!)**			**u = 1.87r^{2}S / Kmt**		**Units**		
1	0.000131366							
2	4.31428E-09		K =	13		gpd/ft^2		
3	1.25945E-13		Y =	700		feet		
4	3.10217E-18		r =	100		feet		
5	6.52033E-23		S =	0.07		NA		
6	1.18966E-27		t =	1095		days		
7	1.91364E-32		u =	0.000131366		NA		
8	2.74956E-37		ln(u) =	-8.93752057		NA		
9	3.5674E-42		W(u) =	8.360451931		NA		
10	4.21773E-47							
11	4.57907E-52							
12	4.59506E-57							
13	4.28618E-62		N:\Everyone\AEG Documents\Wilton Rancheria\SS - Wilton Rancheria Historic Rancheria Site Drawdown Calcs.xls					
14	3.73458E-67							
15	3.05261E-72			= input		= output		

Wilton Rancheria - Historic Rancheria Site								
Drawdown Calculations - Closest Off-Site Domestic Well to AG-2								
Dane Frank								
7/1/2015								
Well: DWR #87669 - southeast of AG-2								
Note: Location of well (and distance to well) is approximate								
		Theis Non-leaky Aquifer Solution						
s = W(u) (114.6Q / KY)			**Symbol**	**Units**	**Description**			
			s =	feet	Drawdown			
Symbol	**Value**	**Units**	Q =	gpm	Flowrate			
s =	9.82	feet	K =	gpd/ft^2	Average Permeability			
Q =	251	gpm	Y =	feet	Saturated Thickness			
n =	0.01	NA	W(u) =	NA	Well Function			
			r =	feet	distance to point of drawdown measurement			
			S =	NA	Specific Yield			
			t =	days	time since pumping started			
			n =	NA	Drawdown / Aquifer Thickness			
W(u) = -0.5772 - ln(u) + (u^1 / 1*1!) - (u^2 / 2*2!) + (u^3 / 3*3!) - (u^4 / 4*4!)...								
X	**(u^x / x*x!)**			**u = 1.87r^{2}S / Kmt**		**Units**		
1	0.025747805							
2	0.000165737		K =	13		gpd/ft^2		
3	9.48305E-07		Y =	700		feet		
4	4.57815E-09		r =	1400		feet		
5	1.88604E-11		S =	0.07		NA		
6	6.74462E-14		t =	1095		days		
7	2.12644E-16		u =	0.025747805		NA		
8	5.9884E-19		ln(u) =	-3.65940591		NA		
9	1.52285E-21		W(u) =	3.107788921		NA		
10	3.5289E-24							
11	7.5092E-27							
12	1.47694E-29							
13	2.70022E-32		N:\Everyone\AEG Documents\Wilton Rancheria\SS - Wilton Rancheria Historic Rancheria Site Drawdown Calcs.xls					
14	4.61133E-35							
15	7.38775E-38			= input		= output		

Wilton Rancheria - Historic Rancheria Site								
Drawdown Calculations - Cosumnes River from AG-2								
Dane Frank								
7/1/2015								
			Theis Non-leaky Aquifer Solution					
s = W(u) (114.6Q / KY)			**Symbol**	**Units**	**Description**			
			s =	feet	Drawdown			
Symbol	**Value**	**Units**	Q =	gpm	Flowrate			
s =	17.67	feet	K =	gpd/ft^2	Average Permeability			
Q =	251	gpm	Y =	feet	Saturated Thickness			
n =	0.03	NA	W(u) =	NA	Well Function			
			r =	feet	distance to point of drawdown measurement			
			S =	NA	Specific Yield			
			t =	days	time since pumping started			
			n =	NA	Drawdown / Aquifer Thickness			
W(u) = -0.5772 - ln(u) + (u^1 / 1*1!) - (u^2 / 2*2!) + (u^3 / 3*3!) - (u^4 / 4*4!)...								
X	**(u^x / x*x!)**			**u = 1.87r^{2}S / Kmt**		**Units**		
1	0.002101862							
2	1.10446E-06		K =	13		gpd/ft^2		
3	5.15869E-10		Y =	700		feet		
4	2.03304E-13		r =	400		feet		
5	6.83706E-17		S =	0.07		NA		
6	1.99591E-20		t =	1095		days		
7	5.13689E-24		u =	0.002101862		NA		
8	1.18093E-27		ln(u) =	-6.16493185		NA		
9	2.4515E-31		W(u) =	5.589832604		NA		
10	4.63744E-35							
11	8.05558E-39							
12	1.2934E-42							
13	1.93032E-46		N:\Everyone\AEG Documents\Wilton Rancheria\SS - Wilton Rancheria Historic Rancheria Site Drawdown Calcs.xls					
14	2.69105E-50							
15	3.51942E-54			= input		= output		

Wilton Rancheria - Historic Rancheria Site									
Drawdown Calculations - At Extraction Well									
Dane Frank									
7/1/2015									
			Theis Non-leaky Aquifer Solution						
s = W(u) (114.6Q / KY)			**Symbol**	**Units**	**Description**				
			s =	feet	Drawdown at point of measurement				
Symbol	**Value**	**Units**	Q =	gpm	Flowrate				
s =	59.92	feet	K =	gpd/ft^2	Average Permeability				
Q =	251	gpm	Y =	feet	Saturated Thickness				
n =	0.09	NA	W(u) =	NA	Well Function				
			r =	feet	Radius of Well				
			S =	NA	Specific Yield				
			t =	days	time since pumping started				
			n =	NA	Drawdown / Aquifer Thickness				
W(u) = -0.5772 - ln(u) + (u^1 / 1*1!) - (u^2 / 2*2!) + (u^3 / 3*3!) - (u^4 / 4*4!)...									
X	**(u^x / x*x!)**			**u = 1.87r^{2}S / Kmt**		**Units**			
1	3.28416E-09								
2	2.69642E-18		K =	13		gpd/ft^2			
3	1.96789E-27		Y =	700		feet			
4	1.21178E-36		r =	0.5		feet			
5	6.36751E-46		S =	0.07		NA			
6	2.90443E-55		t =	1095		days			
7	1.16799E-64		u =	3.28416E-09		NA			
8	4.19549E-74		ln(u) =	-19.5341553		NA			
9	1.36085E-83		W(u) =	18.95695531		NA			
10	4.02234E-93								
11	1.0917E-102								
12	2.7389E-112								
13	6.3869E-122		N:\Everyone\AEG Documents\Wilton Rancheria\SS - Wilton Rancheria Historic Rancheria Site Drawdown Calcs.xls						
14	1.3912E-131								
15	2.843E-141			= input		= output			

Wilton Rancheria - Historic Rancheria Site									
Drawdown Calculations - Distance to Three Feet of Drawdown									
Dane Frank									
7/1/2015									
Theis Non-leaky Aquifer Solution									
s = W(u) (114.6Q / KY)			**Symbol**	**Units**	**Description**				
			s =	feet	Drawdown at point of measurement				
Symbol	**Value**	**Units**	Q =	gpm	Flowrate				
s =	3.00	feet	K =	gpd/ft^2	Average Permeability				
Q =	251	gpm	Y =	feet	Saturated Thickness				
n =	0.00	NA	W(u) =	NA	Well Function				
			r =	feet	distance from the well to point of drawdown measurement				
			S =	NA	Specific Yield				
			t =	days	time since pumping started				
			n =	NA	Drawdown / Aquifer Thickness				
W(u) = -0.5772 - ln(u) + (u^1 / 1*1!) - (u^2 / 2*2!) + (u^3 / 3*3!) - (u^4 / 4*4!)...									
X	**(u^x / x*x!)**			**u = 1.87r^{2}S / Kmt**		**Units**			
1	0.282826498								
2	0.019997707		K =	13		gpd/ft^2			
3	0.001256863		Y =	700		feet			
4	6.66514E-05		r =	4640		feet			
5	3.01612E-06		S =	0.07		NA			
6	1.18478E-07		t =	1095		days			
7	4.1031E-09		u =	0.2828265		NA			
8	1.26926E-10		ln(u) =	-1.2629217		NA			
9	3.54548E-12		W(u) =	0.94974355		NA			
10	9.02481E-14								
11	2.10947E-15								
12	4.55746E-17								
13	9.15245E-19		N:\Everyone\AEG Documents\Wilton Rancheria\SS - Wilton Rancheria Historic Rancheria Site Drawdown Calcs.xls						
14	1.7169E-20								
15	3.02142E-22			= input		= output			

Wilton Rancheria - Historic Rancheria Site								
Drawdown Calculations - Closest Site Boundary to AG-1								
Dane Frank								
7/1/2015								
Southern Site boundary								
Note: exact location of property line is unknown, measuring to edge of asphalt								
		Theis Non-leaky Aquifer Solution						
s = W(u) (114.6Q / KY)			**Symbol**	**Units**	**Description**			
			s =	feet	Drawdown			
Symbol	**Value**	**Units**	Q =	gpm	Flowrate			
s =	17.49	feet	K =	gpd/ft^2	Average Permeability			
Q =	184	gpm	Y =	feet	Saturated Thickness			
n =	0.02	NA	W(u) =	NA	Well Function			
			r =	feet	distance to point of drawdown measurement			
			S =	NA	Specific Yield			
			t =	days	time since pumping started			
			n =	NA	Drawdown / Aquifer Thickness			
W(u) = -0.5772 - ln(u) + (u^1 / 1*1!) - (u^2 / 2*2!) + (u^3 / 3*3!) - (u^4 / 4*4!)...								
X	**(u^x / x*x!)**			**u = 1.87r^{2}S / Kmt**		**Units**		
1	0.000295574							
2	2.1841E-08		K =	13		gpd/ft^2		
3	1.43459E-12		Y =	700		feet		
4	7.95052E-17		r =	150		feet		
5	3.75995E-21		S =	0.07		NA		
6	1.54353E-25		t =	1095		days		
7	5.58648E-30		u =	0.000295574		NA		
8	1.80602E-34		ln(u) =	-8.12659035		NA		
9	5.27223E-39		W(u) =	7.549685905		NA		
10	1.4025E-43							
11	3.42598E-48							
12	7.73538E-53							
13	1.62346E-57		N:\Everyone\AEG Documents\Wilton Rancheria\SS - Wilton Rancheria Historic Rancheria Site Drawdown Calcs.xls					
14	3.18271E-62							
15	5.85341E-67			= input		= output		

Wilton Rancheria - Historic Rancheria Site								
Drawdown Calculations - Closest Off-Site Domestic Well to AG-1								
Dane Frank								
7/1/2015								
Well: Unknown well name - at residence south-southwest of AG-1								
Note: Location of well (and distance to well) is approximate								
		Theis Non-leaky Aquifer Solution						
s = W(u) (114.6Q / KY)			**Symbol**	**Units**	**Description**			
			s =	feet	Drawdown			
Symbol	**Value**	**Units**	Q =	gpm	Flowrate			
s =	9.48	feet	K =	gpd/ft^2	Average Permeability			
Q =	184	gpm	Y =	feet	Saturated Thickness			
n =	0.01	NA	W(u) =	NA	Well Function			
			r =	feet	distance to point of drawdown measurement			
			S =	NA	Specific Yield			
			t =	days	time since pumping started			
			n =	NA	Drawdown / Aquifer Thickness			
W(u) = -0.5772 - ln(u) + (u^1 / 1*1!) - (u^2 / 2*2!) + (u^3 / 3*3!) - (u^4 / 4*4!)...								
X	**(u^x / x*x!)**			**u = 1.87r^{2}S / Kmt**		**Units**		
1	0.009491219							
2	2.25208E-05		K =	13		gpd/ft^2		
3	4.75E-08		Y =	700		feet		
4	8.45311E-11		r =	850		feet		
5	1.28369E-13		S =	0.07		NA		
6	1.69219E-16		t =	1095		days		
7	1.96664E-19		u =	0.009491219		NA		
8	2.04158E-22		ln(u) =	-4.65738824		NA		
9	1.91378E-25		W(u) =	4.089656987		NA		
10	1.63477E-28							
11	1.28231E-31							
12	9.29706E-35							
13	6.26559E-38		N:\Everyone\AEG Documents\Wilton Rancheria\SS - Wilton Rancheria Historic Rancheria Site Drawdown Calcs.xls					
14	3.94431E-41							
15	2.32937E-44			= input		= output		

Wilton Rancheria - Historic Rancheria Site								
Drawdown Calculations - Cosumnes River from AG-1								
Dane Frank								
7/1/2015								
			Theis Non-leaky Aquifer Solution					
s = W(u) (114.6Q / KY)			**Symbol**	**Units**	**Description**			
			s =	feet	Drawdown			
Symbol	**Value**	**Units**	Q =	gpm	Flowrate			
s =	6.60	feet	K =	gpd/ft^2	Average Permeability			
Q =	184	gpm	Y =	feet	Saturated Thickness			
n =	0.01	NA	W(u) =	NA	Well Function			
			r =	feet	distance to point of drawdown measurement			
			S =	NA	Specific Yield			
			t =	days	time since pumping started			
			n =	NA	Drawdown / Aquifer Thickness			
W(u) = -0.5772 - ln(u) + (u^1 / 1*1!) - (u^2 / 2*2!) + (u^3 / 3*3!) - (u^4 / 4*4!)...								
X	**(u^x / x*x!)**			**u = 1.87r^{2}S / Kmt**		**Units**		
1	0.033629786							
2	0.000282741		K =	13		gpd/ft^2		
3	2.113E-06		Y =	700		feet		
4	1.33237E-08		r =	1600		feet		
5	7.16918E-11		S =	0.07		NA		
6	3.34858E-13		t =	1095		days		
7	1.37892E-15		u =	0.033629786		NA		
8	5.07204E-18		ln(u) =	-3.39234312		NA		
9	1.68466E-20		W(u) =	2.848492269		NA		
10	5.09892E-23							
11	1.41715E-25							
12	3.64058E-28							
13	8.6934E-31		N:\Everyone\AEG Documents\Wilton Rancheria\SS - Wilton Rancheria Historic Rancheria Site Drawdown Calcs.xls					
14	1.9391E-33							
15	4.05761E-36			= input		= output		

Wilton Rancheria - Historic Rancheria Site								
Drawdown Calculations - Closest Site Boundary to AG-2								
Dane Frank								
7/1/2015								
Northern Site boundary								
Note: exact location of property line is unknown								
		Theis Non-leaky Aquifer Solution						
s = W(u) (114.6Q / KY)			**Symbol**	**Units**	**Description**			
			s =	feet	Drawdown			
Symbol	**Value**	**Units**	Q =	gpm	Flowrate			
s =	19.37	feet	K =	gpd/ft^2	Average Permeability			
Q =	184	gpm	Y =	feet	Saturated Thickness			
n =	0.03	NA	W(u) =	NA	Well Function			
			r =	feet	distance to point of drawdown measurement			
			S =	NA	Specific Yield			
			t =	days	time since pumping started			
			n =	NA	Drawdown / Aquifer Thickness			
W(u) = -0.5772 - ln(u) + (u^1 / 1*1!) - (u^2 / 2*2!) + (u^3 / 3*3!) - (u^4 / 4*4!)...								
X	**(u^x / x*x!)**			**u = 1.87r^{2}S / Kmt**		**Units**		
1	0.000131366							
2	4.31428E-09		K =	13		gpd/ft^2		
3	1.25945E-13		Y =	700		feet		
4	3.10217E-18		r =	100		feet		
5	6.52033E-23		S =	0.07		NA		
6	1.18966E-27		t =	1095		days		
7	1.91364E-32		u =	0.000131366		NA		
8	2.74956E-37		ln(u) =	-8.93752057		NA		
9	3.5674E-42		W(u) =	8.360451931		NA		
10	4.21773E-47							
11	4.57907E-52							
12	4.59506E-57							
13	4.28618E-62		N:\Everyone\AEG Documents\Wilton Rancheria\SS - Wilton Rancheria Historic Rancheria Site Drawdown Calcs.xls					
14	3.73458E-67							
15	3.05261E-72			= input		= output		

Wilton Rancheria - Historic Rancheria Site								
Drawdown Calculations - Closest Off-Site Domestic Well to AG-2								
Dane Frank								
7/1/2015								
Well: DWR #87669 - southeast of AG-2								
Note: Location of well (and distance to well) is approximate								
			Theis Non-leaky Aquifer Solution					
s = W(u) (114.6Q / KY)			**Symbol**	**Units**	**Description**			
			s =	feet	Drawdown			
Symbol	**Value**	**Units**	Q =	gpm	Flowrate			
s =	7.20	feet	K =	gpd/ft^2	Average Permeability			
Q =	184	gpm	Y =	feet	Saturated Thickness			
n =	0.01	NA	W(u) =	NA	Well Function			
			r =	feet	distance to point of drawdown measurement			
			S =	NA	Specific Yield			
			t =	days	time since pumping started			
			n =	NA	Drawdown / Aquifer Thickness			
W(u) = -0.5772 - ln(u) + (u^1 / 1*1!) - (u^2 / 2*2!) + (u^3 / 3*3!) - (u^4 / 4*4!)...								
X	**(u^x / x*x!)**			**u = 1.87r^{2}S / Kmt**		**Units**		
1	0.025747805							
2	0.000165737		K =	13		gpd/ft^2		
3	9.48305E-07		Y =	700		feet		
4	4.57815E-09		r =	1400		feet		
5	1.88604E-11		S =	0.07		NA		
6	6.74462E-14		t =	1095		days		
7	2.12644E-16		u =	0.025747805		NA		
8	5.9884E-19		ln(u) =	-3.65940591		NA		
9	1.52285E-21		W(u) =	3.107788921		NA		
10	3.5289E-24							
11	7.5092E-27							
12	1.47694E-29							
13	2.70022E-32		N:\Everyone\AEG Documents\Wilton Rancheria\SS - Wilton Rancheria Historic Rancheria Site Drawdown Calcs.xls					
14	4.61133E-35							
15	7.38775E-38			= input		= output		

Wilton Rancheria - Historic Rancheria Site								
Drawdown Calculations - Cosumnes River from AG-2								
Dane Frank								
7/1/2015								
			Theis Non-leaky Aquifer Solution					
s = W(u) (114.6Q / KY)			**Symbol**	**Units**	**Description**			
			s =	feet	Drawdown			
Symbol	**Value**	**Units**	Q =	gpm	Flowrate			
s =	12.95	feet	K =	gpd/ft^2	Average Permeability			
Q =	184	gpm	Y =	feet	Saturated Thickness			
n =	0.02	NA	W(u) =	NA	Well Function			
			r =	feet	distance to point of drawdown measurement			
			S =	NA	Specific Yield			
			t =	days	time since pumping started			
			n =	NA	Drawdown / Aquifer Thickness			
W(u) = -0.5772 - ln(u) + (u^1 / 1*1!) - (u^2 / 2*2!) + (u^3 / 3*3!) - (u^4 / 4*4!)...								
X	**(u^x / x*x!)**			**u = 1.87r^{2}S / Kmt**		**Units**		
1	0.002101862							
2	1.10446E-06		K =	13		gpd/ft^2		
3	5.15869E-10		Y =	700		feet		
4	2.03304E-13		r =	400		feet		
5	6.83706E-17		S =	0.07		NA		
6	1.99591E-20		t =	1095		days		
7	5.13689E-24		u =	0.002101862		NA		
8	1.18093E-27		ln(u) =	-6.16493185		NA		
9	2.4515E-31		W(u) =	5.589832604		NA		
10	4.63744E-35							
11	8.05558E-39							
12	1.2934E-42							
13	1.93032E-46		N:\Everyone\AEG Documents\Wilton Rancheria\SS - Wilton Rancheria Historic Rancheria Site Drawdown Calcs.xls					
14	2.69105E-50							
15	3.51942E-54			= input		= output		

Wilton Rancheria - Historic Rancheria Site									
Drawdown Calculations - At Extraction Well									
Dane Frank									
7/1/2015									
			Theis Non-leaky Aquifer Solution						
s = W(u) (114.6Q / KY)			**Symbol**	**Units**	**Description**				
			s =	feet	Drawdown at point of measurement				
Symbol	**Value**	**Units**	Q =	gpm	Flowrate				
s =	43.93	feet	K =	gpd/ft^2	Average Permeability				
Q =	184	gpm	Y =	feet	Saturated Thickness				
n =	0.06	NA	W(u) =	NA	Well Function				
			r =	feet	Radius of Well				
			S =	NA	Specific Yield				
			t =	days	time since pumping started				
			n =	NA	Drawdown / Aquifer Thickness				
W(u) = -0.5772 - ln(u) + (u^1 / 1*1!) - (u^2 / 2*2!) + (u^3 / 3*3!) - (u^4 / 4*4!)...									
X	**(u^x / x*x!)**			**u = 1.87r^{2}S / Kmt**		**Units**			
1	3.28416E-09								
2	2.69642E-18		K =	13		gpd/ft^2			
3	1.96789E-27		Y =	700		feet			
4	1.21178E-36		r =	0.5		feet			
5	6.36751E-46		S =	0.07		NA			
6	2.90443E-55		t =	1095		days			
7	1.16799E-64		u =	3.28416E-09		NA			
8	4.19549E-74		ln(u) =	-19.5341553		NA			
9	1.36085E-83		W(u) =	18.95695531		NA			
10	4.02234E-93								
11	1.0917E-102								
12	2.7389E-112								
13	6.3869E-122		N:\Everyone\AEG Documents\Wilton Rancheria\SS - Wilton Rancheria Historic Rancheria Site Drawdown Calcs.xls						
14	1.3912E-131								
15	2.843E-141			= input		= output			

Wilton Rancheria - Historic Rancheria Site									
Drawdown Calculations - Distance to Three Feet of Drawdown									
Dane Frank									
7/1/2015									
Theis Non-leaky Aquifer Solution									
s = W(u) (114.6Q / KY)			**Symbol**	**Units**	**Description**				
			s =	feet	Drawdown at point of measurement				
Symbol	**Value**	**Units**	Q =	gpm	Flowrate				
s =	3.00	feet	K =	gpd/ft^2	Average Permeability				
Q =	184	gpm	Y =	feet	Saturated Thickness				
n =	0.00	NA	W(u) =	NA	Well Function				
			r =	feet	distance from the well to point of drawdown measurement				
			S =	NA	Specific Yield				
			t =	days	time since pumping started				
			n =	NA	Drawdown / Aquifer Thickness				
W(u) = -0.5772 - ln(u) + (u^1 / 1*1!) - (u^2 / 2*2!) + (u^3 / 3*3!) - (u^4 / 4*4!)...									
X	**(u^x / x*x!)**			**u = 1.87r^{2}S / Kmt**		**Units**			
1	0.183749996								
2	0.008441015		K =	13		gpd/ft^2			
3	0.000344675		Y =	700		feet			
4	1.18751E-05		r =	3740		feet			
5	3.49129E-07		S =	0.07		NA			
6	8.91005E-09		t =	1095		days			
7	2.00476E-10		u =	0.18375		NA			
8	4.0291E-12		ln(u) =	-1.6941792		NA			
9	7.31207E-14		W(u) =	1.29262128		NA			
10	1.20923E-15								
11	1.83634E-17								
12	2.57757E-19								
13	3.36304E-21		N:\Everyone\AEG Documents\Wilton Rancheria\SS - Wilton Rancheria Historic Rancheria Site Drawdown Calcs.xls						
14	4.0987E-23								
15	4.68618E-25			= input		= output			

Wilton Rancheria - Historic Rancheria Site								
Drawdown Calculations - Closest Site Boundary to AG-1								
Dane Frank								
7/1/2015								
Southern Site boundary								
Note: exact location of property line is unknown, measuring to edge of asphalt								
		Theis Non-leaky Aquifer Solution						
s = W(u) (114.6Q / KY)			**Symbol**	**Units**	**Description**			
			s =	feet	Drawdown			
Symbol	**Value**	**Units**	Q =	gpm	Flowrate			
s =	4.85	feet	K =	gpd/ft^2	Average Permeability			
Q =	51	gpm	Y =	feet	Saturated Thickness			
n =	0.01	NA	W(u) =	NA	Well Function			
			r =	feet	distance to point of drawdown measurement			
			S =	NA	Specific Yield			
			t =	days	time since pumping started			
			n =	NA	Drawdown / Aquifer Thickness			
W(u) = -0.5772 - ln(u) + (u^1 / 1*1!) - (u^2 / 2*2!) + (u^3 / 3*3!) - (u^4 / 4*4!)...								
X	**(u^x / x*x!)**			**u = 1.87r^{2}S / Kmt**		**Units**		
1	0.000295574							
2	2.1841E-08		K =	13		gpd/ft^2		
3	1.43459E-12		Y =	700		feet		
4	7.95052E-17		r =	150		feet		
5	3.75995E-21		S =	0.07		NA		
6	1.54353E-25		t =	1095		days		
7	5.58648E-30		u =	0.000295574		NA		
8	1.80602E-34		ln(u) =	-8.12659035		NA		
9	5.27223E-39		W(u) =	7.549685905		NA		
10	1.4025E-43							
11	3.42598E-48							
12	7.73538E-53							
13	1.62346E-57		N:\Everyone\AEG Documents\Wilton Rancheria\SS - Wilton Rancheria Historic Rancheria Site Drawdown Calcs.xls					
14	3.18271E-62							
15	5.85341E-67			= input		= output		

Wilton Rancheria - Historic Rancheria Site								
Drawdown Calculations - Closest Off-Site Domestic Well to AG-1								
Dane Frank								
7/1/2015								
Well: Unknown well name - at residence south-southwest of AG-1								
Note: Location of well (and distance to well) is approximate								
		Theis Non-leaky Aquifer Solution						
s = W(u) (114.6Q / KY)			**Symbol**	**Units**	**Description**			
			s =	feet	Drawdown			
Symbol	**Value**	**Units**	Q =	gpm	Flowrate			
s =	2.63	feet	K =	gpd/ft^2	Average Permeability			
Q =	51	gpm	Y =	feet	Saturated Thickness			
n =	0.00	NA	W(u) =	NA	Well Function			
			r =	feet	distance to point of drawdown measurement			
			S =	NA	Specific Yield			
			t =	days	time since pumping started			
			n =	NA	Drawdown / Aquifer Thickness			
W(u) = -0.5772 - ln(u) + (u^1 / 1*1!) - (u^2 / 2*2!) + (u^3 / 3*3!) - (u^4 / 4*4!)...								
X	**(u^x / x*x!)**			**u = 1.87r^{2}S / Kmt**		**Units**		
1	0.009491219							
2	2.25208E-05		K =	13		gpd/ft^2		
3	4.75E-08		Y =	700		feet		
4	8.45311E-11		r =	850		feet		
5	1.28369E-13		S =	0.07		NA		
6	1.69219E-16		t =	1095		days		
7	1.96664E-19		u =	0.009491219		NA		
8	2.04158E-22		ln(u) =	-4.65738824		NA		
9	1.91378E-25		W(u) =	4.089656987		NA		
10	1.63477E-28							
11	1.28231E-31							
12	9.29706E-35							
13	6.26559E-38		N:\Everyone\AEG Documents\Wilton Rancheria\SS - Wilton Rancheria Historic Rancheria Site Drawdown Calcs.xls					
14	3.94431E-41							
15	2.32937E-44			= input		= output		

Wilton Rancheria - Historic Rancheria Site								
Drawdown Calculations - Cosumnes River from AG-1								
Dane Frank								
7/1/2015								
			Theis Non-leaky Aquifer Solution					
s = W(u) (114.6Q / KY)			**Symbol**	**Units**	**Description**			
			s =	feet	Drawdown			
Symbol	**Value**	**Units**	Q =	gpm	Flowrate			
s =	1.83	feet	K =	gpd/ft^2	Average Permeability			
Q =	51	gpm	Y =	feet	Saturated Thickness			
n =	0.00	NA	W(u) =	NA	Well Function			
			r =	feet	distance to point of drawdown measurement			
			S =	NA	Specific Yield			
			t =	days	time since pumping started			
			n =	NA	Drawdown / Aquifer Thickness			
W(u) = -0.5772 - ln(u) + (u^1 / 1*1!) - (u^2 / 2*2!) + (u^3 / 3*3!) - (u^4 / 4*4!)...								
X	**(u^x / x*x!)**			**u = 1.87r^{2}S / Kmt**		**Units**		
1	0.033629786							
2	0.000282741		K =	13		gpd/ft^2		
3	2.113E-06		Y =	700		feet		
4	1.33237E-08		r =	1600		feet		
5	7.16918E-11		S =	0.07		NA		
6	3.34858E-13		t =	1095		days		
7	1.37892E-15		u =	0.033629786		NA		
8	5.07204E-18		ln(u) =	-3.39234312		NA		
9	1.68466E-20		W(u) =	2.848492269		NA		
10	5.09892E-23							
11	1.41715E-25							
12	3.64058E-28							
13	8.6934E-31		N:\Everyone\AEG Documents\Wilton Rancheria\SS - Wilton Rancheria Historic Rancheria Site Drawdown Calcs.xls					
14	1.9391E-33							
15	4.05761E-36			= input		= output		

Wilton Rancheria - Historic Rancheria Site								
Drawdown Calculations - Closest Site Boundary to AG-2								
Dane Frank								
7/1/2015								
Northern Site boundary								
Note: exact location of property line is unknown								
		Theis Non-leaky Aquifer Solution						
s = W(u) (114.6Q / KY)			**Symbol**	**Units**	**Description**			
			s =	feet	Drawdown			
Symbol	**Value**	**Units**	Q =	gpm	Flowrate			
s =	5.37	feet	K =	gpd/ft^2	Average Permeability			
Q =	51	gpm	Y =	feet	Saturated Thickness			
n =	0.01	NA	W(u) =	NA	Well Function			
			r =	feet	distance to point of drawdown measurement			
			S =	NA	Specific Yield			
			t =	days	time since pumping started			
			n =	NA	Drawdown / Aquifer Thickness			
W(u) = -0.5772 - ln(u) + (u^1 / 1*1!) - (u^2 / 2*2!) + (u^3 / 3*3!) - (u^4 / 4*4!)...								
X	**(u^x / x*x!)**			**u = 1.87r^{2}S / Kmt**		**Units**		
1	0.000131366							
2	4.31428E-09		K =	13		gpd/ft^2		
3	1.25945E-13		Y =	700		feet		
4	3.10217E-18		r =	100		feet		
5	6.52033E-23		S =	0.07		NA		
6	1.18966E-27		t =	1095		days		
7	1.91364E-32		u =	0.000131366		NA		
8	2.74956E-37		ln(u) =	-8.93752057		NA		
9	3.5674E-42		W(u) =	8.360451931		NA		
10	4.21773E-47							
11	4.57907E-52							
12	4.59506E-57							
13	4.28618E-62		N:\Everyone\AEG Documents\Wilton Rancheria\SS - Wilton Rancheria Historic Rancheria Site Drawdown Calcs.xls					
14	3.73458E-67							
15	3.05261E-72			= input		= output		

Wilton Rancheria - Historic Rancheria Site								
Drawdown Calculations - Closest Off-Site Domestic Well to AG-2								
Dane Frank								
7/1/2015								
Well: DWR #87669 - southeast of AG-2								
Note: Location of well (and distance to well) is approximate								
		Theis Non-leaky Aquifer Solution						
s = W(u) (114.6Q / KY)			**Symbol**	**Units**	**Description**			
			s =	feet	Drawdown			
Symbol	**Value**	**Units**	Q =	gpm	Flowrate			
s =	2.00	feet	K =	gpd/ft^2	Average Permeability			
Q =	51	gpm	Y =	feet	Saturated Thickness			
n =	0.00	NA	W(u) =	NA	Well Function			
			r =	feet	distance to point of drawdown measurement			
			S =	NA	Specific Yield			
			t =	days	time since pumping started			
			n =	NA	Drawdown / Aquifer Thickness			
W(u) = -0.5772 - ln(u) + (u^1 / 1*1!) - (u^2 / 2*2!) + (u^3 / 3*3!) - (u^4 / 4*4!)...								
X	**(u^x / x*x!)**			**u = 1.87r^{2}S / Kmt**		**Units**		
1	0.025747805							
2	0.000165737		K =	13		gpd/ft^2		
3	9.48305E-07		Y =	700		feet		
4	4.57815E-09		r =	1400		feet		
5	1.88604E-11		S =	0.07		NA		
6	6.74462E-14		t =	1095		days		
7	2.12644E-16		u =	0.025747805		NA		
8	5.9884E-19		ln(u) =	-3.65940591		NA		
9	1.52285E-21		W(u) =	3.107788921		NA		
10	3.5289E-24							
11	7.5092E-27							
12	1.47694E-29							
13	2.70022E-32		N:\Everyone\AEG Documents\Wilton Rancheria\SS - Wilton Rancheria Historic Rancheria Site Drawdown Calcs.xls					
14	4.61133E-35							
15	7.38775E-38			= input		= output		

Wilton Rancheria - Historic Rancheria Site								
Drawdown Calculations - Cosumnes River from AG-2								
Dane Frank								
7/1/2015								
			Theis Non-leaky Aquifer Solution					
s = W(u) (114.6Q / KY)			**Symbol**	**Units**	**Description**			
			s =	feet	Drawdown			
Symbol	**Value**	**Units**	Q =	gpm	Flowrate			
s =	3.59	feet	K =	gpd/ft^2	Average Permeability			
Q =	51	gpm	Y =	feet	Saturated Thickness			
n =	0.01	NA	W(u) =	NA	Well Function			
			r =	feet	distance to point of drawdown measurement			
			S =	NA	Specific Yield			
			t =	days	time since pumping started			
			n =	NA	Drawdown / Aquifer Thickness			
W(u) = -0.5772 - ln(u) + (u^1 / 1*1!) - (u^2 / 2*2!) + (u^3 / 3*3!) - (u^4 / 4*4!)...								
X	**(u^x / x*x!)**			**u = 1.87r^{2}S / Kmt**		**Units**		
1	0.002101862							
2	1.10446E-06		K =	13		gpd/ft^2		
3	5.15869E-10		Y =	700		feet		
4	2.03304E-13		r =	400		feet		
5	6.83706E-17		S =	0.07		NA		
6	1.99591E-20		t =	1095		days		
7	5.13689E-24		u =	0.002101862		NA		
8	1.18093E-27		ln(u) =	-6.16493185		NA		
9	2.4515E-31		W(u) =	5.589832604		NA		
10	4.63744E-35							
11	8.05558E-39							
12	1.2934E-42							
13	1.93032E-46		N:\Everyone\AEG Documents\Wilton Rancheria\SS - Wilton Rancheria Historic Rancheria Site Drawdown Calcs.xls					
14	2.69105E-50							
15	3.51942E-54			= input		= output		

Wilton Rancheria - Historic Rancheria Site									
Drawdown Calculations - At Extraction Well									
Dane Frank									
7/1/2015									
		Theis Non-leaky Aquifer Solution							
s = W(u) (114.6Q / KY)			**Symbol**	**Units**	**Description**				
			s =	feet	Drawdown at point of measurement				
Symbol	**Value**	**Units**	Q =	gpm	Flowrate				
s =	12.18	feet	K =	gpd/ft^2	Average Permeability				
Q =	51	gpm	Y =	feet	Saturated Thickness				
n =	0.02	NA	W(u) =	NA	Well Function				
			r =	feet	Radius of Well				
			S =	NA	Specific Yield				
			t =	days	time since pumping started				
			n =	NA	Drawdown / Aquifer Thickness				
W(u) = -0.5772 - ln(u) + (u^1 / 1*1!) - (u^2 / 2*2!) + (u^3 / 3*3!) - (u^4 / 4*4!)...									
X	**(u^x / x*x!)**			**u = 1.87r^{2}S / Kmt**		**Units**			
1	3.28416E-09								
2	2.69642E-18		K =	13		gpd/ft^2			
3	1.96789E-27		Y =	700		feet			
4	1.21178E-36		r =	0.5		feet			
5	6.36751E-46		S =	0.07		NA			
6	2.90443E-55		t =	1095		days			
7	1.16799E-64		u =	3.28416E-09		NA			
8	4.19549E-74		ln(u) =	-19.5341553		NA			
9	1.36085E-83		W(u) =	18.95695531		NA			
10	4.02234E-93								
11	1.0917E-102								
12	2.7389E-112								
13	6.3869E-122		N:\Everyone\AEG Documents\Wilton Rancheria\SS - Wilton Rancheria Historic Rancheria Site Drawdown Calcs.xls						
14	1.3912E-131								
15	2.843E-141			= input		= output			

Wilton Rancheria - Historic Rancheria Site									
Drawdown Calculations - Distance to Three Feet of Drawdown									
Dane Frank									
7/1/2015									
Theis Non-leaky Aquifer Solution									
s = W(u) (114.6Q / KY)			**Symbol**	**Units**	**Description**				
			s =	feet	Drawdown at point of measurement				
Symbol	**Value**	**Units**	Q =	gpm	Flowrate				
s =	3.00	feet	K =	gpd/ft^2	Average Permeability				
Q =	51	gpm	Y =	feet	Saturated Thickness				
n =	0.00	NA	W(u) =	NA	Well Function				
			r =	feet	distance from the well to point of drawdown measurement				
			S =	NA	Specific Yield				
			t =	days	time since pumping started				
			n =	NA	Drawdown / Aquifer Thickness				
W(u) = -0.5772 - ln(u) + (u^1 / 1*1!) - (u^2 / 2*2!) + (u^3 / 3*3!) - (u^4 / 4*4!)...									
X	**(u^x / x*x!)**			**u = 1.87r^{2}S / Kmt**		**Units**			
1	0.00529702								
2	7.0146E-06		K =	13		gpd/ft^2			
3	8.257E-09		Y =	700		feet			
4	8.20078E-12		r =	635		feet			
5	6.95035E-15		S =	0.07		NA			
6	5.11335E-18		t =	1095		days			
7	3.3166E-21		u =	0.00529702		NA			
8	1.92151E-24		ln(u) =	-5.2406109		NA			
9	1.00526E-27		W(u) =	4.66870096		NA			
10	4.7924E-31								
11	2.09797E-34								
12	8.48908E-38								
13	3.19291E-41		N:\Everyone\AEG Documents\Wilton Rancheria\SS - Wilton Rancheria Historic Rancheria Site Drawdown Calcs.xls						
14	1.12178E-44								
15	3.69728E-48			= input		= output			

Wilton Rancheria - Historic Rancheria Site								
Drawdown Calculations - Closest Site Boundary to AG-1								
Dane Frank								
7/1/2015								
Southern Site boundary								
Note: exact location of property line is unknown, measuring to edge of asphalt								
		Theis Non-leaky Aquifer Solution						
s = W(u) (114.6Q / KY)			**Symbol**	**Units**	**Description**			
			s =	feet	Drawdown			
Symbol	**Value**	**Units**	Q =	gpm	Flowrate			
s =	3.52	feet	K =	gpd/ft^2	Average Permeability			
Q =	37	gpm	Y =	feet	Saturated Thickness			
n =	0.01	NA	W(u) =	NA	Well Function			
			r =	feet	distance to point of drawdown measurement			
			S =	NA	Specific Yield			
			t =	days	time since pumping started			
			n =	NA	Drawdown / Aquifer Thickness			
W(u) = -0.5772 - ln(u) + (u^1 / 1*1!) - (u^2 / 2*2!) + (u^3 / 3*3!) - (u^4 / 4*4!)...								
X	**(u^x / x*x!)**			**u = 1.87r^{2}S / Kmt**		**Units**		
1	0.000295574							
2	2.1841E-08		K =	13		gpd/ft^2		
3	1.43459E-12		Y =	700		feet		
4	7.95052E-17		r =	150		feet		
5	3.75995E-21		S =	0.07		NA		
6	1.54353E-25		t =	1095		days		
7	5.58648E-30		u =	0.000295574		NA		
8	1.80602E-34		ln(u) =	-8.12659035		NA		
9	5.27223E-39		W(u) =	7.549685905		NA		
10	1.4025E-43							
11	3.42598E-48							
12	7.73538E-53							
13	1.62346E-57		N:\Everyone\AEG Documents\Wilton Rancheria\SS - Wilton Rancheria Historic Rancheria Site Drawdown Calcs.xls					
14	3.18271E-62							
15	5.85341E-67			= input		= output		

Wilton Rancheria - Historic Rancheria Site								
Drawdown Calculations - Closest Off-Site Domestic Well to AG-1								
Dane Frank								
7/1/2015								
Well: Unknown well name - at residence south-southwest of AG-1								
Note: Location of well (and distance to well) is approximate								
		Theis Non-leaky Aquifer Solution						
s = W(u) (114.6Q / KY)			**Symbol**	**Units**	**Description**			
			s =	feet	Drawdown			
Symbol	**Value**	**Units**	Q =	gpm	Flowrate			
s =	1.91	feet	K =	gpd/ft^2	Average Permeability			
Q =	37	gpm	Y =	feet	Saturated Thickness			
n =	0.00	NA	W(u) =	NA	Well Function			
			r =	feet	distance to point of drawdown measurement			
			S =	NA	Specific Yield			
			t =	days	time since pumping started			
			n =	NA	Drawdown / Aquifer Thickness			
W(u) = -0.5772 - ln(u) + (u^1 / 1*1!) - (u^2 / 2*2!) + (u^3 / 3*3!) - (u^4 / 4*4!)...								
X	**(u^x / x*x!)**			**u = 1.87r^{2}S / Kmt**		**Units**		
1	0.009491219							
2	2.25208E-05		K =	13		gpd/ft^2		
3	4.75E-08		Y =	700		feet		
4	8.45311E-11		r =	850		feet		
5	1.28369E-13		S =	0.07		NA		
6	1.69219E-16		t =	1095		days		
7	1.96664E-19		u =	0.009491219		NA		
8	2.04158E-22		ln(u) =	-4.65738824		NA		
9	1.91378E-25		W(u) =	4.089656987		NA		
10	1.63477E-28							
11	1.28231E-31							
12	9.29706E-35							
13	6.26559E-38		N:\Everyone\AEG Documents\Wilton Rancheria\SS - Wilton Rancheria Historic Rancheria Site Drawdown Calcs.xls					
14	3.94431E-41							
15	2.32937E-44			= input		= output		

Wilton Rancheria - Historic Rancheria Site								
Drawdown Calculations - Cosumnes River from AG-1								
Dane Frank								
7/1/2015								
			Theis Non-leaky Aquifer Solution					
s = W(u) (114.6Q / KY)			**Symbol**	**Units**	**Description**			
			s =	feet	Drawdown			
Symbol	**Value**	**Units**	Q =	gpm	Flowrate			
s =	1.33	feet	K =	gpd/ft^2	Average Permeability			
Q =	37	gpm	Y =	feet	Saturated Thickness			
n =	0.00	NA	W(u) =	NA	Well Function			
			r =	feet	distance to point of drawdown measurement			
			S =	NA	Specific Yield			
			t =	days	time since pumping started			
			n =	NA	Drawdown / Aquifer Thickness			
W(u) = -0.5772 - ln(u) + (u^1 / 1*1!) - (u^2 / 2*2!) + (u^3 / 3*3!) - (u^4 / 4*4!)...								
X	**(u^x / x*x!)**			**u = 1.87r^{2}S / Kmt**		**Units**		
1	0.033629786							
2	0.000282741		K =	13		gpd/ft^2		
3	2.113E-06		Y =	700		feet		
4	1.33237E-08		r =	1600		feet		
5	7.16918E-11		S =	0.07		NA		
6	3.34858E-13		t =	1095		days		
7	1.37892E-15		u =	0.033629786		NA		
8	5.07204E-18		ln(u) =	-3.39234312		NA		
9	1.68466E-20		W(u) =	2.848492269		NA		
10	5.09892E-23							
11	1.41715E-25							
12	3.64058E-28							
13	8.6934E-31		N:\Everyone\AEG Documents\Wilton Rancheria\SS - Wilton Rancheria Historic Rancheria Site Drawdown Calcs.xls					
14	1.9391E-33							
15	4.05761E-36			= input		= output		

Wilton Rancheria - Historic Rancheria Site								
Drawdown Calculations - Closest Site Boundary to AG-2								
Dane Frank								
7/1/2015								
Northern Site boundary								
Note: exact location of property line is unknown								
		Theis Non-leaky Aquifer Solution						
s = W(u) (114.6Q / KY)			**Symbol**	**Units**	**Description**			
			s =	feet	Drawdown			
Symbol	**Value**	**Units**	Q =	gpm	Flowrate			
s =	3.90	feet	K =	gpd/ft^2	Average Permeability			
Q =	37	gpm	Y =	feet	Saturated Thickness			
n =	0.01	NA	W(u) =	NA	Well Function			
			r =	feet	distance to point of drawdown measurement			
			S =	NA	Specific Yield			
			t =	days	time since pumping started			
			n =	NA	Drawdown / Aquifer Thickness			
W(u) = -0.5772 - ln(u) + (u^1 / 1*1!) - (u^2 / 2*2!) + (u^3 / 3*3!) - (u^4 / 4*4!)...								
X	**(u^x / x*x!)**			**u = 1.87r^{2}S / Kmt**		**Units**		
1	0.000131366							
2	4.31428E-09		K =	13		gpd/ft^2		
3	1.25945E-13		Y =	700		feet		
4	3.10217E-18		r =	100		feet		
5	6.52033E-23		S =	0.07		NA		
6	1.18966E-27		t =	1095		days		
7	1.91364E-32		u =	0.000131366		NA		
8	2.74956E-37		ln(u) =	-8.93752057		NA		
9	3.5674E-42		W(u) =	8.360451931		NA		
10	4.21773E-47							
11	4.57907E-52							
12	4.59506E-57							
13	4.28618E-62		N:\Everyone\AEG Documents\Wilton Rancheria\SS - Wilton Rancheria Historic Rancheria Site Drawdown Calcs.xls					
14	3.73458E-67							
15	3.05261E-72			= input		= output		

Wilton Rancheria - Historic Rancheria Site								
Drawdown Calculations - Closest Off-Site Domestic Well to AG-2								
Dane Frank								
7/1/2015								
Well: DWR #87669 - southeast of AG-2								
Note: Location of well (and distance to well) is approximate								
			Theis Non-leaky Aquifer Solution					
s = W(u) (114.6Q / KY)			**Symbol**	**Units**	**Description**			
			s =	feet	Drawdown			
Symbol	**Value**	**Units**	Q =	gpm	Flowrate			
s =	1.45	feet	K =	gpd/ft^2	Average Permeability			
Q =	37	gpm	Y =	feet	Saturated Thickness			
n =	0.00	NA	W(u) =	NA	Well Function			
			r =	feet	distance to point of drawdown measurement			
			S =	NA	Specific Yield			
			t =	days	time since pumping started			
			n =	NA	Drawdown / Aquifer Thickness			
W(u) = -0.5772 - ln(u) + (u^1 / 1*1!) - (u^2 / 2*2!) + (u^3 / 3*3!) - (u^4 / 4*4!)...								
X	**(u^x / x*x!)**			**u = 1.87r^{2}S / Kmt**		**Units**		
1	0.025747805							
2	0.000165737		K =	13		gpd/ft^2		
3	9.48305E-07		Y =	700		feet		
4	4.57815E-09		r =	1400		feet		
5	1.88604E-11		S =	0.07		NA		
6	6.74462E-14		t =	1095		days		
7	2.12644E-16		u =	0.025747805		NA		
8	5.9884E-19		ln(u) =	-3.65940591		NA		
9	1.52285E-21		W(u) =	3.107788921		NA		
10	3.5289E-24							
11	7.5092E-27							
12	1.47694E-29							
13	2.70022E-32		N:\Everyone\AEG Documents\Wilton Rancheria\SS - Wilton Rancheria Historic Rancheria Site Drawdown Calcs.xls					
14	4.61133E-35							
15	7.38775E-38			= input		= output		

Wilton Rancheria - Historic Rancheria Site								
Drawdown Calculations - Cosumnes River from AG-2								
Dane Frank								
7/1/2015								
			Theis Non-leaky Aquifer Solution					
s = W(u) (114.6Q / KY)			**Symbol**	**Units**	**Description**			
			s =	feet	Drawdown			
Symbol	**Value**	**Units**	Q =	gpm	Flowrate			
s =	2.60	feet	K =	gpd/ft^2	Average Permeability			
Q =	37	gpm	Y =	feet	Saturated Thickness			
n =	0.00	NA	W(u) =	NA	Well Function			
			r =	feet	distance to point of drawdown measurement			
			S =	NA	Specific Yield			
			t =	days	time since pumping started			
			n =	NA	Drawdown / Aquifer Thickness			
W(u) = -0.5772 - ln(u) + (u^1 / 1*1!) - (u^2 / 2*2!) + (u^3 / 3*3!) - (u^4 / 4*4!)...								
X	**(u^x / x*x!)**			**u = 1.87r^{2}S / Kmt**		**Units**		
1	0.002101862							
2	1.10446E-06		K =	13		gpd/ft^2		
3	5.15869E-10		Y =	700		feet		
4	2.03304E-13		r =	400		feet		
5	6.83706E-17		S =	0.07		NA		
6	1.99591E-20		t =	1095		days		
7	5.13689E-24		u =	0.002101862		NA		
8	1.18093E-27		ln(u) =	-6.16493185		NA		
9	2.4515E-31		W(u) =	5.589832604		NA		
10	4.63744E-35							
11	8.05558E-39							
12	1.2934E-42							
13	1.93032E-46		N:\Everyone\AEG Documents\Wilton Rancheria\SS - Wilton Rancheria Historic Rancheria Site Drawdown Calcs.xls					
14	2.69105E-50							
15	3.51942E-54			= input		= output		

Wilton Rancheria - Historic Rancheria Site									
Drawdown Calculations - At Extraction Well									
Dane Frank									
7/1/2015									
		Theis Non-leaky Aquifer Solution							
s = W(u) (114.6Q / KY)			**Symbol**	**Units**	**Description**				
			s =	feet	Drawdown at point of measurement				
Symbol	**Value**	**Units**	Q =	gpm	Flowrate				
s =	8.83	feet	K =	gpd/ft^2	Average Permeability				
Q =	37	gpm	Y =	feet	Saturated Thickness				
n =	0.01	NA	W(u) =	NA	Well Function				
			r =	feet	Radius of Well				
			S =	NA	Specific Yield				
			t =	days	time since pumping started				
			n =	NA	Drawdown / Aquifer Thickness				
W(u) = -0.5772 - ln(u) + (u^1 / 1*1!) - (u^2 / 2*2!) + (u^3 / 3*3!) - (u^4 / 4*4!)...									
X	**(u^x / x*x!)**			**u = 1.87r^{2}S / Kmt**		**Units**			
1	3.28416E-09								
2	2.69642E-18		K =	13		gpd/ft^2			
3	1.96789E-27		Y =	700		feet			
4	1.21178E-36		r =	0.5		feet			
5	6.36751E-46		S =	0.07		NA			
6	2.90443E-55		t =	1095		days			
7	1.16799E-64		u =	3.28416E-09		NA			
8	4.19549E-74		ln(u) =	-19.5341553		NA			
9	1.36085E-83		W(u) =	18.95695531		NA			
10	4.02234E-93								
11	1.0917E-102								
12	2.7389E-112								
13	6.3869E-122		N:\Everyone\AEG Documents\Wilton Rancheria\SS - Wilton Rancheria Historic Rancheria Site Drawdown Calcs.xls						
14	1.3912E-131								
15	2.843E-141			= input		= output			

Wilton Rancheria - Historic Rancheria Site									
Drawdown Calculations - Distance to Three Feet of Drawdown									
Dane Frank									
7/1/2015									
Theis Non-leaky Aquifer Solution									
s = W(u) (114.6Q / KY)			**Symbol**	**Units**	**Description**				
			s =	feet	Drawdown at point of measurement				
Symbol	**Value**	**Units**	Q =	gpm	Flowrate				
s =	3.00	feet	K =	gpd/ft^2	Average Permeability				
Q =	37	gpm	Y =	feet	Saturated Thickness				
n =	0.00	NA	W(u) =	NA	Well Function				
			r =	feet	distance from the well to point of drawdown measurement				
			S =	NA	Specific Yield				
			t =	days	time since pumping started				
			n =	NA	Drawdown / Aquifer Thickness				
W(u) = -0.5772 - ln(u) + (u^1 / 1*1!) - (u^2 / 2*2!) + (u^3 / 3*3!) - (u^4 / 4*4!)...									
X	**(u^x / x*x!)**			**u = 1.87r^{2}S / Kmt**		**Units**			
1	0.000901751								
2	2.03289E-07		K =	13		gpd/ft^2			
3	4.07369E-11		Y =	700		feet			
4	6.88772E-15		r =	262		feet			
5	9.93762E-19		S =	0.07		NA			
6	1.24462E-22		t =	1095		days			
7	1.37429E-26		u =	0.00090175		NA			
8	1.35545E-30		ln(u) =	-7.0111719		NA			
9	1.20719E-34		W(u) =	6.43487348		NA			
10	9.79725E-39								
11	7.30139E-43								
12	5.02947E-47								
13	3.22035E-51		N:\Everyone\AEG Documents\Wilton Rancheria\SS - Wilton Rancheria Historic Rancheria Site Drawdown Calcs.xls						
14	1.92609E-55								
15	1.08071E-59			= input		= output			

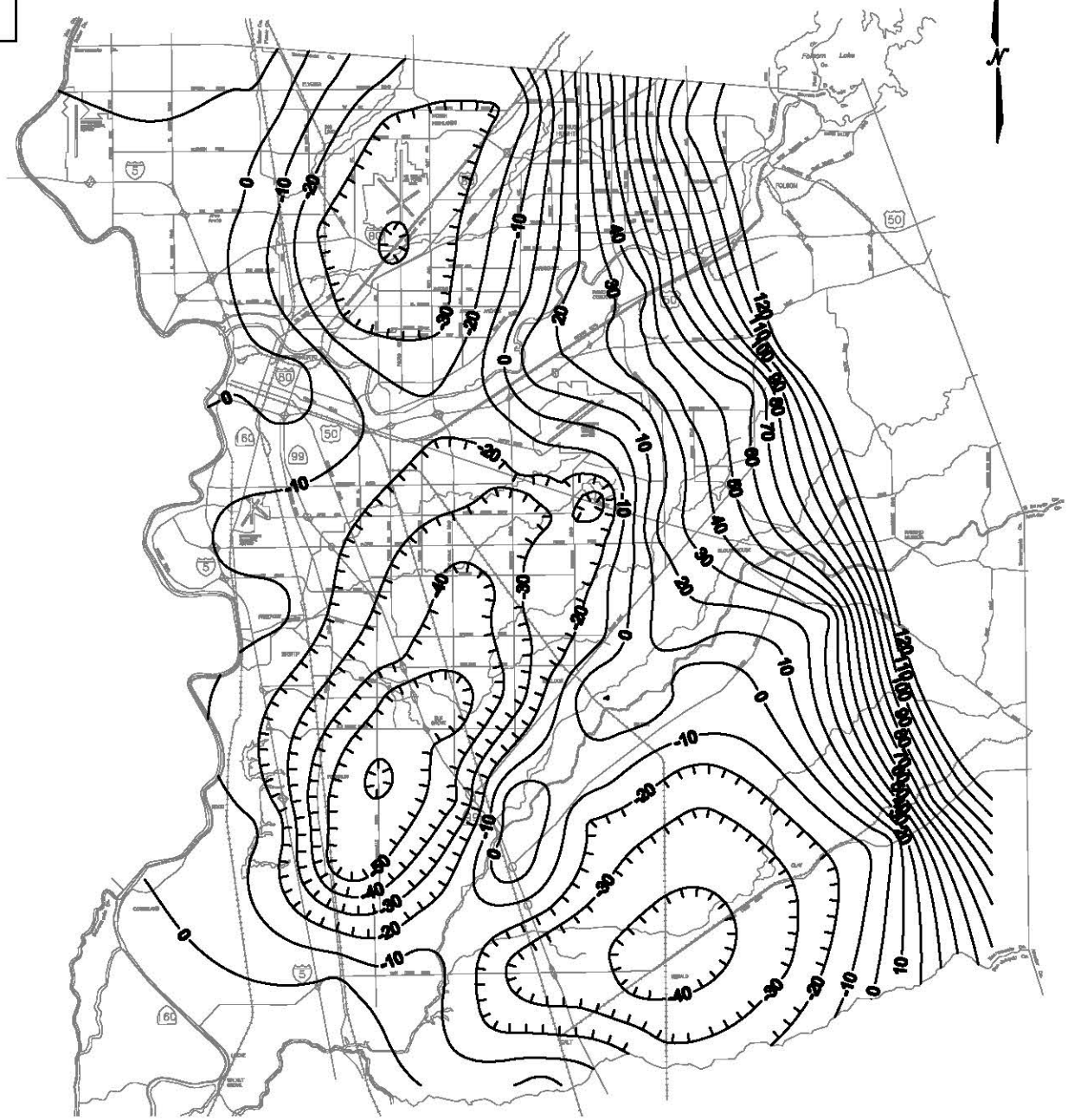
Appendix C

Groundwater Elevation Figures and Hydrographs

(Prepared By Others)

LOCATION MAP

Source: Sacramento County Water Resources Ground Water Elevation Contour Maps. Sacramento County, California Groundwater Elevations Spring 2007 Accessed February 28, 2014, http://www.waterresources.saccounty.net/Pages/ContourMaps.aspx.



SACRAMENTO COUNTY, CALIFORNIA

GROUNDWATER ELEVATIONS
SPRING 2000

MEAN SEA LEVEL

COUNTY OF SACRAMENTO | PUBLIC WORKS AGENCY | DEPARTMENT OF WATER RESOURCES

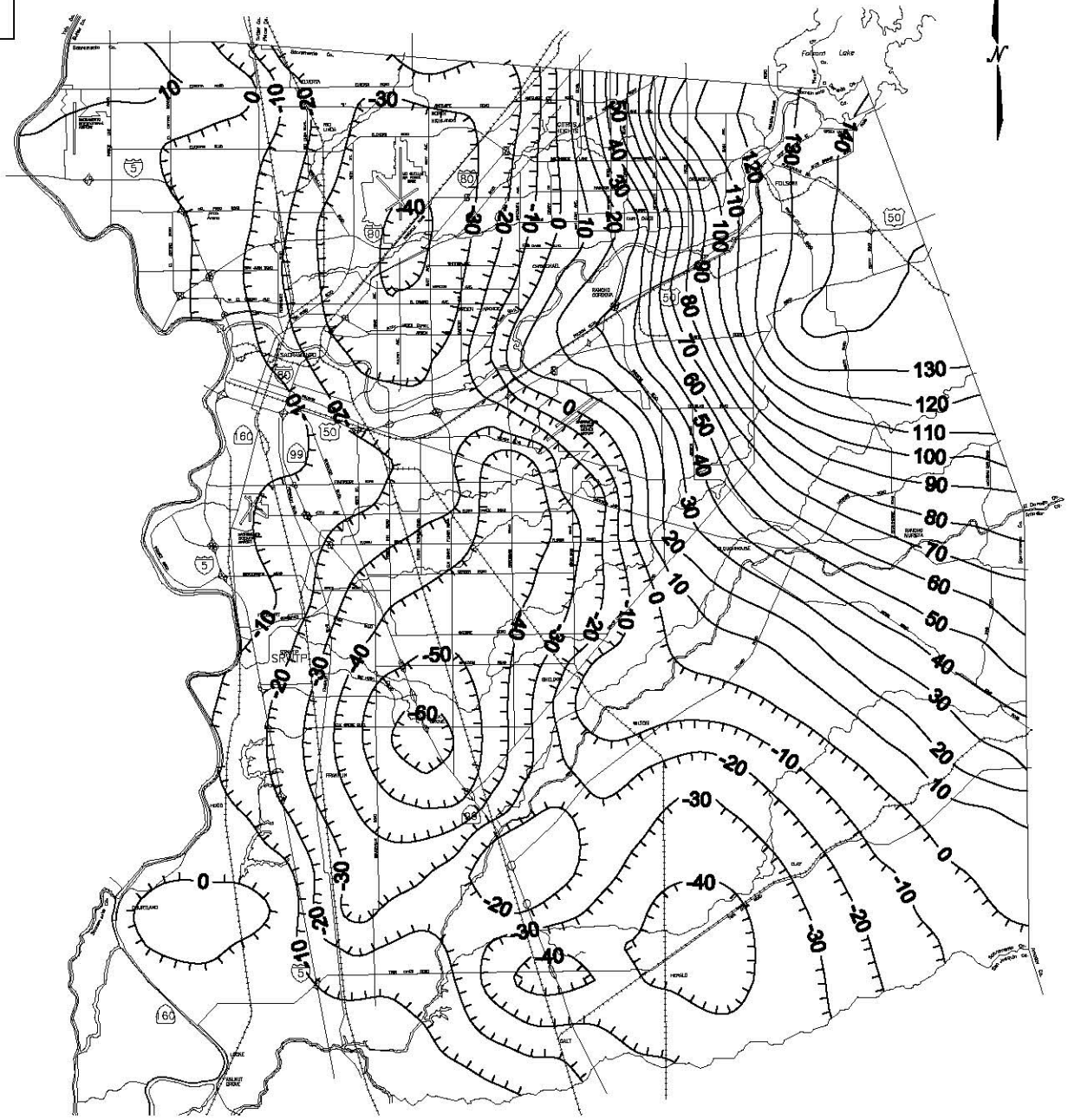
SPRING 2000

NOTE: THIS GROUND WATER CONTOUR MAP IS FOR COMPARISON PURPOSES ONLY. SPECIFIC INFORMATION SHOULD BE OBTAINED BY INDEPENDENT INVESTIGATION.

DRAWN: March 2002
BY: R. Steeg

LOCATION MAP

Source: Sacramento County Water Resources Ground Water Elevation Contour Maps. Sacramento County, California Groundwater Elevations Spring 2007 Accessed February 28, 2014, http://www.waterresources.saccounty.net/Pages/ContourMaps.aspx.



SACRAMENTO COUNTY, CALIFORNIA

GROUNDWATER ELEVATIONS
FALL 2000

MEAN SEA LEVEL

COUNTY OF SACRAMENTO | PUBLIC WORKS AGENCY | DEPARTMENT OF WATER RESOURCES

FALL 2000

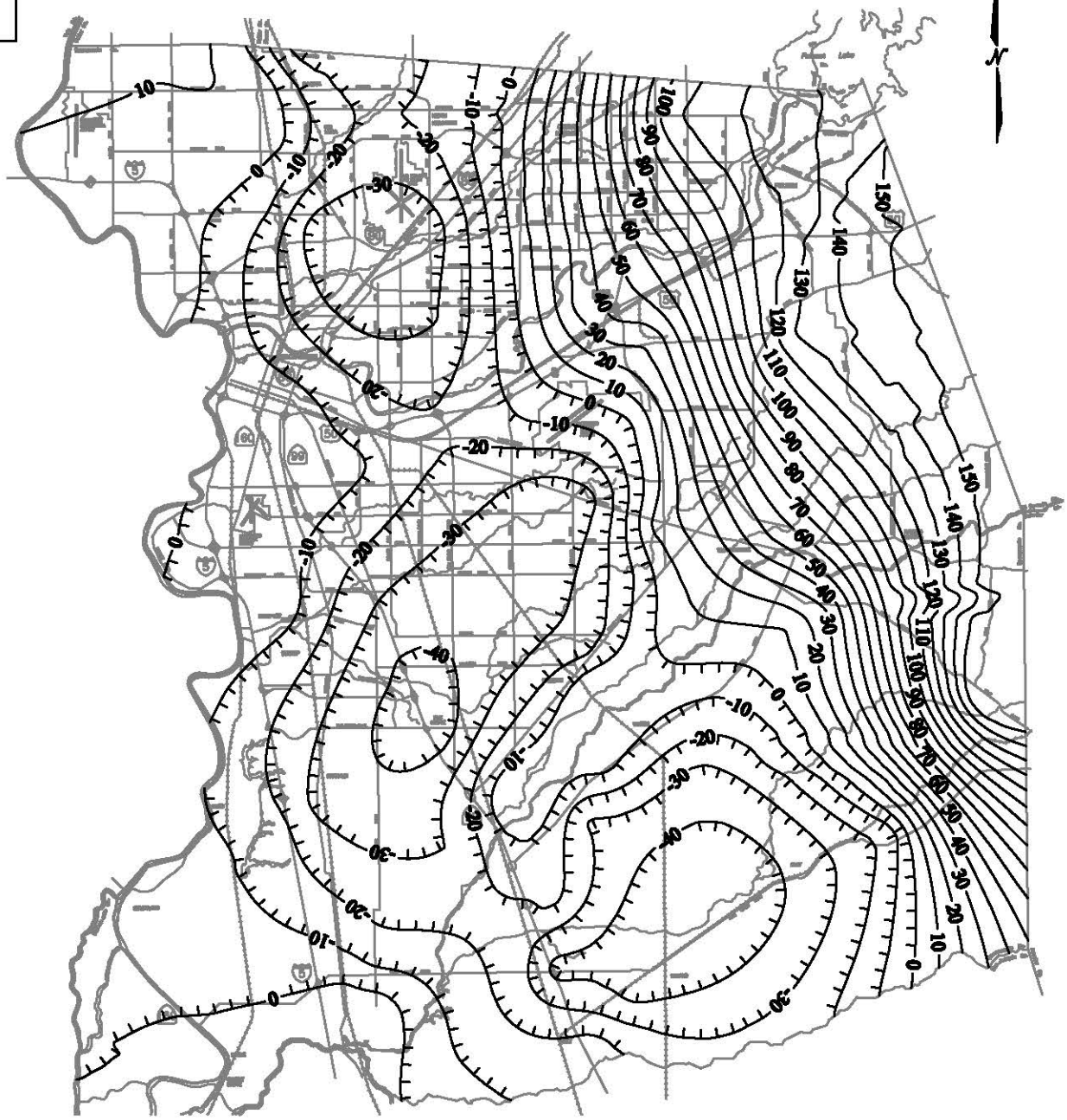
NOTE: THIS GROUND WATER CONTOUR MAP IS FOR COMPARISON PURPOSES ONLY. SPECIFIC INFORMATION SHOULD BE OBTAINED BY INDEPENDENT INVESTIGATION.

DRAWN: June 2003
BY: T. Crick

CAD # P:\Shared Folders\Vxplandev\Zone 12\State Well Program\GW Contour Maps\2000\Fall 00.dwg

LOCATION MAP

Source: Sacramento County Water Resources Ground Water Elevation Contour Maps. Sacramento County, California Groundwater Elevations Spring 2007 Accessed February 28, 2014, http://www.waterresources.saccounty.net/Pages/ContourMaps.aspx.



SACRAMENTO COUNTY, CALIFORNIA

GROUNDWATER ELEVATIONS
SPRING 2007

MEAN SEA LEVEL

COUNTY OF SACRAMENTO | MUNICIPAL SERVICES AGENCY | DEPARTMENT OF WATER RESOURCES

SPRING 2007

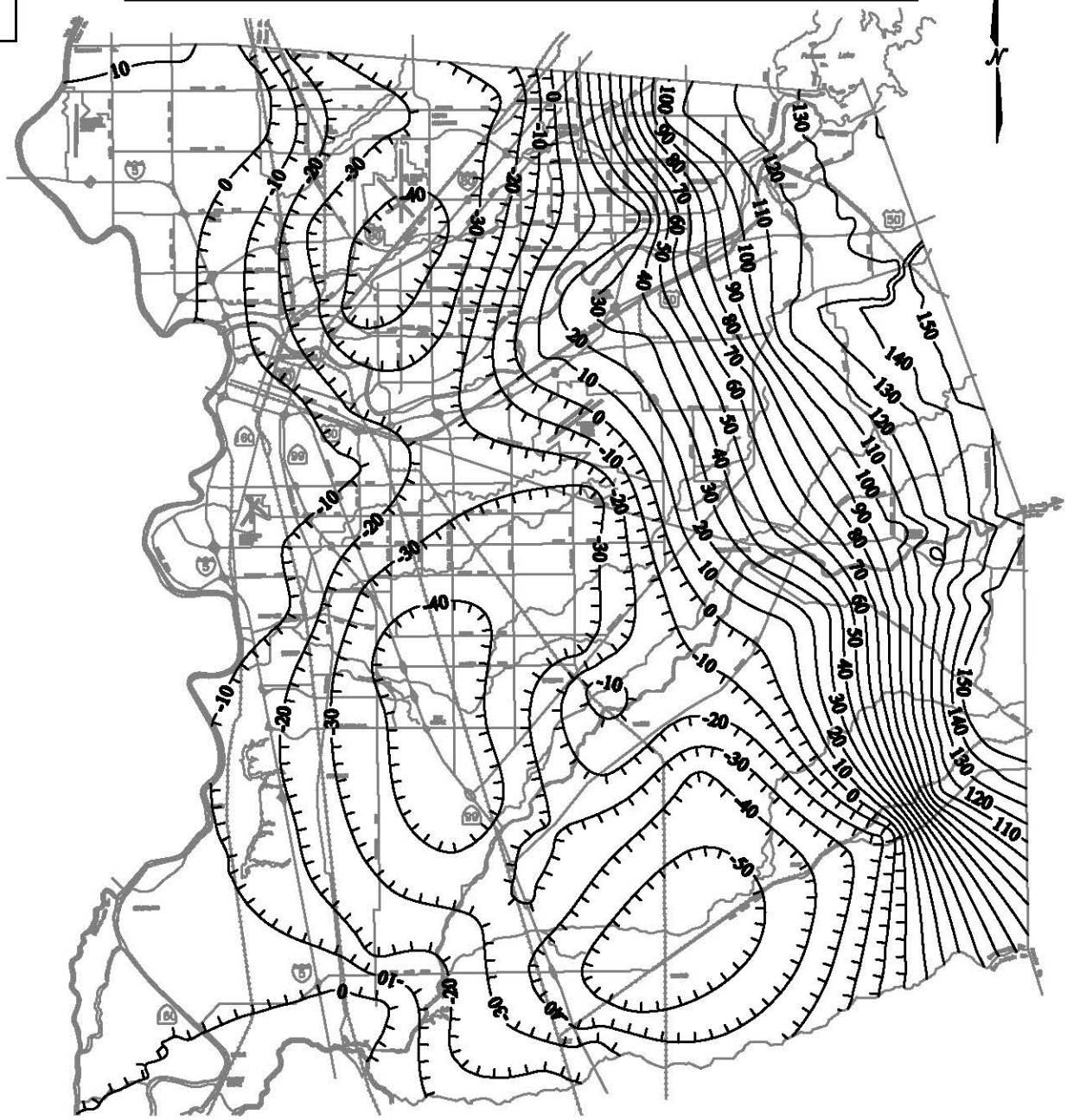
NOTE: THIS GROUND WATER CONTOUR MAP IS FOR COMPARISON PURPOSES ONLY. SPECIFIC INFORMATION SHOULD BE OBTAINED BY INDEPENDENT INVESTIGATION.

DRAWN: March 2009
BY: I. Borgo

CAD © P:\Shared Folders\Vaplander\Zone 12\State Well Program\GW Contour Maps\2007\Spring 2007\GW Contour Map Spring 2007.dwg

LOCATION MAP

Source: Sacramento County Water Resources Ground Water Elevation Contour Maps. Sacramento County, California Groundwater Elevations Spring 2007 Accessed February 28, 2014, http://www.waterresources.saccounty.net/Pages/ContourMaps.aspx.



SACRAMENTO COUNTY, CALIFORNIA

GROUNDWATER ELEVATIONS
FALL 2007

MEAN SEA LEVEL

COUNTY OF SACRAMENTO

MUNICIPAL SERVICES AGENCY

DEPARTMENT OF WATER RESOURCES

FALL 2007

NOTE: THIS GROUND WATER CONTOUR MAP IS FOR COMPARISON PURPOSES ONLY. SPECIFIC INFORMATION SHOULD BE OBTAINED BY INDEPENDENT INVESTIGATION.

DRAWN: March 2009
BY: I. Borgo

CAD © F:\Shared Folders\Vaplander\Zone 12\State Well Program\GW Contour Maps\2007\Fall 2007\GW Contour Map Fall 2007.dwg

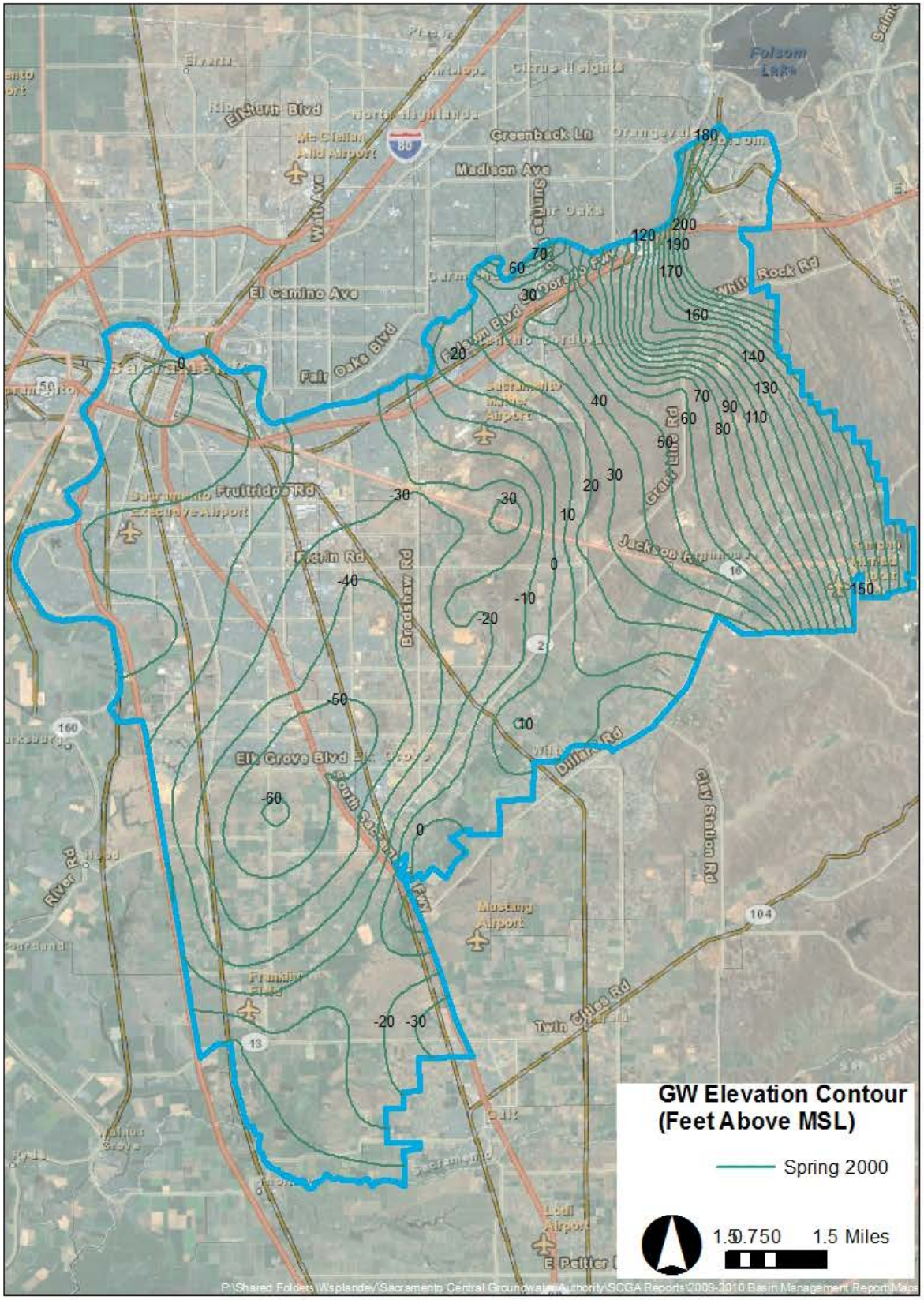


Figure 4 Spring 2000 Groundwater Elevation Contour Map

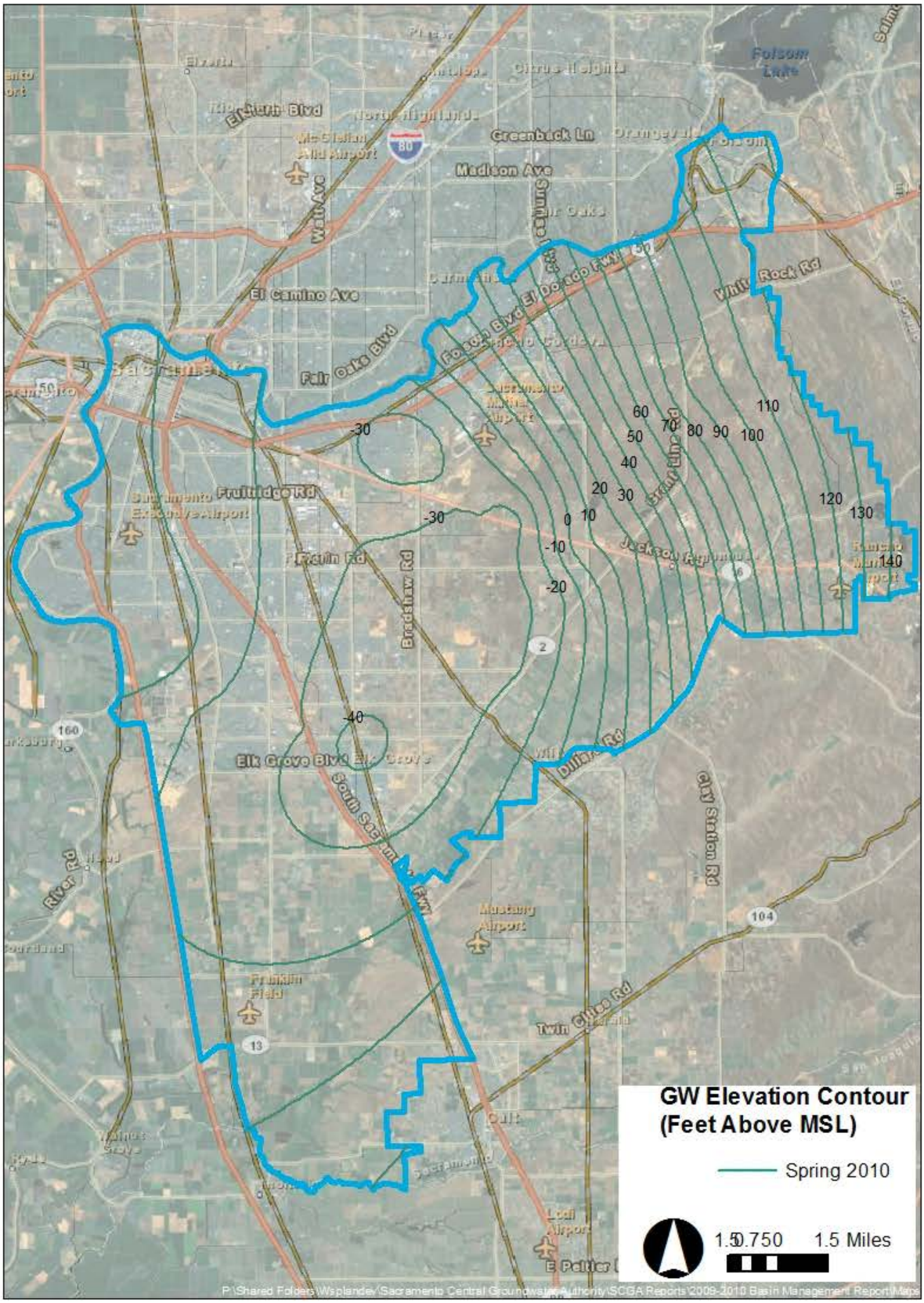


Figure 5 Spring 2010 Groundwater Elevation Contour Map

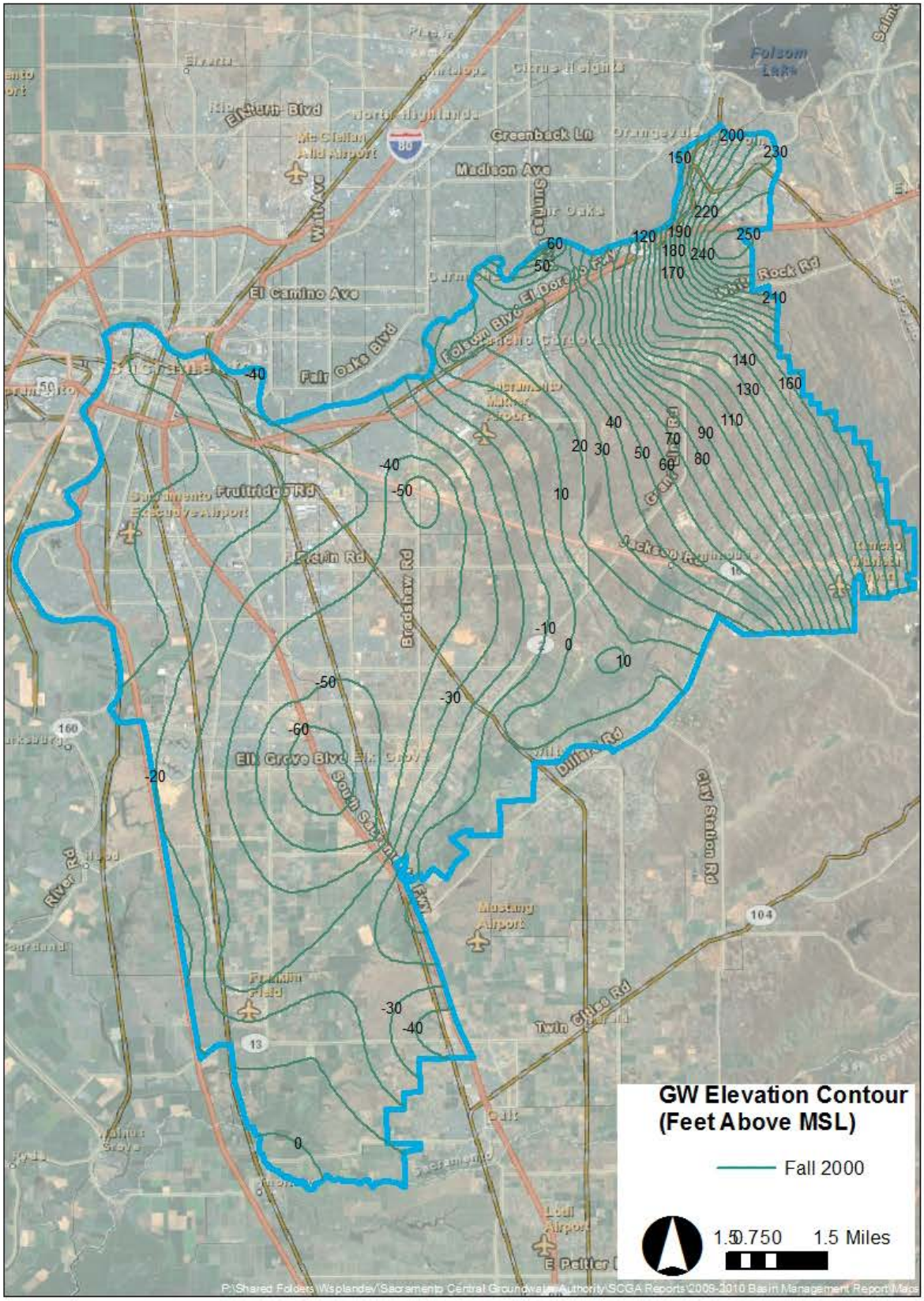


Figure 6 Fall 2000 Groundwater Elevation Contour Map

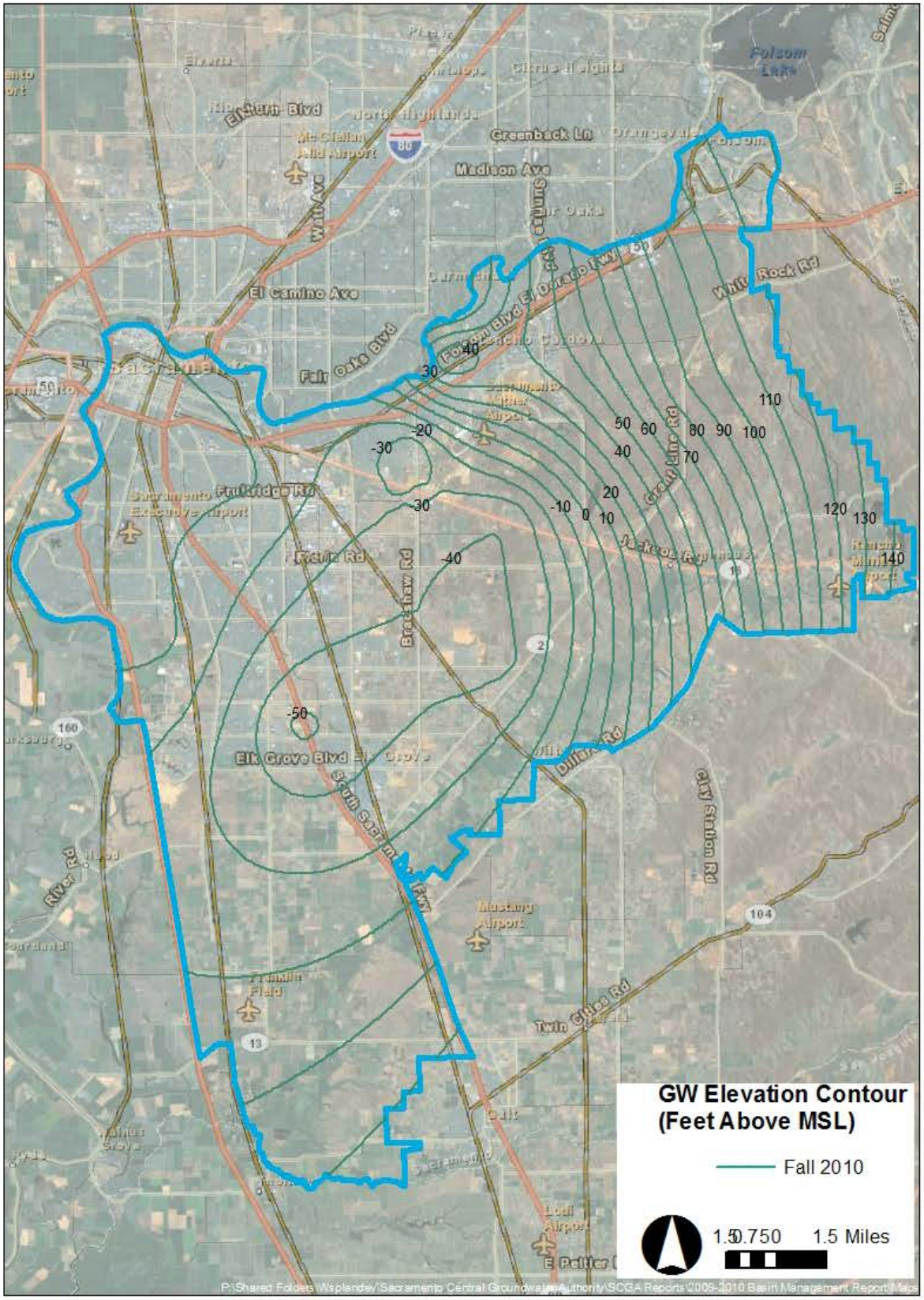


Figure 7 Fall 2010 Groundwater Elevation Contour Map

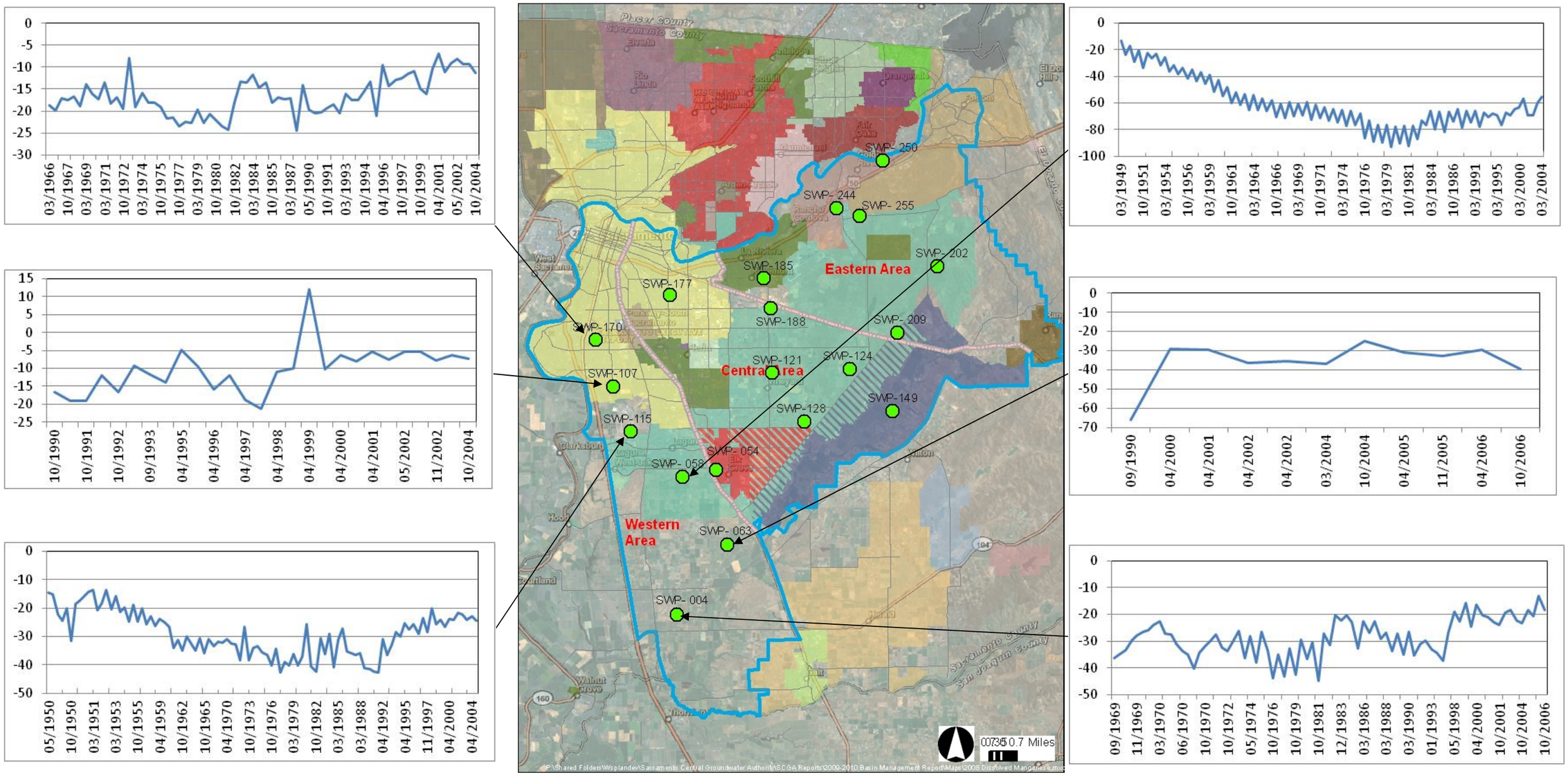


Figure 8 Central Basin Groundwater Hydrographs – Western Area (Feet, above MSL)

Source: Sacramento Central Groundwater Authority. 2009-2010 Basin Management Report.

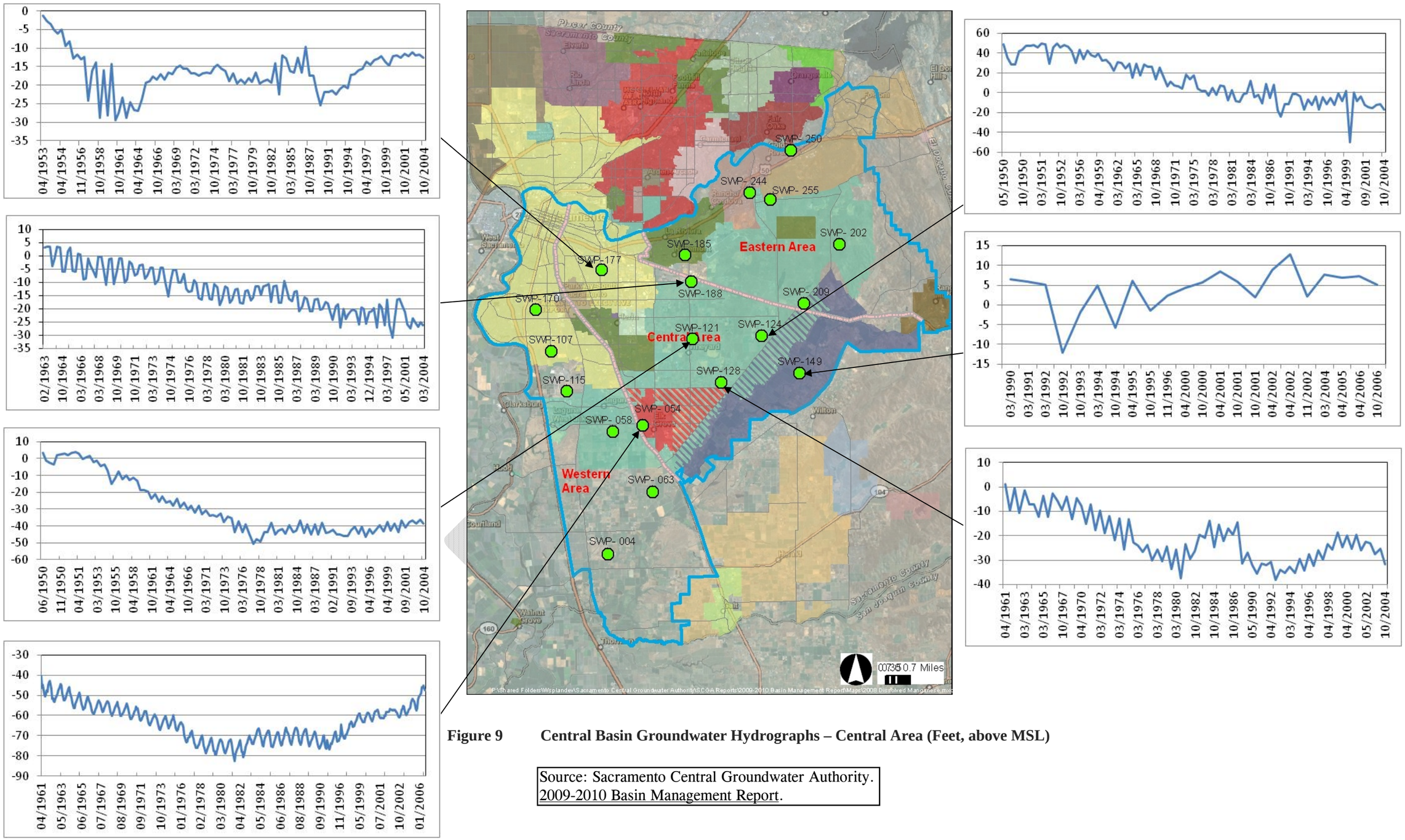


Figure 9 **Central Basin Groundwater Hydrographs – Central Area (Feet, above MSL)**

Source: Sacramento Central Groundwater Authority. 2009-2010 Basin Management Report.

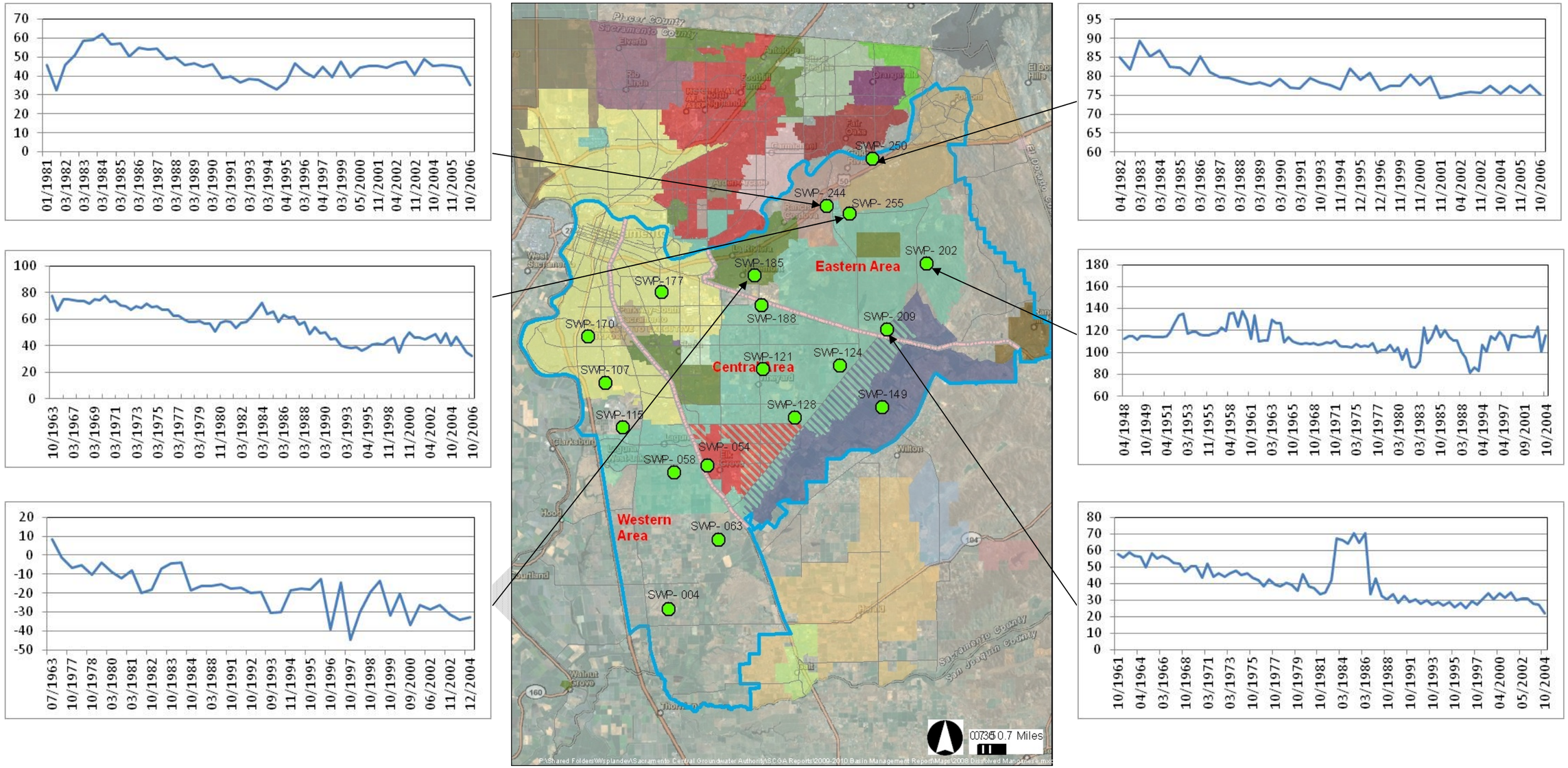


Figure 10 Central Basin Groundwater Hydrographs – Eastern Area (Feet, above MSL)

Source: Sacramento Central Groundwater Authority. 2009-2010 Basin Management Report.

Source: Dunn Environmental, Inc. Fourth Quarter 2013 Ground Water Monitoring and Ground Water Quality Assessment Report for the City of Galt Wastewater Treatment Plant and Reclamation Facility, Revision 0 January 2014.

Monitoring Well

Property Boundary

Discharge

Ground Water Contour, contour interval 1 foot

0 1,000 2,000 3,000

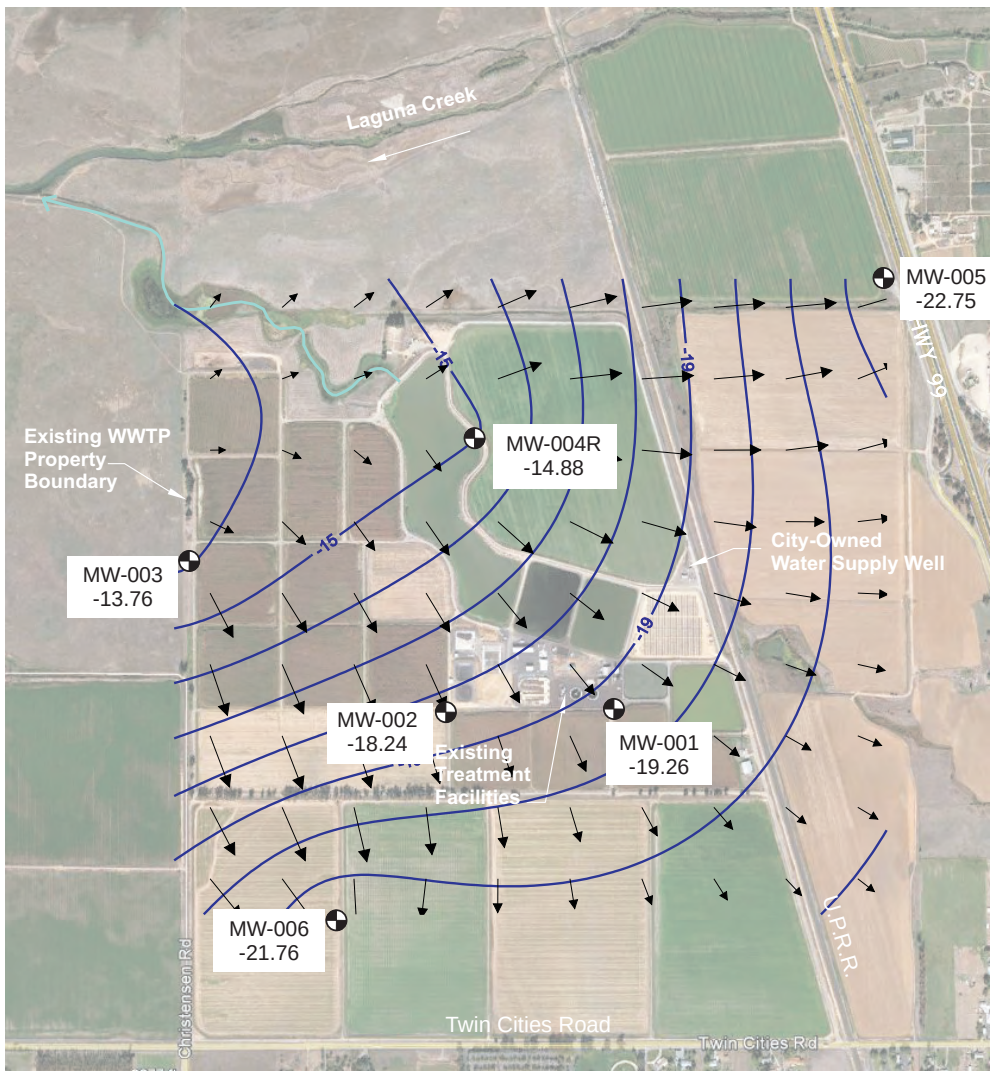
N

Map adapted from WYA past reports.
Aerial photo from Google Earth™, Image Date: 10/30/2011

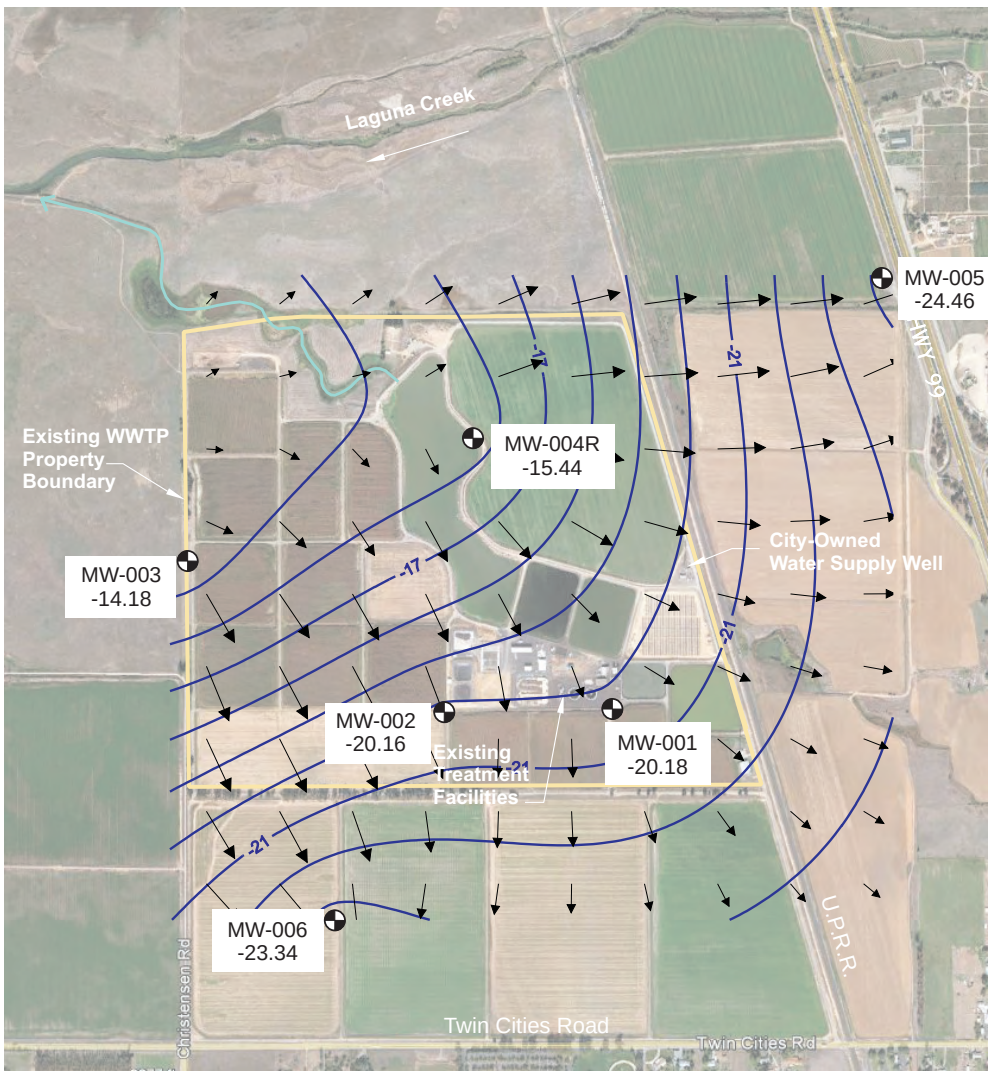
Dunn ENVIRONMENTAL, INC.

DATE: 12/18/2013	FOURTH QUARTER 2013 GROUND WATER CONTOUR MAP CITY OF GALT WWTP SACRAMENTO COUNTY, CA
SCALE: As Shown	
PROJECT NO: SAB121000	
DRAWN: JF/CT	
CHECKED: PFD	
FIGURE: 5	

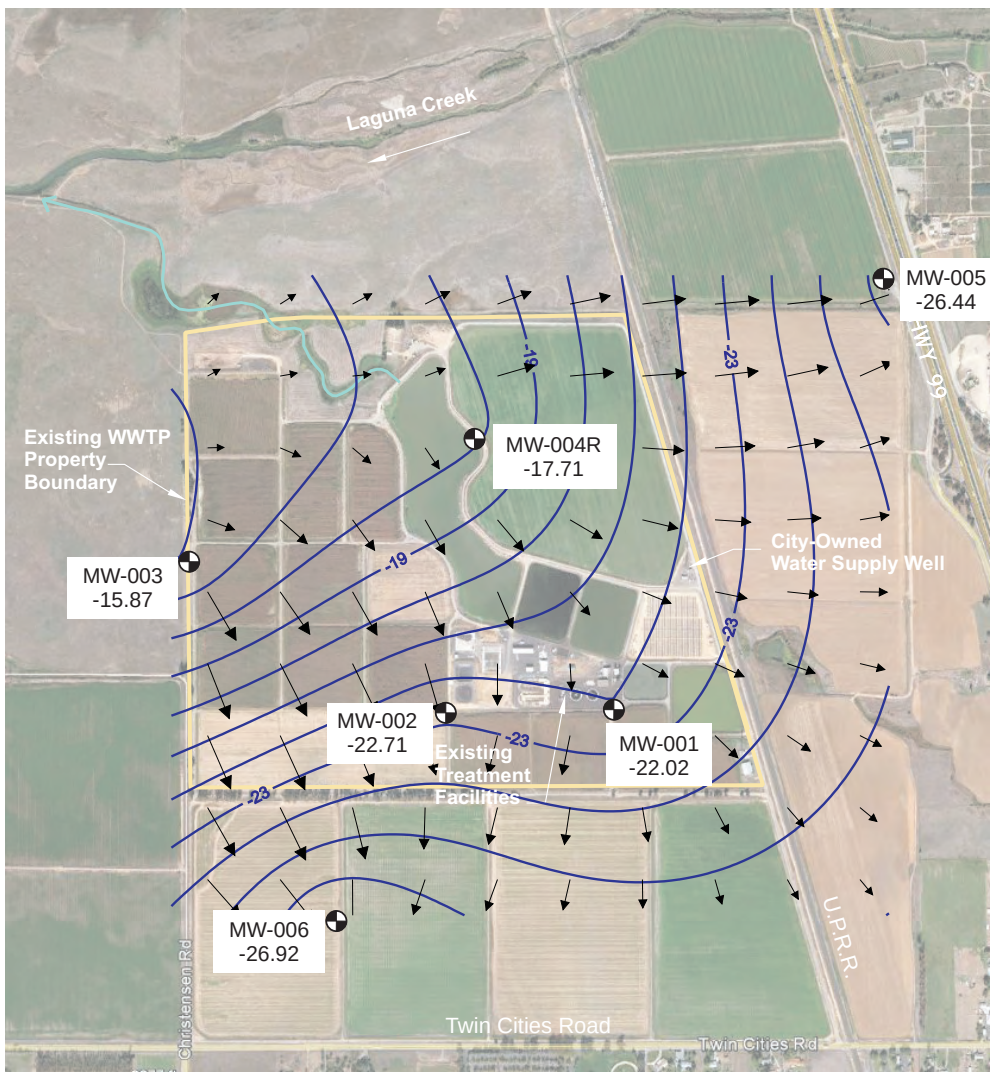
FIRST QUARTER 2012



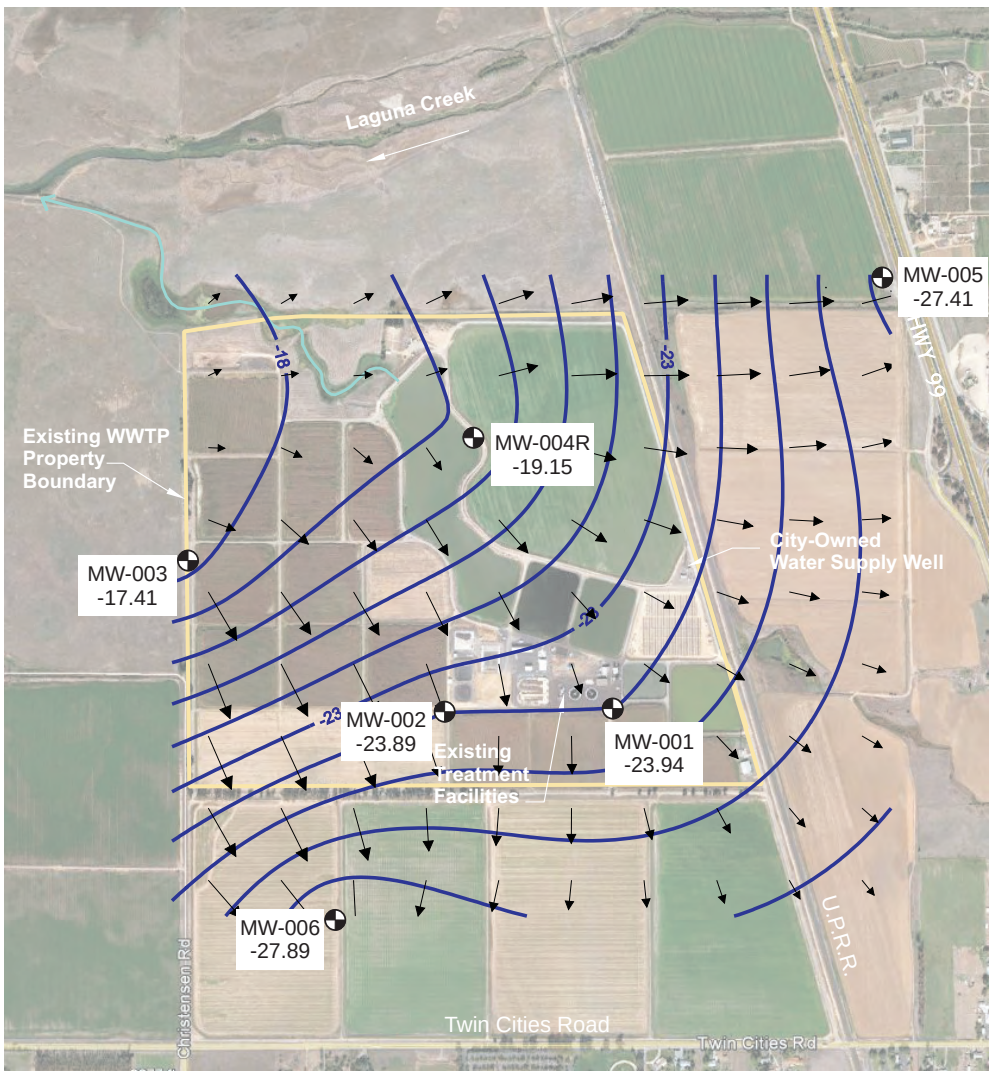
SECOND QUARTER 2012



THIRD QUARTER 2012



FOURTH QUARTER 2012



Monitoring Well

Property Boundary

Discharge

Ground Water Contour, contour interval 1 foot

0 1,000 2,000 3,000

N

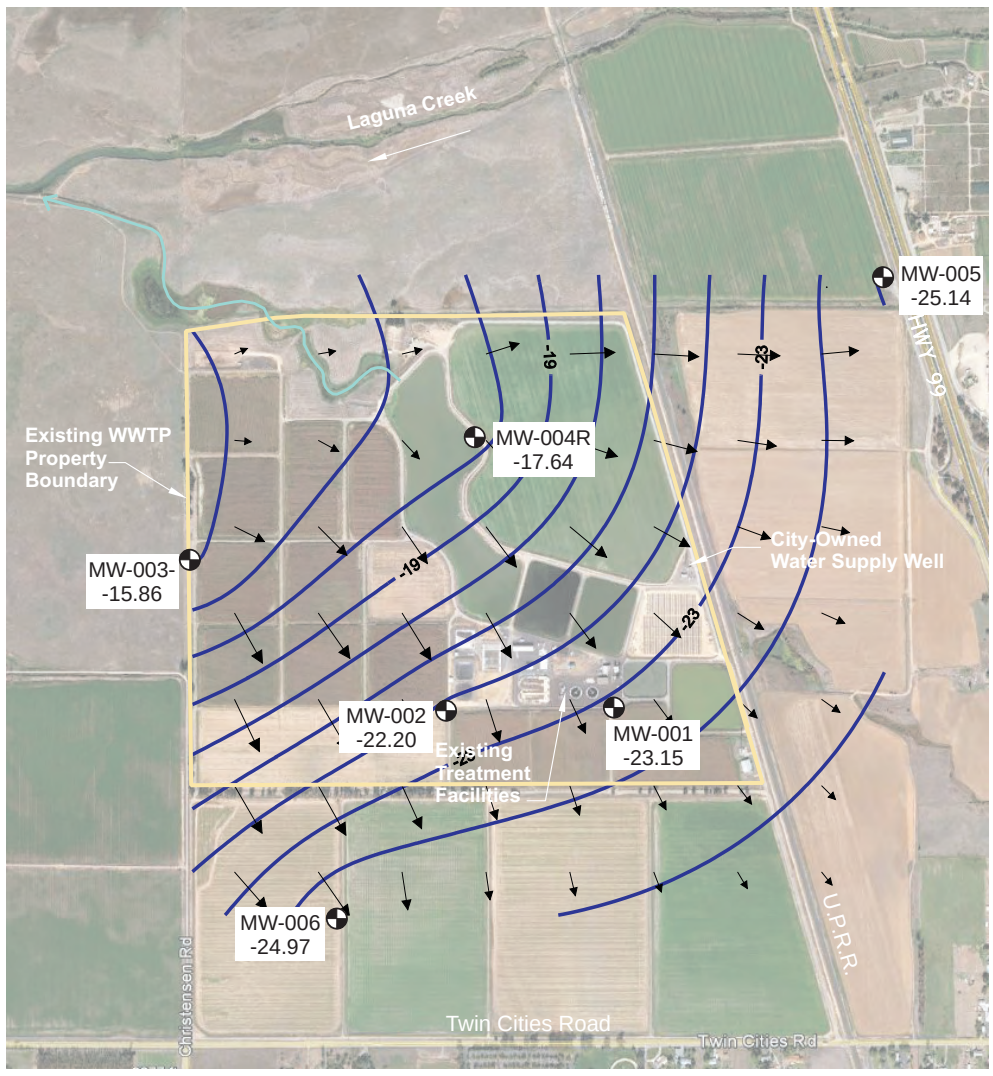
Map adapted from WYA past reports.
Aerial photo from Google Earth™, Image Date: 10/30/2011

Source: Dunn Environmental, Inc. Fourth Quarter 2013 Ground Water Monitoring and Ground Water Quality Assessment Report for the City of Galt Wastewater Treatment Plant and Reclamation Facility, Revision 0 January 2014.

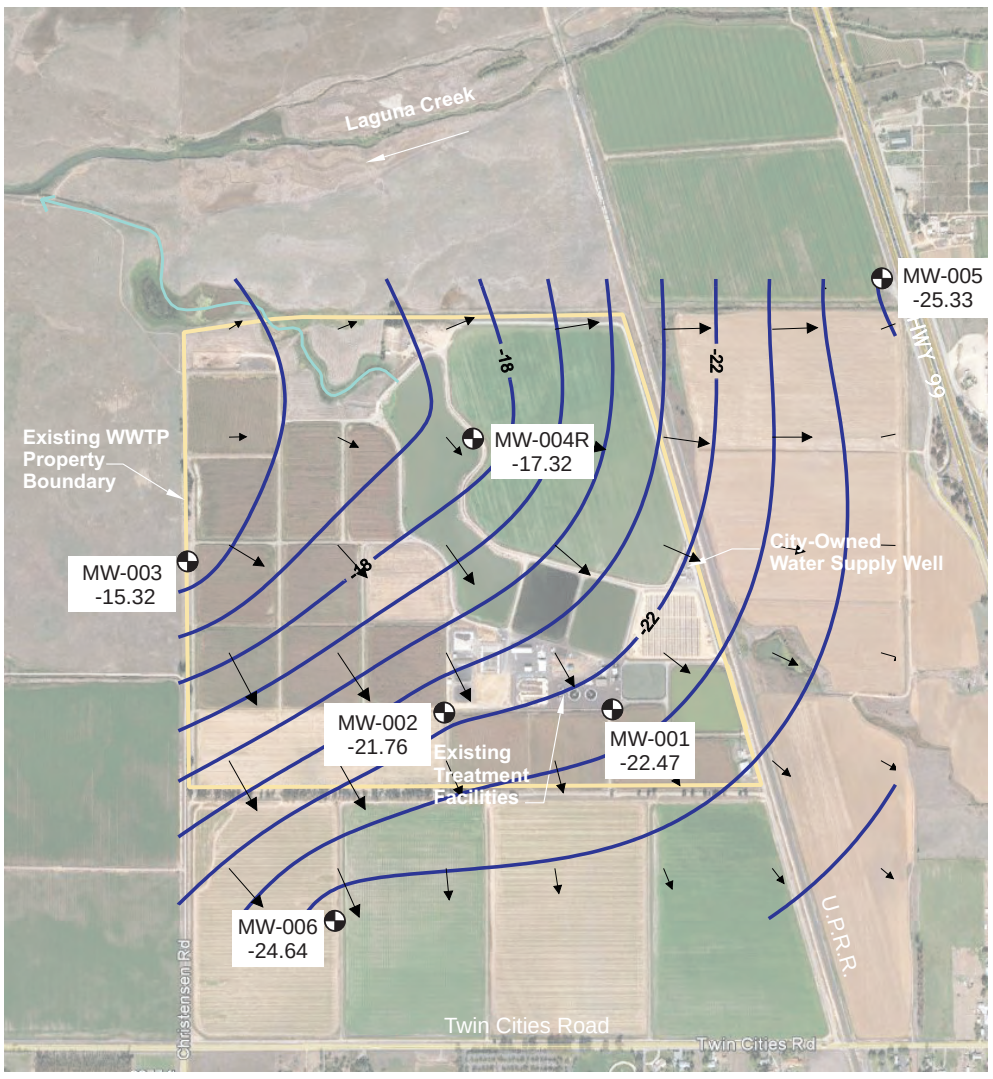
Dunn ENVIRONMENTAL, INC.

DATE: 12/18/13	HISTORIC CONTOUR MAPS 1Q12 THROUGH 4Q12
SCALE: As Shown	CITY OF GALT WWTP
PROJECT NO: SAB121000	SACRAMENTO COUNTY, CALIFORNIA
DRAWN: CT/JF	
CHECKED: PFD	
FIGURE: A-1	

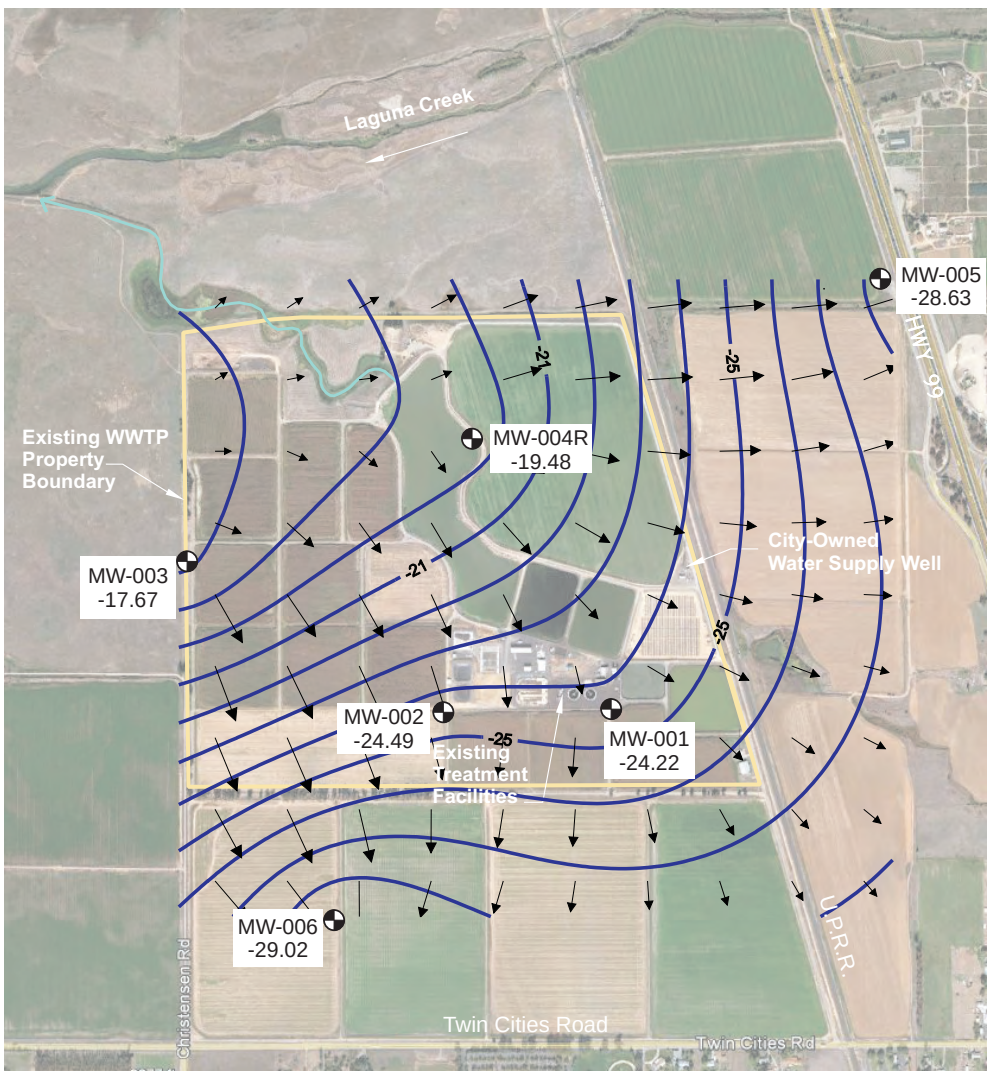
FIRST QUARTER 2013



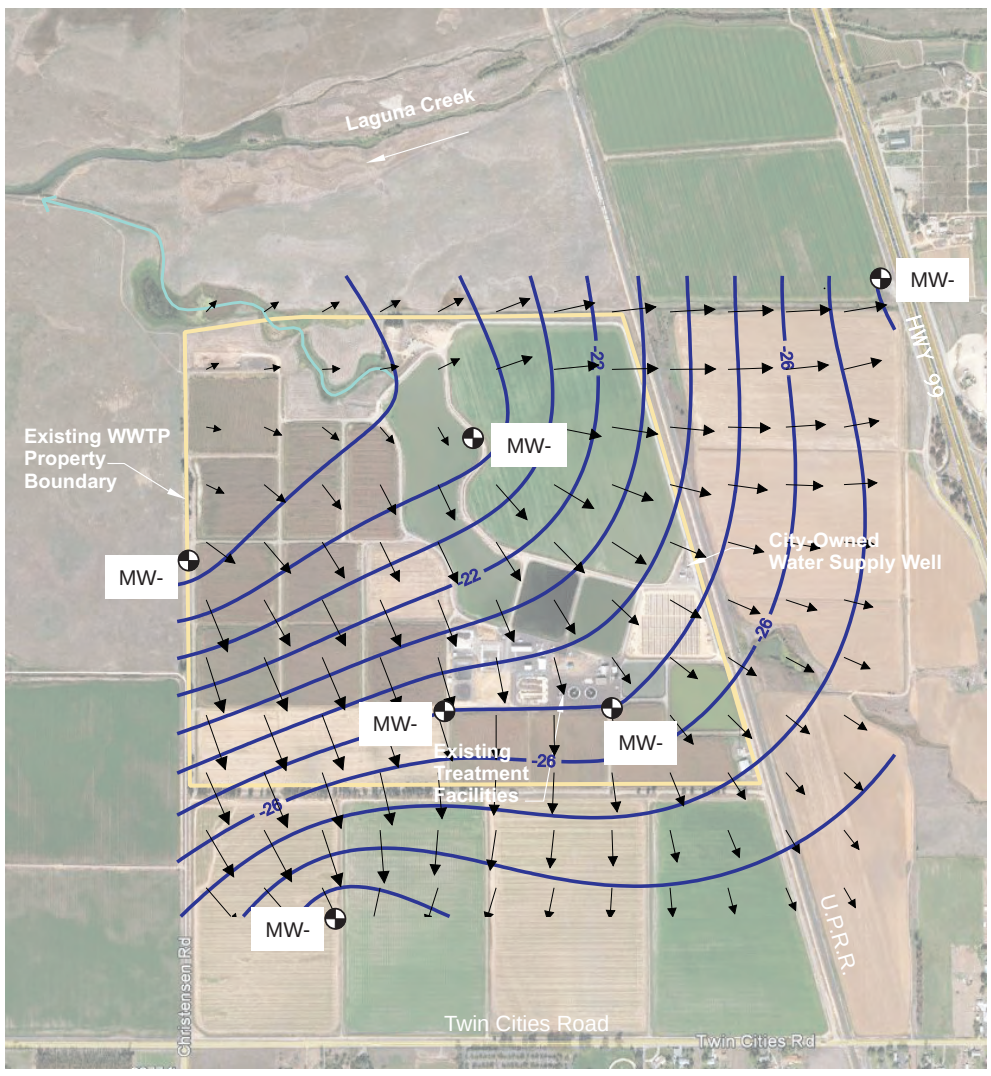
SECOND QUARTER 2013



THIRD QUARTER 2013



FOURTH QUARTER 2013



Monitoring Well
Property Boundary
Discharge
Ground Water Contour, contour interval 1 foot

0 1,000 2,000 3,000

N

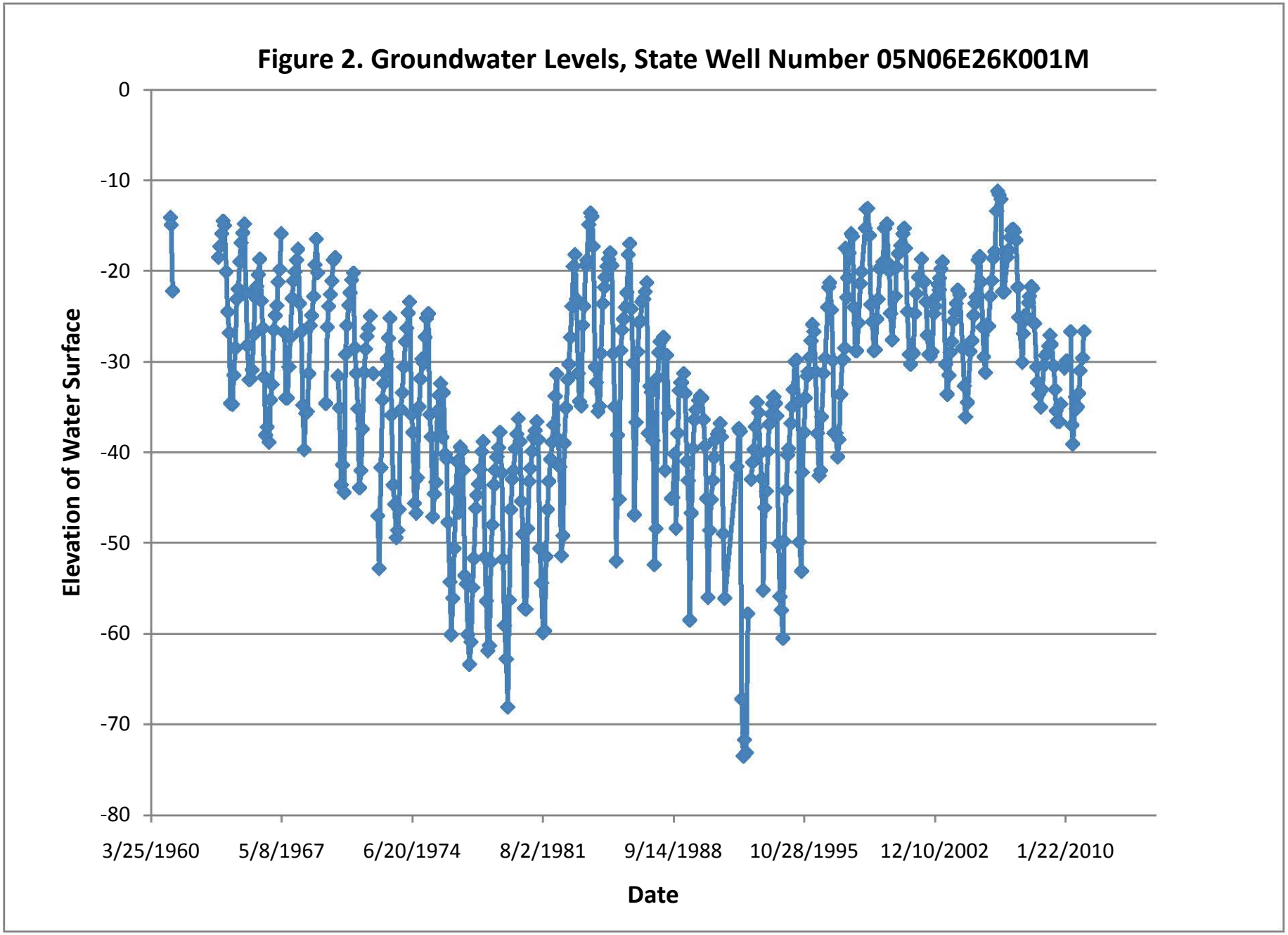
Map adapted from WYA past reports.
Aerial photo from Google Earth™, Image Date: 10/30/2011

Source: Dunn Environmental, Inc. Fourth Quarter 2013 Ground Water Monitoring and Ground Water Quality Assessment Report for the City of Galt Wastewater Treatment Plant and Reclamation Facility, Revision 0 January 2014.

Dunn ENVIRONMENTAL, INC.

DATE: 12/18/13	HISTORIC CONTOUR MAPS 1Q13 THROUGH 4Q13
SCALE: As Shown	CITY OF GALT WWTP
PROJECT NO: SAB121000	SACRAMENTO COUNTY, CALIFORNIA
DRAWN: CT/JF	
CHECKED: PFD	
FIGURE: A-2	

Source: Carollo Engineers. City of Galt 2010 Urban Water Management Plan February 2013.
Note: City Well #14 (Gateway Well), approximately 3 miles south of Twin Cities Site

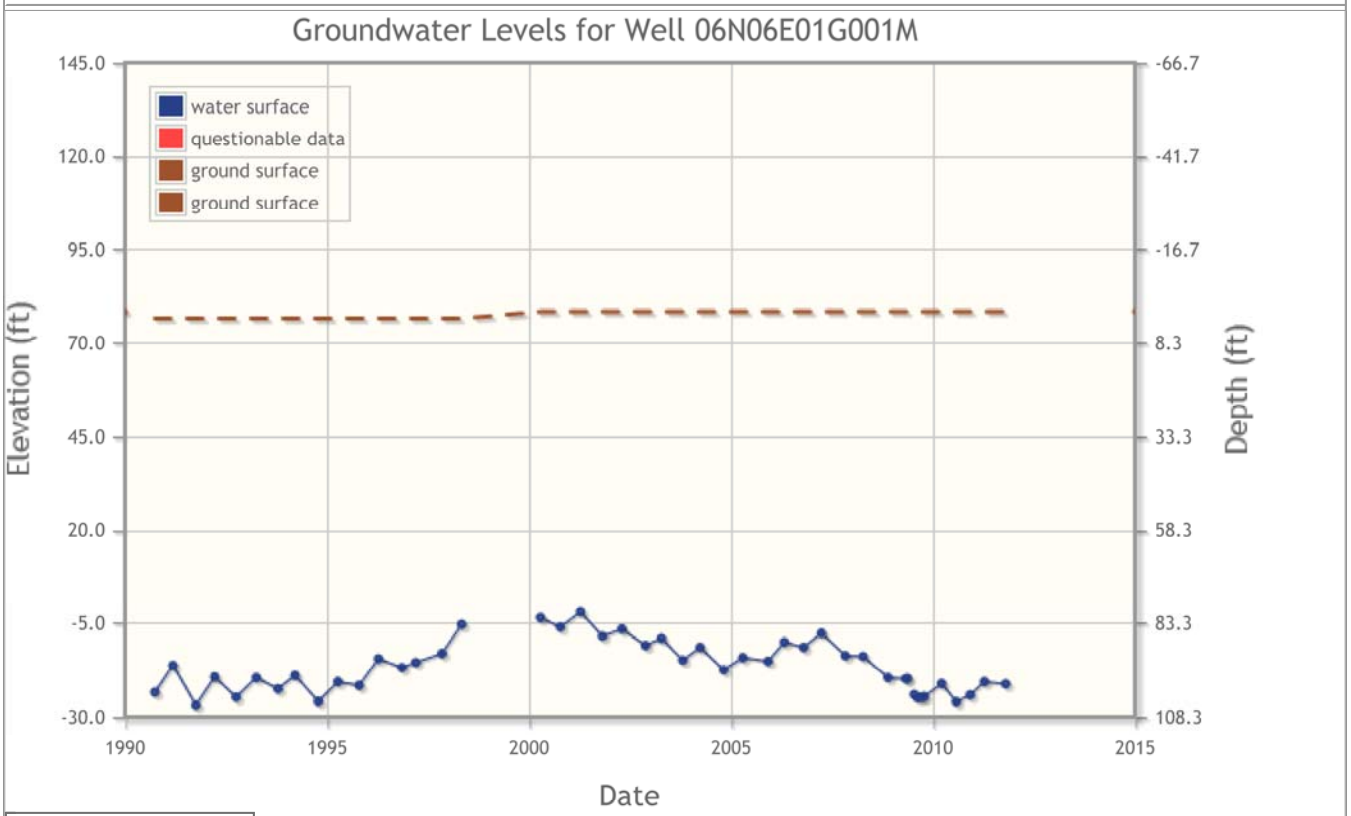


Source: California Department of Water Resources. Water Data Library Online Database, Accessed February 28, 2014, http://www.water.ca.gov/

Groundwater Levels for Station 384026N1212641W001

Data for your selected well is shown in the tabbed interface below. To view data managed in the updated WDL tables, including data collected under the CASGEM program, click the "Recent Groundwater Level Data" tab. To view data stored in the former WDL tables, click the "Historical Groundwater Level Data" tab. To download the data in CSV format, click the "Download CSV File" button on the respective tab. Please note that the vertical datum for "recent" measurements is NAVD88, while the vertical datum for "historical" measurements is NGVD29. To change your well selection criteria, click the "Perform a New Well Search" button.

Vwdwlrq#Gdwd Uhfhqw#Jurxqgz dwhu#Dhyhd#Gdwd **Historical Groundwater Level Data**



Download CSV File

Date	RPE	GSE	RPWS	WSE	GS to...	NM Code	QM Code	Agency
03/15/1990	78.3	76.5				7		5001
09/26/1990	78.3	76.5	101.8	-23.5	100			5001
03/07/1991	78.3	76.5	94.6	-16.3	92.8			5001
10/01/1991	78.3	76.5	105.2	-26.9	103.4			5001
03/19/1992	78.3	76.5	97.7	-19.4	95.9			5001
09/30/1992	78.3	76.5	103.1	-24.8	101.3			5001
03/30/1993	78.3	76.5	97.9	-19.6	96.1			5001
10/13/1993	78.3	76.5	100.9	-22.6	99.1			5001
03/15/1994	78.3	76.5	97.3	-19	95.5			5001

10/12/1994	78.3	76.5	104.2	-25.9	102.4		5001
04/07/1995	78.3	76.5	99	-20.7	97.2		5001
10/16/1995	78.3	76.5	100	-21.7	98.2		5001
04/08/1996	78.3	76.5	92.8	-14.5	91		5001
11/08/1996	78.3	76.5	95.2	-16.9	93.4		5001
03/11/1997	78.3	76.5	93.8	-15.5	92		5001
11/04/1997	78.3	76.5	91.4	-13.1	89.6		5001
04/30/1998	78.3	76.5	83.7	-5.4	81.9		5001
11/16/1998	78.3	76.5				7	5001
04/01/1999	78.3	76.5				7	5001
04/12/2000	80.1	78.3	83.7	-3.6	81.9		5050
10/09/2000	80.1	78.3	86.2	-6.1	84.4		5050
04/09/2001	80.1	78.3	82.2	-2.1	80.4		5050
10/24/2001	80.1	78.3	88.6	-8.5	86.8		5050
04/18/2002	80.1	78.3	86.7	-6.6	84.9		5050
11/18/2002	80.1	78.3	91.1	-11	89.3		5050
04/10/2003	80.1	78.3	89.2	-9.1	87.4		5050
10/20/2003	80.1	78.3	95	-14.9	93.2		5050
03/25/2004	80.1	78.3	91.6	-11.5	89.8		5050
10/25/2004	80.1	78.3	97.6	-17.5	95.8		5050
04/15/2005	80.1	78.3	94.3	-14.2	92.5		5050
11/30/2005	80.1	78.3	95.3	-15.2	93.5		5050
04/25/2006	80.1	78.3	90.2	-10.1	88.4		5050
10/17/2006	80.1	78.3	91.6	-11.5	89.8		5050
03/26/2007	80.1	78.3	87.8	-7.7	86		5050
10/29/2007	80.1	78.3	93.8	-13.7	92		5050
04/07/2008	80.1	78.3	94	-13.9	92.2		5050
11/19/2008	80.1	78.3	99.7	-19.6	97.9		5050
04/27/2009	80.1	78.3	100	-19.9	98.2		5050
05/13/2009	80.1	78.3	99.9	-19.8	98.1		5050
06/25/2009	80.1	78.3				1	5050
07/13/2009	80.1	78.3	104.2	-24.1	102.4		5050
08/12/2009	80.1	78.3	105	-24.9	103.2		5050
09/14/2009	80.1	78.3	104.9	-24.8	103.1		5050
10/12/2009	80.1	78.3	104.7	-24.6	102.9		5050
03/17/2010	80.1	78.3	101.3	-21.2	99.5		5050
07/27/2010	80.1	78.3	106.1	-26	104.3		5050
12/01/2010	80.1	78.3	104.3	-24.2	102.5		5050
04/08/2011	80.1	78.3	100.8	-20.7	99		5050
10/18/2011	80.1	78.3	101.4	-21.3	99.6		5001

All elevation and depth measurements are in feet. The vertical datum for historical measurements is NGVD29.

Perform a New Well Search