GEI Consultants

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Baseline Groundwater Quality Study

Western Placer County

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Prepared for the Western Placer County Groundwater Management Plan Group:

- City of Roseville
- City of Lincoln
- Placer County Water Agency
- California American Water

Baseline Groundwater Quality Study

Western Placer County, California

Submitted to:
Western Placer County Groundwater Management Plan Partners and Placer County

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WESTERN PLACER COUNTY
BASELINE GROUNDWATER QUALITY STUDY

Certifications and Seals

This report and analysis was prepared by GEI Consultants' professional geologists.

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List of Acronyms

ASR	Aquifer Storage and Recovery
CASGEM	California Statewide Groundwater Elevation Monitoring System
CrVI	hexavalent chromium
COC	Constituent of Concern
DCW	Diamond Creek Well
DCMW	Diamond Creek Monitoring Well
DWR	Department of Water Resources
GEI	GEI Consultants Inc.
GMP	Groundwater Management Plan
gpm	gallons per minute
MCL	maximum contaminant level
mg/L	milligrams per liter
µg/L	micrograms per liter
Partners	WPC Partners: City of Roseville, City of Lincoln, Placer County Water Agency, California American Water
SAR	Sodium-adsorption ratio
SGA	Sacramento Groundwater Authority
SGMA	Sustainable Groundwater Management Act
Subbasin	North American Groundwater Subbasin
TDS	total dissolved solids
THMs	Trihalomethanes; a group of disinfection biproducts
TTHMs	Total Trihalomethanes, the sum of all THM concentrations
VOCs	Volatile organic compounds
WPC	Western Placer County

1. Executive Summary

Fifty-five groundwater samples were collected from 52 monitoring wells to characterize the water quality within portions of Western Placer County (WPC) and provide a regional assessment of groundwater quality conditions. All 52 monitoring wells were within the WPC Partner (the City of Roseville, City of Lincoln, Placer County Water Agency and California American Water) jurisdictions. This assessment analyzes the results of these samples along with three additional wells that were sampled by Placer County, located within the groundwater basin but outside of the WPC Partner jurisdictions. This investigation did not include sampling or analysis of water from drinking water supply wells or near existing sites where releases of contaminants to the environment are under regulatory agency purview.

The monitoring wells were constructed to help characterize both horizontal and vertical profiles of the various aquifers in WPC. The aquifers monitored are not necessarily used for water supply due to water quality. The intent of the project is to identify where areas of poor quality water are present, identify those aquifers where degradation of water quality could occur and to manage the groundwater to prevent degradation of good quality water.

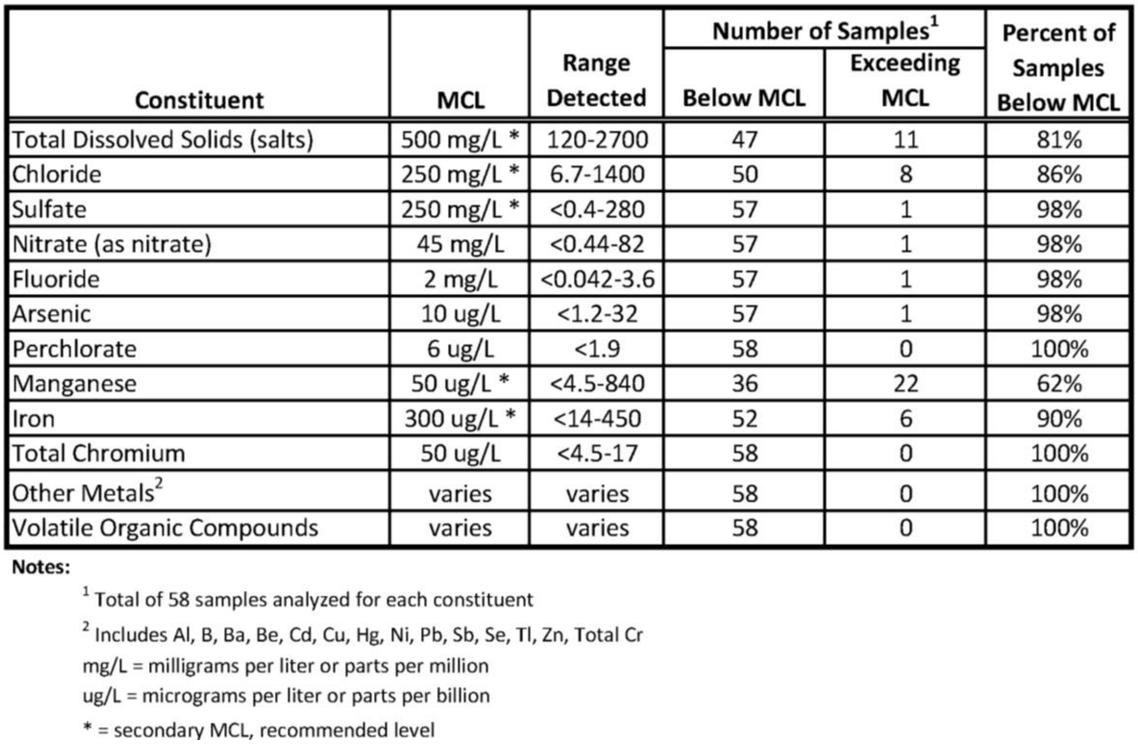
Water collected from the wells were analyzed for general minerals (calcium, potassium, sodium, magnesium, bicarbonate, sulfate and chloride), nitrate, metals, perchlorate, and volatile organic compounds (VOCs).

Although not sampled during the investigation, all municipal water supply wells in the WPC area supply drinking water meet or exceed drinking water standards.

1.1 Water Quality Summary

The following table provides a summary of constituents that were above their primary or secondary drinking water maximum contaminant levels (MCLs). A discussion of each of the constituents detected above the MCL is provided and in which aquifers the constituents were detected. The aquifers from shallowest to deepest are Shallow Aquifer (including Younger Alluvium, Riverbank, Turlock Lake/Laguna Formations) Upper Mehrten, Lower Mehrten and Ione Formation. The Ione Formation, due to its poor quality water, is not used for drinking water. The aquifers are generally thinnest in the eastern portion of WPC and are thickest in the western portion of WPC.

Executive Summary Table ES1 Summary of Constituents above primary or secondary MCLs



Constituent	MCL	Range Detected	Number of Samples[1]		Percent of Samples Below MCL
			Below MCL	Exceeding MCL	
Total Dissolved Solids (salts)	500 mg/L *	120-2700	47	11	81%
Chloride	250 mg/L *	6.7-1400	50	8	86%
Sulfate	250 mg/L *	<0.4-280	57	1	98%
Nitrate (as nitrate)	45 mg/L	<0.44-82	57	1	98%
Fluoride	2 mg/L	<0.042-3.6	57	1	98%
Arsenic	10 ug/L	<1.2-32	57	1	98%
Perchlorate	6 ug/L	<1.9	58	0	100%
Manganese	50 ug/L *	<4.5-840	36	22	62%
Iron	300 ug/L *	<14-450	52	6	90%
Total Chromium	50 ug/L	<4.5-17	58	0	100%
Other Metals[2]	varies	varies	58	0	100%
Volatile Organic Compounds	varies	varies	58	0	100%

Notes:

[1] Total of 58 samples analyzed for each constituent

[2] Includes Al, B, Ba, Be, Cd, Cu, Hg, Ni, Pb, Sb, Se, Tl, Zn, Total Cr

mg/L = milligrams per liter or parts per million

ug/L = micrograms per liter or parts per billion

* = secondary MCL, recommended level

1.2 TDS, Chloride, and Sulfate

The elevated concentrations of total dissolved solids (TDS), chloride, and sulfate all appear to be related to brackish water contained in the Ione Formation that underlies most of the fresh water bearing aquifers. Some of the freshwater bearing aquifers in contact with the Ione Formation contain chemical evidence of the Ione type water affecting the water quality. In the Mehrten Formation Aquifer seven and possibly up to about 20 monitoring wells are being affected by brackish Ione Formation water. Due to the limited number of analyses it is unknown whether the concentrations are increasing. The distribution of these constituents is detailed in **Figures 12 through 23**.

1.3 Nitrate, Fluoride, Arsenic, and Perchlorate

High concentrations of nitrate, fluoride, and arsenic were few and random. Nitrate had measureable, low level concentrations in both the Shallow and deeper aquifers. The reason for the nitrate being present at deeper depths could be related to the naturally interconnected aquifers or by wells allowing shallow water to recharge deeper aquifers. These connections allow for deep percolation of agricultural applied water containing fertilizers, historic wastewater discharges, and septic systems to migrate into the aquifers. The distribution of nitrate and arsenic are detailed in **Figures 24 through 31**. Perchlorate was not detected in any samples.

1.4 Manganese and Iron

Twenty-two wells had concentrations of manganese, a naturally occurring metal, above the MCL. Most of these wells are screened in the Mehrten Formation aquifers and located in the western portion of WPC where wells are generally not used for municipal drinking water. There were some high concentrations detected near Sheridan, the City of Lincoln, and east of Highway 65, in the Mehrten aquifers. Iron concentrations were above the MCL in six wells, but there was no discernable pattern to the occurrences. The distribution of manganese is detailed in **Figures 32 through 35**.

1.5 Total Chromium

Chromium and hexavalent chromium (a variety of chromium which has a +6 oxidation state) can both occur naturally or due to human activities. Total chromium is regulated in California with a drinking water MCL of 50 ug/L. In 2014, a MCL was established for hexavalent chromium of 10 ug/L. The rule established exceedances of the MCL as a running average (average of four most recent sample results). However, on August 8, 2017, the State Water Resources Control Board (SWRCB) removed (redacted) the MCL for hexavalent chromium in response to a judge's ruling that said that the State had failed to consider economic feasibility in setting the rule. The SWRCB is to re-evaluate the MCL rule with economic feasibility included. Until the SWRCB releases a new rule for hexavalent chromium, the MCL for total chromium MCL is the only applicable standard.

Of the 58 samples collected only one monitoring well had concentrations of hexavalent chromium above 10 ug/L. The one sample was from the Shallow Aquifer. Additional sampling and investigation is recommended. The distribution of hexavalent chromium is detailed in **Figures 36 through 39**.

1.6 Other Metals

With the exception of the constituents discussed above, no metals were detected above their respective MCL.

1.7 Volatile Organic Compounds

With the exception of trihalomethanes (THMs, a group of disinfection by-products) no volatile organic compounds were detected. All detections of THMs were below the MCL.

1.8 Next Steps

We recommend semi-annual water quality sampling commence at nine wells to assess the trend in concentrations and whether groundwater management actions are needed. Additional water quality investigation is needed to define the extent of the hexavalent chromium to assess whether it is naturally occurring or if it is related to a release of the contaminant to the environment or a change in conditions that is allowing a transition of chromium to hexavalaent chromium.

2. Background

Over the last eight years, the Western Placer County Groundwater Management Plan Partners (City of Roseville, City of Lincoln, Placer County Water Agency, and California American Water Company) have developed a groundwater-level monitoring network as part of the California Statewide Groundwater Elevation Monitoring (CASGEM) system. During Year 8 implementation of the Groundwater Management Plan (GMP), the Partners authorized collection of water quality samples from their CASGEM wells as part of this Baseline Groundwater Quality Study (Study). The sample collection was performed by staff from GEI Consultants (GEI) between September 15, 2015 and November 3, 2015. The chemical analyses were performed by BSK Laboratories (BSK). In addition, three samples were collected by Placer County Staff in March and April, 2016. These samples are included in this analysis.

Some of the monitoring wells previously had water quality samples taken when the wells were built, but typically only once and the data from different wells were difficult to compare since they were taken in different years and different seasons. Water quality samples are collected from agency municipal water supply wells and a summary of the results are included within each agency annual water quality consumer confidence reports. A WPC region-wide evaluation of water quality had not been performed since 1977 (DWR, 1977) and the Partners saw the need to establish a new groundwater quality baseline in light of upcoming requirements under the Sustainable Groundwater Management Act (SGMA). The dataset also provides further understanding of water quality in the basin to be able to more effectively manage groundwater use programs in the basin such as Aquifer Storage and Recover (ASR), recycled water usage, and potential siting of new municipal water supply wells for the Partners.

Most of the sampling was performed during fall of 2015 at the end of a four-year dry period with 2015 being one of the driest years on record. The conditions likely represent a stressed condition of the basin making potential water quality issues more readily identifiable.

2.1 Monitoring Network

The Partners developed a groundwater monitoring well network for its WPCGMP. Groundwater levels from these wells are made public through the California Statewide Groundwater Elevation Monitoring (CASGEM) program. Placer County also has three CASGEM monitoring wells. For this Study, water quality samples were collected from CASGEM wells, supplemented with a few additional wells within the WPC area and three wells in the northern part of the WPC area that were sampled by Placer County staff. The construction details of the wells sampled are provided in **Table 1**. The well locations are shown on **Figure 1**. Many of the wells are nested with up to four wells constructed at different depths within the same borehole.

Prior to sampling, two wells (WPMW-1A and WPMW-9A) were identified as needing further development because they were not producing clear water. Further development was performed by Confluence Environmental Field Services. The wells still did not produce clear water and were not sampled. WPMW-5A was also not sampled because the well was dry. Samples were collected from three Placer County CASGEM wells.

2.1.1 Production Wells

Figure 1 shows the Partner and County drinking water supply wells in WPC. The City of Roseville has six aquifer storage and recovery (ASR) wells which are designed to store water during times of surplus supplies and extract the water during times of need. They plan to construct an additional ten wells. The Diamond Creek Well (DCW) was constructed in 2002 and was operated as an ASR well at various times between 2006 and 2012. The last time the well was operated was in 2012, when about 1,700 acre-feet of surplus water was injected into the Upper Mehrten Aquifer. The injected water comes from Roseville’s potable water supply and is chlorinated.

The City of Lincoln owns and operates five active groundwater wells that supplement PCWA and NID surface supplies. These groundwater wells supply about 10 percent of the annual demand during normal years. Placer County owns three wells that supply water to the town of Sheridan. Placer County Water Agency owns two wells that are used on an emergency basis to supplement water supply. Cal Am has two in Placer County although both wells are considered to be part of the Antelope System which almost entirely resides in Sacramento County.

Water quality sampling is required for all municipal water supply wells and reported to the California Division of Drinking Water. All water quality constituents are below the MCLs.   Water quality from the drinking water supply wells are not included in this study.

Table 1. Well Details

Local Well ID	CASGEM Well ID	Sample Date	Monitoring Entity	Latitude (NAD83)	Longitude (NAD83)	Casing Diam. (inches)	Borehole Diam. (inches)	Well Depth (feet)	Screen Interval(s) (feet)	Permanent Pump Installed	Sampling Method	Formation	Aquifer
11N05E17A004M		11/12/2015	Private	38.807182	-121.433473	8	12	100		Yes	Pump and Purge	Turlock Lake/Laguna	Shallow
Airport Well 4 MW	389011N1213514W001	10/19/2015	Lincoln	38.901124	-121.351438	4	12	380	120-140, 210-230, 360-380	No	Depth Discrete	Multiple Formations	Multiple Aquifers
Cemetary Well	389740N1213606W001	4/13/2016	Placer County	38.974027	-121.360615	10/8	unknown	111.2	70-111.2	Yes	Pump and Purge	Turlock Lake/Laguna	Shallow
CVMW-1A	387957N1213813W001	9/17/2015	Roseville	38.795656	-121.381259	2	10.625	285	260-280	No	Pump and Purge	Turlock Lake/Laguna	Shallow
CVMW-1B	387957N1213813W002	9/17/2015	Roseville	38.795655	-121.381259	2	10.625	495	460-490	No	Pump and Purge	Transition Zone	Upper Mehrten
CVMW-1C	387957N1213813W003	9/17/2015	Roseville	38.795655	-121.38126	2	8.75	590	565-585	No	Pump and Purge	Lower Mehrten	Lower Mehrten
DCMW-1	388058N1213355W001	10/15/2015	Roseville	38.805832	-121.335453	4	11	455	320-450	Yes	Pump and Purge	Lower Mehrten	Lower Mehrten
DCMW-2	388063N1213354W001	10/15/2015	Roseville	38.806366	-121.335352	4	11	437	322-432	Yes	Pump and Purge	Lower Mehrten	Lower Mehrten
DCMW-3	388027N1213384W001	10/15/2015	Roseville	38.80271	-121.338432	4	11	520	400-515	Yes	Pump and Purge	Lower Mehrten	Lower Mehrten
Fiddyment14MW-A		9/21/2015	Roseville	38.796358	-121.358298	2	14	279	264-274	No	Pump and Purge	Turlock Lake/Laguna	Shallow
Fiddyment14MW-B		9/21/2015	Roseville	38.796358	-121.358298	2	12.25	387	372-382	No	Pump and Purge	Transition Zone	Upper Mehrten
Fiddyment14MW-C		9/21/2015	Roseville	38.796358	-121.358298	2	8.75	508	493-503	No	Pump and Purge	Upper Mehrten	Upper Mehrten
Fiddyment14MW-D		9/21/2015	Roseville	38.796358	-121.358298	2	12.25	445	430-440	No	Pump and Purge	Transition Zone	Upper Mehrten
MW 1-1	388604N1213544W001	9/28/2015	Lincoln	38.860383	-121.354383	2	12.25	398	378-398	No	Pump and Purge	Lower Mehrten	Lower Mehrten
MW 1-2	388604N1213544W002	9/28/2015	Lincoln	38.860383	-121.354383	2	12.25	318	298-318	No	Pump and Purge	Turlock Lake/Laguna	Shallow
MW 1-3	388604N1213544W003	9/28/2015	Lincoln	38.860383	-121.354383	2	12.25	204	184-204	No	Pump and Purge	Turlock Lake/Laguna	Shallow
MW 1-4	388604N1213544W004	9/29/2015	Lincoln	38.860383	-121.354383	2	12.25	92	82-92	No	Pump and Purge	Riverbank	Shallow
MW 2-1	389255N1213566W001	9/28/2015	Lincoln	38.925467	-121.356633	2	12.25	310	290-310	No	Pump and Purge	Ione	Ione
MW 2-2	389255N1213566W002	9/28/2015	Lincoln	38.925467	-121.356633	2	12.25	170	160-170	No	Pump and Purge	Lower Mehrten	Lower Mehrten
MW 2-3	389255N1213566W003	9/28/2015	Lincoln	38.925467	-121.356633	2	12.25	85	75-85	No	Pump and Purge	Turlock Lake/Laguna	Shallow
MW 3-1	388971N1213301W001	9/29/2015	Lincoln	38.897133	-121.330083	2	8.5	133	118-133	No	Pump and Purge	Lower Mehrten	Lower Mehrten
MW 3-2	388971N1213301W002	9/29/2015	Lincoln	38.897133	-121.330083	2	8.5	75	65-75	No	Pump and Purge	Turlock Lake/Laguna	Shallow
MW 4	388893N1212847W001	9/28/2015	Lincoln	38.889283	-121.284683	2	8.25	25	15-25	No	Pump and Purge	Lower Mehrten	Lower Mehrten
MW 5-1	388826N1213078W001	9/29/2015	Lincoln	38.882583	-121.30775	2	8.5	100	80-100	No	Pump and Purge	Ione	Ione
MW 5-2	388826N1213078W002	9/29/2015	Lincoln	38.882583	-121.30775	2	8.5	62	52-62	No	Pump and Purge	Lower Mehrten	Lower Mehrten
Sheridan Old Well 2	389791N1213727W001	3/28/2016	Placer County	38.979133	-121.372694	12	unknown	209	Open Hole 144-209	Yes	Pump and Purge	Laguna/Mehrten	Upper Mehrten
SLC-1	388755N1213144W001	10/19/2015	Lincoln	38.875475	-121.314399	2.5	6.25	249	142-249	No	Depth Discrete	Lower Mehrten	Lower Mehrten
SLC-2	388637N1213222W001	10/19/2015	Lincoln	38.863733	-121.322183	2.5	6.25	293	143.5-292.5	No	Depth Discrete	Multiple Formations	Multiple Aquifers
SLC-3	388677N1213397W001	10/19/2015	Lincoln	38.867683	-121.339733	2.5	6.25	311	131.6-152.8, 195.2-216.4, 237.6-258.8, 290.2-311.4	No	Depth Discrete (4 samples)	Riverbank, Turlock Lake/Laguna, Turlock Lake/Laguna, Lower Mehrten	Shallow, Shallow, Shallow, Lower Mehrten
SVMW East-2A	387626N1213651W001	9/15/2015	Roseville	38.762629	-121.365099	2	12.25	140	125-135	No	Pump and Purge	Turlock Lake/Laguna	Shallow
SVMW East-2B	381626N1213651W001	9/16/2015	Roseville	38.76263	-121.365098	2	10.625	525	510-520	No	Pump and Purge	Upper Mehrten	Upper Mehrten
SVMW East-2C	387626N1213651W002	9/15/2015	Roseville	38.76263	-121.365099	2	8.75	670	655-665	No	Pump and Purge	Lower Mehrten	Lower Mehrten
SVMW West-1A	387623N1213915W001	9/16/2015	Roseville	38.762324	-121.39153	2	12.25	145	120-140	No	Pump and Purge	Turlock Lake/Laguna	Shallow
SVMW West-1B	387623N1213915W002	9/16/2015	Roseville	38.762325	-121.39153	2	10.625	560	535-555	No	Pump and Purge	Transition Zone	Upper Mehrten
SVMW West-1C	387623N1213915W003	9/17/2015	Roseville	38.762325	-121.391529	2	8.75	750	725-745	No	Pump and Purge	Lower Mehrten	Lower Mehrten
Swainson Well	389185N1213268W001	4/21/2016	Placer County	38.918461	-121.326842	10	unknown	91.9	44.1-91.9	Yes	Pump and Purge	Turlock Lake/Laguna	Shallow
Tinker	388116N1213054W001	9/24/2015	PCWA	38.811594	-121.305387	4	9.25	177	117-177	No	Pump and Purge	Turlock Lake/Laguna	Shallow
W-77MW-A	387816N1213870W001	9/23/2015	Roseville	38.778604	-121.373698	2	12	516	486-506	No	Pump and Purge	Upper Mehrten	Upper Mehrten
W-77MW-B	387816N1213870W002	9/23/2015	Roseville	38.778604	-121.373698	2	8.75	604	584-594	No	Pump and Purge	Lower Mehrten	Lower Mehrten
WPMW-10A (Linc. Est.)	387515N1212725W001	9/30/2015	Roseville	38.751494	-121.272511	2	8	36	26-36	No	Pump and Purge	Alluvium - Dry Creek	Shallow
WPMW-10B (Linc. Est.)	387515N1212725W002	9/30/2015	Roseville	38.751494	-121.272511	2	8	100	80-100	No	Pump and Purge	Turlock Lake/Laguna	Shallow
WPMW-10C (Linc. Est.)	387515N1212725W003	9/30/2015	Roseville	38.751494	-121.272511	2	8	260	240-260	No	Pump and Purge	Upper Mehrten	Upper Mehrten
WPMW-1A	387786N1213737W001	Not Sampled	Roseville	38.778604	-121.373698	2	12.25	120	110-120	No	No Sample Collected	Turlock Lake/Laguna	Shallow
WPMW-1B	387786N1213737W002	9/29/2015	Roseville	38.778603	-121.373697	2	10.625	480	460-480	No	Pump and Purge	Upper Mehrten	Upper Mehrten
WPMW-1C	387786N1213737W003	9/29/2015	Roseville	38.778603	-121.373698	2	8.75	545	535-545	No	Pump and Purge	Lower Mehrten	Lower Mehrten
WPMW-2A	388145N1213491W001	9/24/2015	PCWA	38.814497	-121.349144	2	10.625	230	215-225	No	Pump and Purge	Turlock Lake/Laguna	Shallow
WPMW-2B	388145N1213491W002	9/24/2015	PCWA	38.814498	-121.349144	2	8.75	425	400-420	No	Pump and Purge	Lower Mehrten	Lower Mehrten
WPMW-3A	388476N1212872W001	9/24/2015	Roseville	38.847609	-121.287189	2	10.625	53	48-53	No	Pump and Purge	Lower Mehrten	Lower Mehrten
WPMW-3B	388476N1212872W002	9/24/2015	Roseville	38.84761	-121.287188	2	8.75	140	130-140	No	Pump and Purge	Ione	Ione
WPMW-4A	387755N1212753W001	9/22/2015	Roseville	38.775536	-121.275255	2	10.625	145	120-140	No	Pump and Purge	Lower Mehrten	Lower Mehrten
WPMW-4B	387755N1212753W002	9/22/2015	Roseville	38.775535	-121.275255	2	8.75	300	275-295	No	Pump and Purge	Ione	Ione
WPMW-5A (Walerga)	387331N1213610W001	Not Sampled	CalAm	38.733106	-121.360994	2	8	100	80-100	No	No Sample Collected	Turlock Lake/Laguna	Shallow
WPMW-5B (Walerga)	387331N1213610W002	11/12/2015	CalAm	38.733106	-121.360994	2.5	8	650	630-650	No	Pump and Purge	Lower Mehrten	Lower Mehrten
WPMW-6A (Scarborough)	387739N1212382W001	9/24/2015	PCWA	38.7739	-121.238183	2	8	65	35-65	No	Pump and Purge	Ione	Ione
WPMW-7A (Rose. Pkwy.)	387512N1212390W001	9/22/2015	Roseville	38.751194	-121.239	2	8	45	35-45	No	Pump and Purge	Lower Mehrten	Lower Mehrten
WPMW-8A (Rose. Pkwy.)	387510N1212390W001	9/22/2015	Roseville	38.750989	-121.23895	2	8	50	30-50	No	Pump and Purge	Lower Mehrten	Lower Mehrten
WPMW-8B (Rose. Pkwy.)	387510N1212390W002	9/22/2015	Roseville	38.750989	-121.23895	2	8	115	95-115	No	Pump and Purge	Lower Mehrten	Lower Mehrten
WPMW-9A (Linc. Est.)	387517N1212727W001	Not Sampled	Roseville	38.751667	-121.272656	2	8	36	26-36	No	No Sample Collected	Alluvium - Dry Creek	Shallow

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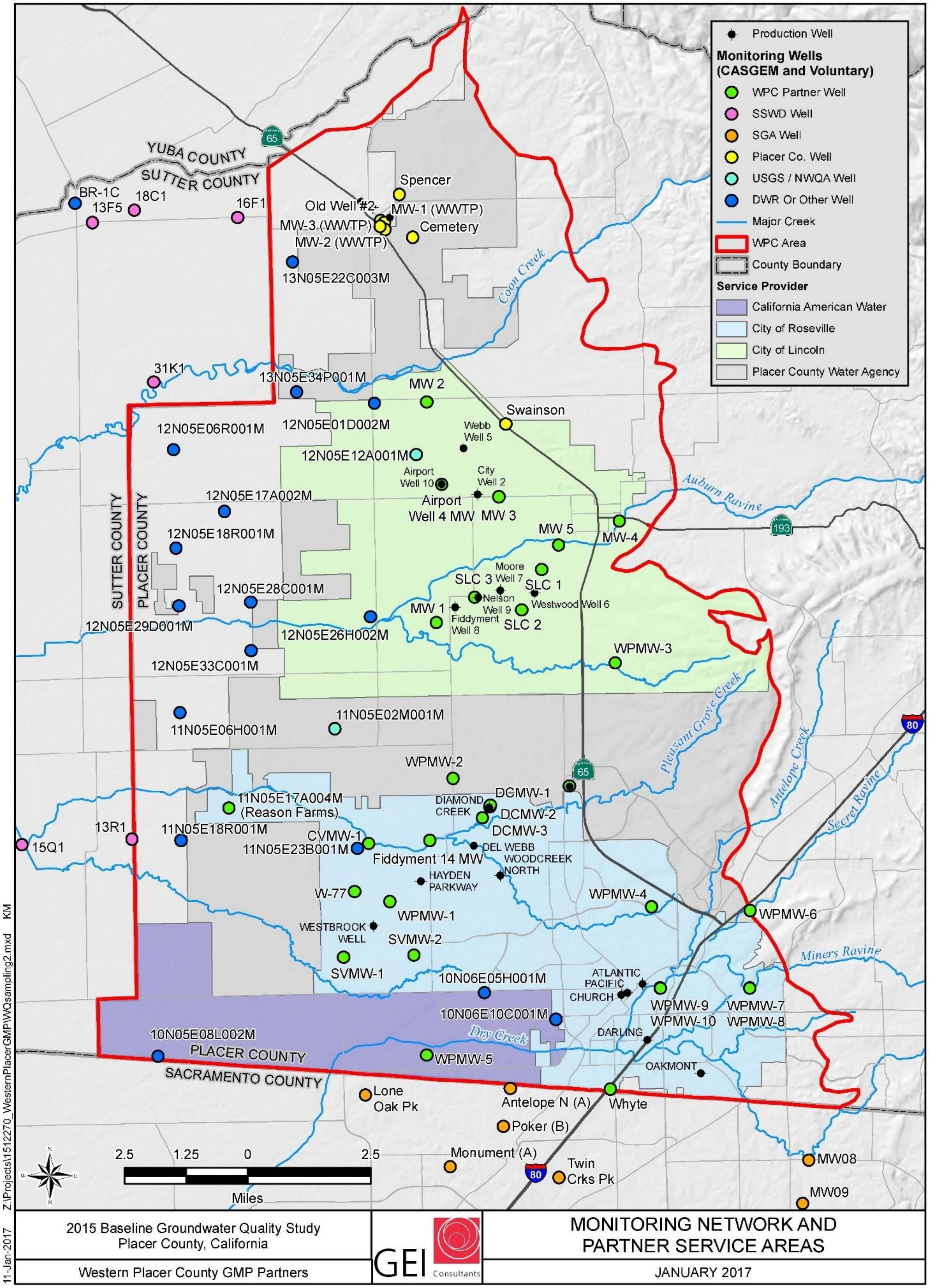


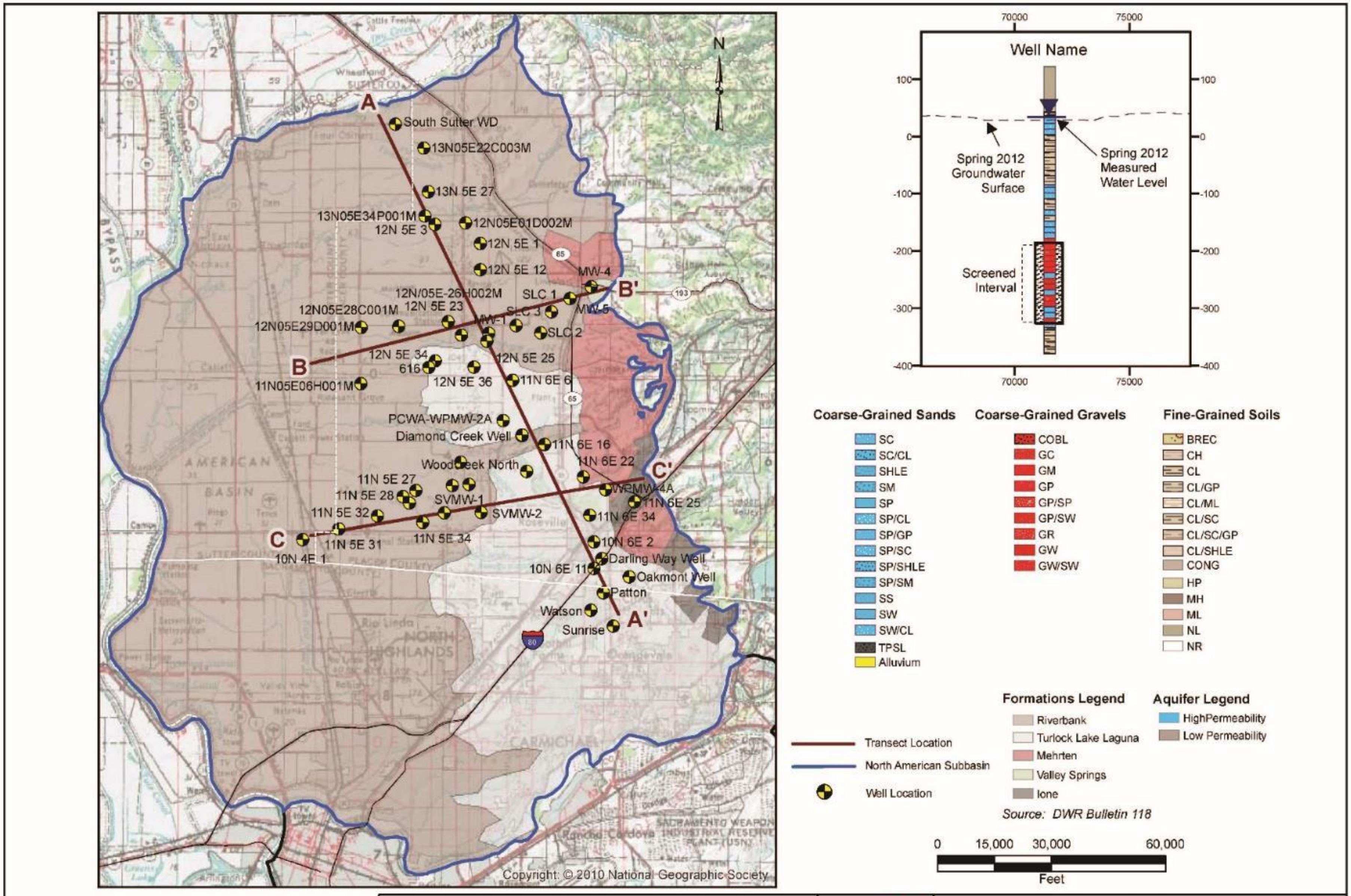
Figure 1. Monitoring Network and Partner Service Areas

2.2 Formations and Hydrogeologic Conditions

A rigorous hydrogeologic framework provides a foundation for understanding the monitoring results and developing sound groundwater management strategies. The hydrogeology beneath WPC is relatively well known.

The Sacramento Valley Groundwater Basin is a trough that is filled with layers of sediments. WPC overlies a small portion of the valley, along its eastern edge within the North American Groundwater Subbasin (Subbasin). The sediments depict a regional change in the depositional environments, from one dominated initially by marine to that of continental sedimentary processes. The deepest portions of the basin are filled with marine sedimentary rocks that contain brackish water that may be residual sea water from the original deposition of the sediments. These marine deposits are overlain by younger, continentally derived sediments that have been grouped into the Younger Alluvium, and the Riverbank, Turlock Lake/Laguna and Mehrten Formations. These formations contain fresh and, for the most part, potable water. During the transition from marine to continental environments the Valley Springs and Ione Formation sediments were deposited. Both of these formations contain fresh and brackish water. **Figure 2** shows the surficial distribution of these formations. **Figures 3 through 5** are cross sections that show the general distribution of the formations and the distribution of coarse-grained sediments that when grouped show the extent of the aquifers. The following sections describe these fresh-water bearing sediments (from youngest to oldest or shallowest to deepest).

Each of the monitoring wells have been assigned to a geologic formation based on the best available information in the area and the depth of the screened intervals. These formations are grouped together as principal aquifers, as described in Section 2.2.8 below, which allows for comparison of water levels and water quality by aquifer.



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Placer County, California

City of Roseville

GEI Consultants

Surficial Geology and Cross Section Legend

NOVEMBER 2013

FIGURE 2

Figure 2. Surficial Geology and Cross Section Legend

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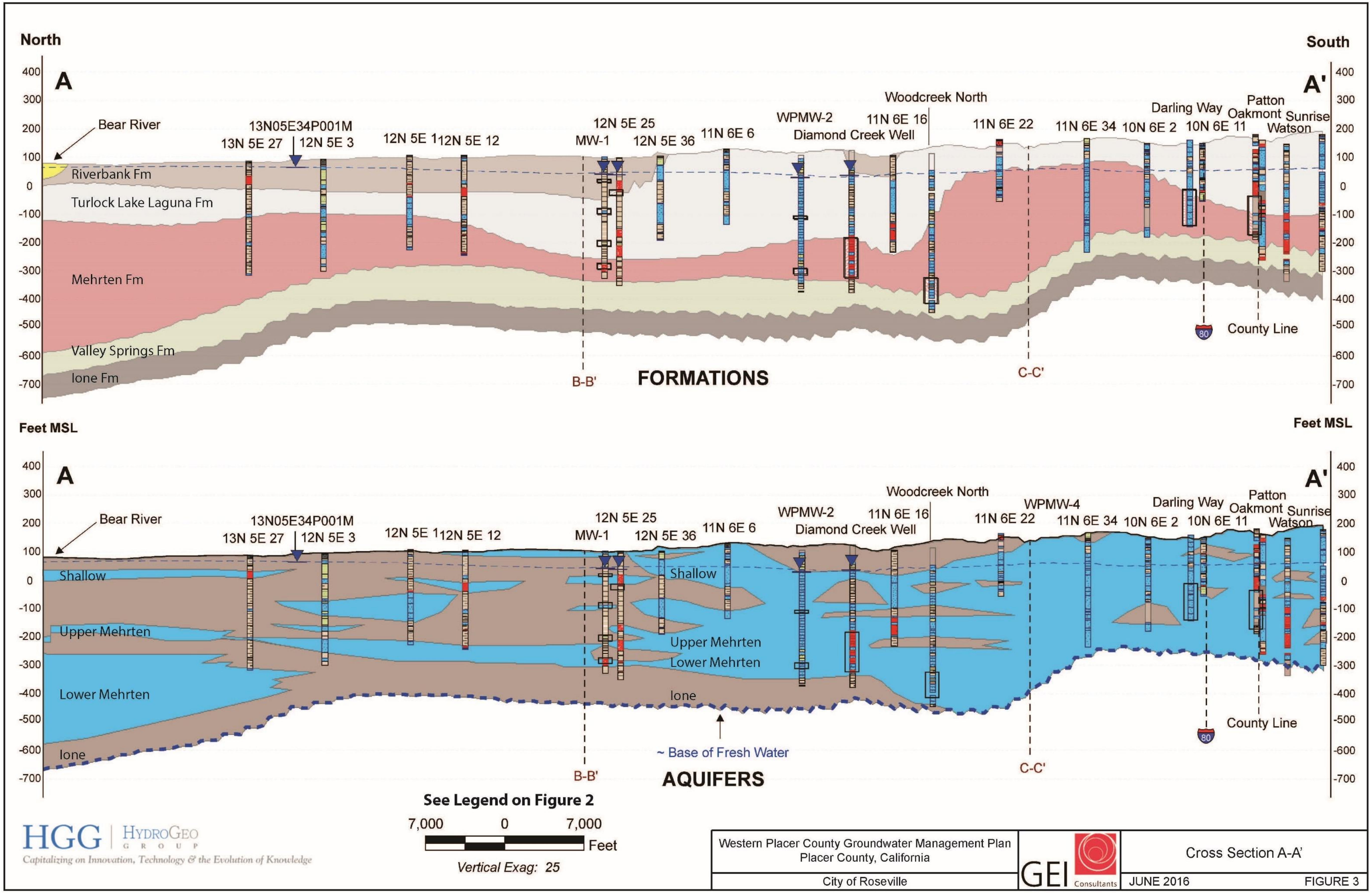

Figure 3. Cross Section A – A'

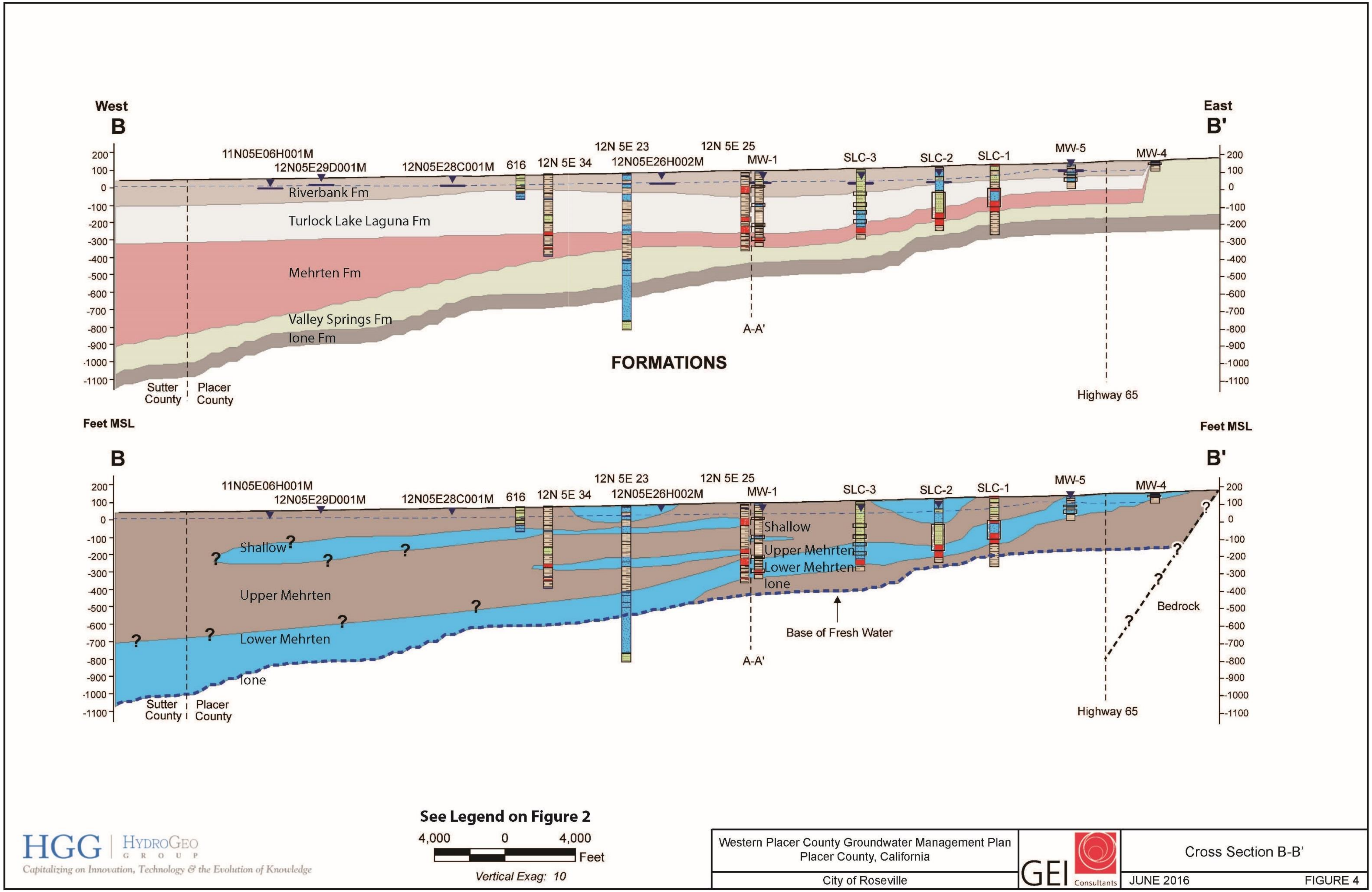

Figure 4. Cross Section B – B'

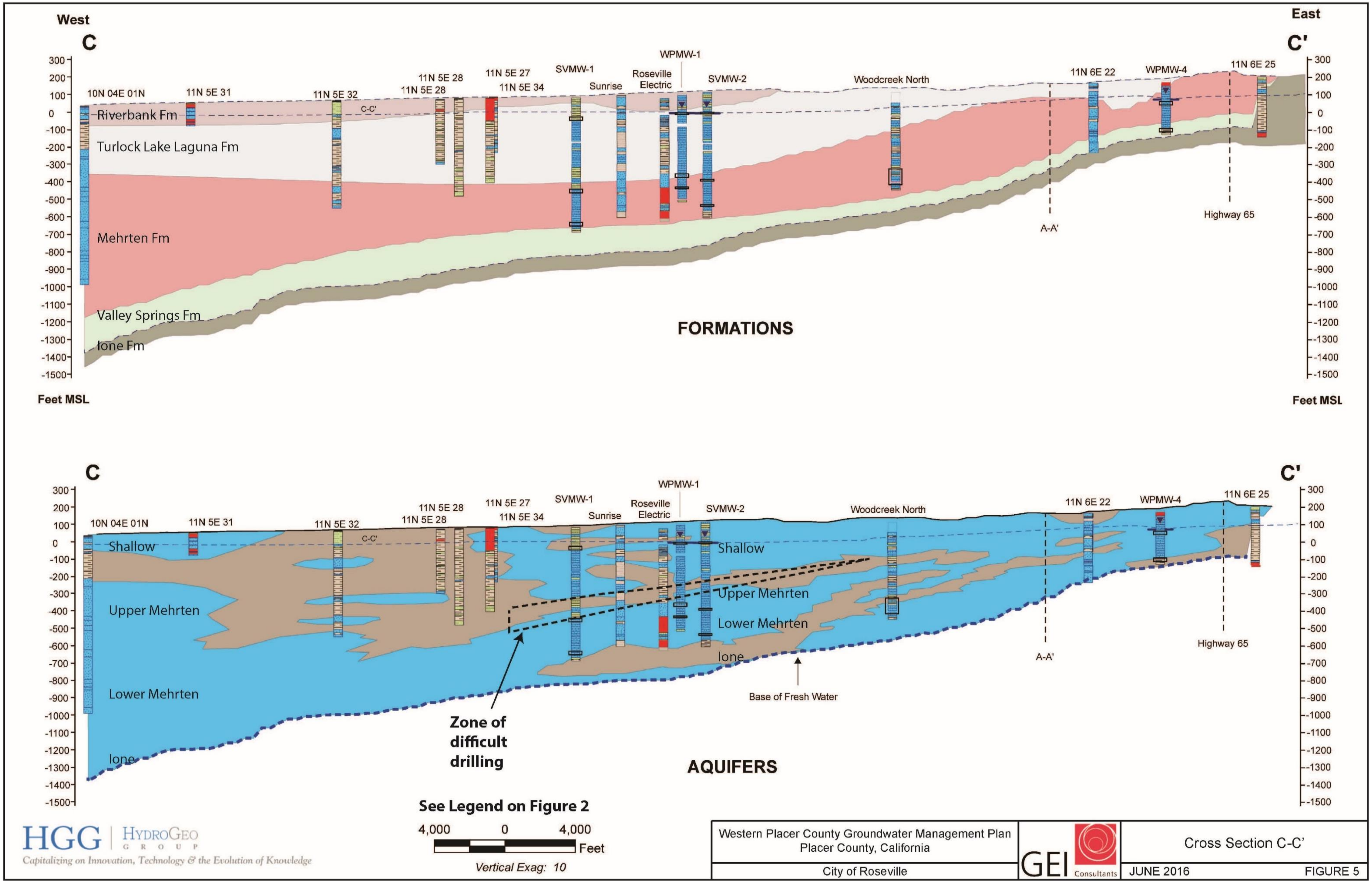

Figure 5. Cross Section C – C'

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2.2.1 Younger Alluvium

These deposits include flood basin deposits and recent stream channel deposits. The flood basin deposits occur along the western margin of the Subbasin adjacent to the Sacramento River. The flood basin deposits consist primarily of silts and clays, although they may be locally interbedded with stream channel deposits. The thickness of the unit ranges from 0 to 100 feet. Because of their fine-grained nature, the flood basin deposits have low permeability and generally yield low quantities of water to wells.

The stream channel deposits include sediments deposited in the channels of active streams as well as the associated overbank deposits. These deposits occur predominantly along the Sacramento and American rivers and their major tributaries, and consist primarily of unconsolidated silt, fine- to medium-grained sand, and gravel. Thickness of the unit ranges from 0 to approximately100 feet. Sand and gravel zones in the younger alluvium are highly permeable and yield significant quantities of water to wells.

The recent stream channel deposits are also present near the Bear River as rather thin, but permeable sediments that support domestic and agricultural wells. The stream channel deposit are unconfined and highly permeable.

Two water quality samples were collected from this Formation.

2.2.2 Riverbank Formation

The Riverbank Formation is comprised of alluvial fan deposits composed of Sierra Nevada Mountain (Sierran) sourced loosely consolidated gravel, sand, and silt. The Riverbank Formation has an estimated thickness of 50 to 200 feet (DWR, 2006). For most of WPC these deposits are predominately fine-grained in the western portion of the area and are coarser-grained in the eastern portion of the basin. For the most part, groundwater in these sediments is not used for water supply due to their low yields.

Two water quality samples were collected from this Formation.

2.2.3 Turlock Lake/Laguna Formation

The Turlock Lake/Laguna Formation is also comprised of Sierran sourced, consolidated alluvial deposited gravel, sand, and silt, which consist of predominantly reworked granitic and metamorphic rocks. Estimates of formation thickness in outcrop range from 125 feet to 200 feet in Sacramento County (DWR, 1974). The Turlock Lake/Laguna Formation is characterized as being moderately consolidated and being poorly-to-moderately cemented. Because of this, the Formation generally has a low-to-moderate permeability. Wells that have been completed in this formation have been observed to yield only moderate quantities of water (DWR, 2006). These formations are generally considered to be unconfined in the eastern portions of WPC and transition to semi-confined in the west.

Near the base of this formation there is a relatively thick clay bed that thickens to the west and thins to the east. In the eastern portion of WPC the bed is absent as shown on **Figure 4**.

Sixteen water quality samples were collected from this Formation.

2.2.4 Transition Zone

The lower portion of the Turlock Lake/Laguna Formation is a gradational contact with the underlying Mehrten Formation. This zone has been named the Laguna/Mehrten Transition Zone (Schlemon, 1967) or for purposes of this report the Transition Zone. In this zone, volcanic sediments of the Mehrten Formation are interbedded with the non-volcanic Turlock Lake/Laguna Formation sediments. These sediments typically result in moderate-to-high yielding wells.

Four water quality samples were collected from this zone.

2.2.5 Mehrten Formation

The Mehrten Formation consists of a sequence of volcanic rocks. In the subsurface, the Mehrten Formation ranges in thickness from 200 to 1,200 feet along the axis of the Sacramento Valley (DWR, 2006). The Mehrten Formation is comprised of two distinct geologic units, the Upper Mehrten Formation and the Lower Mehrten Formation.

The Upper Mehrten Formation consists of gravels and well sorted black andesitic sands, reported by well drillers as "black sands," and interbedded blue-to-brown silts and clays (DWR, 1974). The sands and gravels are highly permeable and wells constructed within this unit can produce 1,000 gallons per minute (gpm) or more (DWR, 2006).

The Lower Mehrten Formation consists of dense volcanic tuff breccias with interbedded conglomerates and sandstones. These consolidated and cemented materials may act as confining layers to the underlying sand intervals. The underlying sand portions of this unit are highly permeable and wells constructed within this unit have been observed to produce yields exceeding 2,000 gpm. This basal portion of the Mehrten Formation is exposed in the eastern portion of the groundwater subbasin.

Both the Upper and Lower Mehrten Formations are unconfined to semi-confined in the eastern portions of WPC and transition to semi-confined to confined in the western portions of the area. The Upper Mehrten Formation appears to be locally semi-confined to confined due to the presence of clayey sediments in the basal portions of the Laguna and Upper Mehrten formations. The Lower Mehrten Formation appears to be more confined due to the presence of consolidated and cemented volcanic flows. Regionally, the Formations are likely more confined to the west as the clay layer and cemented volcanic flow thickness increases.

Five water quality samples were collected from the Upper Mehrten Formation and 22 were from the Lower Mehrten Formation.

2.2.6 Valley Springs Formation

The Valley Springs Formation consists largely of white to olive, stream-laid tuff, sand, and beds of clay (DWR, 1978). Yields from wells are generally low. The Formation is relatively thin and has only been identified at a few locations in WPC. For the most part, it appears to have been eroded by the Mehrten Formation sediments allowing the Mehrten Formation to rest directly on top of the Ione Formation.

No samples were collected from this Formation.

2.2.7 Ione Formation

The Ione Formation typically contains brackish water and is not used for water supply in the WPC area; however, this formation is important because groundwater in the Ione Formation is typically at higher heads than the overlying Mehrten Formation and could up-well and degrade water quality in the overlying fresh water formations.

The Ione Formation underlies the Mehrten Formation and is exposed north of Lincoln (in the mine pits of Gladding McBean) and in the southeastern portion of WPC along the Highway 80 corridor and near Sierra College Boulevard. **Figure 2** shows the locations of the Ione Formation exposures. It should be noted that the Lincoln outcrop is not shown because of the small size of the exposure and the scale of the map.

The Ione Formation is divisible into three distinct members, only the upper two of which are exposed in the valley. The uppermost member of the formation is composed principally of white, medium to coarse-grained quartz sandstone. The second member is a thick, white clay of ceramic quality. The lower member is a blue to gray clay with occasional seams of brown coal. The base of the formation is frequently a zone of gravel composed of quartz and metamorphic fragments.

Wells penetrating into this formation typically yield water with high chloride and TDS (which is related to salt content) concentrations. In the eastern portion of the valley where the Ione Formation was deposited under near-shore or on-shore conditions the formation yields fresh-to-brackish water to wells. Yields to wells are low.

Monitoring and production wells have shown that the Ione Formation can contain fresh water. This suggests that the Ione Formation may be connected to the Mehrten Formation and flow-through has allowed the flushing of the brackish water and replacement with fresh water. North of Lincoln, wells often have higher TDS concentrations when they have been drilled close to or have encountered this formation.

Five water quality samples were collected from this Formation.

2.2.8 Aquifers

Aquifers can be a geologic formation, groups of formations, or part of a formation that is capable of yielding a significant amount of water to a well. Aquifers within the WPC area were interpreted from the well logs and the cross-section shown in **Figures 3 through 5**. For the purposes of this report and to understand the distribution of constituents within the various formations, the formations have been combined into four aquifers. These aquifers (coarse grained permeable sediments) include:

- Shallow Aquifer: Younger Alluvium, Riverbank, and Turlock Lake/Laguna Formations
- Upper Mehrten Aquifer: Transition Zone and the upper portion of the Mehrten Formation
- Lower Mehrten Aquifer: Lower portion of the Mehrten Formation
- Ione Formation Aquifer: Below the Mehrten, including the Valley Springs and Ione Formations.

The Ione Formation does not consistently produce economical quantities of water because of low yields and poor quality. It therefore should not be considered, by many accepted standards, an aquifer. But this formation can have an impact on water quality in other WPC formations and aquifers. Hence, it is classified as an aquifer for the purposes of this report.

Table 1 shows the monitoring wells sampled for this Study by these aquifers.

2.3 Groundwater Levels and Flow Direction

Groundwater levels and flow direction are important factors to consider when interpreting water quality results and determining potential sources of particular constituents. The difference in groundwater levels throughout the basin determine the direction of flow. Groundwater contour maps have been developed to determine the flow direction in the subbasin.

The difference in groundwater levels between the Lower Mehrten, Upper Mehrten, and Turlock Lake/Laguna Formation aquifers at any particular point within the basin are generally small; however, there is up to a 10-foot head difference at SVMW-2 between the Turlock Lake/Laguna (Shallow Aquifer) and the Upper and Lower Mehrten Formation Aquifer. Therefore, for groundwater contouring purposes water levels from wells screened in the Upper and Lower Mehrten formations were used to develop groundwater contours and show the flow directions for the WPC area. Groundwater levels in the Ione Formation monitoring wells were not used in the contouring process due to significant head difference.

Figure 6 shows groundwater contours for fall 2015. The contours show the groundwater flow direction is generally to the west southwest. In the southwestern portion of the WPC area there is a large pumping depression that extends from Sacramento County into WPC. It started forming about 60 years ago, but has been stable for over 20 years due to groundwater management actions. The pumping depression has modified the groundwater flow direction to the south, so that most of the groundwater migrates from WPC into Sacramento County. The pumping depression is also causing inflow to WPC from the west from Sutter County.

A second small pumping depression is present near the City of Lincoln. This depression has been present since at least 2005 when Lincoln constructed its groundwater monitoring network. Over the last 10 years, the depression has been about 14 to 29 feet deep and partially refills seasonally.

2.4 Existing Water Quality Data

Previous water quality samples were collected from some of the wells, typically shortly after they were constructed. Fifteen wells were sampled between 2003 and 2005, eighteen wells were sampled in 2011 and ten wells were sampled in early 2015. The previous samples help to verify the data from this Study, particularly where concentrations are high, and to allow some interpretation about how water quality may be changing over time.

2.5 Concurrent Sampling Events

Concurrent with collection of water quality samples for this Study, the Sacramento Groundwater Authority (SGA) collected water quality samples from some of its monitoring wells to better define the distribution of hexavalent chromium in the subbasin.

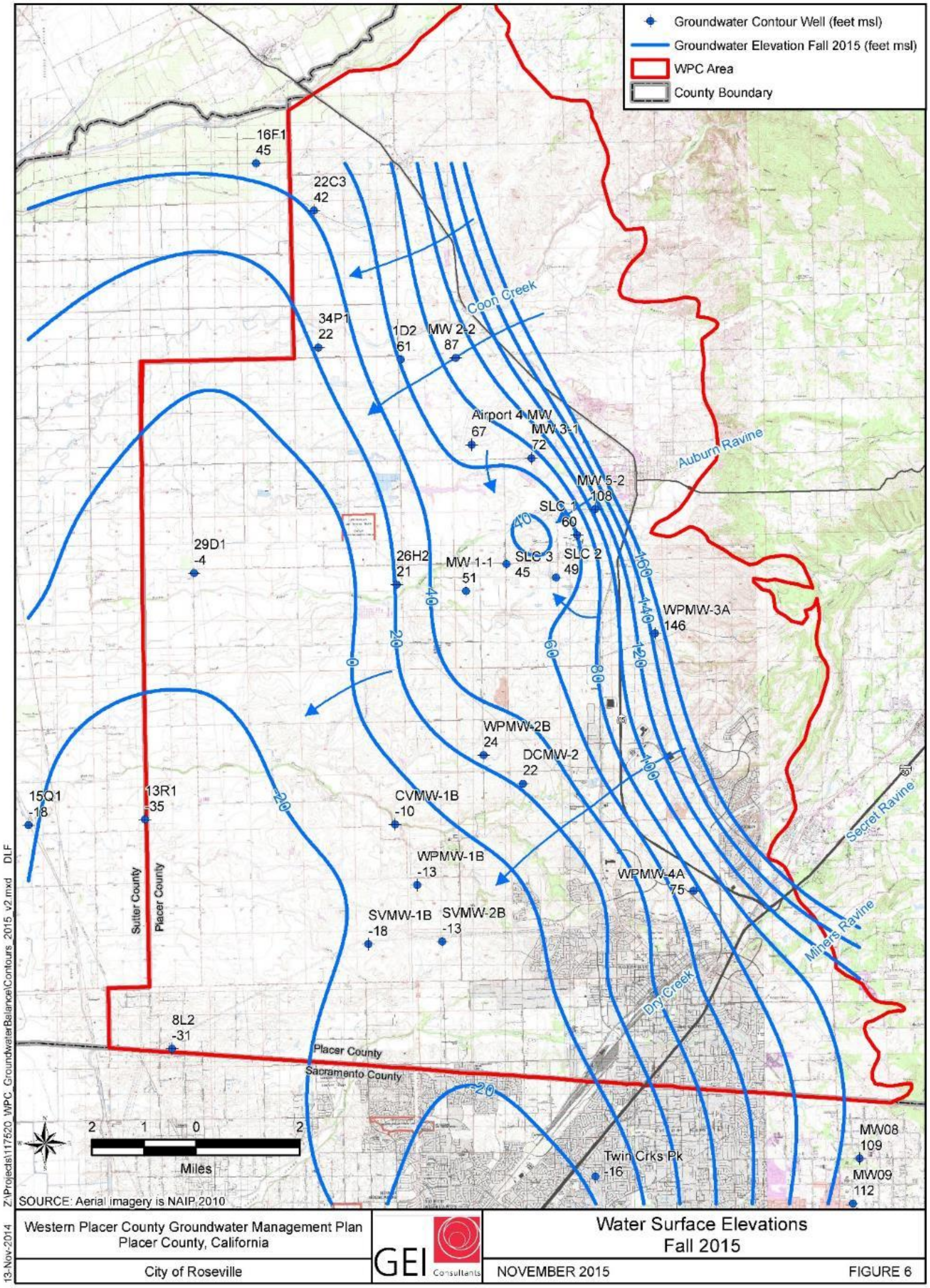


Figure 6. Water Surface Elevations Fall 2015

3. Sample Collection and Constituents Analyzed

Samples were collected from most of the monitoring wells in the early fall between September 15 and November 12, 2015 and three Placer County wells were sampled in March and April 2016. No major precipitation events occurred during the fall sampling period. Samples were collected from most wells using the pump and purge method as shown in **Table 1**. The pump and purge sampling procedures used are detailed in **Appendix A.** At least three well volumes were pumped from each well prior to sampling in order to ensure that the samples collected were indicative of aquifer conditions. Field parameters, including temperature, pH, electrical conductivity, dissolved oxygen, and turbidity, were also measured during pumping to ensure stabilization prior to sample collection. These measurements, along with pumping rates and volumes are documented on the field purge logs included in **Appendix B**. The three Placer County wells were sampled using similar sampling procedures.

Seven samples were collected using a depth discrete method from four wells as shown in **Table 1**. Wells were selected for depth discrete sampling to collect samples at several different depths or because the pump and purge method was not practical given the well volume and pumping rates (typically 2 to 10 gpm) of the sampling pumps. Depth discrete samples were collected using the Hydrasleeve™ sampling device. These devices are deployed within the screened interval, left to stabilize for several days, and then removed while capturing water samples only from the zone just above where the sleeve was deployed. The depth discrete sampling procedures are contained in **Appendix C**. No water was purged for depth discrete sampling.

During the Study dedicated pumps and transducers were found in monitoring wells DCMW-1, DCMW-2, and DCMW-3. The pumps were found to be operational once a CU300 motor control panel was rented from a vendor. The pumps are submersible, 3-inch diameter ½ Horsepower pumps manufactured by Grundfos. Attempts were made to recover the groundwater level measurements from the transducers, but the data was unrecoverable. As a result of the sampling it was found that the groundwater level measurements were being made through the pump discharge pipe. This makes most of the historic groundwater level measurements in these wells invalid since the check valve does not allow water within the discharge pipe to equilibrate with groundwater levels. The location for groundwater level monitoring was moved to the ports where the transducers were located and staff was provide instructions as to the new location. The CASGEM database was also updated.

Each sample was analyzed for various constituents including general mineral (calcium, potassium, sodium, magnesium, bicarbonate, sulfate and chloride), nitrate, boron, hexavalent chromium, metals, perchlorate, and VOCs. The testing methods, hold times, and minimum reporting limits are detailed in **Table 2**. All samples were filtered prior to analysis for metals. Many of these constituents were selected for this Study to characterize the differences in general character between aquifer formations and between different spatial areas of the basin.

Table 2. Analytical Parameters and Testing Methods

Parameter	**ANALYTICAL TESTING METHOD**	**MAXIMUM HOLDING TIME**	**SAMPLE CONTAINER**		**PRESERVATION**	**MINIMUM REPORTING LIMIT**	**SAMPLE BOTTLES**
			BOTTLE TYPE	**SIZE/SET**			
General Minerals							
Akalinity	EPA 310.1	14 Days	Plastic	1 Liter	Cool to 4 ^{o}C	5.0 mg/L	***1x1L plastic - no preservation*** (anions/TDS) ***1x500 ml plastic*** ***(w/ NO3 if filtered in the field)*** ***(non-preserved if lab filtered)***
Calcium	EPA 200.7	6 Months	Plastic	1 Liter	Cool to 4 ^{o}C	1.0 mg/L	
Chloride	EPA 300.0	28 Days	Plastic	1 Liter	Cool to 4 ^{o}C	1.0 mg/L	
Fluoride	EPA 300.0	28 Days	Plastic	1 Liter	Cool to 4 ^{o}C	0.1 mg/L	
Hardness	SM2340B	6 Months	Plastic	1 Liter	Cool to 4 ^{o}C	1.0 mg/L	
Magnesium	EPA 200.7	6 Months	Plastic	1 Liter	Cool to 4 ^{o}C	1.0 mg/L	
Nitrate	EPA 300.0	48 Hours	Plastic	1 Liter	Cool to 4 ^{o}C	2.0 mg/L	
pH	EPA 150.1	Immediate	Plastic	1 Liter	Cool to 4 ^{o}C	None Required	
Potassium	EPA 200.7	6 Months	Plastic	1 Liter	Cool to 4 ^{o}C	1.0 mg/L	
Sodium	EPA 200.7	6 Months	Plastic	1 Liter	Cool to 4 ^{o}C	1.0 mg/L	
Specific Conductance (EC)	SM 2510-B	28 Days	Plastic	1 Liter	Cool to 4 ^{o}C	10 umhos/cm	
Sulfate	EPA 300.0	28 Days	Plastic	1 Liter	Cool to 4 ^{o}C	0.50 mg/L	
Total Dissolved Solids (TDS)	SM 2450-C	7 Days	Plastic	1 Liter	Cool to 4 ^{o}C	1.0 mg/L	
Metals							
Drinking Water Metals (dissolved) (Ag,Al,As,B,Ba,Be,Cd,Cr,Cu,Fe,Hg, Mn,Ni,Pb,Sb,Se,Tl,V,Zn)	EPA 200 Series	6 Months	Plastic	200 mL	HNO3, cool to 4 ^{o}C	Varies	see metals above (will use same bottle)
Hexavalent Chromium	EPA 218.6	7 days	Plastic	125 mL.	NH3 + NH4 (pH 9)	1 ug/L	***250 ml p w/HN4 + buffer***
Other							
Perchlorate	EPA 314.0	14 Days	Plastic	1 Liter	Cool to 4 ^{o}C		from GM bottle
VOCs	EPA 524.2	14 Days	Glass	3x 40ml	Cool to 4 ^{o}C		***3x40 ml VOA w/ HCl***

4. Water Quality Results

The water quality sampling results for those constituents with drinking water maximum contaminant levels (MCLs) are summarized in **Table 3**. MCLs in California are based on those established by the United States Environmental Protection Agency (USEPA) or the California Division of Drinking Water (DDW). Both primary and secondary MCLs are enforced for public drinking water systems in California.

A complete table of historic and water quality analysis are provided in **Appendix D**, **Table D-1**, along with the original water quality analytical reports. The analytical results from the historic measurements are colored purple and results from the current sampling are in green. Historical results for most constituents compare well with the current sampling except for iron and manganese. This may be due to previous samples not being filtered, to remove sediments, prior to analysis.

4.1 Piper Diagrams

Piper diagrams are used to display water quality results to illustrate relationships between the major cations (calcium, potassium, sodium, magnesium) and anions (bicarbonate, sulfate and chloride) in the water. The relationships shown on a Piper Diagram are often used to identify water of similar types and common sources. When points plot in a common area (grouped together) they have similar mineral constituents and suggest common sources and formations. Water mixing from different sources can also be identified.

Identification of water types and sources are best assessed by using anions that remain fairly stable even with contact with sediments. Cations are readily exchangeable with the soils and are not typically used to interpret different sources of water.

Groundwater in WPC can be grouped into two predominate types; bicarbonate and chloride dominated. Bicarbonate water is typical of water recharged from local precipitation or the Sierra Nevada Mountains. Chloride dominated water is from older marine deposits or surface water that has been substantially evaporated in shallow lakes or ponds. **Figure 7** illustrates these groupings. About sixteen wells had an intermediate water quality, plotting between the two groupings and may indicate a mixture of the two source types.

Figure 8 shows that most Shallow Aquifer wells are bicarbonate-type with a few wells showing a mixture of bicarbonate and chloride-type. The deeper aquifers show more influence from chloride-type waters as shown in **Figures 9 through 11**. This may indicate that the aquifers are interconnected and brackish water from the Ione Formation is upwelling into the Lower Mehrten Aquifer. Three of the Ione Aquifer wells shown in **Figure 11** are not chloride-type, which indicates that these wells may be located in an area where the Ione Aquifer has been recharged by fresh bicarbonate-type water. Two of the wells in **Figure 11**

(MW 2-1 and WPMW-4B) are bicarbonate-type, but have a high proportion of sodium. This may indicate that residual sodium from the brackish water present during the deposition of the Ione Formation is adsorbed to the formation material.

Wells that have been identified as being chloride type of water or that are displaying mixing warrant continued monitoring to assess long term trends.   **Figures 8 through 11** show the locations of these wells.

Table 3 Distribution of Results Relative to MCL

		Statistical Analysis of Results (58 samples, incl Placer County)						Number of Samples Relative to the MCL						
Constituent	Units	Minimum Value	Maximum Value	Mean Value	Median Value	Standard Deviation	MCL	Less than Detection Limit	Greater than Detection Limit but Less than One-quarter of the MCL	Concentration Greater than One Quarter but Less than One-half MCL	Concentration greater than One-Half but less than Three-quarters of the MCL	Concentrations greater than Three-quarters but less than the MCL	Concentrations Above MCL	Total Number of Samples
pH	pH	6.9	9.4	7.7	7.6	0.44	6.5 to 8.5	--	--	--	--	--	3	58
Electrical Conductivity	uS/cm	170	5000	691	420	868	900*	0	4	30	12	3	9	58
Total Dissolved Solids (salts)	mg/L	120	2700	447	284	494	500*	0	1	19	24	3	11	58
Chloride	mg/L	6.7	1400	131	44	244	250*	0	33	15	1	1	8	58
Sulfate	mg/L	<0.4	280	27	10	52	250*	4	49	2	0	2	1	58
Nitrate (as nitrate)	mg/L	<0.44	82	6	3	13	45	23	28	4	1	1	1	58
Fluoride	mg/L	<0.042	3.6	0.3	0.2	0.55	2	7	45	2	0	2	1	57
Arsenic	ug/L	<1.2	32	3	1	4.2	10	38	2	13	3	1	1	58
Perchlorate	ug/L	<0.01	<3.8	<1.9	<1.9	--	6	58	0	0	0	0	0	58
Manganese	ug/L	<4.5	1544	103	15	237	50*	27	1	5	3	0	22	58
Iron	ug/L	<14	1520	93	14	228.7	300*	39	7	5	1	0	6	58
Hexavalent Chromium	ug/L	<0.029	15	2	0	2.7	10	27	16	8	5	1	1	58
Aluminum	mg/L	<0.001	0.28	0.03	0.02	0.041	1	51	6	1	0	0	0	58
Boron	mg/L	<0.046	17	1	0	2.7	50	18	39	1	0	0	0	58
Barium	ug/L	7.4	260	68	57	47	1000	0	57	1	0	0	0	58
Beryllium	ug/L	<0.2	<0.45	<0.45	<0.45	--	4	57	1	0	0	0	0	58
Cadmium	ug/L	<0.2	<0.45	<0.45	<0.45	--	5	58	1	0	0	0	0	58
Copper	ug/L	<2.3	14	2.8	2.3	2.0	1300	51	7	0	0	0	0	58
Total Chromium	ug/L	<0.28	17	5	5	2.3	50	52	5	1	0	0	0	58
Mercury	ug/L	<0.091	0.18	0.09	0.09	0.012	2	58	0	0	0	0	0	58
Nickel	ug/L	<0.28	33	5.2	4.5	4.7	100	56	0	2	0	0	0	58
Lead	ug/L	<1.4	4.5	2.3	2.3	0.36	15	58	0	0	0	0	0	58
Antimony	ug/L	<0.91	4.9	1.0	0.9	0.56	6	57	0	0	0	1	0	58
Selinium	ug/L	<0.91	18	1.9	0.9	2.8	50	51	6	1	0	0	0	58
Thallium	ug/L	<0.45	<3.21	0.60	0.45	0.62	2	58	0	0	0	0	0	58
Zinc	mg/L	<0.0015	0.049	0.023	0.023	0.01	5	55	3	0	0	0	0	58
VOCs (excluding THMs)	ug/L	1 detection above detection limit					various	57	1**	0	0	0	0	58
Trihalomethanes (THMs)	ug/L	<0.5	42	1.4	0.50	5.6	80	53	4	0	1	0	0	58

Notes:

For statistical calculations, when the concentration was below the detection limit, the detection limit was used

uS/cm = microsiemens per centimeter

mg/L = milligrams per liter or parts per million

ug/L = micrograms per liter or parts per billion

* = secondary MCL, recommended limit

-- = not applicable

< indicates below the detection limit

** Swainson Well had a detections of Toluene (0.3 ug/L) and 1,2,4-Trichlorobenzene (1.9 ug/L), both less than 1/4 of the mcl.

A new pump was installed in the well just prior to sampling and detections are likely a result of tape adhesives used during pump installation.

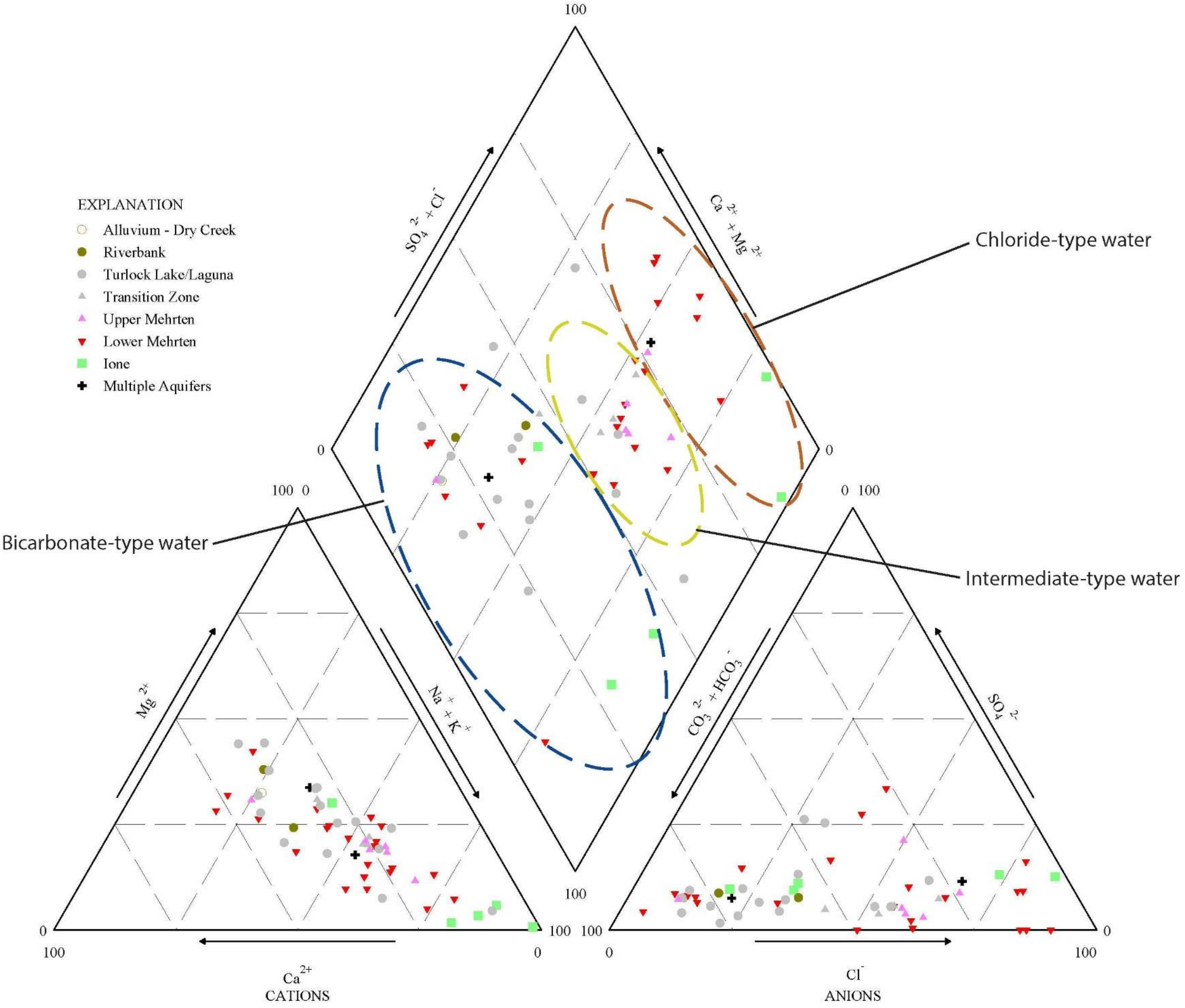


Figure 7. Piper Diagram

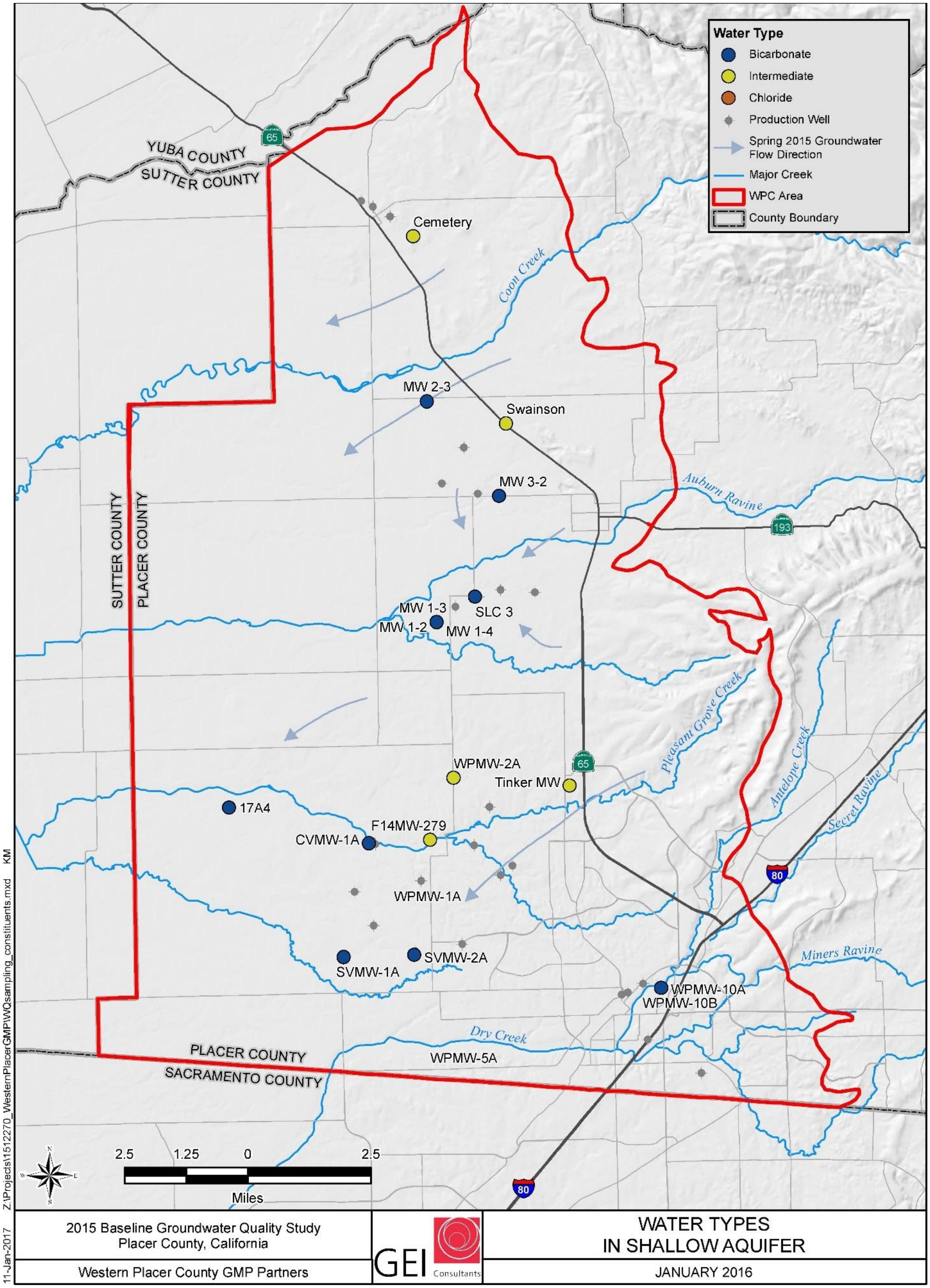


Figure 8. Distribution of Water Types Shallow Aquifer

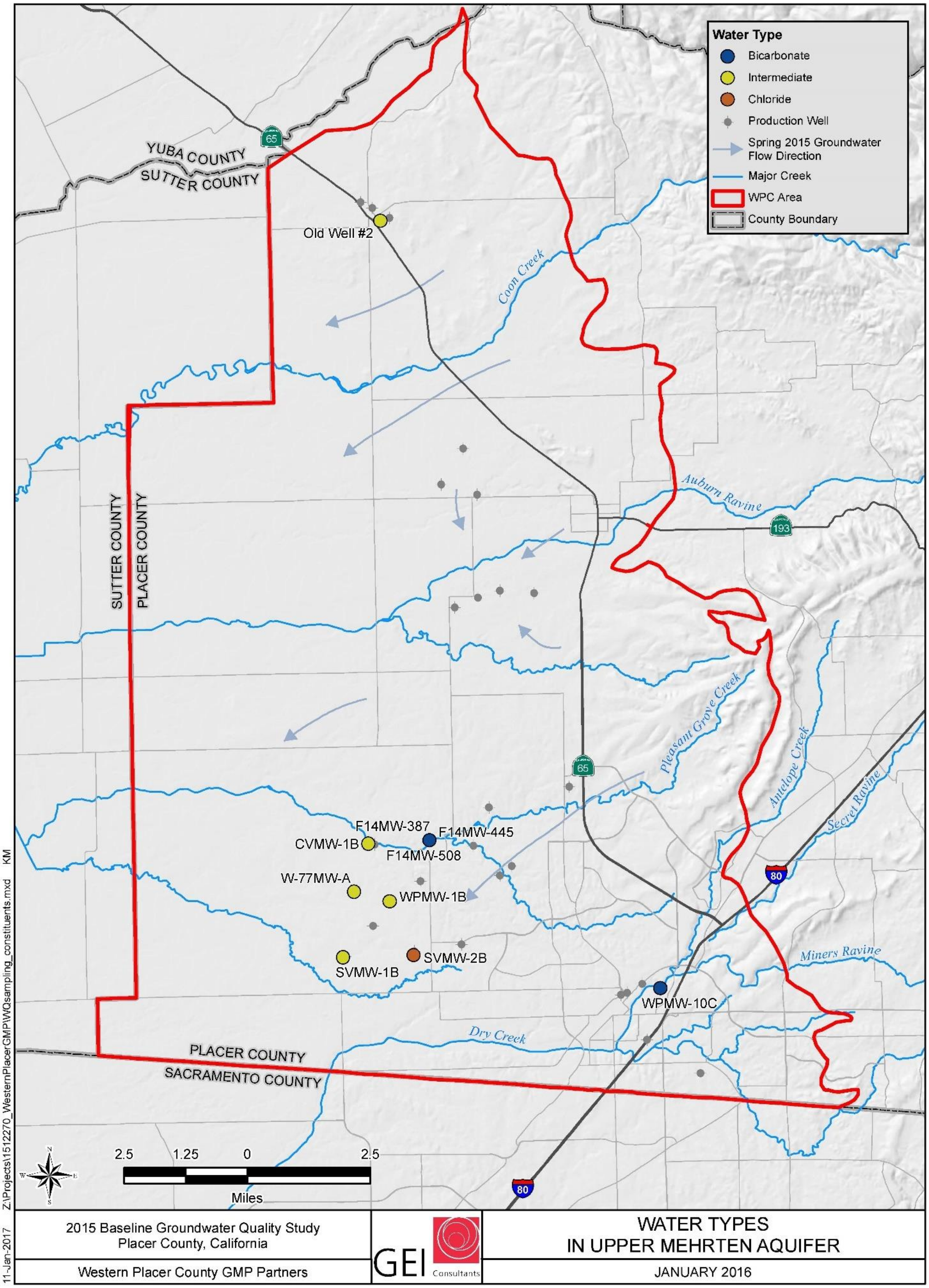
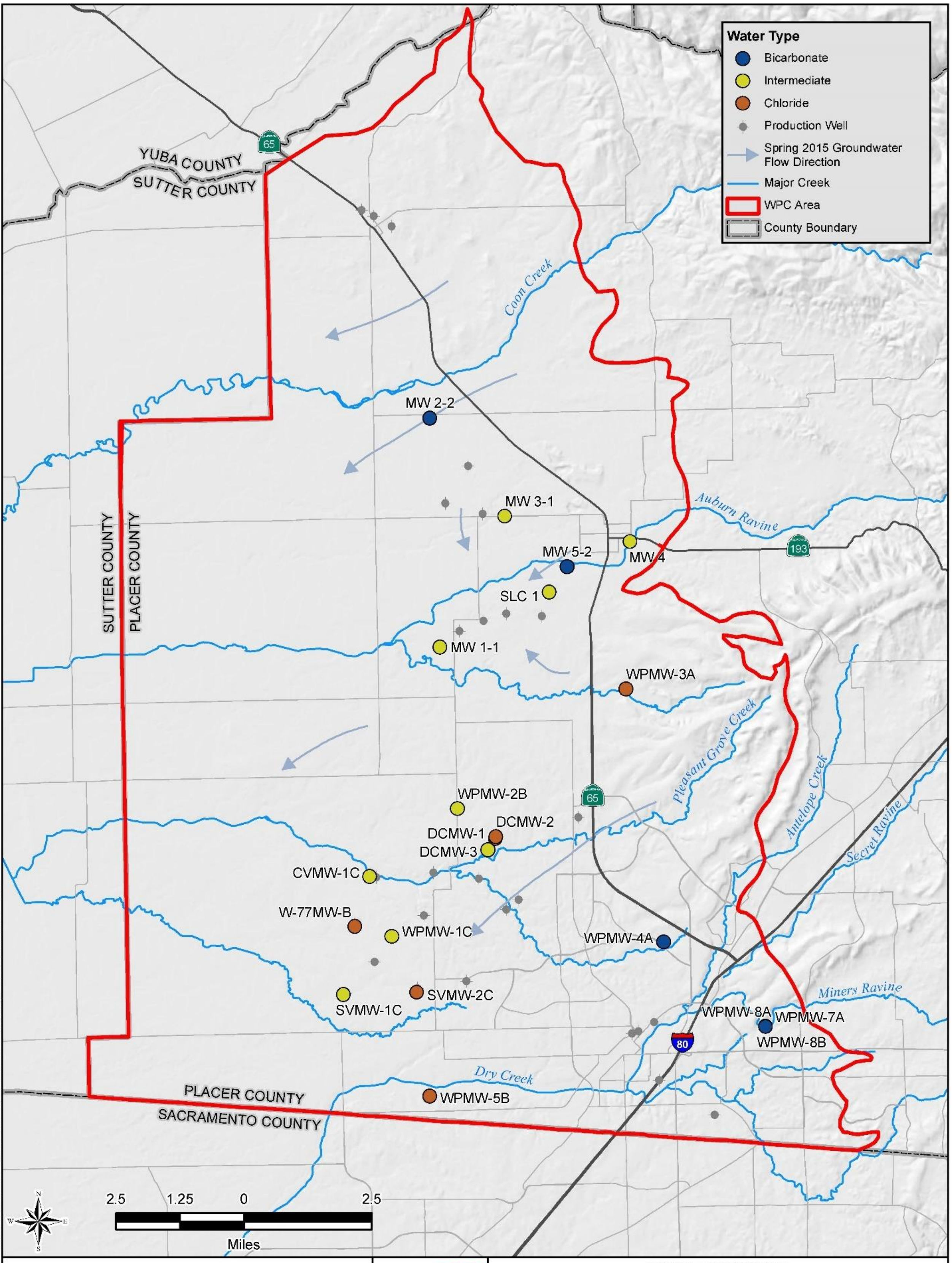


Figure 9. Distribution of Water Types Upper Mehrten Aquifer



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WATER TYPES
IN LOWER MEHRTEN AQUIFER

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Figure 10. Distribution of Water Types Lower Mehrten Aquifer

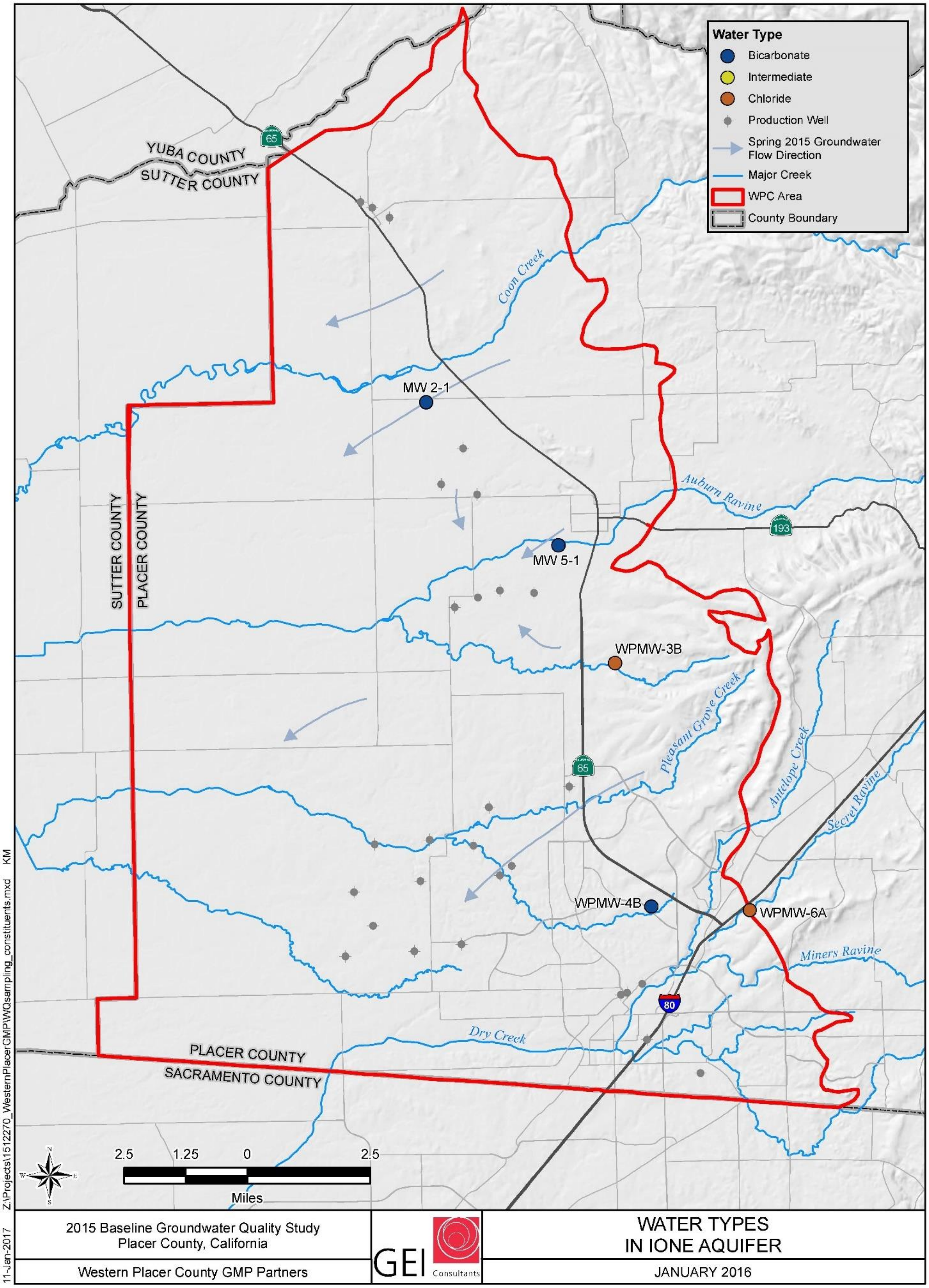


Figure 11. Distribution of Water Types in Ione Aquifer

4.2 Spatial Distribution of Constituents

Fifty-two constituents were detected above their MCL: chloride, sulfate, TDSs, hexavalent chromium, fluoride, manganese, and iron, not counting electrical conductivity, which is directly correlated to TDS. Three constituents were detected at elevated levels, but not above their MCL: nitrate, total trihalomethanes (TTHMs) and arsenic. Perchlorate and volatile organic compounds other than TTHMs were not detected. To evaluate each of these constituents in more detail, concentrations for each were plotted on maps of the WPC area for each aquifer described in Section 2. These maps are included as **Figures 12 through 39**.

4.2.1 Total Dissolved Solids

TDS is a measure of all the dissolved constituents in water, in general the major anions and cations. In the WPC area, sources for these dissolved constituents include naturally occurring and man-contributed (anthropogenic). Human sources include discharge from septic systems, percolation or waste discharge ponds, fertilizers and soil amendments, and irrigation with recycled water. Natural sources include brackish water from the Ione Formation and the dissolution of formation material as water percolates through soils and sediments.

TDS is regulated under a secondary drinking water standard with a varying MCL. The secondary drinking water standard has a recommended level of 500 milligrams per liter (mg/L), an upper recommended level of 1,000 mg/L and a short-term level of 1,500 mg/L. TDS is typically used as a general measure of the quality of water for a variety of uses.

The lower TDS values typically represent percolated rain water or water imported from the Sierra Nevada Mountains. Higher TDS values are associated with water that has been evaporated or of marine origin.

TDS results for the 58 samples collected ranged from 120 to 2,700 mg/L. Eleven wells had measurements above recommended 500 mg/L MCL. Of these eleven occurrences five wells were over 1,000 mg/L the upper recommended MCL and only two wells were over the short-term limit of 1,500 mg/L. **Figures 12 through 15** show the distribution of measurements in the four aquifers described in Section 2.

The Shallow and Upper Mehrten Aquifers mostly have good quality with TDS less than 300 mg/L. One measurement over 500 mg/L was detected at MW-3-2 near the City of Lincoln. The higher concentration at MW 3-2 could be related to infiltration from industrial wastewater ponds that are located about a mile away, from deep percolation of applied agricultural water, or from the Ione Formation.

The Lower Mehrten Aquifer and Ione Aquifer contain numerous wells with high levels of TDS. Brackish water (TDS values exceeding 1,500 mg/L) is present within the Ione Formation. Wells screened in this aquifer are located on the eastern margins of the basin. High TDS levels in the Lower Mehrten Aquifer could be attributed to being in areas that are screened near the bottom of the Mehrten Aquifer and where brackish water may be discharging to the Mehrten Aquifer or is upwelling from the underlying Ione Aquifer. It should be noted that in both the Ione and Lower Mehrten Aquifers the majority of wells contain high quality water, generally below 300 mg/L.

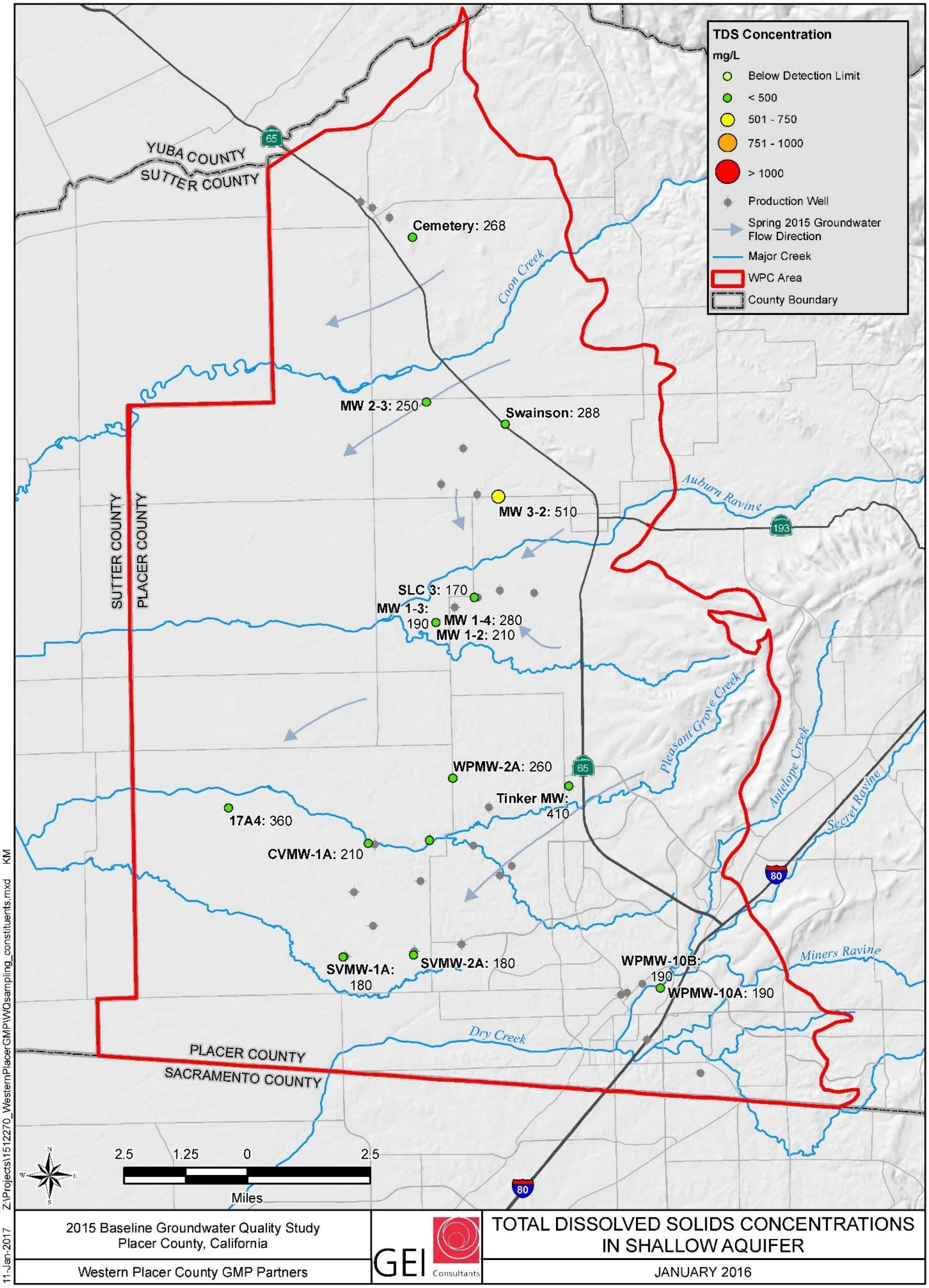


Figure 12. Total Dissolved Solids Concentrations in the Shallow Aquifer

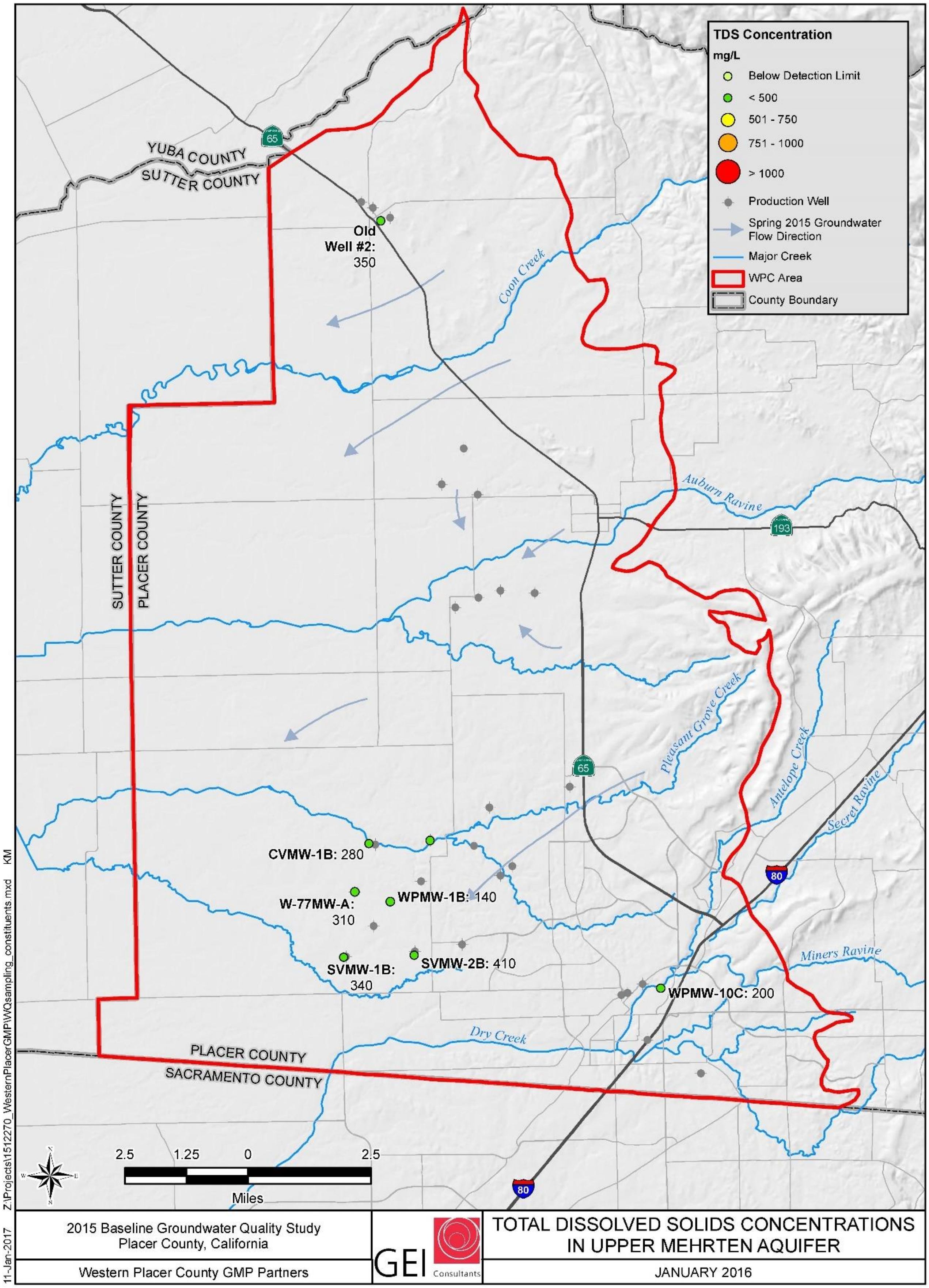


Figure 13. Total Dissolved Solids Concentrations in the Upper Mehrten Aquifer

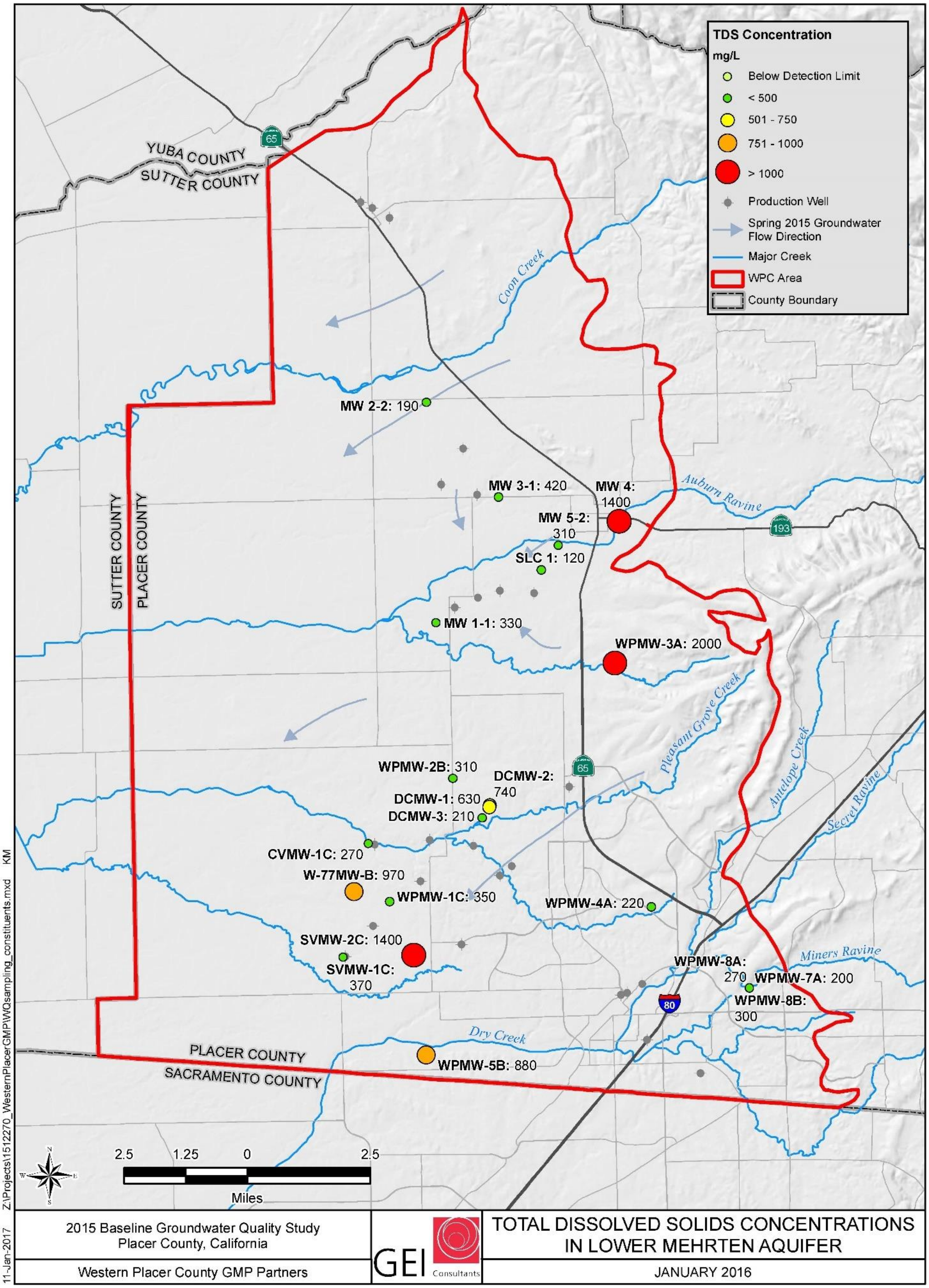


Figure 14. Total Dissolved Solids Concentrations in the Lower Mehrten Aquifer

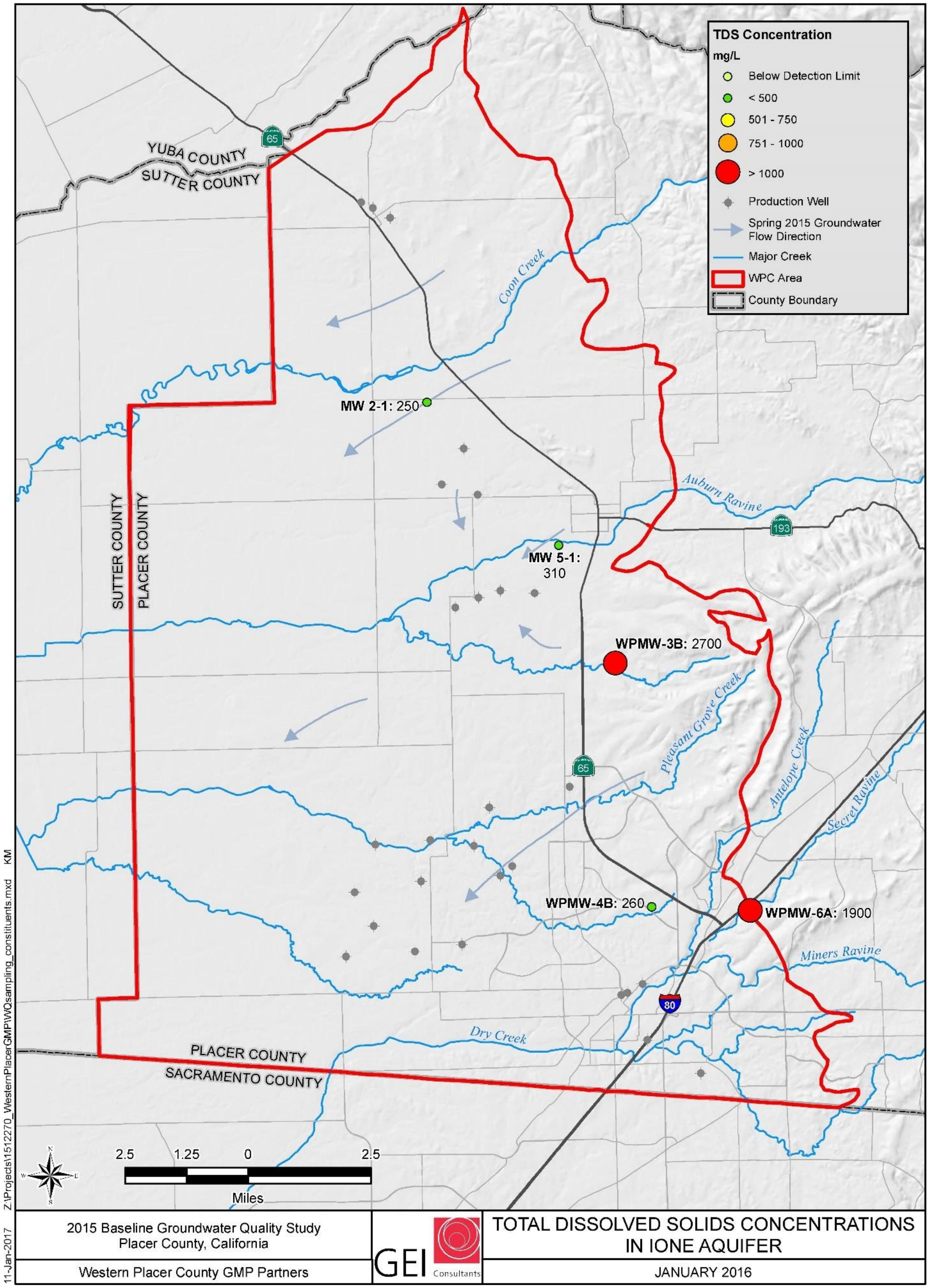


Figure 15. Total Dissolved Solids Concentrations in the Ione Formation

4.2.2 Chloride

Chloride (Cl) is a major anion found in all natural waters. Sources of the anion are similar to those for TDS. Chloride is regulated under a secondary drinking water standard with a varying MCL. The standard has a recommended level of 250 mg/L, an upper recommended level of 500 mg/l and a short-term level of 600 mg/L.

Chloride results for the 58 samples range from 7 to 1,400 mg/L with eight samples above the secondary recommended level of 250 mg/L. Only five of the eleven samples above short-term limit of 500 mg/L. The distribution of elevated chloride concentrations follow the same patterns as TDS as shown in **Figures 16 through 19** with the highest concentrations being present in the Ione Formation and the next highest values being present in the Lower Mehrten Aquifer.

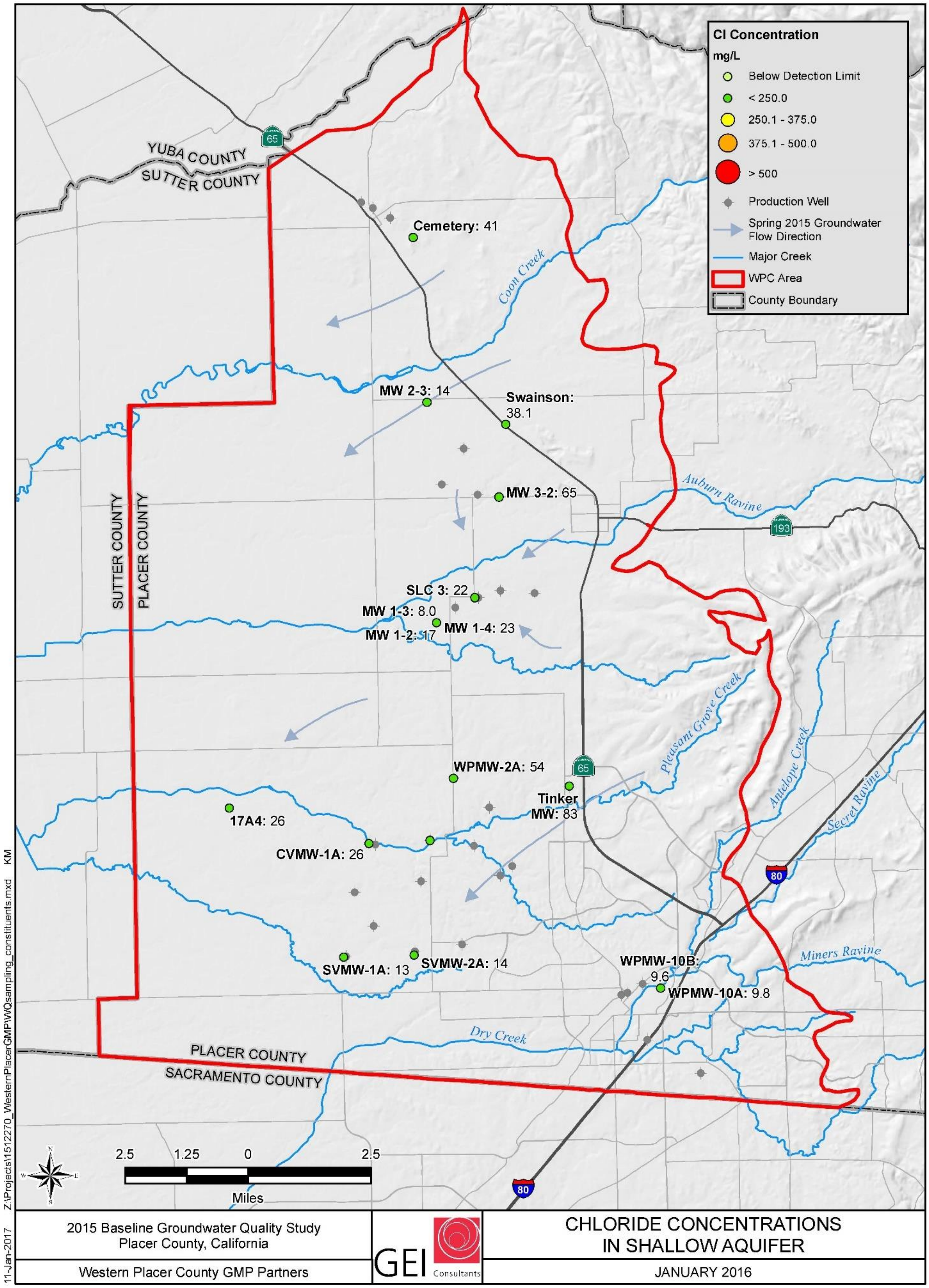


Figure 16. Chloride Concentrations in the Shallow Aquifer

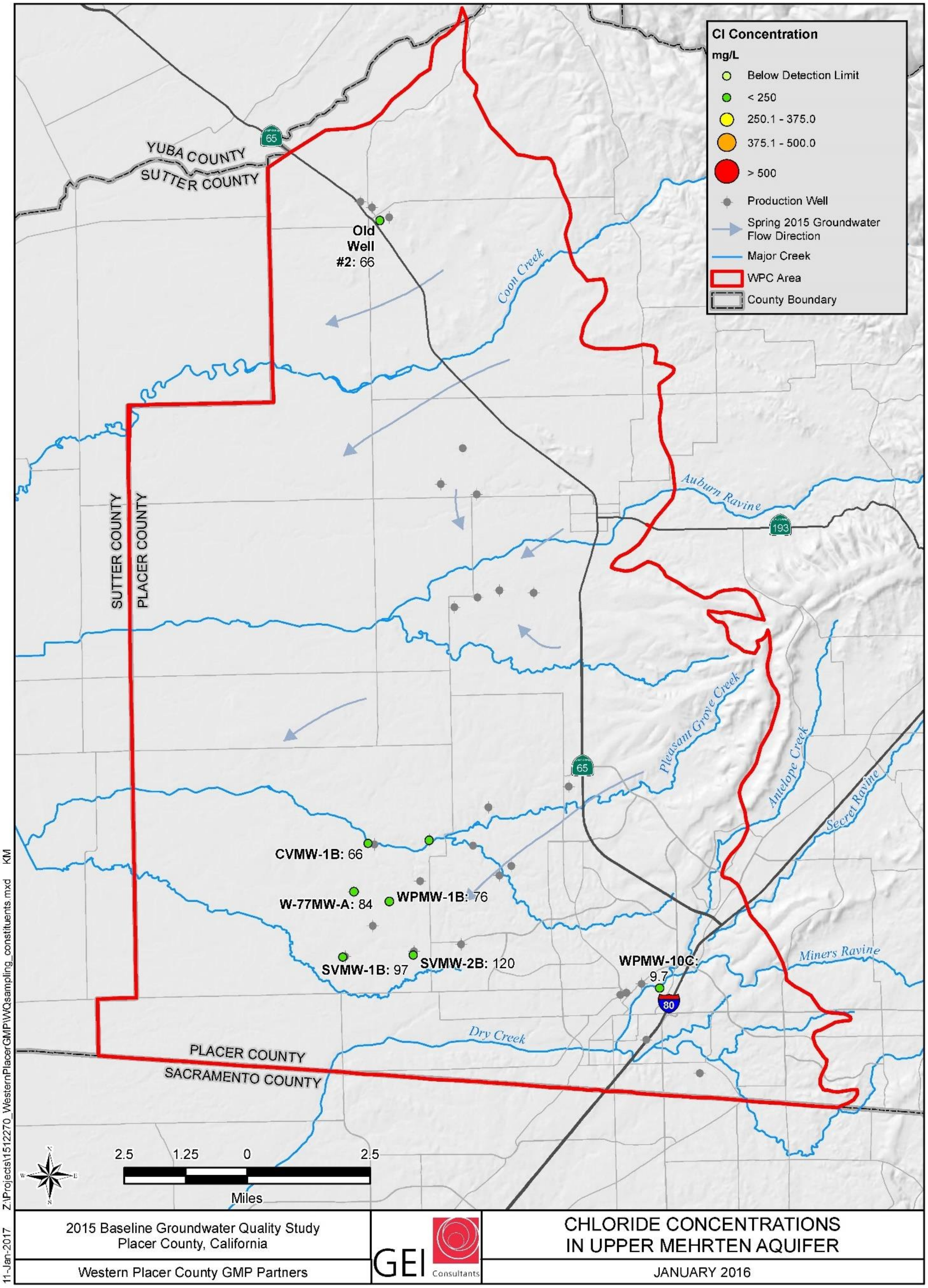


Figure 17. Chloride Concentrations in the Upper Mehrten Aquifer

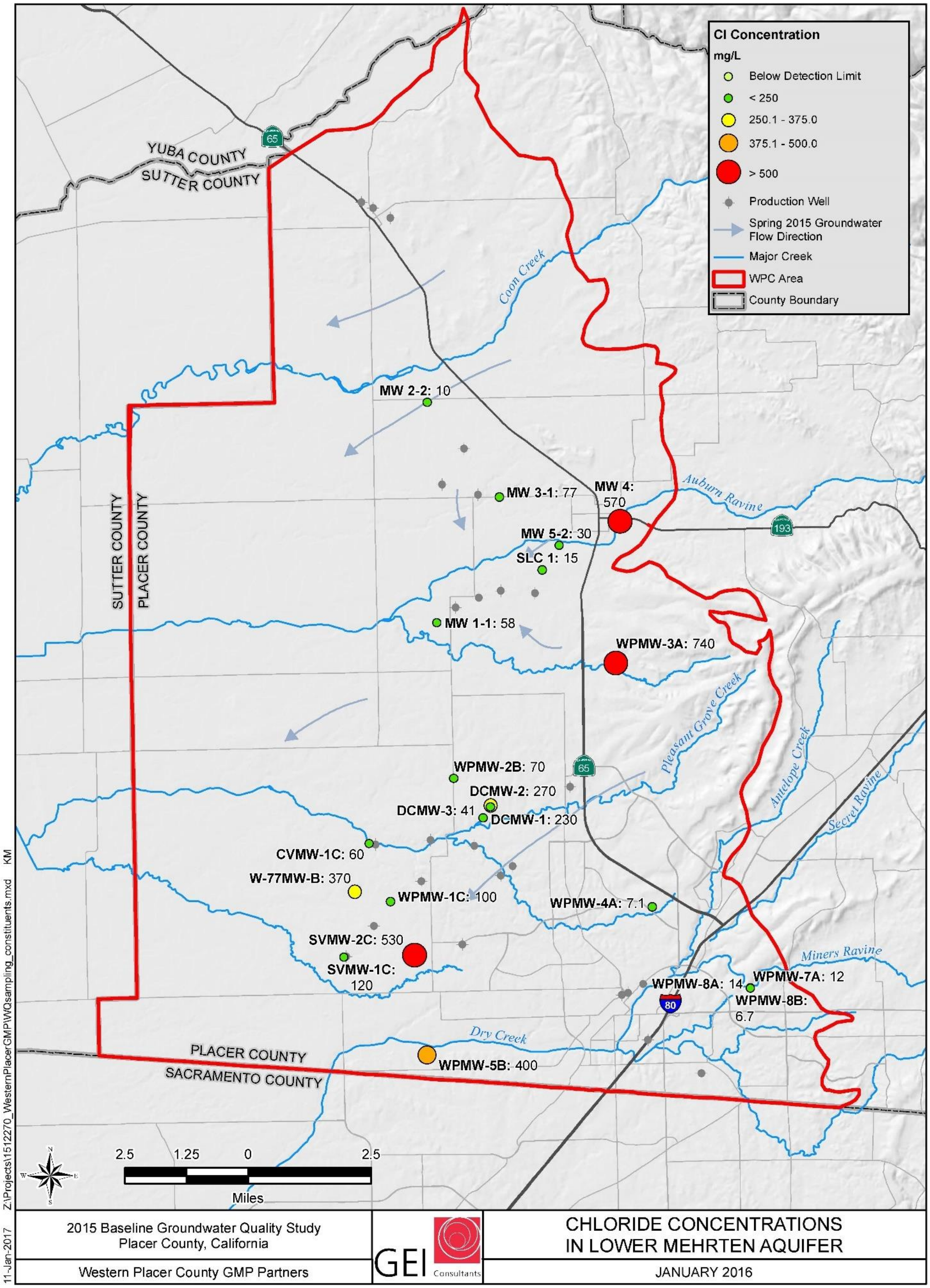


Figure 18. Chloride Concentrations in the Lower Mehrten Aquifer

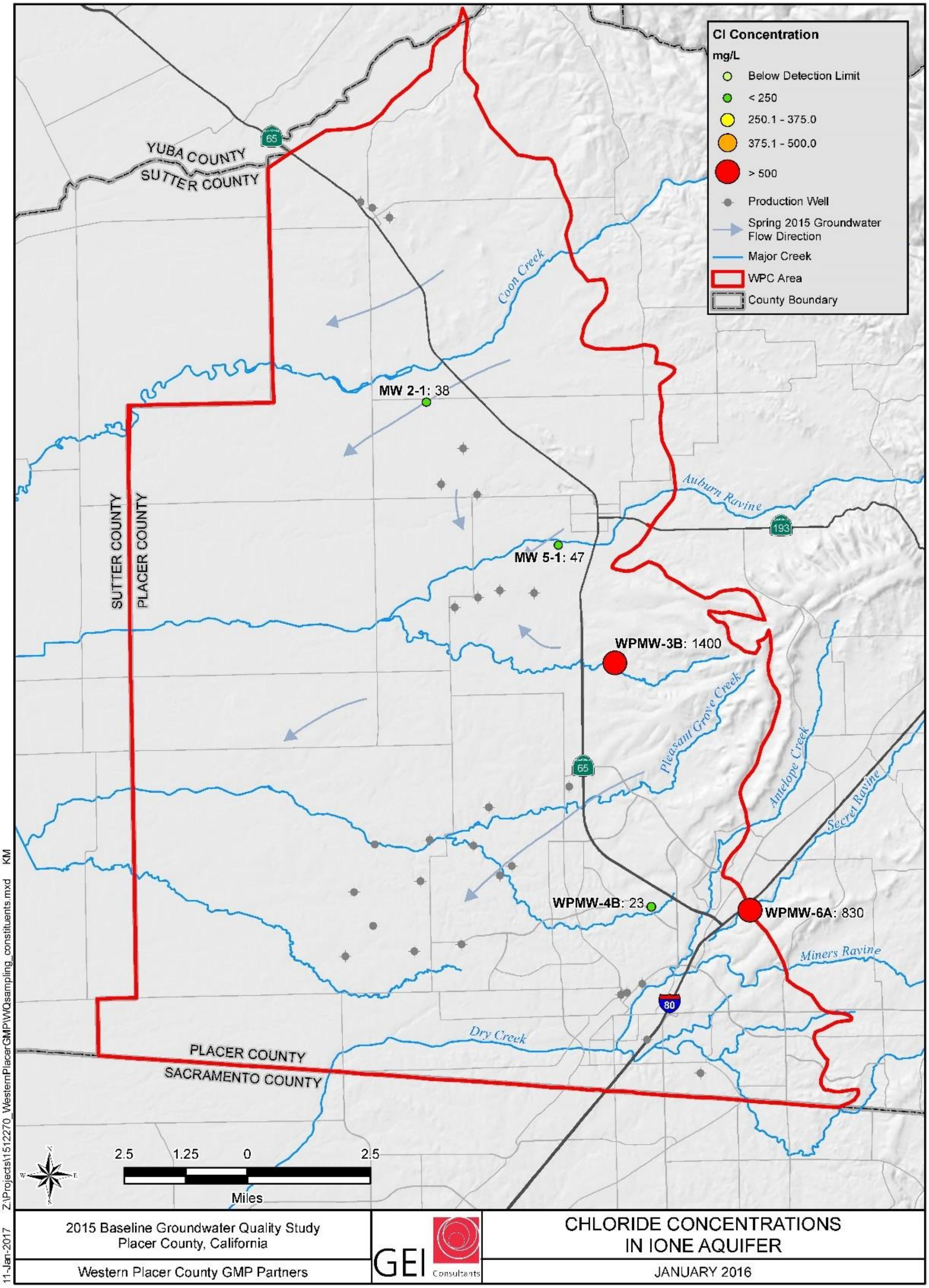


Figure 19. Chloride Concentrations in the Ione Aquifer

4.2.3 Sulfate

Sulfate (SO_4) is a major anion that occurs naturally in groundwater. It typically results from dissolution of sulfate-containing minerals in the aquifer material, but can be from industrial processes and soaps from wastewater discharges. Sulfate is regulated under a secondary drinking water standard with a varying MCL. The standard has a recommended level of 250 mg/L, an upper recommended level of 500 mg/L and a short-term level of 600 mg/L.

Sulfate results from the 58 samples show that concentrations are generally below 100 mg/L. Three samples showed elevated levels above 200 mg/L. All samples were below the recommended drinking water standard. Two of the three elevated concentrations were located in the eastern portions of the basin in the Ione Aquifer shown in **Figures 20 through 23**. The third elevated concentration was also located in the east basin in the Lower Mehrten Aquifer. This elevated sulfate concentration indicates water may be migrating upward from the underlying Ione Aquifer or through a leaky seal in the nested well.

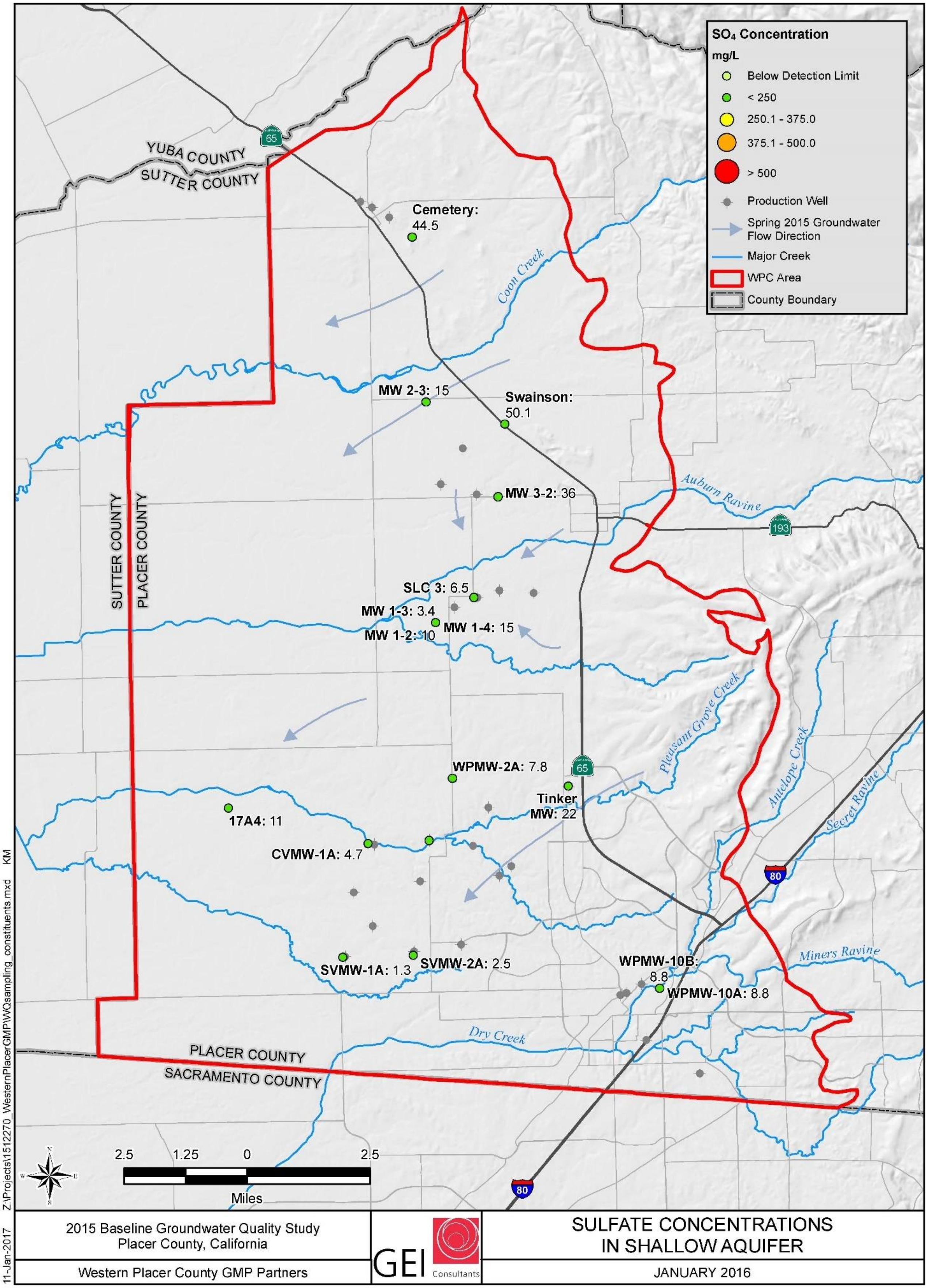


Figure 20. Sulfate Concentrations in the Shallow Aquifer

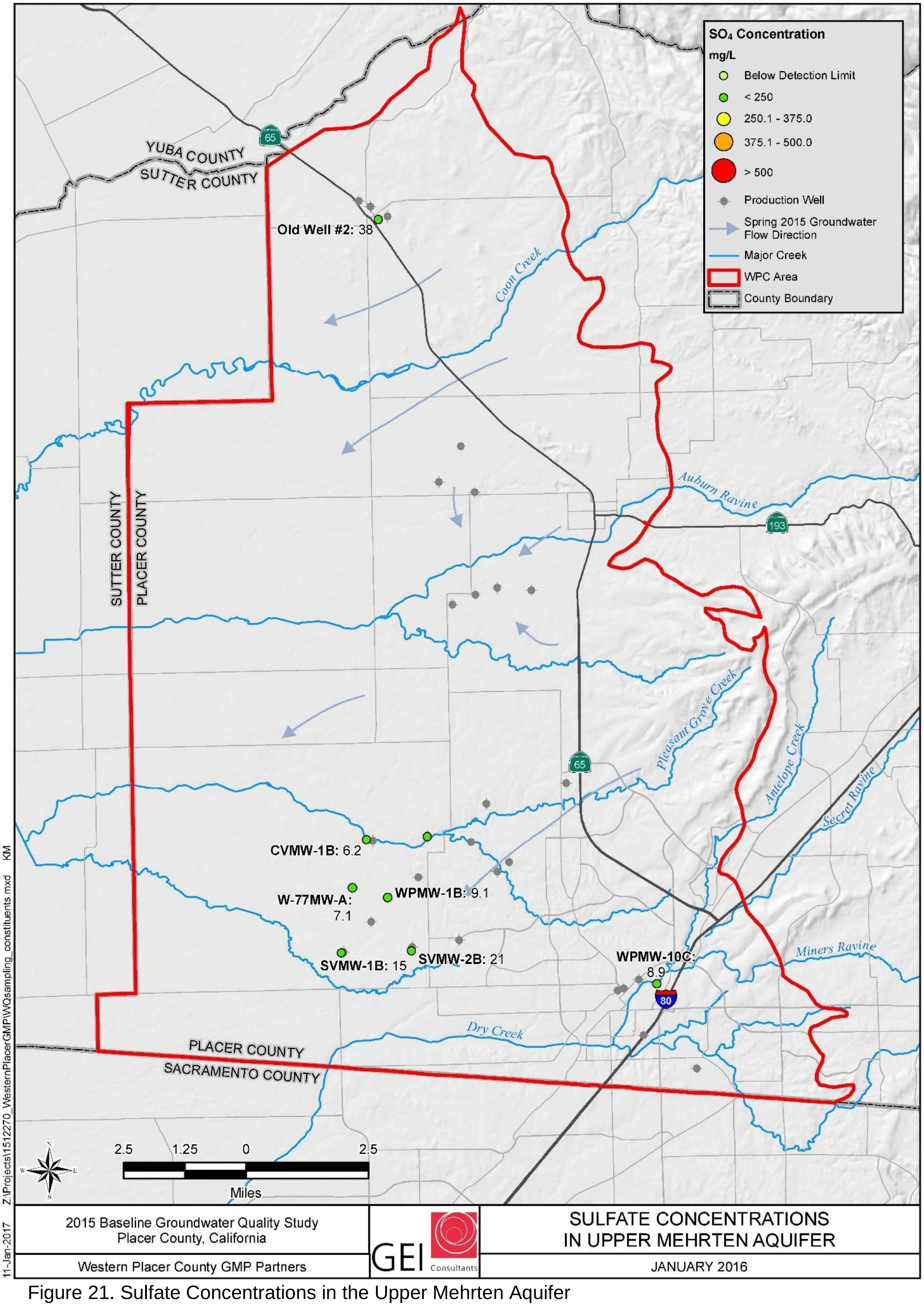


Figure 21. Sulfate Concentrations in the Upper Mehrten Aquifer

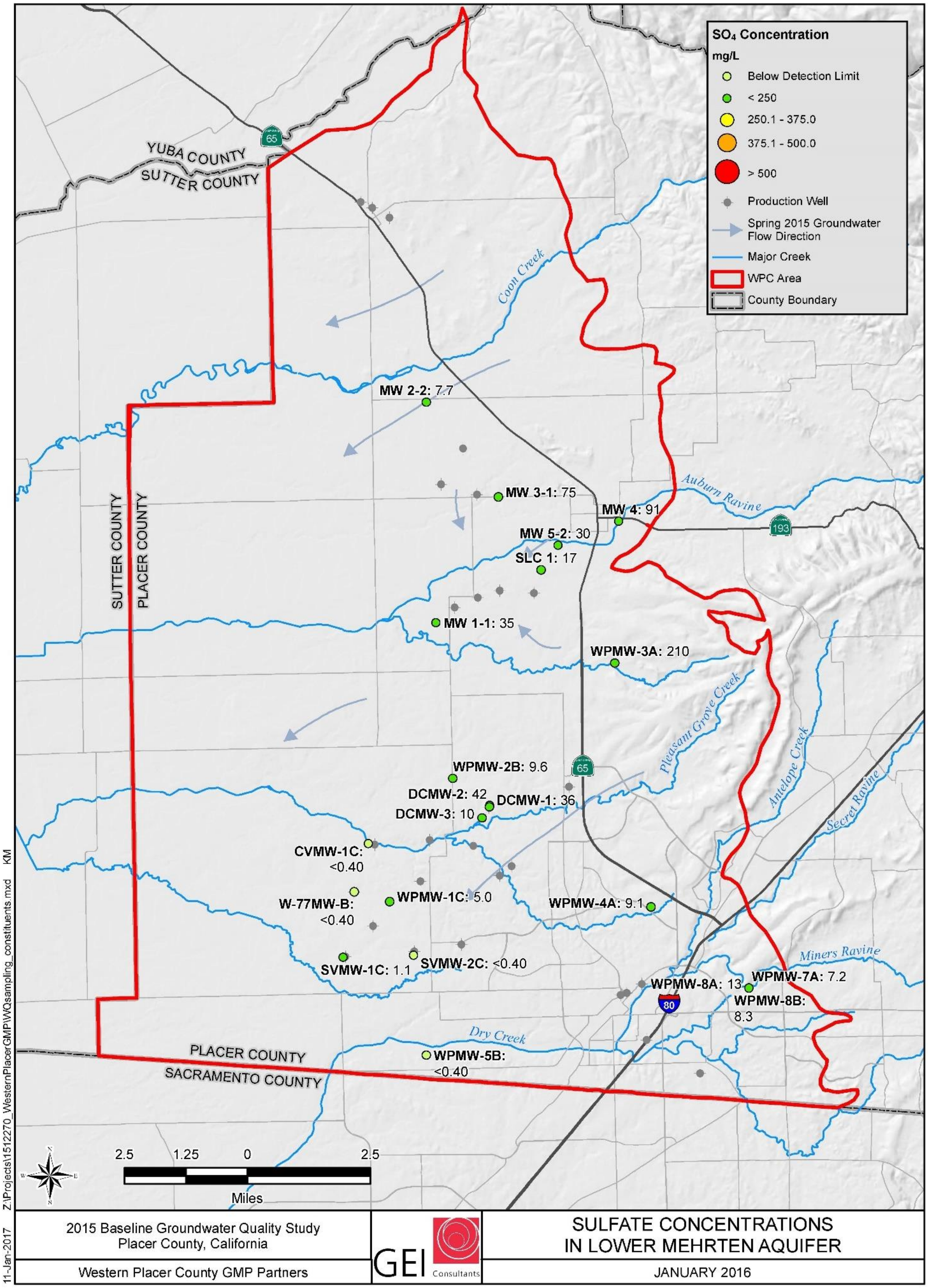


Figure 22. Sulfate Concentrations in the Lower Mehrten Aquifer

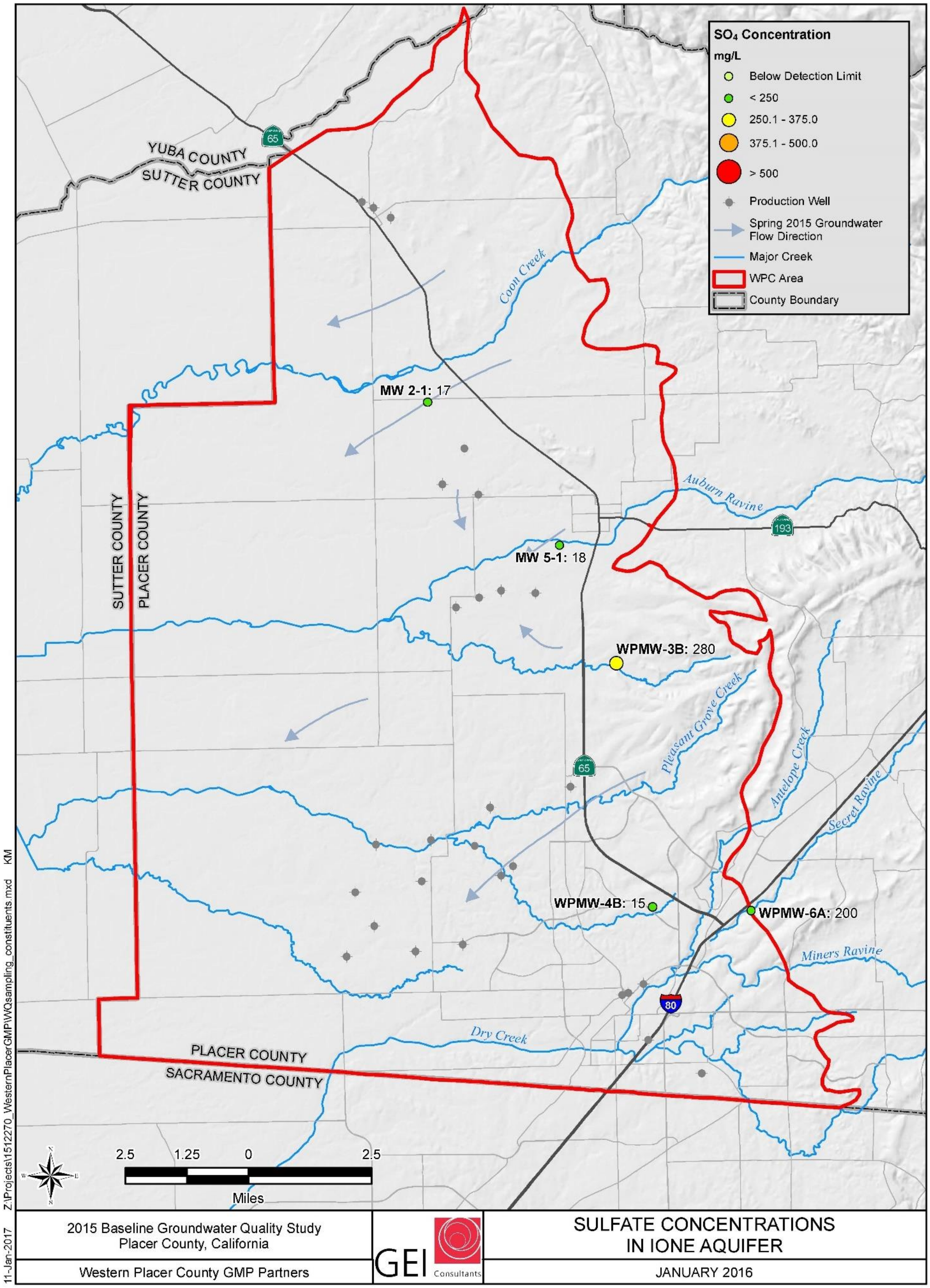


Figure 23. Sulfate Concentrations in the Ione Aquifer

4.2.4 Nitrate

Nitrate (reported as NO_3) is a naturally occurring nutrient found in living organisms. Nitrate concentrations can fluctuate as nitrogen cycles between atmospheric nitrogen, nitrate, nitrite, ammonia, and assimilation into living organisms. Natural concentrations of nitrate in groundwater are typically fairly low. High concentrations generally originate from anthropogenic sources such as fertilizers or wastewater. Nitrate is regulated under a drinking water primary MCL of 45 mg/L (as Nitrate).

Of the 58 samples collected, only one sample (MW 3-2 near Lincoln) exceeded the MCL and only two samples had elevated concentrations (greater than one-half the MCL). Well 17A4, a domestic well, had elevated concentrations (39 mg/L).

Although there were very few elevated detections of nitrate, low level detections were numerous and are present in all aquifers except the Ione Formation. The presence of these low levels suggests that water in these areas has been carried from surface sources into the underlying aquifers. **Figures 24 through 27** show the nitrate distribution.

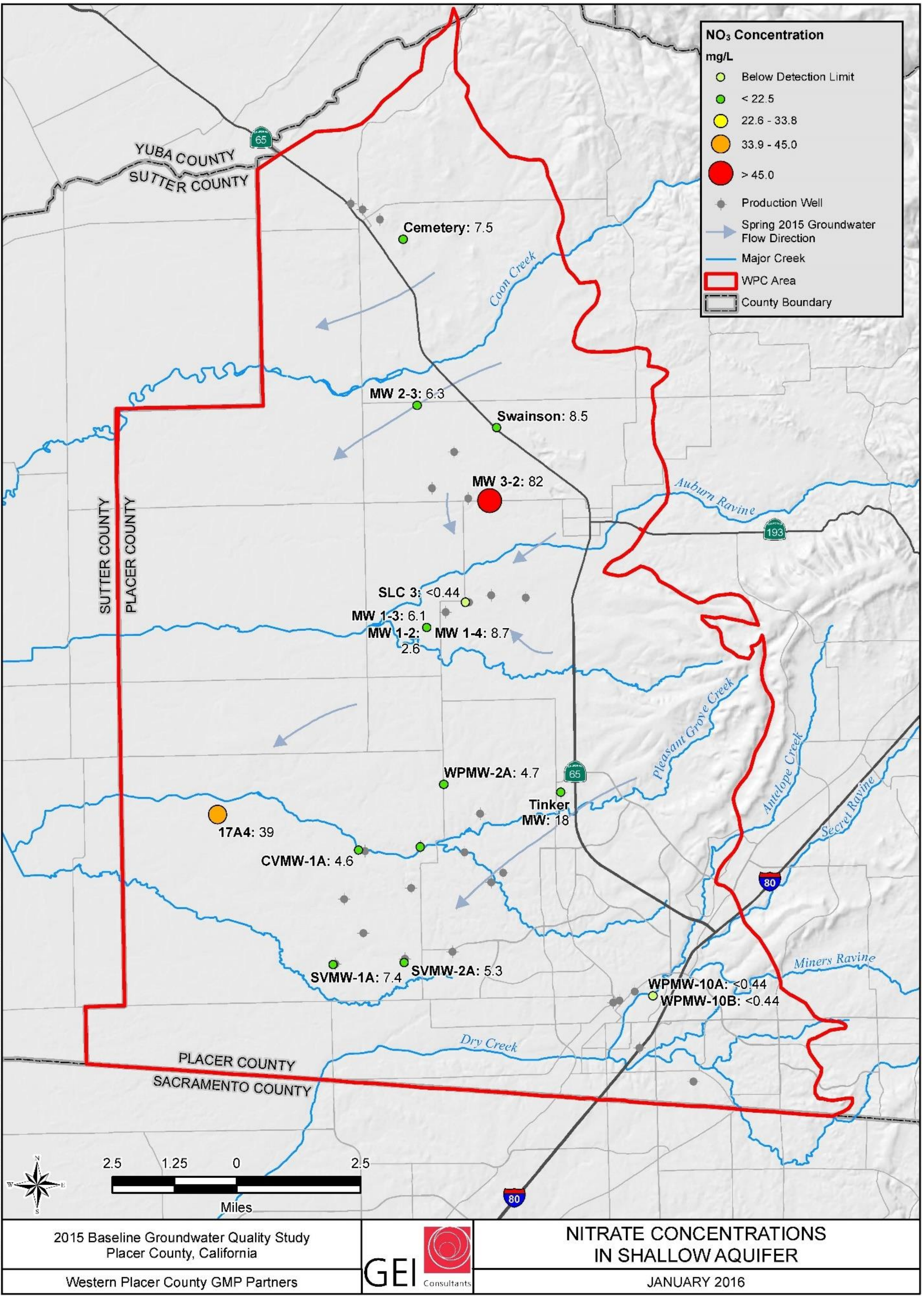


Figure 24. Nitrate Concentrations in the Shallow Aquifer

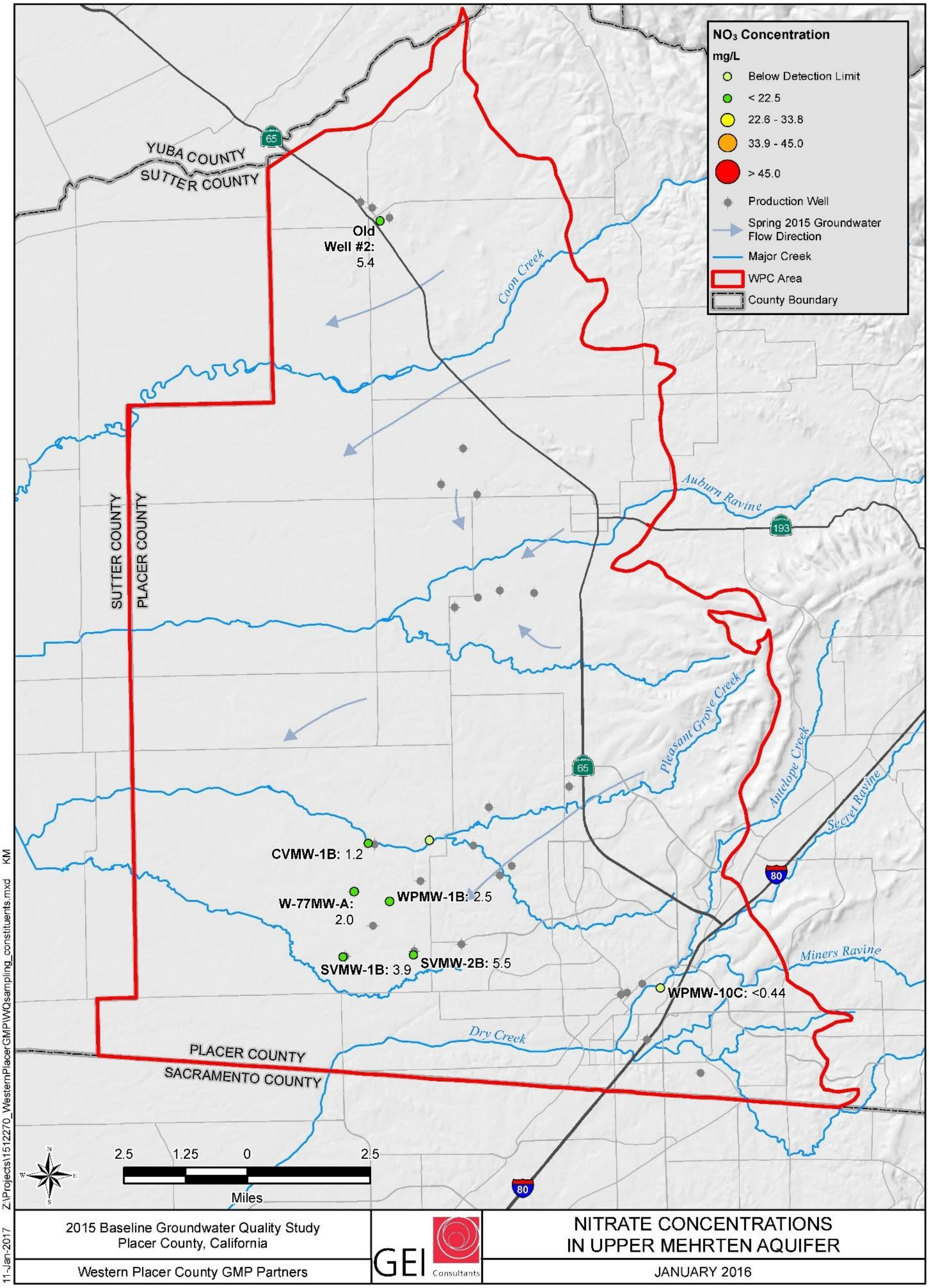


Figure 25. Nitrate Concentrations in the Upper Mehrten Aquifer

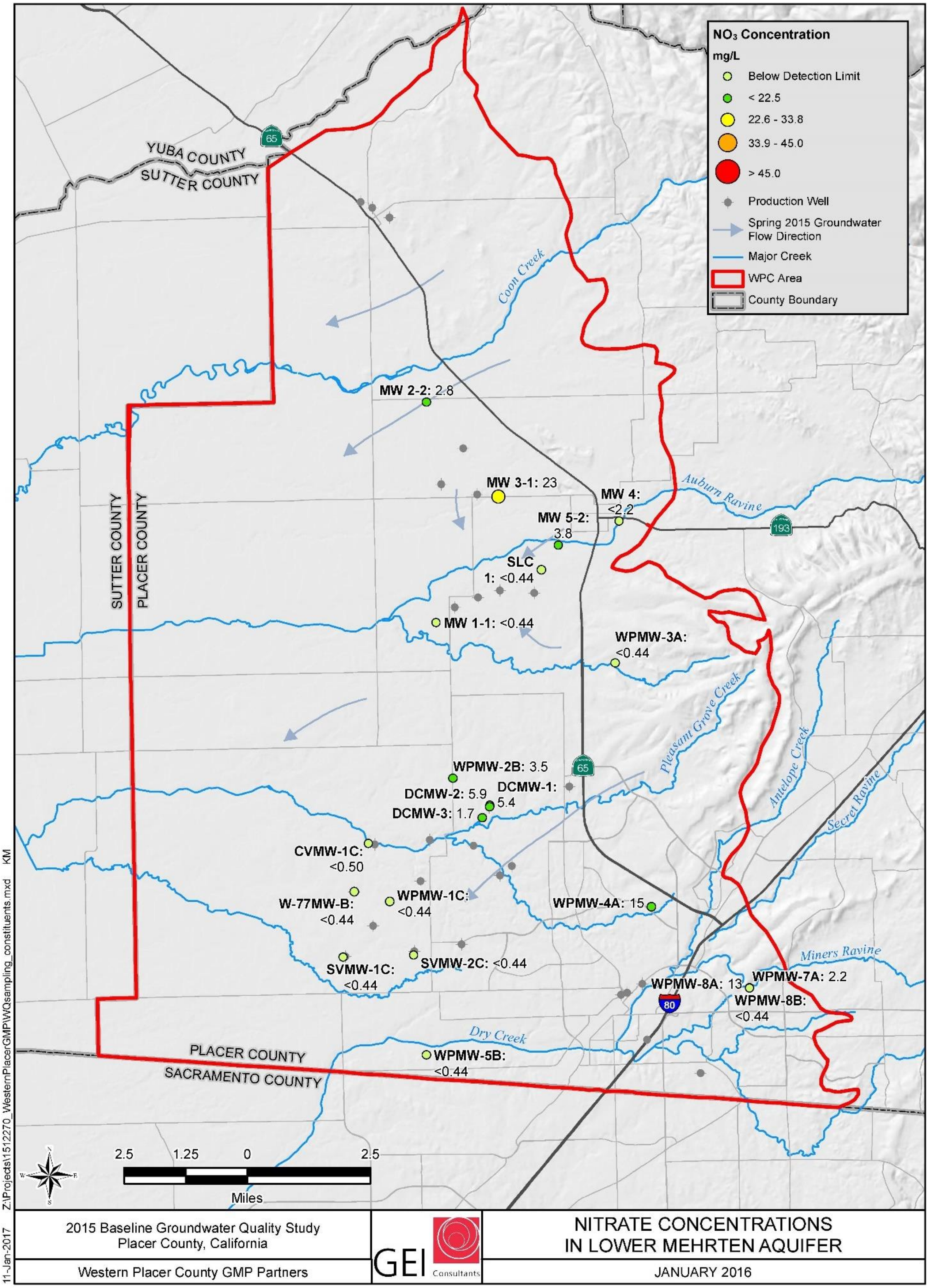


Figure 26. Nitrate Concentrations in the Lower Mehrten Aquifer

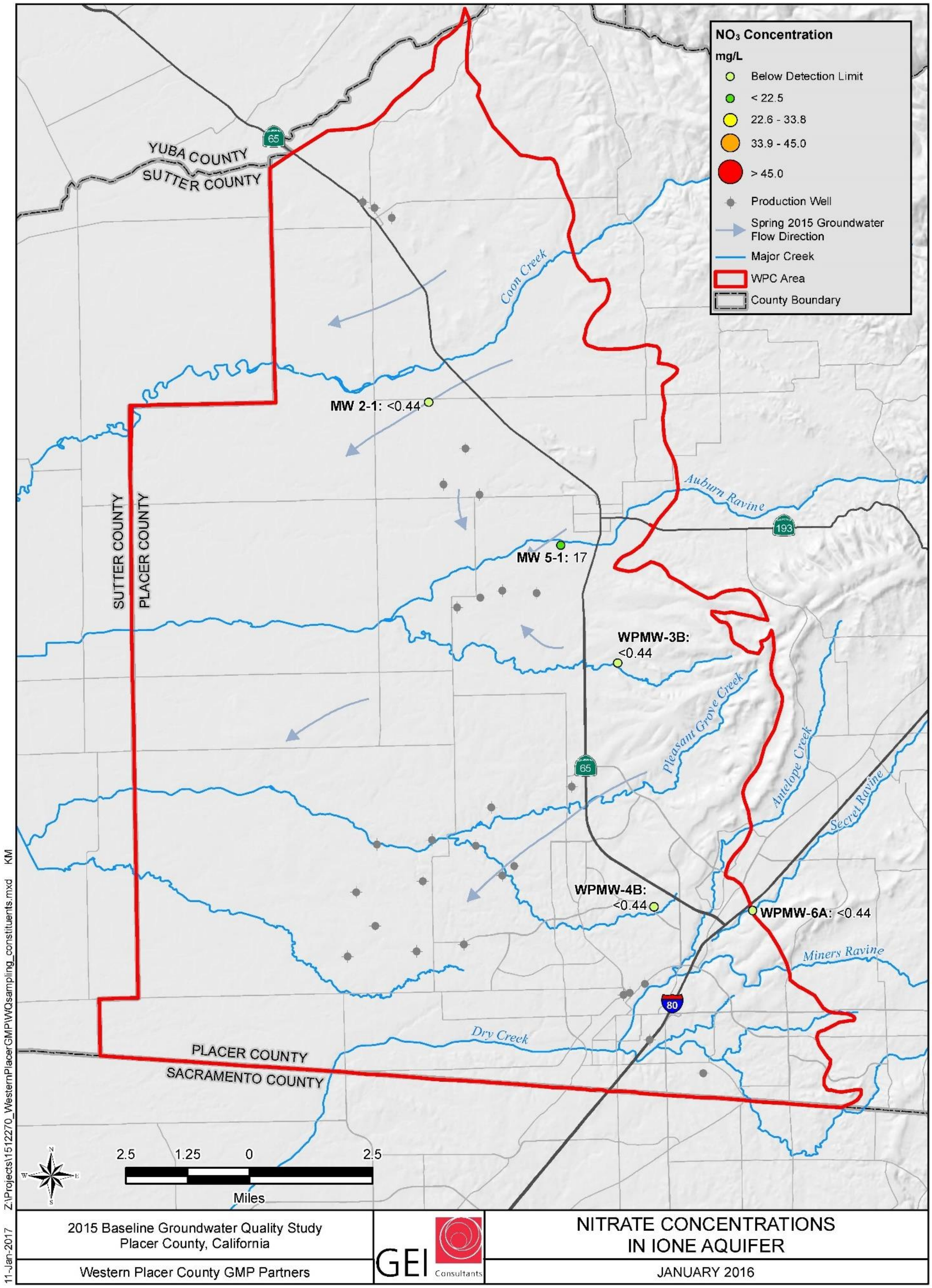


Figure 27. Nitrate Concentrations in the Ione Formation

4.2.5 Fluoride

Fluoride (F) is a naturally occurring element found in groundwater, but can have anthropogenic sources. Volcanic rocks such as the Mehrten Formation can be sources of fluoride. Occasionally fluoride can occur from industrial wastes or from the percolation of Fluorinated water from municipal systems. Fluoride is regulated under a drinking water primary MCL of 2 mg/L due to being related to dental damage.

Only one out of the 58 samples collected had fluoride above the MCL. The sample was from monitoring well WPCMW-6A, located adjacent to Secret Ravine, and screened in the Ione Formation. Due to the minimal detections no figures were generated to show its distribution.

4.2.6 Arsenic

Arsenic (As) is a naturally occurring element that is found in many rocks and minerals. Certain volcanic geologic formations can be a source of arsenic in groundwater, including the Mehrten Formation and the Turlock Lake/Laguna. Arsenic can also occur from anthropogenic sources. The primary MCL for arsenic is 10 µg/L.

Arsenic results for the 58 samples ranged from less than 1.2 to 32 µg/L. Only two of the 55 samples had elevated concentrations (above one-half of the MCL) and only one exceeded the MCL. The location of the wells by aquifer are shown in **Figures 28 through 31**. Elevated levels occur in the Lower Mehrten Aquifer in wells one well and one well in the Shallow Aquifer (Turlock Lake/Laguna Formation). One well was at exactly one-half of the MCL and is screened in the Lower Mehrten Aquifer. MW 1-1 is located on the western edge of the Lincoln pumping depression. It cannot be determined if water in this well would move toward their pumping wells or move to the west. The occurrences of elevated arsenic appears random.

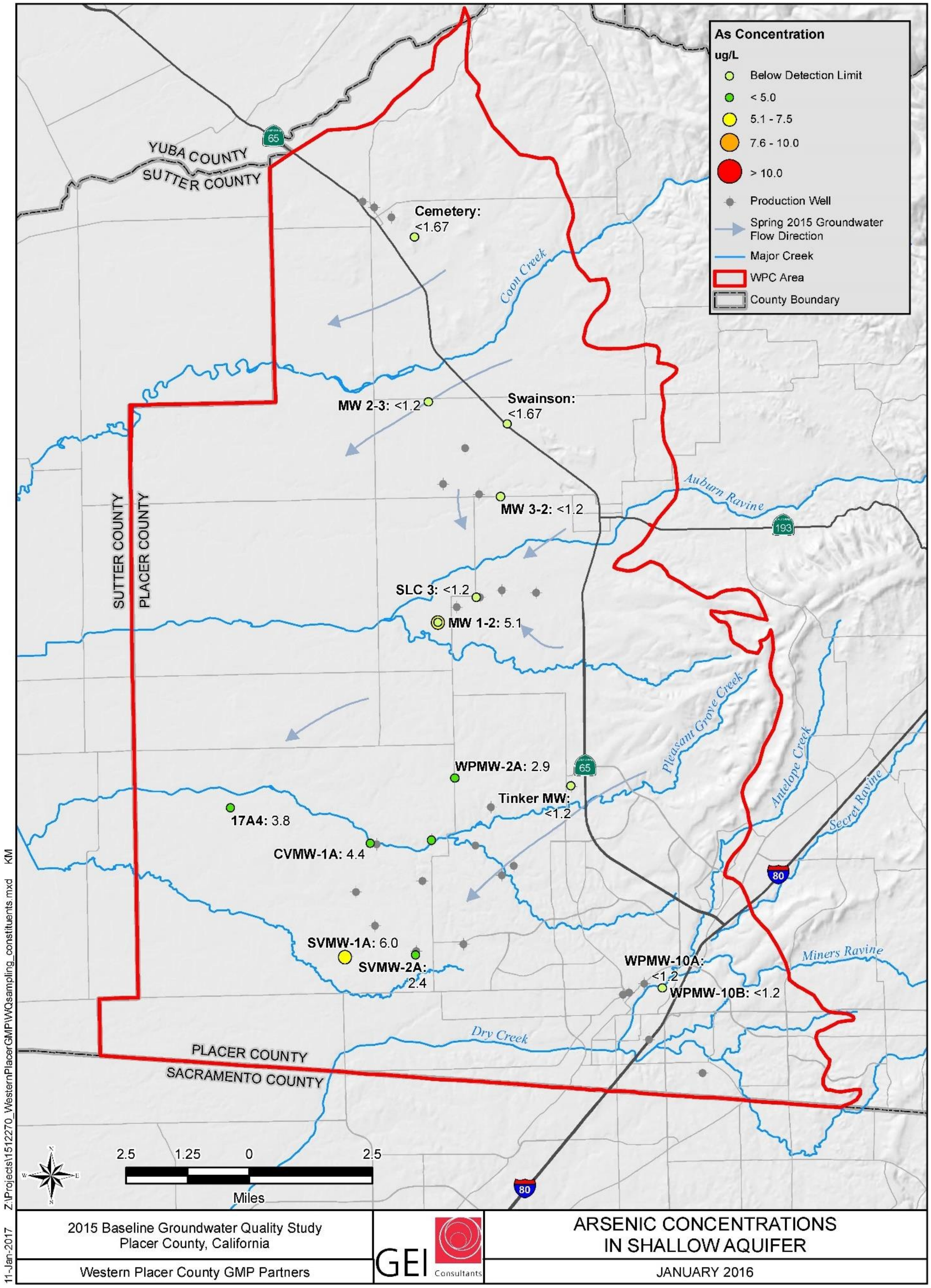


Figure 28. Arsenic Concentrations in the Shallow Aquifer

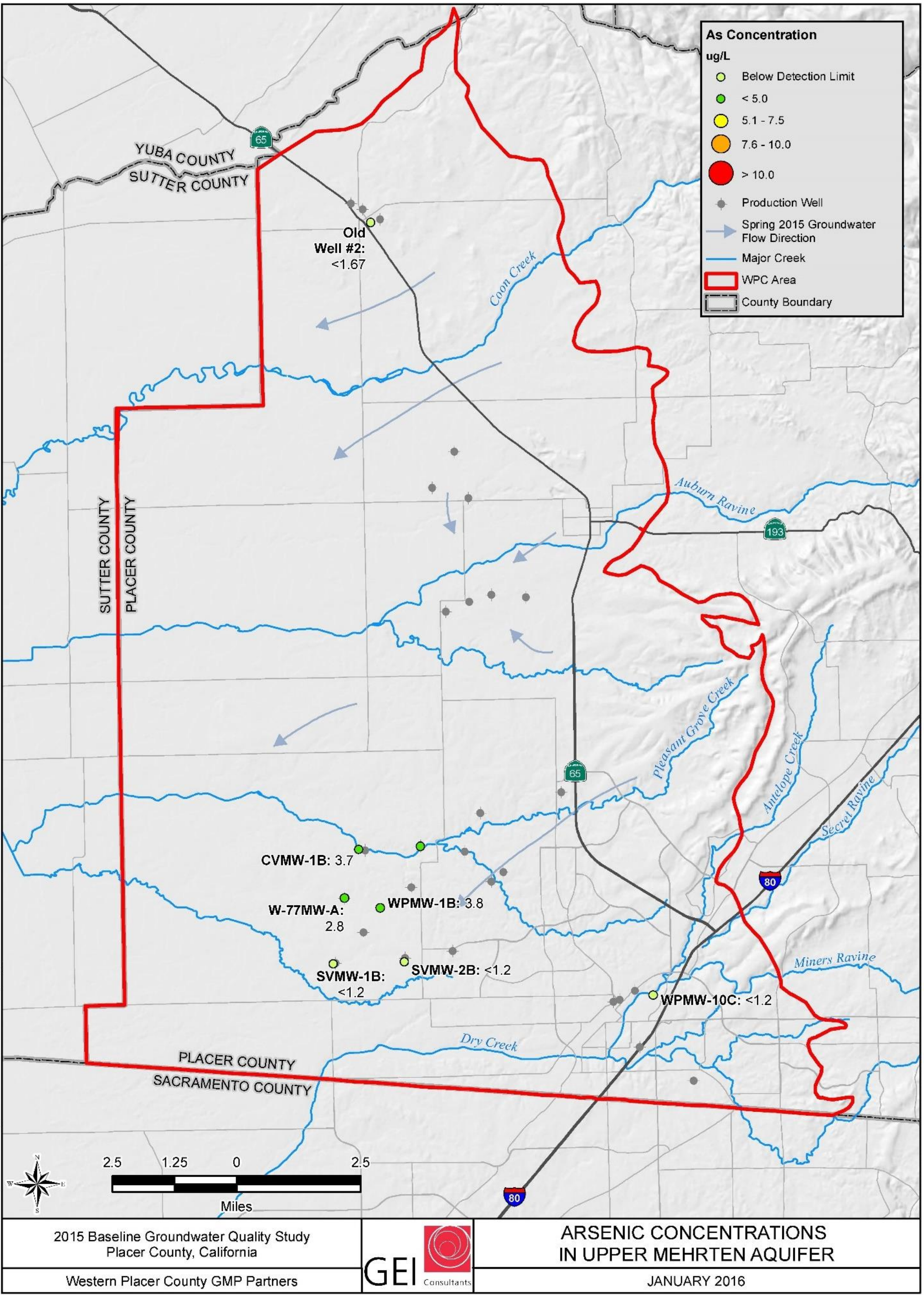


Figure 29. Arsenic Concentrations in the Upper Mehrten Aquifer

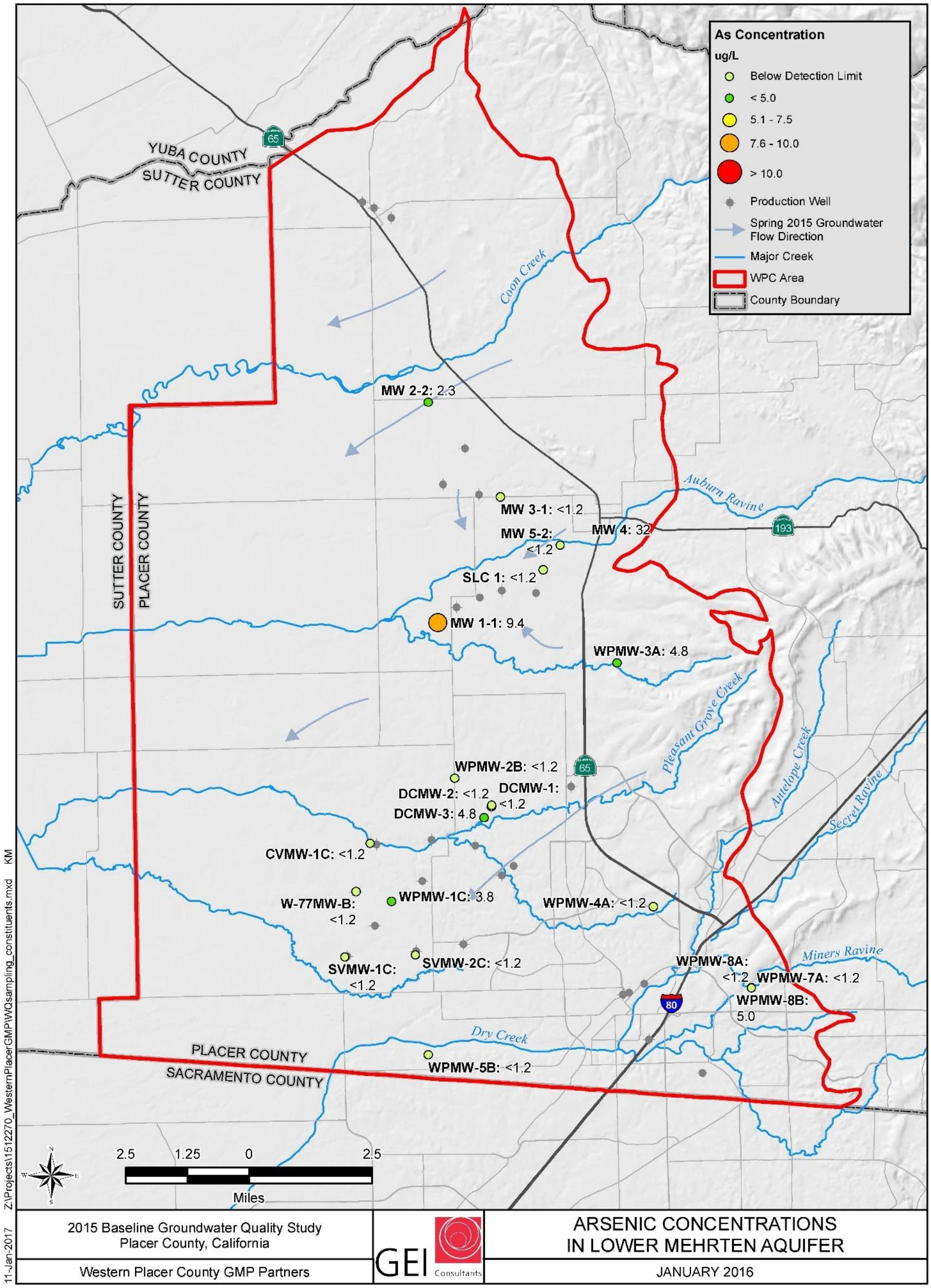


Figure 30. Arsenic Concentrations in the Lower Mehrten Aquifer

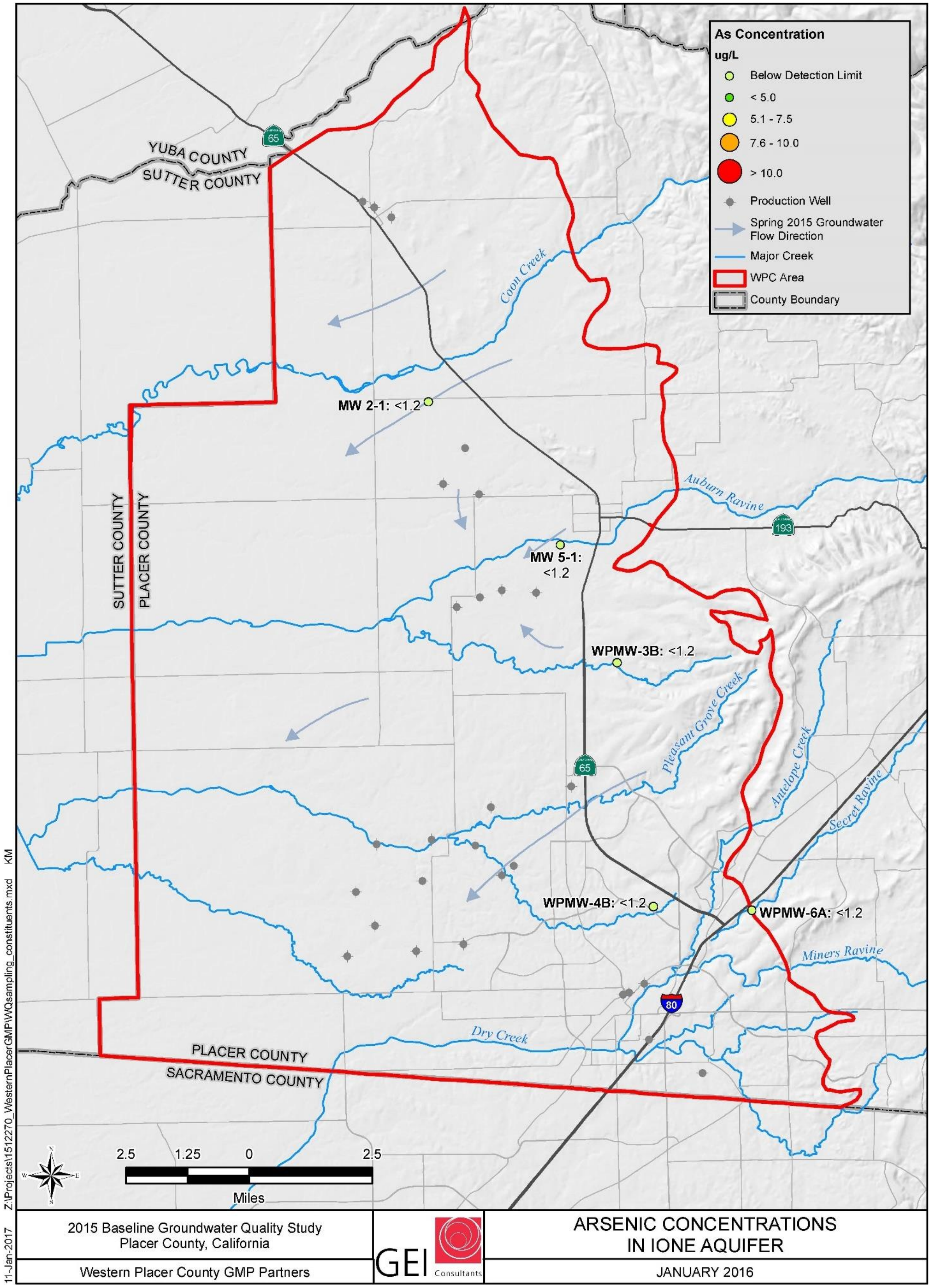


Figure 31. Arsenic Concentrations in the Ione Aquifer

4.2.7 Perchlorate

Perchlorates are a group of salts derived from perchloric acid and are used as a propellant for rockets and fireworks. This was identified as a Constituent of Concern in the GMP due to the Alpha Explosives site near the City of Lincoln. There were no detections of perchlorate in the 58 wells tested for this Study.

4.2.8 Manganese

Manganese (Mn) is a naturally occurring element found in groundwater. Elevated concentrations typically result from volcanic formations such as the Mehrten Formation, but occasionally can occur from industrial wastes where it is used as a metal alloy. Manganese is regulated under a secondary drinking water standard with an MCL of 50 µg/L due to taste, stained laundry, and black scaling on plumbing fixtures.

Manganese results from the 58 samples range from less than 4.5 to 840 µg/L. Twenty-two samples were above the MCL. Most of these detections were in water in the Upper and Lower Mehrten Aquifers and two samples from the Ione Formation as shown in **Figures 32 through 35**. For the most part groundwater from the Lower Mehrten Aquifer, especially toward the west are not used due to these higher manganese concentrations.

The results of sampling during this Study are not entirely consistent with previous sampling efforts. Eight wells had significantly lower results, with concentrations previously over the MCL and now are below the detection limit. The reason for this may be due to the previous samples not being collected after adequate purging of the wells or filtering to remove sediments prior to analysis.

4.2.9 Iron

Iron (Fe) is a naturally occurring element found in groundwater. Elevated concentrations typically result from volcanic formations high in iron-containing minerals which are distributed throughout the subbasin. Volcanic formations such as the Mehrten are typically high in iron. Iron is regulated as a secondary drinking water standard with a MCL of 300 µg/L due to taste and scaling on plumbing fixtures.

Six samples contained iron above the MCL. Similar to manganese, the results of sampling during this Study are not entirely consistent with previous sampling efforts. In some wells recent concentrations are significantly higher than they were historically while in others the concentrations are lower. The reason for the variability may be due to the wells not producing low turbidity water. The samples were not filtered prior to analysis, but some fine particle may have passed through the filters. Due to the minimal detections no figures were generated to show its distribution.

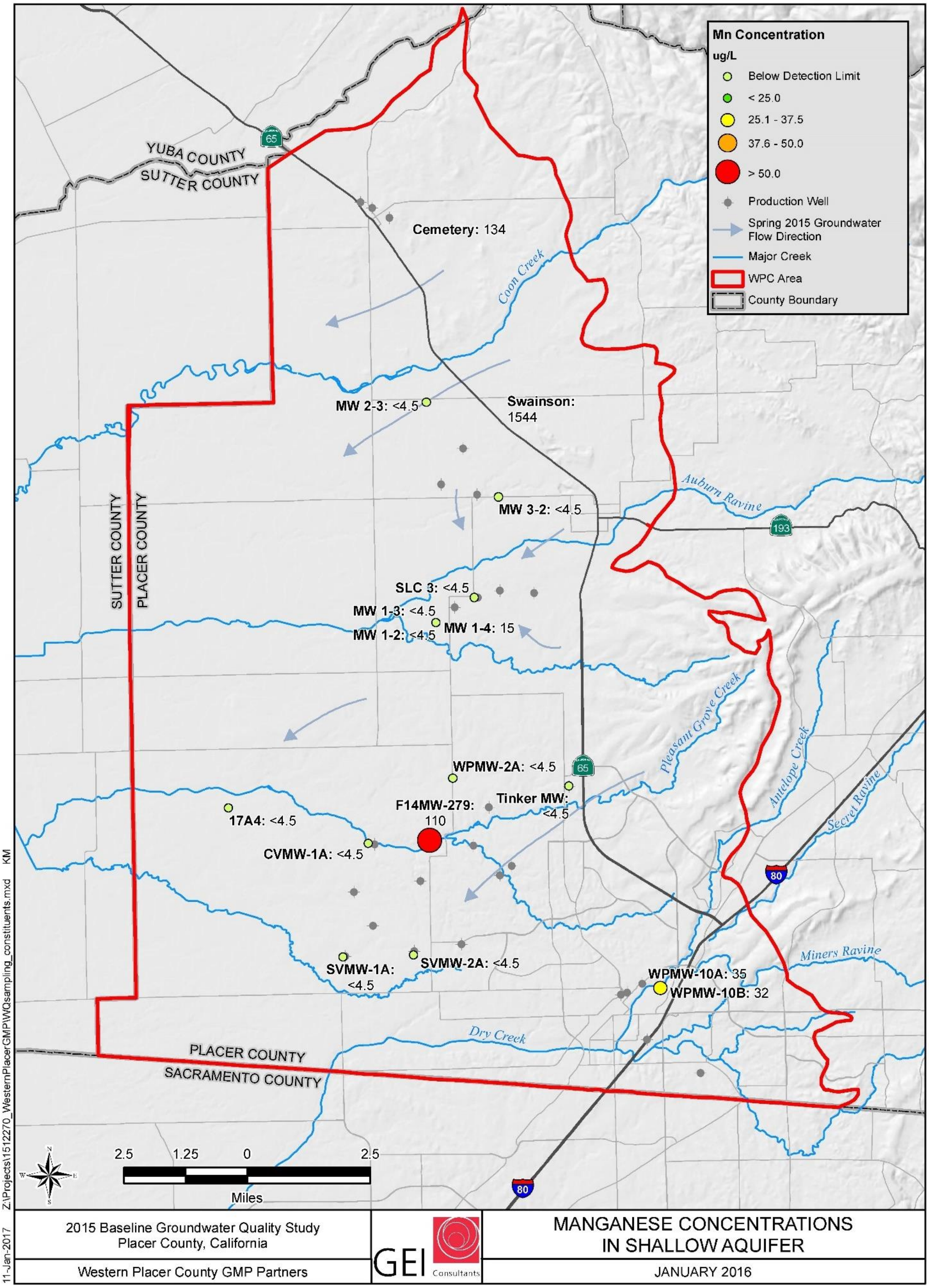


Figure 32. Manganese Concentrations in the Shallow Aquifer

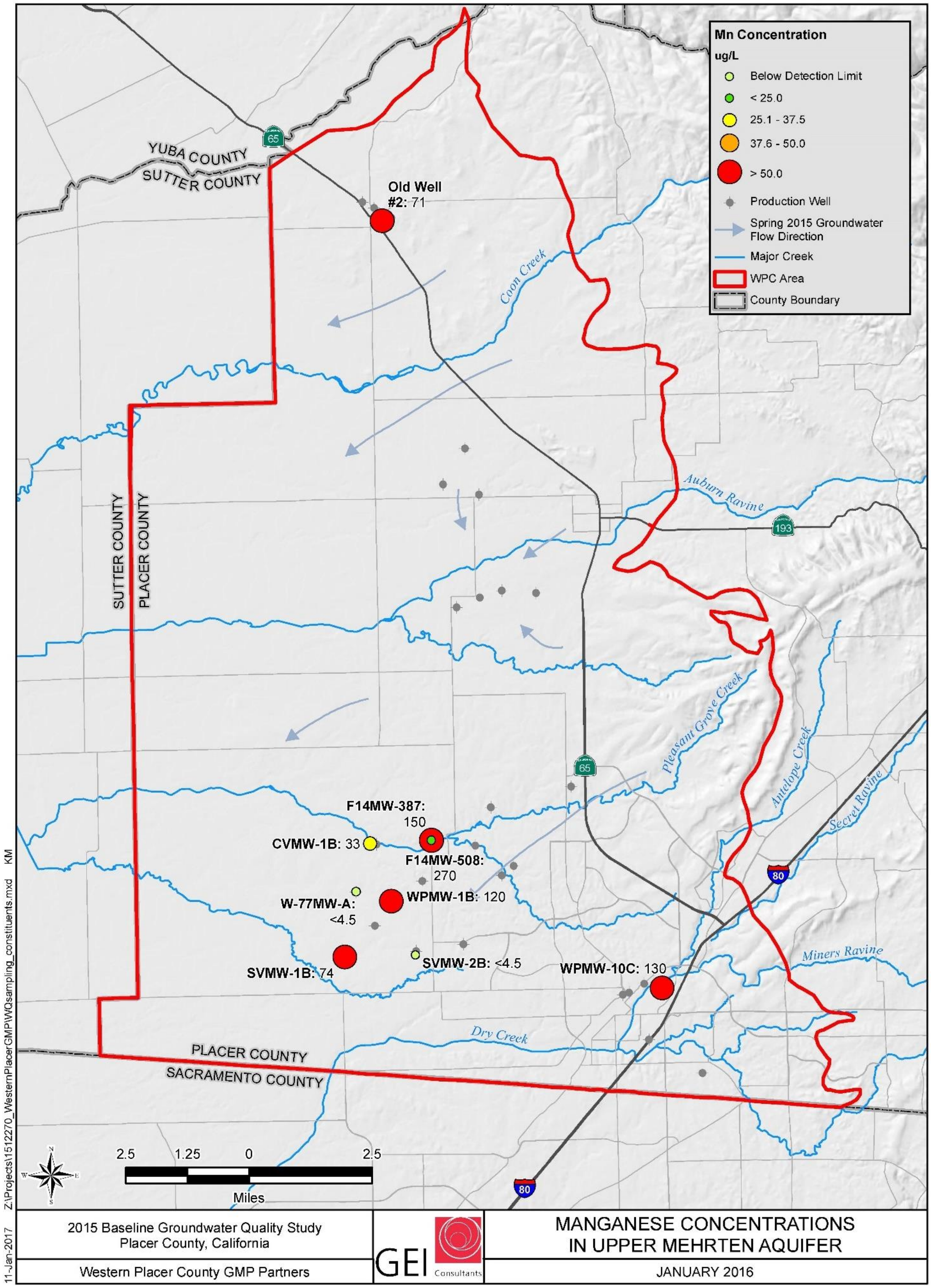


Figure 33. Manganese Concentrations in the Upper Mehrten Aquifer

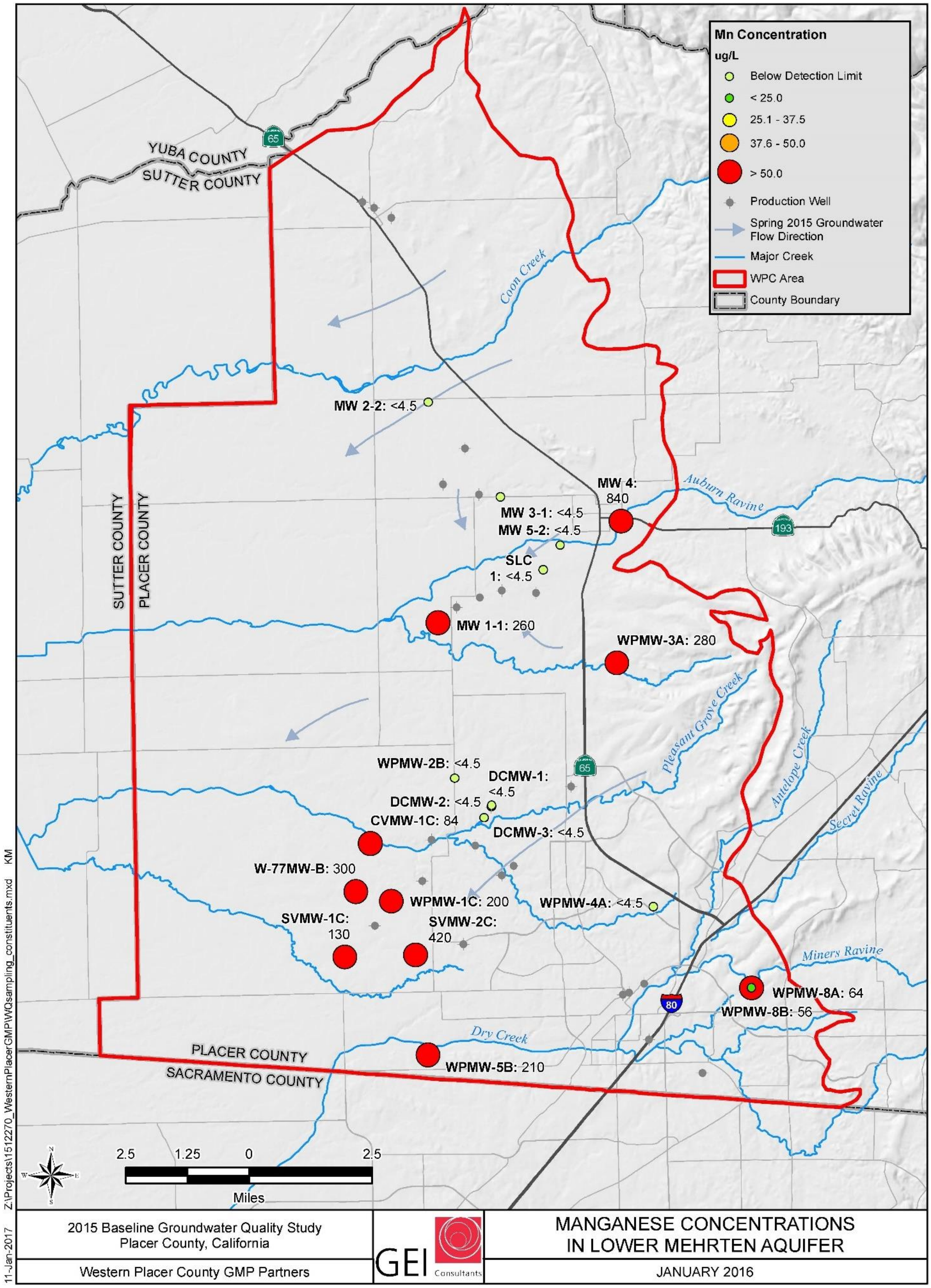


Figure 34. Manganese Concentrations in the Lower Mehrten Aquifer

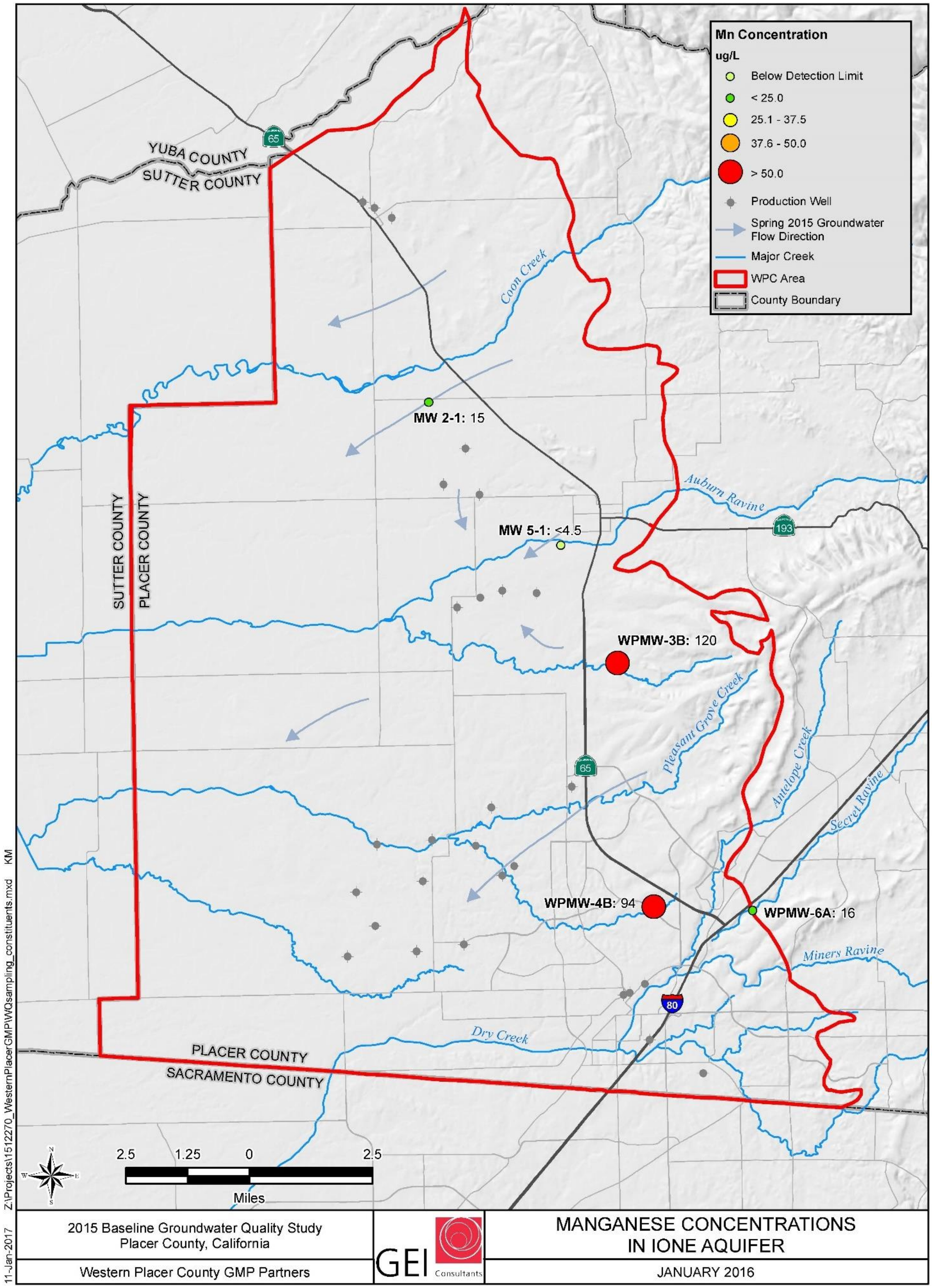


Figure 35. Manganese Concentrations in the Ione Aquifer

4.2.10 Chromium

Chromium (Cr) is a metallic element found in rocks, soils, plants, and animals. It is used in steel making, metal plating, leather tanning, corrosion inhibitors, paints, dyes, and wood preservatives. The most common forms of chromium in the environment are trivalent and hexavalent. Hexavalent chromium (CrVI) can be naturally occurring (typically within volcanic rocks, serpentine, manganese minerals, or thermal water) or from anthropogenic sources. Recent evidence has shown that elevated concentrations can also be developed under conditions where sediments containing other forms of chromium (such as trivalent chromium) are exposed to oxidizing agents and react to form hexavalent chromium.

Total chromium is regulated in California with a drinking water MCL of 50 ug/L. In 2014, a MCL was established for hexavalent chromium of 10 ug/L. The rule establishes exceedances of the MCL as a running average (average of four most recent sample results). However, on August 8, 2017, the State Water Resources Control Board (SWRCB) removed (redacted) the MCL for hexavalent chromium in response to a judge’s ruling that said that the State had failed to consider economic feasibility in setting the rule. The SWRCB is to re-evaluate the MCL rule with economic feasibility included. Until the SWRCB releases a new rule for hexavalent chromium, the MCL for total chromium MCL is the only applicable standard.

Total chromium results for the 58 samples collected ranged from less than 4.5 to 17 mg/L. No samples exceed the MCL.

Hexavalent chromium results for the 58 samples ranged from less than 0.029 to 15 µg/L. The spatial distribution of the results in the three aquifers and the Ione Formation are shown in **Figures 36 through 39** and indicates low levels of hexavalent chromium are present in all aquifers. Six monitoring wells had concentrations greater than 5 µg/L and are located primarily in the Shallow Aquifer, and primarily in the central and southwestern portions of the basin. Only one sample from the Upper Mehrten Aquifer had concentrations greater than 5 ug/L.

The Sacramento Groundwater Authority sampled some of their monitoring wells in the fall of 2015 for hexavalent chromium. In general, they found elevated detections of hexavalent chromium in the Shallow Aquifer, similar to those results found in WPC. They also found a correlation to higher nitrate concentrations. A weak correlation to nitrate was found in WPC analytical results.

The source or cause of the elevated concentrations of hexavalent chromium is unknown, but based on groundwater flow directions it is within the WPC area and warrants further investigation.

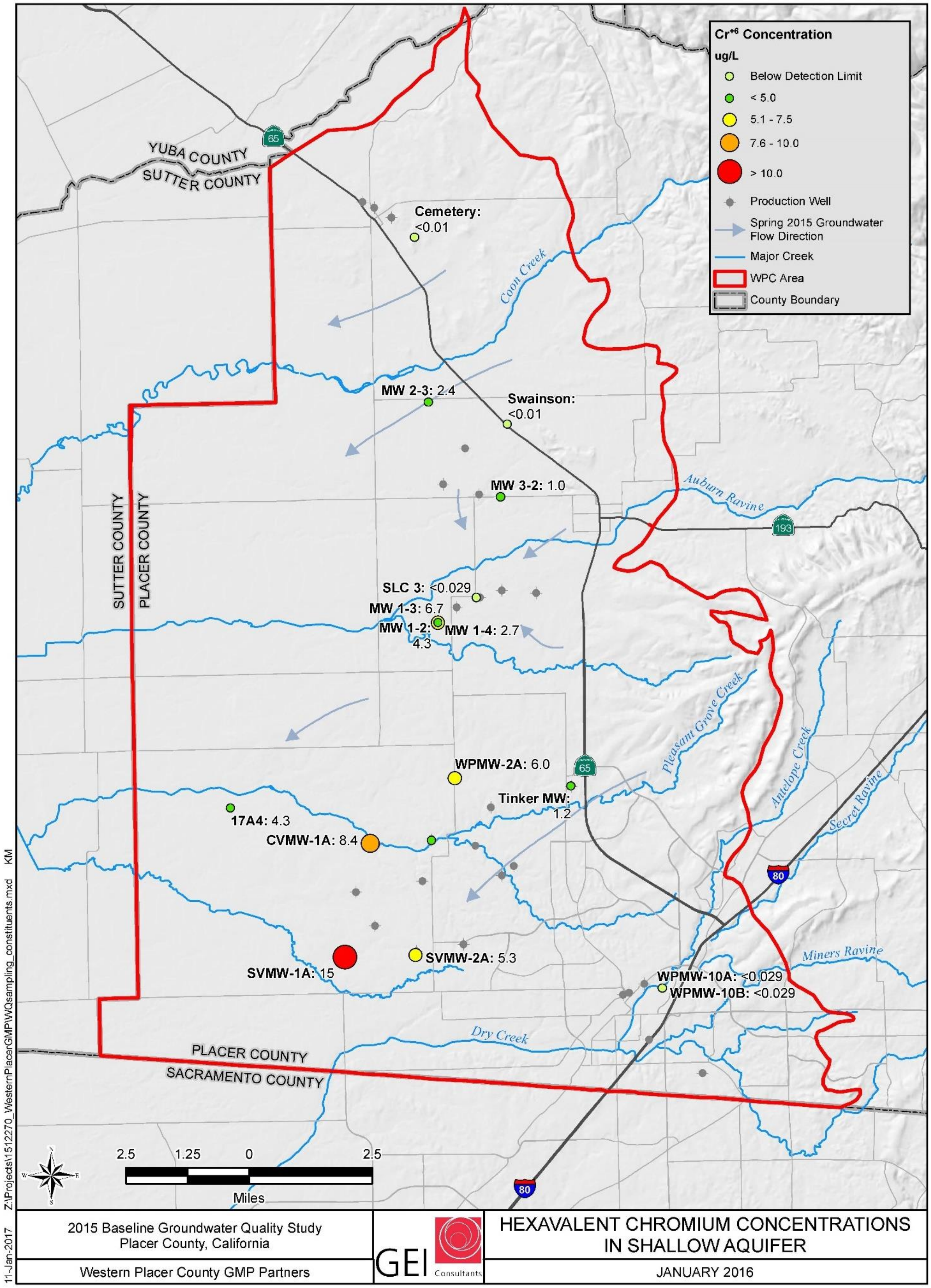


Figure 36. Hexavalent Chromium Concentrations in the Shallow Aquifer

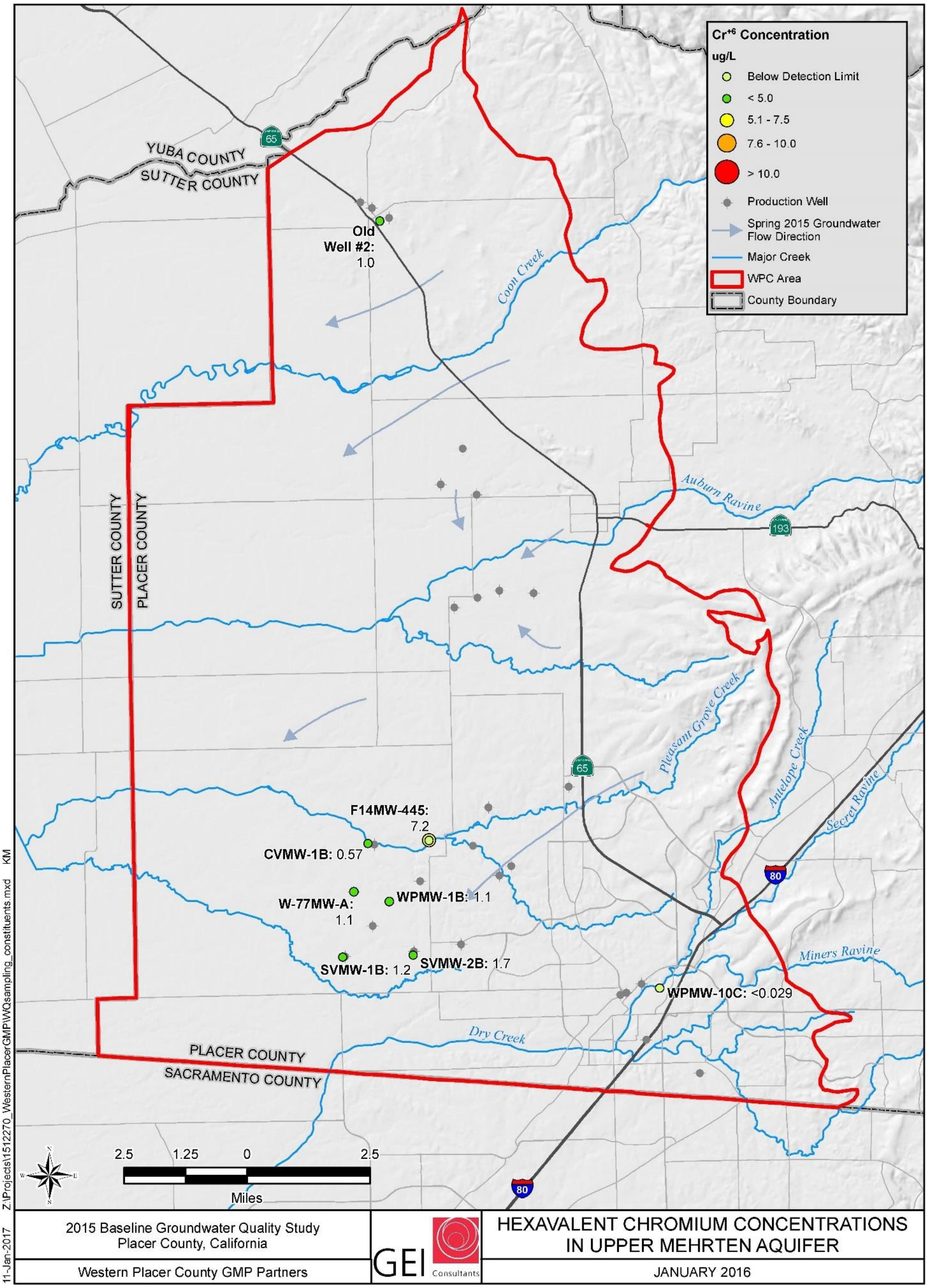
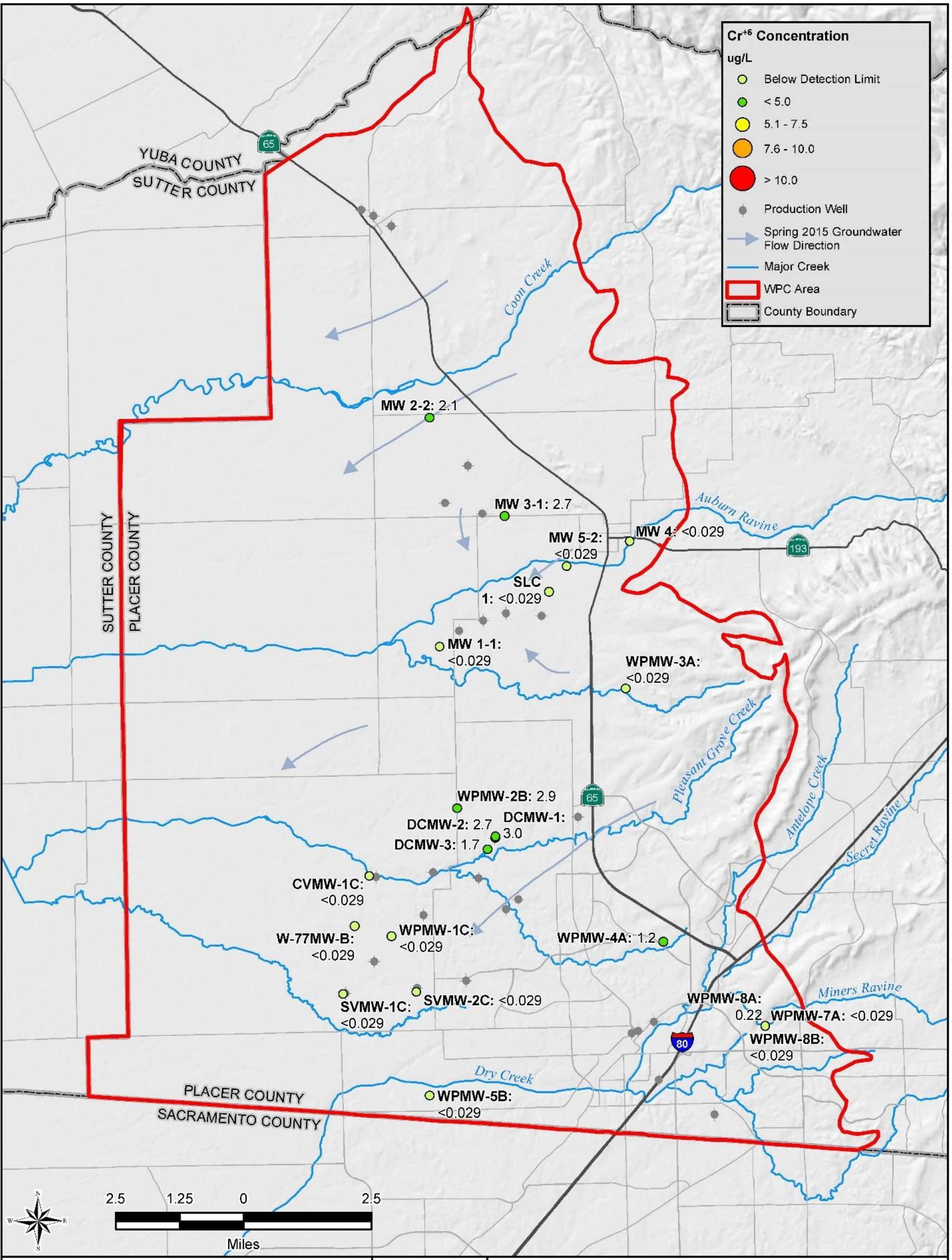


Figure 37. Hexavalent Chromium Concentrations in the Upper Mehrten Aquifer



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11-Jan-2017

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Placer County, California

Western Placer County GMP Partners

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HEXAVALENT CHROMIUM CONCENTRATIONS
IN LOWER MEHRTEN AQUIFER

JANUARY 2016

Figure 38. Hexavalent Chromium Concentrations in the Lower Mehrten Aquifer

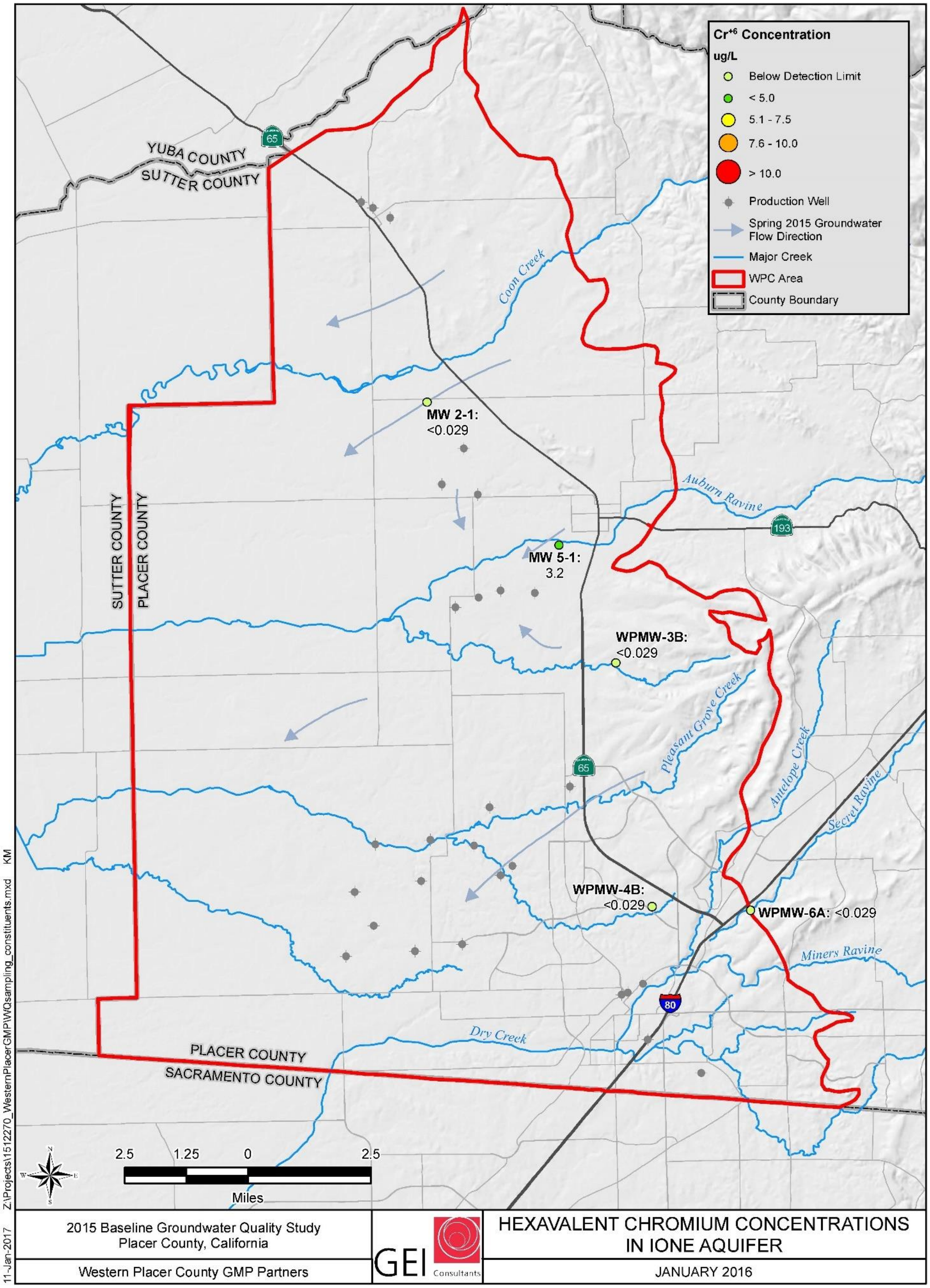


Figure 39. Hexavalent Chromium Concentrations in the Ione Aquifer

4.2.11 Other Metals

Metals tested in this Study other than those discussed in Sections 4.2.1 through 4.2.10 are shown in Table 3, including aluminum (Al), boron (B), barium (Ba), beryllium (Be), cadmium (Cd), copper (Cu), mercury (Hg), nickel (Ni), lead (Pb), antimony (Sb), selenium (Se), thallium (Tl), zinc (Zn), and total chromium (Cr). The majority of these metals were in concentrations below their detection limit. For those that were detected, levels were generally not elevated. Over 99 percent of the samples for these metals were either below the detection limit or less than ¼ of the MCL. Only one sample showed a concentration of above half of its MCL (Sb at MW 4).

4.2.12 Volatile Organic Compounds

Volatile Organic Compounds (VOCs) are a set of organic chemicals that are regulated by the California Division of Drinking Water. A suite of over 60 different chemicals in this category were analyzed in each groundwater sample. 52 of the 58 samples collected showed no detections of VOCs. The six wells that had detections were all in concentrations below the respective MCL for the constituents. The constituents detected fell into two categories of chemicals: solvents/adhesives and disinfection biproducts.

1,2,3-Trichlorobenzene and Toluene were detected in the Swainson Well. These chemicals are often used as solvents and adhesives in electrical tape. A new pump was installed in the Swainson Well (an irrigation well) just prior to sampling and use of tape during installation is likely responsible for these detections. The concentrations were well below their respective MCL. These constituents are expected to be reduced below their detection limits as the well gets used.

Trihalomethanes (THMs) are a category of VOC that typically are created as a disinfection byproduct from chlorination of water. THMs are formed when free chlorine or bromine react with organic matter. There are numerous forms of THM, but the most commonly found compound is chloroform followed by bromoform. Laboratory analyses report the sum of all THM concentrations as total trihalomethanes (TTHMs). The primary MCL for TTHMs is 80 µg/L.

TTHM results for the 58 wells show that all but five samples were below the detection limit. Two of the detections were in the Shallow Aquifer. A concentration of 0.63 µg/L was found at MW 3-2. The other shallow well with a detection of 2.6 µg/L was SVMW-2A. This shallow well is downgradient of several golf courses that use recycled water in water features and as irrigation water, which could explain the detection. Leaky recycled water and/or potable water distribution system pipes are also a potential source. THMs were also found in three deeper, Mehrten monitoring wells located near the City of Roseville’s municipal Diamond Creek Well (DCW).

The source of the THMs in the three DCW's monitoring wells (screened across both the Upper and Lower Mehrten Aquifers) is most likely a result of the municipal water that was stored underground at the DCW in 2012 as part of the City's Aquifer Storage and Recovery (ASR) program. DCMW-1 and -2 are located about 150 feet from the ASR well, while DCMW-3 is about 1,000 feet down-gradient from the DCW. DCMW-1 and -2 had concentrations of 5.6 and 3.2 µg/L respectively. DCMW-3 had the highest concentration of 42 µg/L. A confirmation sample was collected at DCMW-3 about two weeks later to verify the initial sampling and it returned a result of 48 µg/L. The higher concentration likely represents the stored water having moved downgradient since 2012. The detection of the THMs at this location suggests the average linear velocity of groundwater in these aquifers may be on the order of about 300 to 500 feet per year. The City of Roseville's permit to operate the ASR wells allows for some degraded water quality effects with the maximum limit being 80 µg/L, the same as the MCL for TTHMs (CVRWQCB, 2013). The permit requires a separate Monitoring and Reporting Program specifically to address groundwater quality for Roseville's ASR Program. All samples are within their permit limitations.

5. Agricultural Water Quality

Concentrations of key water quality constituents known to impact agricultural production were examined to determine whether water discharged from wells included in this Study would have any limitations with respect to agricultural usage. Two key parameters are examined in this section:

- Boron (B), and
- Sodium-adsorption ratio (SAR).

Generally, concentrations of constituents reported for soil water are taken from water extracted from a saturated soil matrix. This saturated soil extract displays constituent concentrations at least as high as those detected in the applied irrigation water and usually higher. The increase in concentration results from evaporation and consumptive use of water by plants. Both of these mechanisms concentrate constituents in the residual soil water. Therefore, when comparing constituent concentrations observed in groundwater with concentration thresholds established for saturated soil extract, it is important to understand that the values given for concentrations are not completely equivalent. Nevertheless, because the target thresholds for the soil extract reflect the effects of mechanisms likely to occur in the soil matrix after groundwater has been applied for irrigation, comparing constituent concentrations of groundwater with threshold values for extracted soil water is a useful. This approach assesses whether groundwater from particular wells is likely to pose any limitations when applied as irrigation water.

5.1 Boron

Boron is among the elements that, while essential for crop growth in low concentrations, may be toxic when present in concentrations only slightly elevated above the optimal level. For most crops, the optimal Boron level is between 0.2 parts per million (ppm) to 0.5 ppm measured in the saturated soil extract. However, Boron concentrations above 0.3 ppm have been observed to damage the most Boron sensitive crops such as lemons, grapefruit, avocado and oranges. Other crops can tolerate concentrations of 1.5 ppm or above.

In the water quality sampling reported in this Study, no Boron concentrations above the Transition Zone exceed the minimum tolerance threshold. Further, with the exception of wells WPMW-3A, WPMW-5B, and DCMW2, no wells above the Ione exhibit Boron concentrations above the 1.5 ppm threshold. Therefore, Boron concentrations from wells in the study area are acceptable for agricultural purposes and do not require implementation of management practices such as application of additional water for leaching.

5.2 Sodium-Adsorption Ratio (SAR)

In addition to water quality constituents that can be directly detrimental to plant health above crop-specific thresholds, increasing proportions of sodium relative to calcium and magnesium can limit agricultural production by adversely affecting soil structure. When the exchangeable sodium in soils exceeds about 10 percent of the soil's cation-exchange capacity in fine-textured soils or 20 percent in coarse-textured soils, soil structure deteriorates and the soil becomes relatively impermeable to water and air. Thus while plants differ in their susceptibility to the nutritional effects of exchangeable sodium, with the exception of rice, all are affected by the poor physical condition of sodic soils.

The standard index for assessing the impact of exchangeable sodium on soil structure is the sodium-adsorption ratio (SAR) which is calculated as shown below:

$$\boldsymbol{SAR = \frac{Na^{+}}{\sqrt{\frac{1}{2}(Ca^{2+} + Mg^{2+})}}}$$

Generally an SAR value below 3.0 is considered to be acceptable under all circumstances with SAR values up to 8.0 being acceptable on some soils. In this Study, groundwater sampled above the Lower Mehrten has only one instance of an SAR above 3.0. A value of 3.5 was computed for well WPMW-1A, a well with an associated sodium concentration of 180 mg/L. In the Lower Mehrten, SAR values exceed 3.0 in approximately 40 percent of the samples with SAR values exceeding 6.0 in 11 percent of the samples, and with the highest value being 8.13. Because of highly elevated sodium concentrations in several locations in the Ione, SAR values computed in samples from this zone are even more elevated.

Due to the occurrence of potentially problematic SAR values in the Lower Mehrten, growers may observe declining infiltration rates caused by deteriorating soil structure. Growers who believe they are observing this problem should contact a local agronomist or a UC Davis Cooperative Extension specialist to determine whether the physical properties of the irrigated land is being harmed by the application of water with high concentrations of sodium.

6. Monitoring Network Evaluation

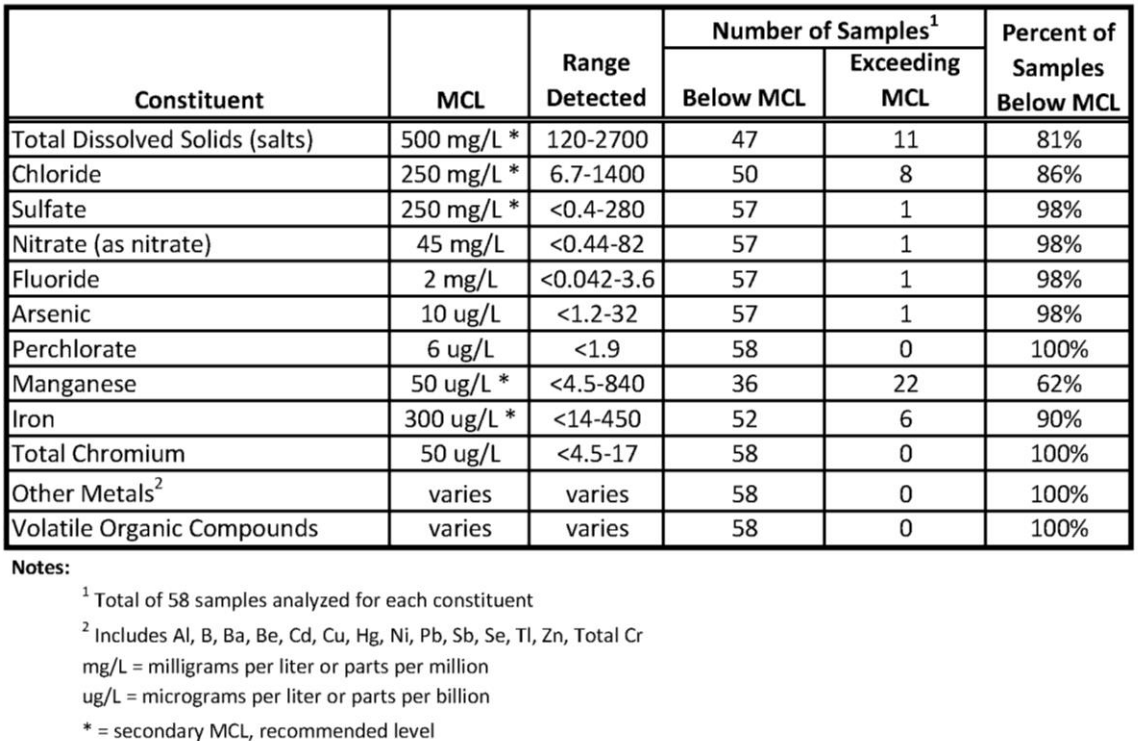
The monitoring network shows adequate coverage of the WPC Partner service areas as shown in **Figure 1**, and the additional information from the Placer County wells covers the northeastern portion of WPC. Many monitoring wells are nested and provide the ability to vertically profile groundwater quality by aquifer. Additional monitoring is needed in the western portion of WPC near the Sutter County line. There are a few wells that have longer screen intervals (SLC-2 with one screen interval between 143 and 293 feet below ground surface (bgs) and SLC-3 four short screens between 131 and 311 feet bgs). Wells with long screen intervals can allow vertical migration of water from one aquifer to another. Analyses of water from SLC-3 at various levels found the water quality to be good and is not causing degradation of water quality due to its longer screen interval. At SLC-2 only one sample was acquired and the analytical results indicate elevated levels of TDS and chloride are present. Additional vertical profiling of the well is warranted.

No water quality samples were obtained from the western portion of the County due to those areas not being within WPC Partners boundaries. Wells in this area are monitored by the Department of Water Resources (DWR). Water quality sampling of these wells, if well logs are available, should be performed to further the water quality evaluation of the area.

7. Conclusions

The results of the water quality sampling show the water quality with the WPC Partner area is generally of good quality. However, there are several constituents that are exceeding the MCL or have elevated levels. The constituents of concern, those that exceed the MCL or have elevated levels (above one-half of the MCL) are provided in the **Table 4**

Table 4 MCL Exceedances for Constituents of Concern



Constituent	MCL	Range Detected	Number of Samples[1]		Percent of Samples Below MCL
			Below MCL	Exceeding MCL	
Total Dissolved Solids (salts)	500 mg/L *	120-2700	47	11	81%
Chloride	250 mg/L *	6.7-1400	50	8	86%
Sulfate	250 mg/L *	<0.4-280	57	1	98%
Nitrate (as nitrate)	45 mg/L	<0.44-82	57	1	98%
Fluoride	2 mg/L	<0.042-3.6	57	1	98%
Arsenic	10 ug/L	<1.2-32	57	1	98%
Perchlorate	6 ug/L	<1.9	58	0	100%
Manganese	50 ug/L *	<4.5-840	36	22	62%
Iron	300 ug/L *	<14-450	52	6	90%
Total Chromium	50 ug/L	<4.5-17	58	0	100%
Other Metals[2]	varies	varies	58	0	100%
Volatile Organic Compounds	varies	varies	58	0	100%

Notes:

[1] Total of 58 samples analyzed for each constituent

[2] Includes Al, B, Ba, Be, Cd, Cu, Hg, Ni, Pb, Sb, Se, Tl, Zn, Total Cr

mg/L = milligrams per liter or parts per million

ug/L = micrograms per liter or parts per billion

* = secondary MCL, recommended level

Elevated TDS, chloride, and sulfate concentrations all appear to be related to brackish water contained in the Ione Formation which underlies most of the fresh water bearing aquifers. Due to the gentle slope of the formations, from east to west, the Ione Formation is at or near surface in the eastern portion of the County where it may be in contact with the Shallower Aquifers. Most of the elevated concentrations occur in the Ione or Lower Mehrten Aquifers. Some of the freshwater bearing aquifers in contact with the Ione Formation contain chemical evidence of the Ione type water affecting the water quality. About 20 samples in the Upper and Lower Mehrten Aquifers were affected but it is unknown whether the concentrations are increasing due to the limited numbers of samples.

Higher concentrations of fluoride and arsenic were few and random. It is believed that these constituents are naturally occurring.

Although nitrate had only a few elevated concentrations, low level concentrations are present in all aquifers. The source of the nitrate may be from fertilizers, historic wastewater discharges, and septic systems. It would be anticipate that the nitrate would be present in the Shallow Aquifer due to these sources being at or near ground surface. The water containing nitrates appears to have migrated into the deeper aquifers. This could be due to the aquifers being exposed in the eastern portion of the area and migrating directly into the deeper aquifers. This migration could be through the naturally interconnected aquifers or by wells allowing shallow water to recharge deeper Aquifers.

Most of the wells that had manganese, a naturally occurring metal, above the MCL are in the Lower Mehrten Aquifer and in the western portion of WPC are not used for drinking water. There was no pattern to the occurrence of iron.

Elevated concentrations of hexavalent chromium (above 5 ug/L) in WPC were detected, mostly in the Shallow Aquifer. Low levels were detected in all aquifers. Elevated concentrations are also being reported across the County line into Sacramento County. In Sacramento County the higher detections are in the Shallow Aquifer, but not in deeper aquifers. In Western Placer County one sample above 5 ug/L was detected in the Upper Mehrten Aquifer. Hexavalent chromium can be naturally occurring, from anthropogenic sources, or due to changes in water quality converting trivalent chromium to hexavalent chromium. The source of the hexavalent chromium is unknown at this time. Based on the groundwater flow direction, the source of the hexavalent chromium or conditions that is allowing it to convert from trivalent chromium, is likely to be within Western Placer County.

With the exception of THMs (a disinfection by-product) no VOCs were detected. The THMs were detected at two locations in the Shallow Aquifer and at three locations within a deeper aquifers used by the City of Roseville for ASR, but all are below the MCL. The presence in the deeper aquifers is likely due to chlorinated water that was placed into storage in 2012 but was not recovered.

Perchlorate was not detected in any samples.

8. Recommendations

While this dataset has provided a snapshot of water quality in most areas of WPC, the western areas near Sutter County have not been sampled. In addition, further sampling should be performed to determine water quality changes over time.

Based on the analytical results and limited historic data we recommend:

- Annual water quality sampling commence at 8 wells (MW 3-2, WPMW-3A, SVMW-2C, MW 4, WPMW-5B, W77-B, DCMW-1, and DCMW-2) that exceed the MCL for TDS, chloride, and sulfate (and that are not screened in the Ione Aquifer) to assess the need for groundwater management actions.

- Additional water quality investigation is needed to define the extent of the hexavalent chromium to assess whether it is naturally occurring or if it is related to a release of the contaminant to the environment or a change in conditions that is allowing a transition of trivalent chromium to hexavalent chromium. Additional Shallow Aquifer monitoring wells within WPC are needed to identify the extent and potential sources.

- Collect water quality samples for THMs from the three Diamond Creek monitoring wells on a semi-annual basis to evaluate the concentrations and trends.

- Collect four additional depth discrete water quality samples from SLC-2 to assess whether this well is a conduit allowing degradation of aquifers.

- Investigations for new drinking water supply wells, including construction of monitoring wells or isolation zone sampling, should include water quality sampling and analyses for those constituents that have been reported as being elevated or above the MCL.

- A sampling schedule for wells not listed in the above bullets will be determined in the GSP.

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Appendix A: Sampling Procedures

WPCGMP Groundwater Quality Sampling Procedures (updated 9/18/15)

Typical purging procedures:

1. Park truck near well and away from traffic and other hazards such as dry grass. Set up equipment near well, including plastic sheeting if necessary. All equipment and working space should be away from traffic and other hazards. Wear reflective vests and place cones nearby if necessary to warn traffic and bystanders to remain clear of area.
2. Take photo(s) of well and wellsite (if camera is gps capable, make sure it records location). Be sure well is labeled appropriately, especially on the well casing.
3. If transducer is present, download the data.
4. Remove transducer if present and coil cable on plastic sheet. Be sure to remove it in a way that it can be replaced at precisely the same depth after sampling. Leave transducer in container of clean water while removed from well.
5. Measure stickup and depth to water. If depth of well is uncertain, it can be measured, but only after sampling.
6. Calculate purge volume/time. Ideal purging volume is 3 times the sum of the volume of water in well and volume of water in gravel pack. At a minimum, each well should be purged until 3*(volume of water in well) and when field parameters stabilize (Dissolved Oxygen (DO), pH, Electrical Conductivity (EC), turbidity and Temperature (T)).
7. Install decontaminated pump 10-20 feet below water surface, but above the screens.
8. Begin pumping well. Discharge to area where water will irrigate/percolate without runoff. If there is not sufficient water in the well or the well cannot be pumped at reasonable rate and/or drawdown is excessive, refer to alternative purging procedures.
9. Measure field parameters (DO, pH, EC, turvidity, and T), DTW, and pumping rate every 3 minutes for the first 6 minutes, then approximately every 10 minutes or periodically as needed thereafter. Monitor water levels to be sure water levels will not be drawn down below the pump.
10. After purging the required volume, take one more set of parameter measurements (DO, pH, EC, turbidity, and T)
11. Reduce pumping rate to an appropriate rate to collect samples.
12. Collect samples.
13. Remove pump and replace transducer if necessary. Be sure to lower the transducer slowly as it approaches the water surface to avoid damaging the membranes on the transducer. Gently insert it into the water column. Be sure it is placed at the same depth below top of the casing as it was previously.
14. Decontaminate pump, tubing, and appropriate appurtenances.
15. Secure well.

Alternative purging procedures:

1. If electric submersible pump cannot be used to purge well, a bailer can be used.
2. Use the bailer to remove water from the well. Keep track of the volume removed.
3. Measure field parameters regularly (DO, pH, EC, T, and turbidity).
4. Remove at least 3 times the volume of water in well casing.
5. Continue bailing as practical until field parameters stabilize or 3 times the sum of the volume of water in well casing and the volume of water in gravel pack have been removed.
6. Collect samples (If well bails dry then wait and collect samples when groundwater levels have recovered sufficiently to obtain a sample).
7. Discard bailer.
8. Secure well.

Decontamination procedures:

1. Pump, tubing and appurtenances shall be decontaminated after sampling and before placing the pump in each well.
2. Prepare a bucket (bucket 1) of 1% solution of Alconox (2.5 Tbsp or 1.25 oz per gallon).
3. Pump the Alconox solution for at least 3 minutes through the pump and tubing, discharging back into the bucket.
4. Pump a bucket of clean water (bucket 2) for at least 3 minutes through the pump and tubing and back into the bucket.
5. Pump another bucket of clean water (bucket 3) until the tubing has cleared of any rinse water.
6. Decontaminate all sampling appurtenances by submerging in or thoroughly spraying with Alconox, rinse water, and distilled water.

Appendix B: Purge Logs

GEI Consultants

GROUNDWATER SAMPLING RECORD

Page No. ____ of ____

Proj. Name WPCGMP
Date 9/17/15
Weather Clear

Proj. No. ________
Task No. ________

Well ID CUMW-1A
SWL (ft btoc) 99.17
T.D. (ft btoc) 285

Water Column (ft) 186 x 0.16 gpf = 29.7 x 3 = 90

Casing Volumes: 2" = 0.16 gpf 4" = 0.65 gpf

no sulfer smell

Time	Purge Vol. Gallons	Flow Rate GPM	DTW ft btoc	Temp. °C	pH	Cond. uhmos/cm	Comments DO (mg/L) Turb (NTU)
14:01	0	2		-			Start pumping
14:04	6	2		24.6	7.4	284	4.77 1.27
14:06	10	2					
14:09				21.4	7.14	288	11.35 0.75
14:22	42	2		22.0	7.18	282	5.5 0.78
14:40	78	2		22.2	7.25	283	4.5 0.78
14:53	104	2		22.0	7.15	282	4.4 0.65
15:00	samples	collected					

Sample Inventory

Time	Volume	Bottle Type	Quantity	Filtration	Preservation	Appearance	Comments

Methods
Decon Equipment: ________
Pumping Equipment: ________
Disposal of Discharged Water : ________
Comments: ________

By K. Croyle/D. Fairman

GEI Consultants

GROUNDWATER SAMPLING RECORD

Page No. ____ of ____

Proj. Name WPC GMP

Date 9/17/15

Weather partly cloudy

Proj. No. ________

Task No. ________

Well ID CVMW 1B

SWL (ft btoc) 97.79

T.D. (ft btoc) 495

Water Column (ft) 398

x .16 gpf = 63.68 x 3 = 191.04

no sulfer smell

Casing Volumes: 2" = 0.16 gpf 4" = 0.65 gpf

Time	Purge Vol. Gallons	Flow Rate GPM	DTW ft btoc	Temp. °C	pH	Cond. uhmos/cm	Comments DO(mg/L) Turb(NTU)
1303		3					Start pumping
1305				20.7	7.71	415	26 4.43
1308		3		21.0	7.47	408	9.1 2.68
1320	51	3		23.0	7.34	410	8.2 1.01
13:31	84	3		22.6	7.34	416	5.9 3.74
13:47	132	3		22.6	7.34	417	5.74 4.12
14:00	171	3		22.7	7.27	415	8.7 4.77
14:09	189	3		22.6	7.29	416	6.5 4.83
14:15	pump stopped						
14:25	Pump started, samples taken						

Sample Inventory

Time	Volume	Bottle Type	Quantity	Filtration	Preservation	Appearance	Comments

Methods

Decon Equipment: ____________________

Pumping Equipment: ____________________

Disposal of Discharged Water : ____________________

Comments: ____________________

By D. Fairman / K. Croyle

GEI Consultants

GROUNDWATER SAMPLING RECORD

Page No. 1 of ____

Proj. Name WPC GMP
Date 9/17/15
Weather partly cloudy

Proj. No. ________
Task No. ________

Well ID CVMW-K (marked on well casing "well #193")
SWL (ft btoc) 97.64'
T.D. (ft btoc) 595 ← says 595 on well
says 590 in our records
Water Column (ft) 498ft x .16 gpf = 79.68 x 3 = 239.0

Casing Volumes: 2" = 0.16 gpf 4" = 0.65 gpf

Sulfer smell and bubbles

Time	Purge Vol. Gallons	Flow Rate GPM	DTW ft btoc	Temp. °C	pH	Cond. uhmos/cm	Comments DO (mg/L) Turb (NTU)
1215		4 gpm					Start pumping
1219				21.7	7.41	410	1.93 0.64
1223	32	4 gpm		21.2	7.20	395	0.53 4.71
1227	42	2.5 gpm					
1228				22.1	7.16	394	0.49 4.43
1238	67	0					flow stopped
1246		2.7					Started pumping
1247				22.6	7.5	400	0.63 4.43
stopped 1252	83	0					Start pump
1314		2.7					
stopped 1316	86	0		23.5	7.61	397	0.75
13 pump removed, no samples taken, pump could not pump any more water							

Sample Inventory

Time	Volume	Bottle Type	Quantity	Filtration	Preservation	Appearance	Comments

Methods
Decon Equipment: ____
Pumping Equipment: ____
Disposal of Discharged Water : ____
Comments: 1250 Home owner Ron Wiggins came by to talk to us said he would have a key made & leave it at gate

By K. Coyle / D. Fairman

GEI Consultants

GROUNDWATER SAMPLING RECORD

Page No. 2 of ____

Proj. Name WPCGMP
Date ~~[illegible]~~ 9/17/15
Weather Clear

Proj. No.________
Task No.________

Well ID CVMW-1C

SWL (ft btoc) __________

T.D. (ft btoc) __________

Water Column (ft) __________ x ______ gpf = ______ x 3 = ______

Casing Volumes: 2" = 0.16 gpf 4" = 0.65 gpf

Time	Purge Vol.	Flow Rate	DTW	Temp.	pH	Cond.	Comments	
	Gallons	GPM	ft btoc	°C		uhmos/cm	DO(mg/L)	Turb(NTU)
1519	86	2.4					Start	Pumping
1533	96	2.72		21.3	7.75	392	8.83	7.60
1541	119	3		22.1	7.82	398	6.04	7.60
1555	160	2.9		22.6	7.88	400	5.79	5.5
1609	203	3.2		22.8	7.89	398	8.30	6.8
1624	283	3.2		22.9	7.92	399	5.37	2.4
1640		Collect		Samples				

Sample Inventory

Time	Volume	Bottle Type	Quantity	Filtration	Preservation	Appearance	Comments

Methods
Decon Equipment: ____________________
Pumping Equipment: ____________________
Disposal of Discharged Water : ____________________
Comments: ____________________

By D. Fairman/K. Coyle

GEI Consultants

GROUNDWATER SAMPLING RECORD

Page No. 1 of 1

Proj. Name WPC GMP
Date 9/21/15
Weather Sunny

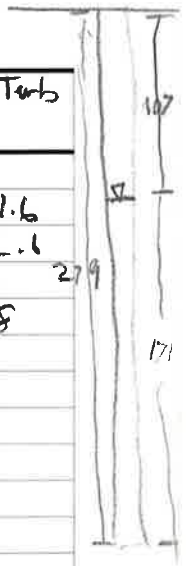
Proj. No. ________
Task No. ________

Well ID Fiddymat 14MN-A
SWL (ft btoc) 107.80
T.D. (ft btoc) 279

Water Column (ft) 171.2 x .16 gpf = 27.39 x 3 = 82.17

Casing Volumes: 2" = 0.16 gpf 4" = 0.65 gpf

Time	Purge Vol. Gallons	Flow Rate GPM	DTW ft btoc	Temp. °C	pH	Cond. uhmos/cm	DO Comments Turb
12:25		3					Start pumping
12:30				23.1	6.42	337.4	4.19 1.6
12:45	77	3.85		22.1	6.97	313.0	6.12 2.1
12:50		3.85		21.9	6.85	312	5.89 1.6
1:10		3.85		22	7.10	312.5	5.38 1.8
1:15	192.5						Collect samples



Sample Inventory

Time	Volume	Bottle Type	Quantity	Filtration	Preservation	Appearance	Comments

Methods
Decon Equipment: ________
Pumping Equipment: ________
Disposal of Discharged Water : ________
Comments: ________

By D. Vincent

GEI Consultants

GROUNDWATER SAMPLING RECORD

Page No. 1 of 1

Proj. Name WPC GMP
Date 9/21/15
Weather sunny/hot

Proj. No.
Task No.

Well ID Fiddyment Well 14 MW B (387)
SWL (ft btoc) 112.56
T.D. (ft btoc) 387

Water Column (ft) 274.5 x .16 gpf = 44 x 3 = 132

Casing Volumes: 2" = 0.16 gpf 4" = 0.65 gpf

Time	Purge Vol. Gallons	Flow Rate GPM	DTW ft btoc	Temp. °C	pH	Cond. uhmos/cm	Comments DO(mg/L)	Turb(NTU)
start 11:55	0	2.7		24.1	728	464	8.9	0.27
12:01	16.2	2.7						0.75
out of gas 12:11	43.2							[illegible]
start 12:15	43.2	3.0		24.2	7.1	462	4.3	2.01
12:20	58	3.0		22.8	7.18	439	7.6	0.63
12:30	87	2.9		23.0	7.26	439	9.3	0.60
12:40	116	2.9		23.2	7.30	439	10.5	0.49
12:50	145	2.9		22.8	7.25	438	8.9	0.33
12:55	samples collected							

Sample Inventory

Time	Volume	Bottle Type	Quantity	Filtration	Preservation	Appearance	Comments
12:55	1 L	plastic	1	—	-	clear	
↓	500ml	"	1	0.45 micro	nitric	↓	
	250ml	"	1	-	NH4+Buff		
	35ml	glass	3	-	HCl		no bubbles

Methods
Decon Equipment:
Pumping Equipment:
Disposal of Discharged Water :
Comments:

	Spreadsheet	Measured
A:	279	=
B:	387	
C:	508	513
D:	445	448

By Kcreyle

GEI Consultants

GROUNDWATER SAMPLING RECORD

Page No. 1 of 1

Proj. Name WPCGMP
Date 9/21/15
Weather sunny/hot

Proj. No.
Task No.

Well ID Fiddyment Well 14 MW 6
SWL (ft btoc) 113.00
T.D. (ft btoc) 445

Water Column (ft) 332 x .16 gpf = 53.1 x 3 = 160 gal

Casing Volumes: 2" = 0.16 gpf 4" = 0.65 gpf

Pumped from 125 ft

Time	Purge Vol.	Flow Rate	DTW	Temp.	pH	Cond.	Comments	
	Gallons	GPM	ft btoc	°C		uhmos/cm	Turb(NTU)	DO (mg/L)
start 10:16	0	4		22.1	8.28	444	0.64	9.6
10:20	16	4		21.9	8.02	418	0.77	8.0
10:24	32	4		21.8	7.85	417	3.13	7.2
10:30	56	4		22.2	7.75	418	1.28	6.3
10:40	96	4		22.6	7.47	535	0.84	4.0
10:50	136	4		22.7	7.24	544	0.61	6.3
11:00	176	4		22.7	7.18	550	0.52	3.67
11:03	Samples collected							

Sample Inventory

Time	Volume	Bottle Type	Quantity	Filtration	Preservation	Appearance	Comments
11:03	1L	plastic	1	NA	NA	clear	
11	500ml	11	1	.45 micron	HNO3	↓	NA
11	250ml	11	1	NA	Ammonia buff	↓	no bubbles
11	35ml	glass	3	NA	HCl		

Methods
Decon Equipment:
Pumping Equipment:
Disposal of Discharged Water :
Comments:

By Kenny Croyle

GEI Consultants

GROUNDWATER SAMPLING RECORD

Page No. 1 of 1

Proj. Name WPCGMP
Date 9/21/15
Weather Sunny

Proj. No.
Task No.

Well ID Fiddyment 14MWP
SWL (ft btoc) 112.10
T.D. (ft btoc) 445

Water Column (ft) 332.90 x .16 gpf = 53.26 x 3 = 160

Casing Volumes: 2" = 0.16 gpf 4" = 0.65 gpf

Time	Purge Vol. Gallons	Flow Rate GPM	DTW ft btoc	Temp. °C	pH	Cond. SPC uhmos/cm	DO mg/L Comments Turb ntu
10:20		3.85					start pumping
10:25				21.8	7.45	463	1.8 0.9
10:30	38.5	3.85					
10:35				22.1	7.12	456	2.32 2.4
10:44				22.4	7.11	452	3.01 3.5
10:48	107.8	3.85					
10:57				22.5	7.08	453	3.2 0.6
11:08	184.8	3.85		22.5	7.25	454	3.4 0.7
11:20				22.4	7.23	453	3.4 0.2
11:25							Collect Samples

Sample Inventory

Time	Volume	Bottle Type	Quantity	Filtration	Preservation	Appearance	Comments

Methods
Decon Equipment:
Pumping Equipment:
Disposal of Discharged Water :
Comments:

By D. Vincent / D. Fairman

GEI Consultants

GROUNDWATER SAMPLING RECORD

Page No. 1 of 1

Proj. Name WPCGMP
Date 9/28/15
Weather Sunny

Proj. No.
Task No.

Well ID MW 1-1
SWL (ft btoc) 64.67
T.D. (ft btoc) 398

Water Column (ft) 333.33 x .16 gpf = 53.33 x 3 = 160

Casing Volumes: 2" = 0.16 gpf 4" = 0.65 gpf

Time	Purge Vol. Gallons	Flow Rate GPM	DTW ft btoc	Temp. °C	pH	Cond. uhmos/cm	DO Comments T
9:50		2					Start Pumping
10:00				21.7	7.98	925	2.80 8.3
10:10	40	3					
10:15				20.7	7.45	932	1.98 4.0
10:20	60	2					
10:25				21.2	7.37	935	1.08 2.9
10:30	90	3		21.1	7.35	924	5.26 3.3
10:40				21.9	7.48	564	4.30 ×
10:50	150	3		22.4	7.50	568	.80 E3
11:00		2.5		22.7	7.51	524	1.09 E3
11:05				22.4	7.36	509	.92 98.9
11:10							Collect Samples

E3

water is dirty

Sample Inventory

Time	Volume	Bottle Type	Quantity	Filtration	Preservation	Appearance	Comments

Methods
Decon Equipment:
Pumping Equipment:
Disposal of Discharged Water :
Comments:

By

GEI Consultants

GROUNDWATER SAMPLING RECORD

Page No. 1 of 1

Proj. Name WPCGMP
Date 9/28
Weather Sunny

Proj. No.
Task No.

Well ID MW 1-2
SWL (ft btoc) 64.94
T.D. (ft btoc) 318

Water Column (ft) 253.06 x .16 gpf = 40.49 x 3 = 121.5

Casing Volumes: 2" = 0.16 gpf 4" = 0.65 gpf

Time	Purge Vol. Gallons	Flow Rate GPM	DTW ft btoc	Temp. °C	pH	Cond. uhmos/cm	DO Comments T
11:30		4					Start pumping
11:35				21.6	7.34	275.5	4.03 10.3
11:45				21.8	6.98	268.6	4.45 3.9
11:50	80	4					
11:55				22.0	6.95	266.5	4.43 0.7
12:00	120	4					
12:10				22.8	7.19	266	4.57 0.6
12:15		4					Collect sample

Sample Inventory

Time	Volume	Bottle Type	Quantity	Filtration	Preservation	Appearance	Comments

Methods
Decon Equipment:
Pumping Equipment:
Disposal of Discharged Water :
Comments:

By

GEI Consultants

GROUNDWATER SAMPLING RECORD

Page No. 1 of 1

Proj. Name WPCGMP
Date 9/28/15
Weather Sunny
Proj. No.
Task No.

Well ID MW-1-3
SWL (ft btoc) 64.49
T.D. (ft btoc) 204
Water Column (ft) 139.51
x .16
gpf = 22.32
x 3 = 66.9

Casing Volumes: 2" = 0.16 gpf 4" = 0.65 gpf

Time	Purge Vol. Gallons	Flow Rate GPM	DTW ft btoc	Temp. °C	pH	Cond. uhmos/cm	DO Comments T
12:40		3					Start Pumping
12:45				21.9	7.28	235.5	6.49 1.1
12:50	30			21.3	6.94	221.4	6.85 99.9 Dirty
12:55		3					
13:00				21.2	7.06	228.9	7.02 11.3
13:10	90	3		20.8	6.81	222.7	6.75 9.3
13:15							Collect Sample

Sample Inventory

Time	Volume	Bottle Type	Quantity	Filtration	Preservation	Appearance	Comments

Methods
Decon Equipment:
Pumping Equipment:
Disposal of Discharged Water :
Comments:

By D. Vert

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GROUNDWATER SAMPLING RECORD

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Proj. Name WPCGMP
Date 9/28/15
Weather Sunny

Proj. No.
Task No.

Well ID MW 1-4
SWL (ft btoc) 38.45
T.D. (ft btoc) 92

Water Column (ft) 53.55 x .16 gpf = 8.568 x 3 = 25.7

Casing Volumes: 2" = 0.16 gpf 4" = 0.65 gpf

Time	Purge Vol. Gallons	Flow Rate GPM	DTW ft btoc	Temp. °C	pH	Cond. uhmos/cm	DO	Comments T
18:45		155nes					Start pumping	
14:00				28.0	7.30	329.3	3.91	3.31
14:05		1						
14:20				25.2	7.10	428.4	4.91	3.0
14:30		1	No	water				
14:40				25.1	7.19	433.2	4.94	3.0

Sample Inventory

Time	Volume	Bottle Type	Quantity	Filtration	Preservation	Appearance	Comments

Methods
Decon Equipment:
Pumping Equipment:
Disposal of Discharged Water :
Comments:

By

GEI Consultants

GROUNDWATER SAMPLING RECORD

Page No. 1 of 1

Proj. Name WPCGMP
Date 4/29/15
Weather partly cloudy

Proj. No.________
Task No.________

Well ID MW1-4
SWL (ft btoc) 37.71
T.D. (ft btoc) 92

Water Column (ft) 54.29 x .16 gpf = 8.7 x 3 = 26

Casing Volumes: 2" = 0.16 gpf 4" = 0.65 gpf

Time	Purge Vol. Gallons	Flow Rate GPM	DTW ft btoc	Temp. °C	pH	Cond. uhmos/cm	Comments DO(mg/L)	Comments Turb (NTU)
12:38	began bailing			20.2	7.26	427	7.0	3.22
after	5 gal bailed:			19.4	7.35	425	5.7	4.11
	10 gal							
	15 gal			19.2	7.25	424	11.5	2.81
	20 gal							
	26 gal							
sampled								

Sample Inventory

Time	Volume	Bottle Type	Quantity	Filtration	Preservation	Appearance	Comments
14:02	1L	plastic	1	-	-	clear	
"	500ml	"	1	~~ss~~	Nitric	↓	
"	250ml	"	1	-	NH4+Buff		
"	35ml	glass	3	-	HCL		no bubbles

Methods
Decon Equipment: ________
Pumping Equipment: ________
Disposal of Discharged Water : ________
Comments: ________

By KCoyle

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GROUNDWATER SAMPLING RECORD

Page No. 1 of 1

Proj. Name WPCGMP
Date 9/28/15
Weather Clear

Proj. No.
Task No.

Well ID MW2-1
SWL (ft btoc) 23.45
T.D. (ft btoc) 310

Water Column (ft) 286.55 x .16 gpf = 46 x 3 = 138

Casing Volumes: 2" = 0.16 gpf 4" = 0.65 gpf

Probe not working started change

Time	Purge Vol.	Flow Rate	DTW	Temp.	pH	Cond.	Comments	
	Gallons	GPM	ft btoc	°C		uhmos/cm	DO(mg/L)	Turb (NTU)
9:30	0	5	-	21.7	7.36	442	3.5	21.1
9:45	45	5	-	21.4	7.30	435	3.4	4.33
9:55	125	5	-	21.3	7.25	409	4.1	0.91
10:05	165	5		21.6	7.21	396	4.4	0.41
10:15	235	5		21.3	7.20	392	4.6	0.61
10:20	260	5		21.2	7.24	389	3.8	0.27
10:25	285	5		21.2	7.20	387	4.2	1.0
10:30		5		21.2	7.19	386	3.6	0.30
1035		5		21.2	7.21	385	3.9	0.36
1040		5		21.2	7.20	385	3.7	0.34
10:45	samples collected							

Sample Inventory

Time	Volume	Bottle Type	Quantity	Filtration	Preservation	Appearance	Comments
10:45	1L	plastic	1	-	-	clear	
"	500 ml	"	1	.45micron	Nitric		
"	250 ml	"	1	-	NH4 buff		
"	35ml	glass	3	-	HCL		no bubbles

Methods
Decon Equipment:
Pumping Equipment:
Disposal of Discharged Water :
Comments:

By K Coyle

GEI Consultants

GROUNDWATER SAMPLING RECORD

Page No. 1 of 1

Proj. Name WPC GMP
Date 9/28/15
Weather Clear

Proj. No. ________
Task No. ________

Well ID MW 2.2
SWL (ft btoc) 41.67
T.D. (ft btoc) 170

Water Column (ft) 128.33 x .16 gpf = 20.5 x 3 = 62

Casing Volumes: 2" = 0.16 gpf 4" = 0.65 gpf

Time	Purge Vol. Gallons	Flow Rate GPM	DTW ft btoc	Temp. °C	pH	Cond. uhmos/cm	Comments DO (mg/l)	Turb (NTU)
11:02	0	4	-	20.6	7.39	250	10.4	3.92
11:07	20	4	-	20.9	7.31	248	6.52	5.90
11:12	40	4	-	21.0	7.31	251	5.3	2.06
11:17	60	4	-	21.2	7.32	250	4.9	1.51
11:29	118	4	-	21.3	7.33	252	5.2	0.60
11:35		4	-	21.2	7.35	251	7.5	0.66
11:42		4	-	21.3	7.37	250	5.3	0.64
11:47	Samples	collected						

Sample Inventory

Time	Volume	Bottle Type	Quantity	Filtration	Preservation	Appearance	Comments
11:47	1L	plastic	1	-	-	clear	
↓	250 ml	"	1	.45 micron	Nitric	↓	
	250 ml	"	1	-	NH4+Buff		
	35 ml	glass	3	-	HCL		no bubbles

Methods
Decon Equipment: ____________
Pumping Equipment: ____________
Disposal of Discharged Water : ____________
Comments: ____________

By K Crasyle

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GROUNDWATER SAMPLING RECORD

Page No. 1 of 1

Proj. Name WPCGMP
Date 9/28/15
Weather Clear

Proj. No.
Task No.

Well ID MW 2-3

SWL (ft btoc) 39.64

T.D. (ft btoc) 85

Water Column (ft) 45.36 x .16 gpf = 7.25 x 3 = 22

Casing Volumes: 2" = 0.16 gpf 4" = 0.65 gpf

Time	Purge Vol. Gallons	Flow Rate GPM	DTW ft btoc	Temp. °C	pH	Cond. uhmos/cm	Comments DO (mg/L)	Turb (NTU)
12:15	0	4	–	21.6	7.47	393	7.1	5.44
12:25	40	4	–	20.9	7.11	390	6.5	0.57
12:35	80	4	–	21.1	7.13	393	6.7	0.26
12:45	120	4	–	21.1	7.07	392	6.5	0.29
12:50	140	4	–	21.1	7.04	392	4.8	0.27
12:57	Samples	collected						

Sample Inventory

Time	Volume	Bottle Type	Quantity	Filtration	Preservation	Appearance	Comments
12:57	1L	Plastic	1	–	–	Clear	
"	250 ml	"	1	.45 micron	Nitric	↓	
"	250 ml	"	1	–	NH4 Buff		
"	35 ml	glass	3	–	HCL		no bubbles

Methods
Decon Equipment:
Pumping Equipment:
Disposal of Discharged Water :
Comments:

By K Coyle

GROUNDWATER SAMPLING RECORD

Page No. 1 of 1

Proj. Name WPCGMP
Date 9/29/15
Weather Sunny

Proj. No.
Task No.

Well ID MW 3-1
SWL (ft btoc) 58.82
T.D. (ft btoc) 133
Water Column (ft) 74.18 x .16 gpf = 11.86 x 3 = 35.60
Casing Volumes: 2" = 0.16 gpf 4" = 0.65 gpf

Time	Purge Vol. Gallons	Flow Rate GPM	DTW ft btoc	Temp. °C	pH	Cond. uhmos/cm	DO Comments T
12:25		4					Start pumping
12:30				22.7	7.36	436.2	2.68 0.9
12:35	40	4		22.3	7.05	691	9.13 0.4
12:40				21.9	6.93	685	9.79 0.3
12:45				21.9	6.84	679	7.83 0.6
12:50							Collect Sample

Sample Inventory

Time	Volume	Bottle Type	Quantity	Filtration	Preservation	Appearance	Comments

Methods
Decon Equipment:
Pumping Equipment:
Disposal of Discharged Water :
Comments:

By

GEI Consultants

GROUNDWATER SAMPLING RECORD

Page No. 1 of 1

Proj. Name WPCGMP
Date 9/25/15
Weather Sunny

Proj. No.
Task No.

Well ID MW 3-2

SWL (ft btoc) 57.1

T.D. (ft btoc) 75

Water Column (ft) 17.9 x .16 gpf = 2.864 x 3 = 8.59

Casing Volumes: 2" = 0.16 gpf 4" = 0.65 gpf

Time	Purge Vol. Gallons	Flow Rate GPM	DTW ft btoc	Temp. °C	pH	Cond. uhmos/cm	DO	Comments T
13:45			No water				Start	pumping
14:30	Bailing							
1450				23.9	6.96	805	5.71	99.9
				23.3	6.74	804	5.61	1000

Sample Inventory

Time	Volume	Bottle Type	Quantity	Filtration	Preservation	Appearance	Comments

Methods
Decon Equipment:
Pumping Equipment:
Disposal of Discharged Water :
Comments:

By

GEI Consultants

GROUNDWATER SAMPLING RECORD

Page No. 1 of 1

Proj. Name WPC GMP
Date 4/29/15
Weather Clear

Proj. No.________
Task No.________

Well ID MW4
SWL (ft btoc) 23.42
T.D. (ft btoc) 25

Water Column (ft) 1.6 x .16 gpf = .24 x 3 = .75

Casing Volumes: 2" = 0.16 gpf 4" = 0.65 gpf roots on sounder tip when pulled up

Time	Purge Vol.	Flow Rate	DTW	Temp.	pH	Cond.	Comments	
	Gallons	GPM	ft btoc	°C		uhmos/cm	DO(mg/L)	Turb(NTU)
14:02	Started bailing well, about 6 inches in bailer each pull							
	very dirty							
				21.6	6.69	2304	6.0	807
1427	bailed out in 1.5 gallons, water a little more clear							
				19.9	7.04	2600	6.0	421
				small roots in water, eucalyptus trees overhead				

Sample Inventory

Time	Volume	Bottle Type	Quantity	Filtration	Preservation	Appearance	Comments
1427	1 L	plastic	1	–	–	milky gray	
"	250ml	"	1	45micron	nitric	"	
"	250ml	"	1	–	NH4 Buff	"	
"	35ml	glass	3	–	HCl	"	no bubbles

Methods
Decon Equipment: ________
Pumping Equipment: ________
Disposal of Discharged Water : ________
Comments: ________

By K Grayb

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GROUNDWATER SAMPLING RECORD

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Proj. Name WPC GMP
Date 9/29/15
Weather partly cloudy

Proj. No.
Task No.

Well ID MW 5-1
SWL (ft btoc) 45.07
T.D. (ft btoc) 100

Water Column (ft) 55 x .16 gpf = 8.8 x 3 = 26.4

Casing Volumes: 2" = 0.16 gpf 4" = 0.65 gpf

pumped from 60ft

Time	Purge Vol.	Flow Rate	DTW	Temp.	pH	Cond.	Comments	
	Gallons	GPM	ft btoc	°C		uhmos/cm	DO (mg/L)	Turb (NTU)
7:45	0	4.8	–	18.7	7.76	439	5.5	17.0
7:52	33.6	4.8		18.7	7.26	460	4.6	6.11
8:00	57.6	3.0		18.5	6.87	460	4.1	1.68
8:10	87.6	3.0		18.6	6.71	485	5.1	6.20
8:17		3.0		18.6	6.73	484	4.0	5.08
8:22		3.0		18.6	6.72	486	6.3	7.28
8:32		3.0		18.6	6.73	485	5.8	4.78
8:37				18.6	6.74	485	4.6	5.40
8:45				18.7	6.74	484	4.0	3.33
8:55				18.6	6.75	485	3.5	3.50
9:00	samples collected							

Start

reduced rate line was bumped

Sample Inventory

Time	Volume	Bottle Type	Quantity	Filtration	Preservation	Appearance	Comments
9:00	1L	plastic	1	–	–	Clear	
"	250ml	"	1	.45 micron	nitric	↓	
"	250ml	"	1	–	NH4 Buff	↓	
"	35ml	glass	3	–	HCL		no bubbles

Methods
Decon Equipment:
Pumping Equipment:
Disposal of Discharged Water :
Comments:

By K Croyle

GEI Consultants

GROUNDWATER SAMPLING RECORD

Page No. 1 of 1

Proj. Name WPC GMP
Date 9/29/15
Weather partly cloudy

Proj. No._______
Task No._______

Well ID MW5-2
SWL (ft btoc) 39.40
T.D. (ft btoc) 62

Water Column (ft) 23 x .16 gpf = 4 x 3 = 12

Casing Volumes: 2" = 0.16 gpf 4" = 0.65 gpf

pump stopped

Time	Purge Vol.	Flow Rate	DTW	Temp.	pH	Cond.	Comments	
	Gallons	GPM	ft btoc	°C		uhmos/cm	DO (mg/L)	Turb (NTU)
9:40	0	2.7	–	18.8	6.98	357	9.7	56
9:44	10.8							
bailed 9 gal								
@ ~1 gal:	–	–	16.8	6.83	476	3.80		946
@ ~3 gal:	–	–	18.9	6.81	478	2.9		OVR
@ ~5 gal:	–	–	18.9	6.84	478	2.1		417
@ ~7 gal	–	–	19.0	6.86	478	2.2		162
@ 9 gal	–	–	19.0	6.66	478	2.0		170

Sample Inventory Sampled, sample turb: 173

Time	Volume	Bottle Type	Quantity	Filtration	Preservation	Appearance	Comments
10:30	1 L	plastic	1	–	–	cloudy brown	
"	250 ml	"	1	–	nitric	↓	not filtered
"	250 ml	"	1	–	NH4+Buff		
"	35 ml	glass	3	–	HCl		no bubbles

Methods
Decon Equipment: __________
Pumping Equipment: __________
Disposal of Discharged Water : __________
Comments: __________

By K Coyle

GEI Consultants

GROUNDWATER SAMPLING RECORD

Page No. 1 of 1

Proj. Name WPCGMP
Date 11/12/15
Weather Clear

Proj. No.
Task No.

Well ID Reason Farms

SWL (ft btoc) ~106 (based on previous visit)

T.D. (ft btoc) 212

Water Column (ft) 106 x 2.61 gpf= 276 x 3 = 830

Casing Volumes: 2" = 0.16 gpf 4" = 0.65 gpf 8" = 2.61 gpf

Time	Purge Vol. Gallons	Flow Rate GPM	DTW ft btoc	Temp. °C	pH	DO	Cond. uhmos/cm	Turb	Comments PSI
1355									50 Turned on hose
1358									40
1400		10							36 Pump turned on
1402	20	10							43 rising, turned on 2nd hose
1422	380	18		18.3	7.87	9.5	544	0.57	
1429	506	18		18.6	7.63	9.3	540	0.66	44
1435	614	18		18.7	7.62	8.1	539	0.35	
1447	830	18		19.1	7.61	8.4	542	0.40	
1450	884								COLLECT SAMPLES

Sample Inventory

Time	Volume	Bottle Type	Quantity	Filtration	Preservation	Appearance	Comments

Methods
Decon Equipment:
Pumping Equipment:
Disposal of Discharged Water :
Comments:

By D. Fairman / K. Croyle

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GROUNDWATER SAMPLING RECORD

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Proj. Name WPC GMP

Date 11/10/15

Weather clear

Proj. No. ________

Task No. ________

Well ID SLC 3

SWL (ft btoc) 69.18

T.D. (ft btoc) 311

Water Column (ft) ________ x ______ gpf = ______ x 3 = _______

Casing Volumes: 2" = 0.16 gpf 4" = 0.65 gpf

Bailed w/ hydrasleeve

Time	Purge Vol. Gallons	Flow Rate GPM	DTW ft btoc	Temp. °C	pH	Cond. uhmos/cm	Comments Turb	DO
1423				19.8	8.60	312	47.7 NTU	3.45 mg/L

Sample Inventory

Time	Volume	Bottle Type	Quantity	Filtration	Preservation	Appearance	Comments
1423	1L	plastic	1	–	–	clear /	not filtered
"	250ml	plastic	1	–	NH_4SO_4	tinge brown	for metals
"	35ml	glass	3	–	HCl		no bubbles

Methods

Decon Equipment: ____________________

Pumping Equipment: ____________________

Disposal of Discharged Water : ____________________

Comments: ____________________

By ____________________

GEI Consultants

GROUNDWATER SAMPLING RECORD

Page No. 1 of ___

Proj. Name WPCGMP
Date 9/15/15
Weather clear

Proj. No. ________
Task No. ________

Well ID SVMW-Past 2A
SWL (ft btoc) 126.26'
T.D. (ft btoc) 140'

Water Column (ft) 13.74 x 0.16 gpf = 2.20 gal x 3 = 6.6

Casing Volumes: 2" = 0.16 gpf 4" = 0.65 gpf

Time	Purge Vol. Gallons	Flow Rate GPM	DTW ft btoc	Temp. °C	pH	Cond. uhmos/cm	Comments	
							DO mg/L	Turb NTU
1353		2		26.3	7.95	195.1	38.4	40.7
1359	12	flow slowed down						
1401		flow back up lowered pump 1'						
1402		1.7		24.2	7.31	205.2	26.5	21.8
1403		flow slowed down again						
1405		turned pump off to allow recharge						
1415		started pump						
1416				24.0	7.12	207	23.0	22.5
1419		lowered pump 1 ft						
1420		2						
1421	16	flow slowed down						
1421				25.1	7.03	205	22.5	21.7
1422		stopped pump						

Sample Inventory

Time	Volume	Bottle Type	Quantity	Filtration	Preservation	Appearance	Comments

Methods
Decon Equipment: ____________________
Pumping Equipment: ____________________
Disposal of Discharged Water : ____________________
Comments: ____________________

By ____________________

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GROUNDWATER SAMPLING RECORD

Page No. 2 of ____

Proj. Name WPCGMP
Date 9/15/15
Weather clear

Proj. No.________
Task No.________

Well ID GWMW east-2A
SWL (ft btoc) 126.26'
T.D. (ft btoc) 140

Water Column (ft) __________ x ______ gpf = ______ x 3 = _______

Casing Volumes: 2" = 0.16 gpf 4" = 0.65 gpf

Time	Purge Vol.	Flow Rate	DTW	Temp.	pH	Cond.	Comments
	Gallons	GPM	ft btoc	°C		uhmos/cm	DO mg/L Turb
1430			Start pumping				
1432		1					
1433	19		Pumping slowed				
1433				24.1	7.14	208	19 38.2

Sample Inventory

Time	Volume	Bottle Type	Quantity	Filtration	Preservation	Appearance	Comments
1410							

Methods
Decon Equipment: ______________________
Pumping Equipment: ______________________
Disposal of Discharged Water : ______________________
Comments: ______________________

By______________________

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GROUNDWATER SAMPLING RECORD

Page No. 1 of 1

Proj. Name WPCGMP
Date 9-16-15
Weather

Proj. No.
Task No.

Well ID SVMW-East 2B
SWL (ft btoc) 138.75 @ 7:58
T.D. (ft btoc) 525

Water Column (ft) 386.25
x 0.16
gpf = 61.8
x 3 = 185.4

Casing Volumes: [✓ 2" = 0.16 gpf] 4" = 0.65 gpf

Time	Purge Vol. Gallons	Flow Rate GPM	Turbidity NTU	Temp. °C	pH	Cond. uhmos/cm	Comments
848		~2.7					Begin Pumping
852	~10	~2.0	0.2	20.5	7.50	609	DO=29.8
859	~24	~1.5	0.4	21.4	7.15	604	DO=20.3
914	~39	~1.5	1.3	22.0	7.09	606	DO=12.7
932	~66	~1.5	1.3	22.2	7.15	611	DO=9.7
950	~92	~1.5	1.3	22.7	7.11	612	DO=7.7
1010	~122	~1.5	1.3	22.9	7.10	612	DO=9.0
1030	~152	~1.5	1.3	22.8	7.06	612	DO=6.6
1052	~185	~1.5	1.0	22.9	7.09	611	DO=11.2

Sample Inventory

Time	Volume	Bottle Type	Quantity	Filtration	Preservation	Appearance	Comments
1100	35 ml	Voas	3	—	HCl	Clear	SVMW-East 2B
1100	1 qt	Plastic	1	—	—	↓	↓
1100	250 ml	Plastic	1	—	—		
1100	250 ml	Plastic	1	0.45 micron	HNO_3		

Methods
Decon Equipment:
Pumping Equipment:
Disposal of Discharged Water :
Comments:

By J. Crose / K. Coyle

GEI Consultants

GROUNDWATER SAMPLING RECORD

Page No. 1 of 2

Proj. Name WPCGMP
Date 9/15/15
Weather Overcast

Proj. No.
Task No.

Well ID SVMW-2C
SWL (ft btoc) 138.83'
T.D. (ft btoc) 670'

Water Column (ft) 531.17 x 0.16 gpf = 85 x 3 = 255 gal + gp = 265 gal

Casing Volumes: 2" = 0.16 gpf 4" = 0.65 gpf

Time	Purge Vol.	Flow Rate	DTW	Temp.	pH	Cond.	Comments	
	Gallons	GPM	ft btoc	°C		uhmos/cm	Turb(NTU)	DO%
10:46	Start							
10:47		1.8		22.2	7.58	1618	0.9NTU	
10:53	10.8	tried to max pump rate but controller failed						
11:01	Started again							
11:01	controller failed again when pump rate was maxed							
11:15	started again							
11:16		3.15		22.7	7.3	1635	1.5	DO: 1.7
11:21	26.5	3.15		22.1	7.25	1624	2.9	1.4
11:26	44	3.5						
11:37	75	3.5					Surging	
11:43	91	2.6		23.8	7.35	1992		2.7
11:52							Stop Pump	
12:07	110	1.3		24.0	7.55	2008	1.8	2.7

Pump Hz
354
371
lowered another 5 Hz

11:26 pump Hz to 371

turned down to 354 Hz

Sample Inventory

Time	Volume	Bottle Type	Quantity	Filtration	Preservation	Appearance	Comments

Methods
Decon Equipment:
Pumping Equipment:
Disposal of Discharged Water :
Comments:

By

GEI Consultants

GROUNDWATER SAMPLING RECORD

Page No. 2 of 2

Proj. Name WPCGMP
Date 9/15/15
Weather partly cloudy

Proj. No.
Task No.

Well ID SVWM-2C

SWL (ft btoc) 138.83'

T.D. (ft btoc) 670'

Water Column (ft) 531.17

x .16

gpf = 85

x 3 = 255 +gp= 265 gal

Casing Volumes: 2" = 0.16 gpf 4" = 0.65 gpf

dropped 10' start

sampled →

Time	Purge Vol. Gallons	Flow Rate GPM	DTW ft btoc	Temp. °C	pH	Cond. uhmos/cm	Comments Turb	DO
12:12	123	1.5		23.4	7.51	2009		27.5 →
12:19		1.6		23.3	7.49	2013	0.9	55.0
12:26	139			23.0	7.50	2012	0.9	69.0
12:42	166	1.7		23.0	7.51	2010	0.6	52.2
12:57	stopped							

stopped sucking air

Sample Inventory

Time	Volume	Bottle Type	Quantity	Filtration	Preservation	Appearance	Comments

Methods
Decon Equipment:
Pumping Equipment:
Disposal of Discharged Water :
Comments:

By

GEI Consultants

GROUNDWATER SAMPLING RECORD

Page No. 1 of ____

Proj. Name WPC GMP
Date 9/16/15
Weather overcast

Proj. No. ________
Task No. ________

Well ID SVMW West-1A
SWL (ft btoc) 121.65
T.D. (ft btoc) 145

Water Column (ft) 23.35 x 0.16 gpf = 3.74 x 3 = 11.22 gal

Casing Volumes: 2" = 0.16 gpf 4" = 0.65 gpf

	Time	Purge Vol. Gallons	Flow Rate GPM	DTW ft btoc	Temp. °C	pH	Cond. uhmos/cm	Comments
	14:55		~3.2					Begin Pumping
↓ rate	14:56	~6.5	~3.2	4.2	21.7	7.56	210	DO= 22.5 mg/L
	14:59	~13.4	~2.3	0.8	21.3	7.38	206	23.7
	15:01	~18.0	~2.3	0.7	21.2	7.31	206	22.5
	15:02	~20.3	~2.3	0.4	21.2	7.25	206	21.5
Samples collected	15:08							

Sample Inventory

Time	Volume	Bottle Type	Quantity	Filtration	Preservation	Appearance	Comments
15:08	35ml	VOCs	3	–	HCL	Clear	SVMW West-1A
15:08	1 quart	plastic	1	–	–	clear	↓
15:08	250ml	plastic	1	–	–	clear	↓
15:08	250ml	plastic	1	0.45 micron	HNO_3	clear	↓

Methods
Decon Equipment: ____________________
Pumping Equipment: ____________________
Disposal of Discharged Water : ____________________
Comments: ____________________

By J. Cruse + K. Crowle

GEI Consultants

GROUNDWATER SAMPLING RECORD

Page No. 1 of 1

Proj. Name WPC GMP
Date 9-16-15
Weather Overcast

Proj. No.
Task No.

Well ID SVMW West-1B
SWL (ft btoc) 113.04 ft @ 12:17
T.D. (ft btoc) 560

Water Column (ft) 446.96 x 0.16 gpf = 71.5 gal x 3 = 214.5 gal

Casing Volumes: 2" = 0.16 gpf 4" = 0.65 gpf

	Time	Purge Vol. Gallons	Flow Rate GPM	~~DTW~~ Turbidity ~~ft btoc~~ NTU	Temp. °C	pH	Cond. uhmos/cm	Comments
Start	12:40		3.0 initial	1.0	21.9	7.25	523	DO = 12.6 mg/L
stop out of gas	12:45	15	~~2.4~~	~~1.5~~	~~22.3~~	~~7.18~~	~~519~~	~~10.7~~
Start	12:47		2.4	1.5	22.3	7.18	519	10.7
	13:04	~43	2.5	1.5	23.2	7.13	524	9.4
	13:24	~93	2.5	1.2	23.6	7.17	513	10.6
	13:44	~143	2.5	1.0	23.3	7.12	509	12.7
	14:04	~193	2.5	1.3	23.2	7.15	509	15.5
	14:14	~218	2.5	1.0	23.5	7.16	508	16.9

Sample Inventory

Time	Volume	Bottle Type	Quantity	Filtration	Preservation	Appearance	Comments
14:20	35 ml	Voas	3	—	HCl	Clear	SVMW-West-1B
14:20	1 qt	Plastic	1	—	—	Clear	↓
14:20	250 ml	Plastic	1	—	—	Clear	
14:20	250 ml	Plastic	1	0.45 micron	HNO_3	Clear	

SWL: SVMW West-1A: 121.71 ft @ 12:20 on 9/16/15
Methods: SVMW West-1C: 112.88 ft @ 12:22 on 9/16/15
Decon Equipment:
Pumping Equipment:
Disposal of Discharged Water :
Comments:

By J. Crose / K. Coyle

GEI Consultants

GROUNDWATER SAMPLING RECORD

Page No. ____ of ____

Proj. Name WPCGMP

Proj. No. ________

Date 9/17/15

Task No. ________

Weather partly cloudy

Well ID SVMW west-1C

SWL (ft btoc) 112.80

T.D. (ft btoc) 750

Water Column (ft) 637 x 0.16 gpf = 102 x 3 = 306

Casing Volumes: 2" = 0.16 gpf 4" = 0.65 gpf

Time	Purge Vol. Gallons	Flow Rate GPM	DTW ft btoc	Temp. °C	pH	Cond. uhmos/cm	Comments DO mg/L	Turb (NTU)
808		2.2					START	
810				21.1	8.23	659	0.7	0.99
816	16.8	2.0		22.0	7.75	644	0.57	0.86
823		2.2		22.4	7.70	651	0.48	0.86
829	45.4	2.3						
841	75	2.5		23.0	7.71	640	0.33	1.03
856	111	2.4		23.2	7.81	638	0.43	0.96
9:20	168	2.4		24.0	7.81	646	0.54	1.25
9:40	216	2.4		23.9	7.78	641	1.50	1.15
10:00	264	2.4		24.0	7.77	643	1.02	1.20
Sampled 10:20	312	2.4		24.0	7.79	644	1.31	1.18

Sample Inventory

Time	Volume	Bottle Type	Quantity	Filtration	Preservation	Appearance	Comments
10:20	1 quart	plastic	1	–	–	clear	–
10:20	250 ml	plastic	1	–	HN4+buffer	clear	–
10:20	500 ml	plastic	1	.45micron	HNO3	clear	–
10:20	35 ml	glass	3	–	HCl	clear	no bubbles

Methods

Decon Equipment: ____________________

Pumping Equipment: ____________________

Disposal of Discharged Water : ____________________

Comments: ____________________

By K. Croyle

GEI Consultants

GROUNDWATER SAMPLING RECORD

Page No. _____ of _____

Proj. Name WPCGMP
Date 9/24/15
Weather Clear

Proj. No. ________
Task No. ________

Well ID Tinker

SWL (ft btoc) 78.83

T.D. (ft btoc) 177

Water Column (ft) 98.17 x .65 gpf = 63.81 x 3 = 191.43

Casing Volumes: 2" = 0.16 gpf 4" = 0.65 gpf

Time	Purge Vol. Gallons	Flow Rate GPM	DTW ft btoc	Temp. °C	pH	Cond. uhmos/cm	DO Comments	Tu
7:30		4					Start pump	
7:40				21.3	7.95	497.3	11.46	3.2
7:45		4						
7:50				21.3	6.94	492.4	7.75	0.2
8:00		4		21.4	6.88	488.9	8.57	0.1
8:10	160			21.4	6.75	490.8	9.50	0.1
8:30				22.0	6.75	492.8	8.98	0.1
8:35		4						
8:40				22.0	6.78	494.4	8.76	0.1
8:45							Collected	Samples

Sample Inventory

Time	Volume	Bottle Type	Quantity	Filtration	Preservation	Appearance	Comments

Methods
Decon Equipment: ______________________
Pumping Equipment: ______________________
Disposal of Discharged Water : ______________________
Comments: ______________________

By______________________

GEI Consultants

GROUNDWATER SAMPLING RECORD

Page No. 1 of ____

Proj. Name WPC GMP
Date 9/23/15
Weather clear

Proj. No. ________
Task No. ________

Well ID W77A
SWL (ft btoc) 116.85
T.D. (ft btoc) 516

Water Column (ft) 399
x .16
gpf = 64
x 3 = 191.6

Casing Volumes: 2" = 0.16 gpf 4" = 0.65 gpf

Time	Purge Vol. Gallons	Flow Rate GPM	DTW ft btoc	Temp. °C	pH	Cond. uhmos/cm	DO Comments	T
9:10		3					Start	Pumping
9:15				21.4	7.63	480.8	2.56	2.6
9:20	30	3						
9:30				22.5	7.46	481.0	2.17	2.8
9:40	90	3						
9:45				22.8	7.43	470.0	2.88	2.1
9:55				23.0	7.38	475.3	2.69	1.5
10:10	180	3		22.9	7.32	472.1	3.17	0.6
10:30				22.9	7.34	473.4	2.57	1.4
10:50	240	3		23.0	7.36	473.2	2.64	1.0
11:10				23.2	7.40	474.3	2.91	2.9
11:25							Collect	Samples

Sample Inventory

Time	Volume	Bottle Type	Quantity	Filtration	Preservation	Appearance	Comments

Methods
Decon Equipment: ____________________
Pumping Equipment: ____________________
Disposal of Discharged Water : ____________________
Comments: ____________________

ICF

By D. Vent

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GROUNDWATER SAMPLING RECORD

Page No. ____ of ____

Proj. Name WPCGMP
Date 9/23/15
Weather Sunny

Proj. No.________
Task No.________

Well ID W77-B
SWL (ft btoc) 116.28
T.D. (ft btoc) 604

Water Column (ft) 487.72 x .16 gpf = 78 x 3 = 234

Casing Volumes: 2" = 0.16 gpf 4" = 0.65 gpf

Time	Purge Vol. Gallons	Flow Rate GPM	DTW ft btoc	Temp. °C	pH	Cond. uhmos/cm	DO	Comments Turb
9:30		3					Start	pumping
9:10				22.1	7.63	1196	1.17	0.6
9:20	60	3						
9:25				22.6	7.23	1413	1.03	3.8
9:30	90	3						
9:40				23.0	7.25	1452	1.41	2.8
9:50	150	3		23.0	7.17	1460	1.58	3.4
10:20	240	3		23.7	7.12	1426	1.52	3.2
10:40				23.6	7.15	1434	1.83	3.4
11:00				23.6	7.12	1430	1.93	5.0
11:20		3		23.7	7.16	1432	2.09	6.4
11:30							Collect	Sample

Sample Inventory

Time	Volume	Bottle Type	Quantity	Filtration	Preservation	Appearance	Comments

Methods
Decon Equipment: ____________________
Pumping Equipment: ____________________
Disposal of Discharged Water : ____________________
Comments: ____________________

By D.Vrant

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GROUNDWATER SAMPLING RECORD

Page No. 1 of 1

Proj. Name WPCGMP
Date 9/29/15
Weather Clear

Proj. No.
Task No.

Well ID WPMW-13
SWL (ft btoc) 119.33
T.D. (ft btoc) 480

Water Column (ft) 360.67 x .16 gpf = 57.7 x 3 = 173.12

Casing Volumes: 2" = 0.16 gpf 4" = 0.65 gpf

Time	Purge Vol. Gallons	Flow Rate GPM	DTW ft btoc	Temp. °C	pH	Cond. uhmos/cm	DO Comments T
7:45		3					Start pumping
7:50				20.6	8.05	441.9	2.67 | 1.8
8:00				21.2	7.56	444.3	2.02 | 0.9
8:05		3					
8:10				21.7	7.40	445.7	1.83 | 1.2
8:15	90	3					
8:20				21.7	7.29	440.7	2.04
8:25	120	3					
8:30				22.4	7.13	440.0	4.13 | 0.9
8:40	150	3		21.9	7.23	440.5	3.20 | 0.4
8:50	180			21.9	7.26	440.2	3.52 | 0.6
8:55							Collect Sample

Sample Inventory

Time	Volume	Bottle Type	Quantity	Filtration	Preservation	Appearance	Comments

Methods
Decon Equipment:
Pumping Equipment:
Disposal of Discharged Water :
Comments:

By D. Vincent

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GROUNDWATER SAMPLING RECORD

Page No. 1 of 1

Proj. Name WPCGMP

Proj. No.

Date 9/29/15

Task No.

Weather Clear

Well ID WPMW 1-C

SWL (ft btoc) 117.8

T.D. (ft btoc) 545

Water Column (ft) 427.2

x .16 gpf = 68.35 x 3 = 205.05

Casing Volumes: 2" = 0.16 gpf 4" = 0.65 gpf

Time	Purge Vol. Gallons	Flow Rate GPM	DTW ft btoc	Temp. °C	pH	Cond. uhmos/cm	DO Comments T
9:40		4					Start pumping
9:45				21.0	7.29	551	2.08 1.1
9:50	40	4		21.9	7.21	553	1.92 0.6
10:00				22.3	7.23	553	1.90 0.5
10:10				22.5	7.24	555	1.87 0.4
10:20	160			22.6	7.22	556	2.19 0.6
10:30		4		22.7	7.22	558	2.23 0.7
10:40	240			22.8	7.25	555	1.47 0.4
10:45							collect Sample

Sample Inventory

Time	Volume	Bottle Type	Quantity	Filtration	Preservation	Appearance	Comments

Methods

Decon Equipment:

Pumping Equipment:

Disposal of Discharged Water :

Comments:

By D. Unt

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GROUNDWATER SAMPLING RECORD

Page No. 1 of ____

Proj. Name WPCGMP
Date 9/29/15
Weather Partly Cloudy

Proj. No.________
Task No.________

Well ID WPMW 2A
SWL (ft btoc) 86.99
T.D. (ft btoc) 230

Water Column (ft) 143 x .16 gpf = 23 x 3 = 69

Casing Volumes: 2" = 0.16 gpf 4" = 0.65 gpf

as soon as pumping started it smelled like a landfill, but no wind (landfill nearby w/in 1 mile)

	Time	Purge Vol.	Flow Rate	DTW	Temp.	pH	Cond.	Comments	
		Gallons	GPM	ft btoc	°C		uhmos/cm	DO(mg/L)	Turb(NTU)
Start	8:32	0	4		21.1	8.36	377	6.70	1.73
	8:36	24	4		21.3	7.76	364	6.50	7.87
	8:44	48	4		21.3	7.64	363	6.40	7.94
	9:00	122	4		21.4	7.25	365	6.70	1.66
	9:10		4		21.4	7.24	365	6.60	0.84
	9:15		4		21.3	7.23	364	6.51	0.76
	9:20		4		21.3	7.24	365	6.40	0.77
	9:24	sampled							

Sample Inventory

Time	Volume	Bottle Type	Quantity	Filtration	Preservation	Appearance	Comments
9:24	1L	plastic	1	-	-	clear	
"	500ml	"	1	45 micron	nitric	↓	
"	250ml	"	1	-	NH4+BAF		
"	39ml	glass	3	-	HCl		no bubbles

Methods
Decon Equipment: ______________________
Pumping Equipment: ______________________
Disposal of Discharged Water : ______________________
Comments: ______________________

By K Croyle

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GROUNDWATER SAMPLING RECORD

Page No. 1 of ___

Proj. Name WPCGMP
Date 9/24/15
Weather partly Cloudy

Proj. No.________
Task No.________

Well ID WPMW2B
SWL (ft btoc) 87.58
T.D. (ft btoc) 425

Water Column (ft) 337 x .16 gpf = 54 x 3 = 162

Casing Volumes: 2" = 0.16 gpf 4" = 0.65 gpf

Time	Purge Vol. Gallons	Flow Rate GPM	DTW ft btoc	Temp. °C	pH	Cond. uhmos/cm	Comments DO(mg/L)	Turb(NTU)
9:55	0	4		21.6	7.19	450	9.30	0.91
10:01	24	4		21.7	7.24	453	5.41	0.74
10:06	44	4		21.9	7.23	453	5.74	0.30
10:16	84	4		22.6	7.20	456	4.4	0.48
10:29	136	4		22.5	7.25	454	6.7	0.27
10:40	180	4		22.4	7.23	452	5.0	0.20
10:50	220	4		22.5	7.20	453	4.9	0.21
10:55	Sampled							

Sample Inventory

Time	Volume	Bottle Type	Quantity	Filtration	Preservation	Appearance	Comments
10:55	1L	plastic	1	-	-	clear	
"	500 ml	"	1	.45 micron filter		↓	
"	250 ml	"	1	-	NH4+Buff		
"	35 ml	glass	3	-	HCL		no bubbles

Methods
Decon Equipment: ________
Pumping Equipment: ________
Disposal of Discharged Water : ________
Comments: ________

By K Gyle

GEI Consultants

GROUNDWATER SAMPLING RECORD

Page No. 1 of ____

Proj. Name WPCGMP
Date 9/24/15
Weather Partly Cloudy

Proj. No. ________
Task No. ________

Well ID WPMW 3A
SWL (ft btoc) 5.22
T.D. (ft btoc) 53

Water Column (ft) 48 x .16 gpf = 7.5 x 3 = 23

Casing Volumes: 2" = 0.16 gpf 4" = 0.65 gpf

	Time	Purge Vol.	Flow Rate	DTW	Temp.	pH	Cond.	Comments	
		Gallons	GPM	ft btoc	°C		uhmos/cm	DO (mg/L)	Turb (NTU)
Start	12:04	0	4		21.5	7.05	3202	3.9	3.65
	12:09	20	4		21.1	7.36	3170	3.7	2.72
	12:14	40	4		21.0	7.48	3138	2.9	1.04
	12:24	80	4		20.8	7.49	3114	2.9	0.76
	12:34	120	4		21.0	7.49	3101	3.5	0.57
	12:44	160	4		21.0	7.51	3099	3.0	0.52
	12:50	Samples collected							

Sample Inventory

Time	Volume	Bottle Type	Quantity	Filtration	Preservation	Appearance	Comments
12:50	1L	plastic	1	-	-	Clear	
"	500ml	"	1	.45 micron	nitric		
"	250ml	"	1	-	NH4-Buff		
"	35ml	glass	3	-	HCL		no bubbles

Methods
Decon Equipment: ____________________
Pumping Equipment: ____________________
Disposal of Discharged Water : ____________________
Comments: ____________________

By K. Croyle

GEI Consultants

GROUNDWATER SAMPLING RECORD

Page No. 1 of ____

Proj. Name WPCGMP
Proj. No.________
Date 8/24/15
Task No.________
Weather partly cloudy

Well ID WPMW3B
SWL (ft btoc) 2.27
T.D. (ft btoc) 140

Water Column (ft) 138 x .16 gpf = 22 x 3 = 66

Casing Volumes: 2" = 0.16 gpf 4" = 0.65 gpf

Time	Purge Vol. Gallons	Flow Rate GPM	DTW ft btoc	Temp. °C	pH	Cond. uhmos/cm	Comments	
							DO (mg/L)	Turb (NTU)
Start 1326	0	4		22.1	7.51	5342	4.3	0.39
1331	20	4		22.4	7.64	5356	3.6	0.52
1336	40	4		22.4	7.74	5335	3.3	0.19
1346	80	4		22.5	7.79	5371	2.50	1.50
1356	120	4		22.5	7.80	5334	2.8	0.37
1407		4		22.3	7.78	5326	4.40	0.12
1411		4		22.5	7.86	5328	3.1	0.10
1416		4		22.5	7.79	5325	2.9	0.10
1420	Sampled							

Sample Inventory

Time	Volume	Bottle Type	Quantity	Filtration	Preservation	Appearance	Comments
1420	1L	plastic	1	–	–	clear	—
"	500ml	"	1	.45 micron	Nitric	↓	
"	250ml	"	1	–	NH4+Buff	↓	
"	35ml	glass	3	–	HCL		no bubbles

Methods
Decon Equipment: ____________________
Pumping Equipment: ____________________
Disposal of Discharged Water : ____________________
Comments: ____________________

By K. Craig

GEI Consultants

GROUNDWATER SAMPLING RECORD

Page No. ____ of ____

Proj. Name WPCGMP
Date 9/22/15
Weather Sunny

Proj. No.________
Task No.________

Well ID WPMW-4A
SWL (ft btoc) 104.7
T.D. (ft btoc) 145
Water Column (ft) 40
x .16
gpf = 6.49
x 3 = 19.35

Casing Volumes: 2" = 0.16 gpf 4" = 0.65 gpf

Time	Purge Vol. Gallons	Flow Rate GPM	DTW ft btoc	Temp. °C	pH	Cond. uhmos/cm	DO Comments	Turb
14:30		4					Start	[illegible]
				23.6	7.26	263.0	9.15	4.3
14:40	40	4		23.1	6.90	262.8	7.20	4.3
14:50				23.3	6.93	261.6	8.37	4.3
15:00	120	4						
15:05				23.0	7.01	261.7	9.31	0.9
15:15				22.8	6.94	259.3	8.20	0.8
15:20		4		22.7	6.99	259.4	8.80	0.6

Sample Inventory

Time	Volume	Bottle Type	Quantity	Filtration	Preservation	Appearance	Comments

Methods
Decon Equipment: ____________________
Pumping Equipment: ____________________
Disposal of Discharged Water : ____________________
Comments: ____________________

By____________________

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GROUNDWATER SAMPLING RECORD

Page No. 1 of ____

Proj. Name WPCGMP
Date 9/22/15
Weather clear

Proj. No. ____
Task No. ____

Well ID WPMW 4B
SWL (ft btoc) 67.05
T.D. (ft btoc) 295

Water Column (ft) 228 x .16 gpf = 36.5 x 3 = 110

Casing Volumes: 2" = 0.16 gpf 4" = 0.65 gpf

Time	Purge Vol.	Flow Rate	DTW	Temp.	pH	Cond.	Comments	
	Gallons	GPM	ft btoc	°C		uhmos/cm	DO(mg/L)	Turb(NTU)
14:16	0	3.3		23.4	7.97	414	4.6	1.51
14:24	26	3.8		23.2	7.51	408	3.8	1.77
14:30	49	3.9		24.1	7.41	403	2.8	2.15
14:40	88	3.9		24.5	7.43	385	3.1	1.73
14:50		3.9		23.6	7.34	380	3.1	1.59
14:55		3.9		23.2	7.36	379	3.7	0.71
15:00	166	3.9		23.1	7.31	376	3.6	0.80
15:05		3.9		23.1	7.29	376	3.4	0.77
Sampled at		15:07						

Sample Inventory

Time	Volume	Bottle Type	Quantity	Filtration	Preservation	Appearance	Comments
15:07	1 L	plastic	1	-	-	clear	
"	500 ml	"	1	0.45 micron	nitric		
"	250 ml	"	1	-	NH4+ Buff		
"	35 ml	glass	3	-	HCl		no bubbles

Methods
Decon Equipment: ____
Pumping Equipment: ____
Disposal of Discharged Water : ____
Comments: ____

By ____

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GROUNDWATER SAMPLING RECORD

Page No. 1 of 1

Proj. Name WPCGMP
Date 9/22/15
Weather Sunny

Proj. No.
Task No.

Well ID WPCMW-5B
welerga

SWL (ft btoc) 120.74

T.D. (ft btoc) 650

TD
-SWL
WC

Water Column (ft) 529

casing: 2.5 inch
x ____ gpf = 135 gal x 3 = 405 gal

Casing Volumes: 2" = 0.16 gpf 4" = 0.65 gpf
2½ =

$\left(\frac{\frac{1.25}{2}}{12}\right)^2 \pi (529) = 18 \text{ ft}^3 = 135 \text{ gal}$

Time	Purge Vol. Gallons	Flow Rate GPM	DTW ft btoc	Temp. °C	pH	Cond. uhmos/cm	DO Comments Turb
8:45		2					Start pumping
8:55	20	2		19.4	8.03	1420	1.33 5.6
9:00		2		19.8	7.99	1408	.53 5.3
9:15				21.2	7.96	1406	.43 4.0
9:25	80	2					
9:45	water turned a grey more solid form of liquid was unable to pump. Retested SWL 122.50. let pump rest to cool. Pump was unable to operate. Ran in reverse, then forward still no intake. Spoke w/ D. Fairman & J. Crose on how to fix. Decided to clean pump took some time, pump was clogged. Cleaned & was advised to move on to next well. This well needs to be cleaned.						

Sample Inventory

Time	Volume	Bottle Type	Quantity	Filtration	Preservation	Appearance	Comments
12:40	WPCMW-5A			103.60	Dry		

Methods
Decon Equipment:
Pumping Equipment:
Disposal of Discharged Water :
Comments:

By D. Vincent

GEI Consultants

Sonny Hannon Cal am
916 869 1071

GROUNDWATER SAMPLING RECORD

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Proj. Name WPCGMP
Proj. No.
Date 11/2/15
Task No.
Weather Clear

Well ID WPCMW 5B
SWL (ft btoc) 118.76 3
T.D. (ft btoc) 650

Water Column (ft) 531.24 water level
x .034
gpf = 18.1 ft³ ×7.48 gal/ft³ gal
x 3 = 406 gal

Casing Volumes: 2" = 0.16 gpf 4" = 0.65 gpf

$2.5in = \pi(\frac{1.25}{12})^2 = .034$ ft = 135

pumped from 145 ft

e.depth → trouble shooting

keep line from kink

Time	Purge Vol.	Flow Rate	DTW	Temp.	pH	Cond.	Comments	
	Gallons	GPM	ft btoc	°C		uhmos/cm	DO mg/l	Turb (NTU)
9:20	—	3	—	17.9	8.57	1503	3.1	3.88
9:30	30	3		17.9	8.41	1473	4.5	2.68
1026-1032	18	3						
10:55	48	3		18.8	7.77	1309	1.7	3.39
11:05	78	3		20.2	7.77	1520	0.5	2.88
11:15	108	3		20.7	7.76	1540	0.9	3.26
11:26	138	3		21.1	7.76	1527	1.8	5.04
11:35	168	3		21.5	7.74	1515	1.1	156
11:50	213	3		21.6	7.76	1535	0.5	51.8
12:05	258	3		21.7	7.75	1532	0.8	12.1
12:20	303	3		22.0	7.72	1529	1.0	7.67
12:35	348	3		21.7	7.72	1510	0.6	9.72
12:45	378	3		21.6	7.71	1539	0.4	9.74
12:50	393	3		21.6	7.72	1541	.5	9.72
12:55	408	3		21.5	7.70	1533	.6	10.11

Sparkley fines in water

Sample Inventory

Time	Volume	Bottle Type	Quantity	Filtration	Preservation	Appearance	Comments
1300	1L	plastic	1	—	—		—
〃	250ml	〃	1	—	NH₄SO₄	Clear	—
〃	250ml	〃	1	.45micron	nitric		—
〃	35ml	glass	3	—	HCL		Some bubbles

Methods Smells like Sulfer
Decon Equipment:
Pumping Equipment:
Disposal of Discharged Water :
Comments:

By KCrayle

909 484 7607

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GROUNDWATER SAMPLING RECORD

Page No. ____ of ____

Proj. Name WPCGMP
Date 9/29/15
Weather Sunny

Proj. No. ________
Task No. ________

Well ID WPCMW-6A
SWL (ft btoc) 1.77
T.D. (ft btoc) 65

Water Column (ft) 63.23 x .16 gpf = 10.11 x 3 = 30.35

Casing Volumes: 2" = 0.16 gpf 4" = 0.65 gpf

make rate high

Time	Purge Vol. Gallons	Flow Rate GPM	DTW ft btoc	Temp. °C	pH	Cond. uhmos/cm	DO Comments Tn
12:30		2.43					Start Purge
12:35				21.9	8.08	3824	2.26 51.8
12:40		4					
12:45				22.6	8.24	3789	2.11 77.1
13:00		2.4					
13:10		4		22.0	8.23	3780	2.16 39.8
13:30				22.6	8.24	3766	1.69 99.97
13:40		3		22.2	8.22	3766	1.05 72.1
13:50				23.4	8.26	3774	1.55 39.0
14:00				22.7	8.23	3768	1.62 31.7
14:10							Collect Samples

Sample Inventory

Time	Volume	Bottle Type	Quantity	Filtration	Preservation	Appearance	Comments

Methods
Decon Equipment: ____________________
Pumping Equipment: ____________________
Disposal of Discharged Water : ____________________
Comments: ____________________

By D. Vincent

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GROUNDWATER SAMPLING RECORD

Page No. 1 of ____

Proj. Name WPC GMP
Proj. No.________
Date 9/22/15
Task No.________
Weather Sunny

Well ID WPC MW-7A
SWL (ft btoc) 24.58
T.D. (ft btoc) 45

Water Column (ft) 20.42 x .16 gpf = 3.2 x 3 = 9.6

Casing Volumes: 2" = 0.16 gpf 4" = 0.65 gpf

	Time	Purge Vol.	Flow Rate	DTW	Temp.	pH	Cond.	Comments	
		Gallons	GPM	ft btoc	°C		uhmos/cm	DO(mg/L)	Turb (NTU)
Start	8:51	0	3		18.3	8.61	306	4.4	109
	8:56	15	3		18.2	7.42	287	4.7	20
	9:02	33	3		18.3	6.90	287	3.4	6.9
	9:07	48	3		18.4	6.71	288	3.5	5.4
	9:12	63	3		18.2	6.63	286	5.0	3.4
	9:18	81	3		18.4	6.67	288	4.0	3.0
Sample Collected	9:30	117	3		18.4	6.65	289	4.0	2.9

Sample Inventory

Time	Volume	Bottle Type	Quantity	Filtration	Preservation	Appearance	Comments
9:30	1 L	Plastic	1	–	–	clear	
"	500ml	"	1	.45 micron	nitric	↓	
"	250ml	"	1	–	NH4 + Buff		
"	35 ml	glass	3	–	HCl		no bubbles

Methods
Decon Equipment: ____________
Pumping Equipment: ____________
Disposal of Discharged Water : ____________
Comments: ____________

By K. Croyle

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GROUNDWATER SAMPLING RECORD

Page No. 1 of ____

Proj. Name WPCGMP
Date 9/22/15
Weather clear

Proj. No. ________
Task No. ________

Well ID WPCMW 8A
SWL (ft btoc) 31.91
T.D. (ft btoc) 50

Water Column (ft) 18 x .16 gpf = 3 x 3 = 9

Casing Volumes: 2" = 0.16 gpf 4" = 0.65 gpf

Time	Purge Vol. Gallons	Flow Rate GPM	DTW ft btoc	Temp. °C	pH	Cond. uhmos/cm	Comments	
							DO(mg/L)	Turb(NTU)
11:23	0	3.5	-	21.9	7.20	480	4.8	343
11:28	17	3.5		19.8	7.19	467	4.5	449
11:33	35	3.5		19.4	6.98	447	4.1	164
11:38	52	3.5		19.3	6.95	422	4.0	8.05
11:44	74	3.5		19.4	6.90	414	4.0	4.6
11:49		3.5		19.3	6.89	409	4.1	3.9
11:53	samples collected							

Sample Inventory

Time	Volume	Bottle Type	Quantity	Filtration	Preservation	Appearance	Comments
11:53	1L	plastic	1	-	-	clear	
"	500ml	↓	1	.45 micron	Nitric	↓	
"	250ml	↓	1	-	NH_4 + Buff	↓	
"	35ml	glass	3	-	HCl	↓	no bubbles

Methods
Decon Equipment: ____
Pumping Equipment: ____
Disposal of Discharged Water : ____
Comments: ____

By K Coyle

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GROUNDWATER SAMPLING RECORD

Page No. 1 of 1

Proj. Name WPCGMP
Date 9/20/15
Weather Overcast

Proj. No.
Task No.

Well ID WRCMW 10A
SWL (ft btoc) 20.75
T.D. (ft btoc) 36

Water Column (ft) 15.25 x .16 gpf = 2.44 x 3 = 7.32

Casing Volumes: 2" = 0.16 gpf 4" = 0.65 gpf

Time	Purge Vol. Gallons	Flow Rate GPM	DTW ft btoc	Temp. °C	pH	Cond. uhmos/cm	DO Comments	T
11:30							Bailing	
11:46				17.9	6.83	276.3	4.57	3.57
12:05				17.4	6.96	278.3	4.96	4.9
12:25				17.5	6.96	278.8	3.98	3.9
12:35				17.5	6.69	779.2	3.21	4.0
12:40							Collect Smpl	

Sample Inventory

Time	Volume	Bottle Type	Quantity	Filtration	Preservation	Appearance	Comments

Methods
Decon Equipment:
Pumping Equipment:
Disposal of Discharged Water :
Comments:

By K. Coyle

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GROUNDWATER SAMPLING RECORD

Page No. 1 of 1

Proj. Name WPCGMP

Date 9/20/15

Weather Overcast

Proj. No.

Task No.

Well ID WPCMW 10B

SWL (ft btoc) 22.25

T.D. (ft btoc) 100

Water Column (ft) 77.75 x .16 gpf = 12.44 x 3 = 37.32

Casing Volumes: 2" = 0.16 gpf 4" = 0.65 gpf

Time	Purge Vol. Gallons	Flow Rate GPM	DTW ft btoc	Temp. °C	pH	Cond. uhmos/cm	Comments
13:20		2					Start purge
13:25				18.3	6.80	289.5	1.96 | 1.6
13:30	30						
13:35				18.2	6.79	285.4	2.61
13:40							Collect Samples

Sample Inventory

Time	Volume	Bottle Type	Quantity	Filtration	Preservation	Appearance	Comments

Methods

Decon Equipment:

Pumping Equipment:

Disposal of Discharged Water :

Comments:

By K. Croyle

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GROUNDWATER SAMPLING RECORD

Page No. 1 of 1

Proj. Name WPCGMP
Date 9/30/15
Weather Overcast

Proj. No.________
Task No.________

Well ID WPCMW 10C
SWL (ft btoc) 24.33
T.D. (ft btoc) 260

Water Column (ft) 235.67 x .16 gpf = 37.70 x 3 = 113.12

Casing Volumes: 2" = 0.16 gpf 4" = 0.65 gpf

Time	Purge Vol. Gallons	Flow Rate GPM	DTW ft btoc	Temp. °C	pH	Cond. uhmos/cm	DO Comments	T
11:00		4					Start	Pumping
11:05				17.9	7.92	311.2	2.85	6.7
11:10	40	4		18.9	6.97	312.1	3.10	6.7
11:15		3						
11:25	30			19.3	6.86	308.6	5.74	7.4
11:45		1		21.8	6.87	305.8	11.74	4.3
12:00	50			19.9	6.76	304.7	4.16	1.9
12:50				19.9	6.86	300.2	2.51	1.9
14:18	80			19.0	6.81	298.1	3.77	2.0
14:40	100	1		19.3	6.48	298.3	1.60	3.5
14:54	114			18.6	6.66	298.9	8.23	5.1
15:00	120						Collect	Sample

Sample Inventory

Time	Volume	Bottle Type	Quantity	Filtration	Preservation	Appearance	Comments

Methods
Decon Equipment: __________
Pumping Equipment: __________
Disposal of Discharged Water : __________
Comments: __________

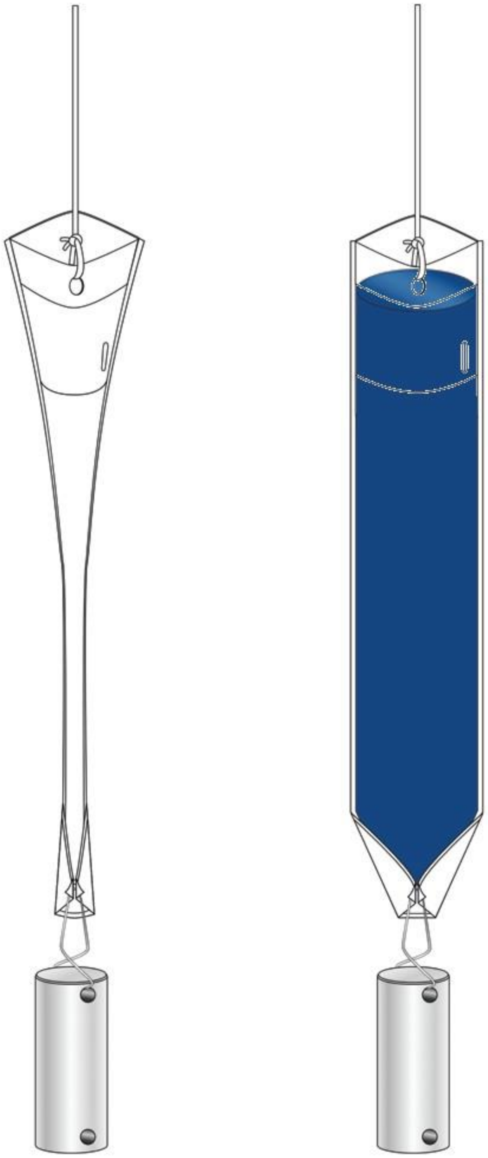
By K. Croyle

Appendix C: Hydrasleeve Standard Operating Procedure

HYDRASleeve™

Simple by Design US Patent No. 6,481,300; No. 6,837,120 others pending

Standard Operating Procedure:
Sampling Groundwater with a HydraSleeve



This guide should be used in addition to field manuals and instructions appropriate to the chosen sampling device (i.e., HydraSleeve, SpeedBag or Super/Skinny Sleeve).

Find the appropriate field manual and instructions on the HydraSleeve website at http://www.hydrasleeve.com.

For more information about the HydraSleeve, or if you have questions, contact:

GeoInsight, P.O. Box 1266, Mesilla Park, NM 88047
800-996-2225, info@hydrasleeve.com.

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Introduction

The HydraSleeve is classified as a no-purge (passive) grab sampling device, meaning that it is used to collect groundwater samples directly from the screened interval of a well without having to purge the well prior to sample collection. When it is used as described in this Standard Operating Procedure (SOP), the HydraSleeve causes no drawdown in the well (until the sample is withdrawn from the water column) and only minimal disturbance of the water column, because it has a very thin cross section and it displaces very little water (<100 ml) during deployment in the well. The HydraSleeve collects a sample from within the screen only. It excludes water from any other part of the water column in the well through the use of a self-sealing check valve at the top of the sampler. It is a single-use (disposable) sampler that is not intended for reuse, so there are no decontamination requirements for the sampler itself.

The use of no-purge sampling as a means of collecting representative groundwater samples depends on the natural movement of groundwater (under ambient hydraulic head) from the formation adjacent to the well screen through the screen. Robin and Gillham (1987) demonstrated the existence of a dynamic equilibrium between the water in a formation and the water in a well screen installed in that formation, which results in formation-quality water being available in the well screen for sampling at all times. No-purge sampling devices like the HydraSleeve collect this formation-quality water as the sample, under undisturbed (non-pumping) natural flow conditions. Samples collected in this manner generally provide more conservative (i.e., higher concentration) values than samples collected using well-volume purging, and values equivalent to samples collected using low-flow purging and sampling (Parsons, 2005).

Applications of the HydraSleeve

The HydraSleeve can be used to collect representative samples of groundwater for all analytes (volatile organic compounds [VOCs], semi-volatile organic compounds [SVOCs], common metals, trace metals, major cations and anions, dissolved gases, total dissolved solids, radionuclides, pesticides, PCBs, explosive compounds, and all other analytical parameters). Designs are available to collect samples from wells from 1” inside diameter and larger. The HydraSleeve can collect samples from wells of any yield, but it is especially well-suited to collecting samples from low-yield wells, where other sampling methods can’t be used reliably because their use results in dewatering of the well screen and alteration of sample chemistry (McAlary and Barker, 1987).

The HydraSleeve can collect samples from wells of any depth, and it can be used for single-event sampling or long-term groundwater monitoring programs. Because of its thin cross section and flexible construction, it can be used in narrow, constricted or damaged wells where rigid sampling devices may not fit. Using multiple HydraSleeves deployed in series along a single suspension line or tether, it is also possible to conduct in-well vertical profiling in wells in which contaminant concentrations are thought to be stratified.

As with all groundwater sampling devices, HydraSleeves should not be used to collect groundwater samples from wells in which separate (non-aqueous) phase hydrocarbons (i.e., gasoline, diesel fuel or jet fuel) are present because of the possibility of incorporating some of the separate-phase hydrocarbon into the sample.

Description of the HydraSleeve

The basic HydraSleeve (Figure 1) consists of the following components*:

- A suspension line or tether (A.), attached to the spring clip or directly to the top of the sleeve to deploy the device into and recover the device from the well. Tethers with depth indicators marked in 1-foot intervals are available from the manufacturer.
- A long, flexible, 4-mil thick lay-flat polyethylene sample sleeve (C.) sealed at the bottom (this is the sample chamber), which comes in different sizes, as discussed below with a self-sealing reed-type flexible polyethylene check valve built into the top of the sleeve (B.) to prevent water from entering or exiting the sampler except during sample acquisition.
- A reusable stainless-steel weight with clip (D.), which is attached to the bottom of the sleeve to carry it down the well to its intended depth in the water column. Bottom weights available from the manufacturer are 0.75" OD and are available in a variety of sizes. An optional top weight may be attached to the top of the HydraSleeve to carry it to depth and to compress it at the bottom of the well (not shown in Figure 1);
- A discharge tube that is used to puncture the HydraSleeve after it is recovered from the well so the sample can be decanted into sample bottles (not shown).
- Just above the self-sealing check valve at the top of the sleeve are two holes which provide attachment points for the spring clip and/or suspension line or tether. At the bottom of the sample sleeve are two holes which provide attachment points for the weight clip and weight.

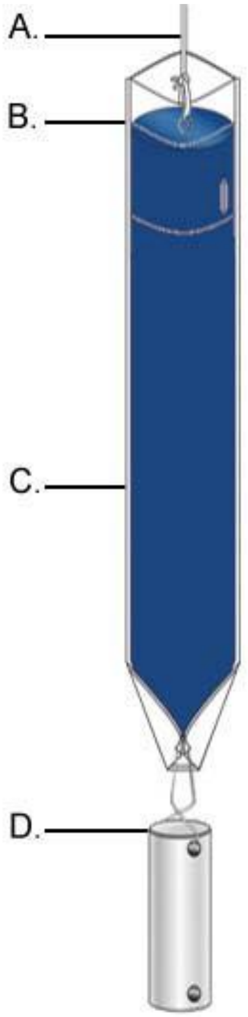


Figure 1. HydraSleeve components.

∗ Other configurations such as top weighted assemblies and Super/SkinnySleeves are available.

> **Note:** The sample sleeve and the discharge tube are designed for one-time use and are disposable. The spring clip, weight and weight clip may be reused after thorough cleaning. Suspension cord is generally disposed after one use although, if it is dedicated to the well, it may be reused at the discretion of the sampling personnel.

Selecting the HydraSleeve Size to Meet Site-Specific Sampling Objectives

It is important to understand that each HydraSleeve is able to collect a finite volume of sample because, after the HydraSleeve is deployed, you only get one chance to collect an undisturbed sample. Thus, the volume of sample required to meet your site-specific sampling and analytical requirements will dictate the size of HydraSleeve you need to meet these requirements.

Table 1. Dimensions and Volumes of HydraSleeve Models.

Diameter	Volume	Length	Lay-Flat Width	Filled Dia.
2-Inch HydraSleeves				
Standard 600 mls HydraSleeve	~600mls	30”	2.5”	1.4”
Standard 1-liter HydraSleeve	~1 Liter	38”	3”	1.9”
Super/SkinnySleeve 1-liter	~1 Liter	38”	2.5"	1.5”*
Super/SkinnySleeve 1.5-liter	~1.5 Liters	52”	2.5”	1.5”*
Super/SkinnySleeve 2-liter	~2 Liters	66"	2.5"	1.5"*
4-Inch HydraSleeves				
Standard 2.5 liter	~2 Liters	38”	4”	2.7”

* outside diameter on the Heavy Duty Universal Super/SkinnySleeves is 1.5" however when using with schedule 40 hardware the O.D. of the assembly will be 1.9"

It's also recommended that you size the diameter of the HydraSleeve according to the diameter of the well (i.e. use 2-inch HydraSleeves in 2-inch wells). Using smaller sleeves in larger diameter wells (i.e. 2-inch HydraSleeves in 4-inch wells) will result in a longer fill rate and will require special retrieval instructions (explained later).

The volume of sample collected by the HydraSleeve varies with the diameter and length of the HydraSleeve. Dimensions and volumes of available HydraSleeve models are detailed in Table 1.

HydraSleeves can be custom-fabricated by the manufacturer in varying diameters and lengths to meet specific volume requirements. HydraSleeves can also be deployed in series (i.e., multiple HydraSleeves attached to one tether) to collect additional sample to meet specific volume requirements, as described below.

If you have questions regarding the availability of sufficient volume of sample to satisfy laboratory requirements for analysis, it is recommended that you contact the laboratory to discuss the minimum volumes needed for each suite of analytes. Laboratories often require only 10% to 25% of the volume they specify to complete analysis for specific suites of analytes, so they can often work with much smaller sample volumes that can easily be supplied using a HydraSleeve.

HydraSleeve Deployment

Information Required Before Deploying a HydraSleeve

Before installing a HydraSleeve in any well, you will need to know the following:

- The inside diameter of the well
- The length of the well screen
- The water level in the well
- The position of the well screen in the well
- The total depth of the well

The inside diameter of the well is used to determine the appropriate HydraSleeve diameter for use in the well. The other information is used to determine the proper placement of the HydraSleeve in the well to collect a representative sample from the screen (see HydraSleeve Placement, below), and to determine the appropriate length of tether to attach to the HydraSleeve to deploy it at the appropriate position in the well.

Most of this information (with the exception of the water level) should be available from the well log; if not, it will have to be collected by some other means. The inside diameter of the well can be measured at the top of the well casing, and the total depth of the well can be measured by sounding the bottom of the well with a weighted tape. The position and length of the well screen may have to be determined using a down-hole camera if a well log is not available. The water level in the well can be measured using any commonly available water-level gauge.

HydraSleeve Placement

The HydraSleeve is designed to collect a sample directly from the well screen. It fills by pulling it up through the screen a distance equivalent to the length of the sampler when correctly sized to the well diameter. This upward motion causes the top check valve to open, which allows the device to fill. To optimize sample recovery, it is recommended that the HydraSleeve be placed in the well so that the bottom weight rests on the bottom of the well and the top of the HydraSleeve is as close to the bottom of the well screen as possible. This should allow the sampler to fill before the top of the device reaches the top of the screen as it is pulled up through the water column, and ensure that only water from the screen is collected as the sample. In short-screen wells, or wells with a short water column, it may be necessary to use a top-weight on the HydraSleeve to compress it in the bottom of the well so that, when it is recovered, it has room to fill before it reaches the top of the screen.

Example

2” ID PVC well, 50’ total depth, 10’ screen at the bottom of the well, with water level above the screen (the entire screen contains water).

Correct Placement (figure 2): Using a standard HydraSleeve for a 2” well (2.5” flat width/1.5” filled OD x 30” long, 600 ml volume), deploy the sampler so the weight (a 5 oz., 2.5” long weight with a 2” long clip) rests at the bottom of the well. The top of the sleeve is thus set at ~34” above the bottom of the well. When the sampler is recovered, it will be pulled upward approximately 30” before it is filled; therefore, it is full (and the top check valve closes) at approximately 64” (5.3 feet) above the bottom of the well, which is well before the sampler reaches the top of the screen. In this example, only water from the screen is collected as a sample.

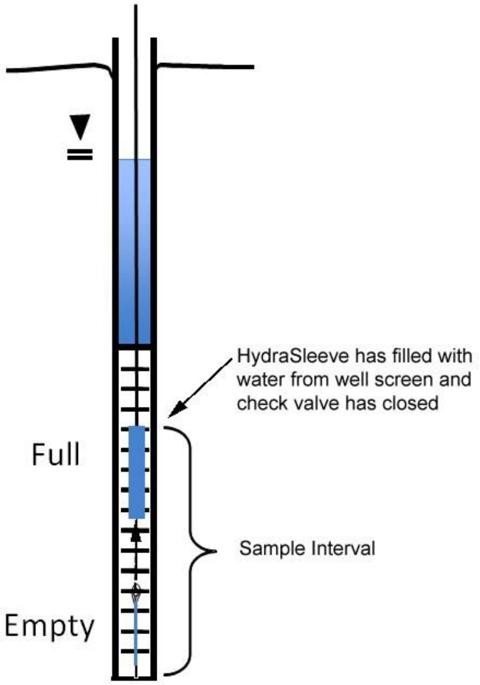


Figure 2. Correct Placement of HydraSleeve.

Incorrect Placement (figure 3): If the well screen in this example was only 5' long, and the HydraSleeve was placed as above, it would not fill before the top of the device reached the top of the well screen, so the sample would include water from above the screen, which may not have the same chemistry.

The solution? Deploy the HydraSleeve with a top weight, so that it is collapsed to within 6"of the bottom of the well. When the HydraSleeve is recovered, it will fill within 36" (3 feet) from the bottom of the well, or 2-feet before the sampler reaches the top of the screen, so it collects only water from the screen as the sample.

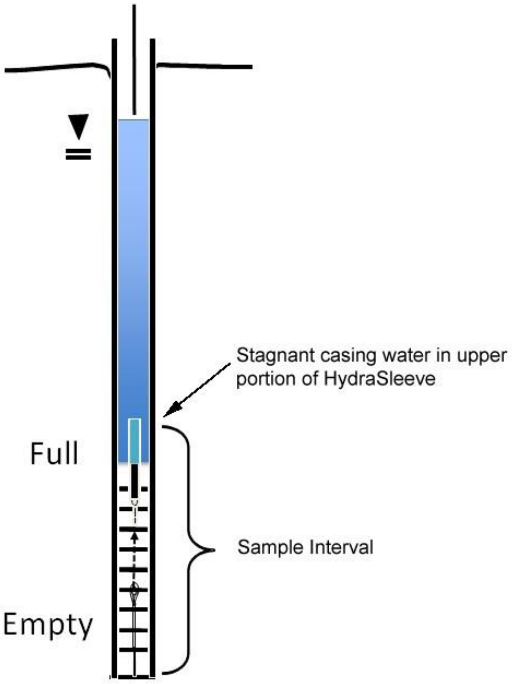


Figure 3. Incorrect placement of HydraSleeve.

This example illustrates one of many types of HydraSleeve placements. More complex placements are discussed in a later section.

NOTE: Using smaller diameter HydraSleeves (2-inch) in larger diameter wells (4-inch) causes a slower fill rate. Special retrieval methods are necessary if this is your set up (shown later in this document).

Procedures for Sampling with the HydraSleeve

Collecting a groundwater sample with a HydraSleeve is usually a simple one-person operation.

Note: Before deploying the HydraSleeve in the well, collect the depth-to-water measurement that you will use to determine the preferred position of the HydraSleeve in the well. This measurement may also be used with measurements from other wells to create a groundwater contour map. If necessary, also measure the depth to the bottom of the well to verify actual well depth to confirm your decision on placement of the HydraSleeve in the water column.

Measure the correct amount of tether needed to suspend the HydraSleeve in the well so that the weight will rest on the bottom of the well (or at your preferred position in the well). Make sure to account for the need to leave a few feet of tether at the top of the well to allow recovery of the sleeve.

Note: Always wear sterile gloves when handling and discharging the HydraSleeve.

I. Assembling the Basic HydraSleeve*

1. Remove the HydraSleeve from its packaging, unfold it, and hold it by its top.
2. Crimp the top of the HydraSleeve by folding the hard polyethylene reinforcing strips at the holes.
3. Attach the spring clip to the holes to ensure that the top will remain open until the sampler is retrieved.
4. Attach the tether to the spring clip by tying a knot in the tether.

Note: Alternatively, if spring clips are not being utilized, attach the tether to one (NOT both) of the holes at the top of the Hydrasleeve by tying a knot in the tether.

5. Fold the flaps with the two holes at the bottom of the HydraSleeve together to align the holes and slide the weight clip through the holes.
6. Attach a weight to the bottom of the weight clip to ensure that the HydraSleeve will descend to the bottom of the well.

*See Super/SkinnySleeve assembly manual and HydraSleeve Field Manual for other assembly instructions.

II. Deploying the HydraSleeve

1. Using the tether, carefully lower the HydraSleeve to the bottom of the well, or to your preferred depth in the water column

   During installation, hydrostatic pressure in the water column will keep the self-sealing check valve at the top of the HydraSleeve closed, and ensure that it retains its flat, empty profile for an indefinite period prior to recovery.

Note: Make sure that it is not pulled upward at any time during its descent. If the HydraSleeve is pulled upward at a rate greater than 0.5'/second at any time prior to recovery, the top check valve will open and water will enter the HydraSleeve prematurely.

2. Secure the tether at the top of the well by placing the well cap on the top of the well casing and over the tether.

Note: Alternatively, you can tie the tether to a hook on the bottom of the well cap (you will need to leave a few inches of slack in the line to avoid pulling the sampler up as the cap is removed at the next sampling event).

III. Equilibrating the Well

The equilibration time is the time it takes for conditions in the water column (primarily flow dynamics and contaminant distribution) to restabilize after vertical mixing occurs (caused by installation of a sampling device in the well).

- Situation: The HydraSleeve is deployed for the first time or for only one time in a well

  The basic HydraSleeve is very thin in cross section and displaces very little water (<100 ml) during deployment so, unlike most other sampling devices, it does not disturb the water column to the point at which long equilibration times are necessary to ensure recovery of a representative sample.

  In some cases, like when useing the SpeedBags, the HydraSleeve can be recovered immediately (with no equilibration time) or within a few hours. In regulatory jurisdictions that impose specific requirements for equilibration times prior to recovery of no-purge sampling devices, these requirements should be followed.

  NOTE: If using top weights additional equilibration time is needed to allow the top weight time to compress the HydraSleeve into the bottom of the well.

- Situation: The HydraSleeve is being deployed for recovery during a future sampling event.

  In periodic (i.e., quarterly, semi-annual, or annual) sampling programs, the sampler for the current sampling event can be recovered and a new sampler (for the next sampling event) deployed immediately thereafter, so the new sampler remains in the well until the next sampling event.

Thus, a long equilibration time is ensured and, at the next sampling event, the sampler can be recovered immediately. This means that separate mobilizations, to deploy and then to recover the sampler, are not required. HydraSleeves can be left in a well for an indefinite period of time without concern.

IV. HydraSleeve Recovery and Sample Collection

1. Hold on to the tether while removing the well cap.
2. Secure the tether at the top of the well while maintaining tension on the tether (but without pulling the tether upwards)
3. Measure the water level in the well.
4. Use one of the following 3 retrieval methods. In all 3 scenarios, when the HydraSleeve is full, the top check valve will close. You should begin to feel the weight of the HydraSleeve on the tether and it will begin to displace water. The closed check valve prevents loss of sample and entry of water from zones above the well screen as the HydraSleeve is recovered.

   a. In one smooth motion, pull the tether up 30”-60" (the length of the sampler) at a rate of about 1foot per second (or faster). The motion will open the top check valve and allow the HydraSleeve to fill (it should fill in about 1:1 ratio or the length of the HydraSleeve). This is analogous to coring the water column in the well from the bottom up.

   b. There are times it is recommended that the HydraSleeve be oscillated in the screen zone to ensure it is full before leaving the screen area. Pull up 1-3 feet, let the sleeve assembly drop back down and repeat 3-5 times before pulling the sleeve to the surface. The collection zone will be the oscillation zone. ***When in doubt use this retrieval method.***

   c. SpeedBags require check valve activation before retrieving to the surface. This means pull hard 1-2 feet once; let the assembly drop back down and then pull up to the surface.

5. Continue pulling the tether upward until the HydraSleeve is at the top of the well.
6. Discard the small volume of water trapped in the Hydrasleeve above the check valve by pinching it off at the top under the stiffeners (above the check valve).

v. Sample Collection

NOTE: Sample collection should be done immediately after the HydraSleeve has been brought to the surface to preserve sample integrity.

Be sure you have discarded the water sitting above the check valve – see step #6 above.

1. Remove the discharge tube from its sleeve.
2. Hold the HydraSleeve at the check valve
3. Puncture the HydraSleeve at least 3-4 inches below the reinforcement strips with the pointed end of the discharge tube. NOTE: For some contaminants (VOC's/sinkers) the best location for discharge is the middle to bottom of the sampler. This would be representative of the deeper portion of the well screen.
4. Discharge water from the HydraSleeve into your sample containers. Control the discharge from the HydraSleeve by either raising the bottom of the sleeve, by squeezing it like a tube of toothpaste, or both.
5. Continue filling sample containers until all are full.

Measurement of Field Indicator Parameters

Field indicator parameter measurement is generally done during well purging and sampling to confirm when parameters are stable and sampling can begin. Because no-purge sampling does not require purging, field indicator parameter measurement is not necessary for the purpose of confirming when purging is complete.

If field indicator parameter measurement is required to meet a specific non-purging regulatory requirement, it can be done by taking measurements from water within a HydraSleeve that is not used for collecting a sample to submit for laboratory analysis (i.e., a second HydraSleeve installed in conjunction with the primary sample collection HydraSleeve [see Multiple Sampler Deployment below]).

Alternate Deployment Strategies

Deployment in Wells with Limited Water Columns

For wells in which only a limited water column needs to be sampled, the HydraSleeve can be deployed with an optional top weight in addition to a bottom weight. The top weight will collapse the HydraSleeve to a very short (approximately 6” to 24”) length, depending on the length and volume of the sampler. This allows the HydraSleeve to fill in a water column only 3’ to 10’ in height (again) depending on the sampler size.

Multiple Sampler Deployment

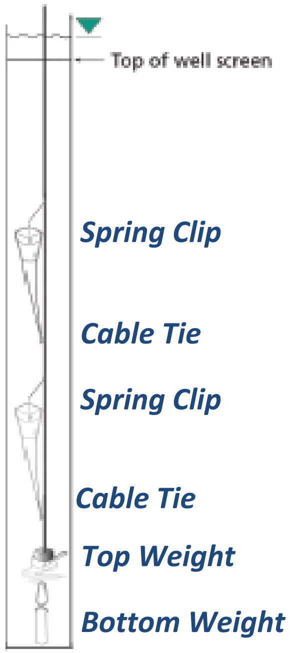
Multiple sampler deployment in a single well screen can accomplish two purposes:

1. It can collect additional sample volume to satisfy site or laboratory-specific sample volume requirements.
2. It can accommodate the need for collecting field indicator parameter measurements.
3. It can be used to collect samples from multiple intervals in the screen to allow identification of possible contaminant stratification.

It is possible to use up to 3 standard 30" HydraSleeves deployed in series along a single tether to collect samples from a 10' long well screen without collecting water from the interval above the screen. The samplers must be attached to the tether at both the top and bottom of the sleeve, and the bottom assembly will need a top weight. Attach the tether at the top with a spring clip (available from the manufacturer and is provided with top weights). Attach each subsequent sleeve to the tether at the bottom using a cable tie (or optional sand weight clip). The samplers must be attached as seen in figure 4.

- The first will have a bottom weight attached to the bottom and a top weight attached to the top of the sleeve. Connect the tether to the top Spring Clip.
- The second attached immediately above the first, using a spring clip at the top and cable tie (or sand weight clip at the bottom.
- The third (attached the same as the second) immediately above the second

Figure 4



If there is enough saturated well screen multiple sleeves can be used in tandem without a top weight on the bottom as shown here.

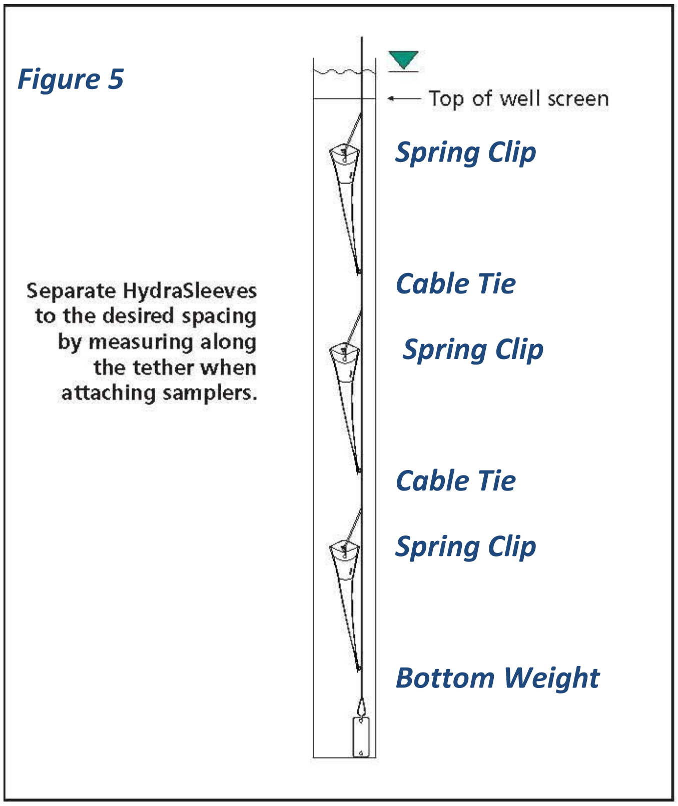


Figure 5. Multiple HydraSleeve deployment

If there is a need for only 2 samplers, they can be installed as follows. The first sampler can be attached to the tether as described above, a second attached to the bottom of the first using your desired length of tether between the two and the weight attached to the bottom of the second sampler (figure 6). This method can only be used with 2 samplers; 3 or more HydraSleeves in tandem need to be attached as described above.

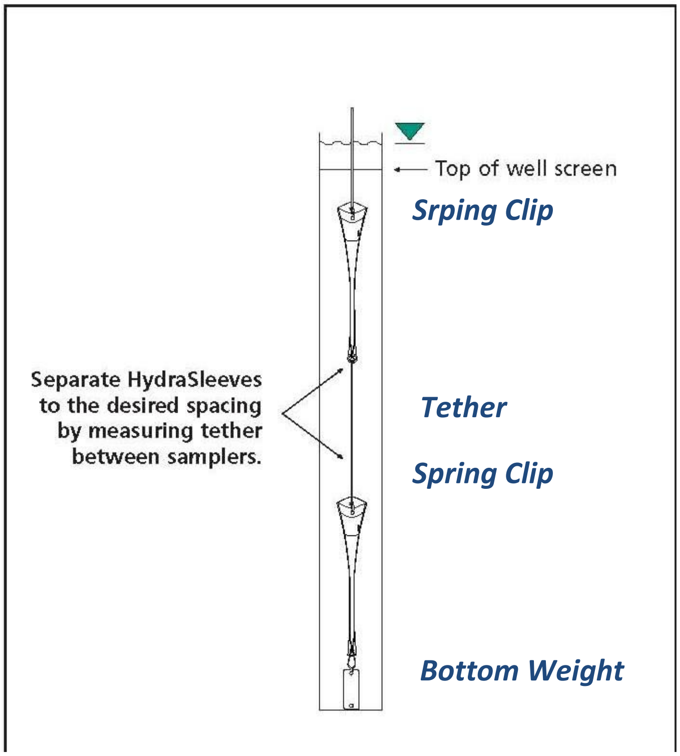


Figure 6. Alternative method for deploying multiple HydraSleeves.

In either case, when attaching multiple HydraSleeves in series, more weight will be required to hold the samplers in place in the well than would be required with a single sampler. Recovery of multiple samplers and collection of samples is done in the same manner as for single sampler deployments.

Post-Sampling Activities

The recovered HydraSleeve and the sample discharge tubing should be disposed as per the solid waste management plan for the site. To prepare for the next sampling event, a new HydraSleeve can be deployed in the well (as described previously) and left in the well until the next sampling event, at which time it can be recovered.

The weight and weight clip can be reused on this sampler after they have been thoroughly cleaned as per the site equipment decontamination plan. The tether may be dedicated to the well and reused or discarded at the discretion of sampling personnel.

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Appendix D: Water Quality Analytical Results

Table D-1 Water Quality Analytical Results

		General Mineral Analyses																
MCLs		**6.5-8.5**	**900**		**500***								**2**	**250***	**250***	**45**		**6**
WELL NAME	**DATE SAMPLED**	**pH**	**EC (uS/cm)**	**EC (dS/m)**	**TDS (mg/L)**	**Alk (mg/L as CaCO3)**	**Hardness (mg/L)**	**Bicarb (mg/L)**	**Ca (mg/L)**	**Mg (mg/L)**	**Na (mg/L)**	**K (mg/L)**	**F mg/L**	**Cl (mg/L)**	**SO4 (mg/L)**	**NO3 as NO3 (mg/L)**	**Nitrite as N (mg/L)**	**Perchlorate (ug/L)**
Alluvium - Dry Creek																		
WPCMW 9A (Lincoln Estates)	No Sample Collected																	
WPMW-10A	09/30/2015 12:40:00	7.1	260	0.26	190	120	100	120	23	11	17	<0.91	<0.042	9.8	8.8	<0.44	<0.020	<1.9
Riverbank																		
MW 1-4	09/29/2015 14:02:00	7.8	420	0.42	280	160	160	160	33	20	24	<0.91	0.19	23	15	8.7	<0.020	<1.9
MW 1-4	12/27/2004		460	0.46	310				32	25	43		0.22	16	45	19		
Turlock Lake/Laguna																		
CVMW-1A	09/17/2015 15:00:00	7.7	280	0.28	210	86	84	86	16	11	23	<0.91	0.21	26	4.7	4.6	<0.020	<1.9
CVMW-1A	5/10/2011		340	0.34	NA				17	9.6	38		0.28	29	9.8	2.5		
WPMW-1A	No Sample Collected																	
WPMW-1A	4/13/2011		540	0.54	NA				92	66	180		0.64	36	81	3.3		
WPMW-2A	09/24/2015 09:24:00	7.6	340	0.34	260	77	91	77	19	10	34	<0.91	0.20	54	7.8	4.7	<0.039	<1.9
WPMW-2A	6/9/2011		350	0.35	NA				22	11	38		0.25	52	8.4	4.8		
SVMW West-1A	09/16/2015 15:08:00	7.8	200	0.2	180	78	44	78	7.7	6.0	27	<0.91	0.38	13	1.3	7.4	<0.020	<1.9
SVMW West-1A	5/18/2011		230	0.23	NA				8.7	5.1	34		0.47	11	7.3	<1		
SVMW East-2A	09/15/2015 14:40:00	7.7	200	0.2	180	70	58	70	12	7.0	18	<0.91	0.26	14	2.5	5.3	<0.020	<1.9
SVMW East-2A	6/9/2011		240	0.24	NA				11	4.9	40		0.42	15	8	4.7		
MW 1-3	09/28/2015 13:15:00	7.6	210	0.21	190	89	71	89	13	9.1	19	<0.91	0.16	8.0	3.4	6.1	<0.020	<1.9
MW 1-3	12/27/2004		310	0.31	220				14	9.9	33		0.23	14	12	5.7		
MW 1-2	09/28/2015 12:15:00	7.6	250	0.25	210	88	65	88	13	8.0	29	<0.91	0.21	17	10	2.6	<0.020	<1.9
MW 1-2	12/22/2004		300	0.3	250				12	7.8	49		0.27	23	18	2.5		
MW 2-3	09/28/2015 12:57:00	7.5	380	0.38	250	160	170	160	33	22	15	<0.91	0.15	14	15	6.3	<0.020	<1.9
MW 2-3	1/3/2005		340	0.34	220				299	19	19		0.21	13	13	6.7		
MW 3-2	09/29/2015 15:00:00	7.5	770	0.77	**510**	190	300	190	53	41	37	<0.91	0.22	65	36	**82**	<0.020	<1.9
MW 3-2	1/3/2005		520	0.52	380				24	19	62		0.33	52	44	23		
WPCMW 5A (Walegra)	No Sample Collected																	
WPMW-10B	09/30/2015 13:40:00	7.1	260	0.26	190	120	110	120	24	11	17	<0.91	<0.042	9.6	8.8	<0.44	<0.020	<1.9
F14MWA (279 ft)	09/21/2015 11:25:00	7.8	420	0.42	300	87	90	87	20	9.8	54	2.1	0.18	74	10	3.0	<0.020	<1.9
Tinker	09/24/2015 08:45:00	7.2	460	0.46	410	64	160	64	39	15	28	2.1	0.13	83	22	18	<0.020	<1.9
Reason Farms	11/12/2015 14:50:00	8.0	550	0.55	360	190	210	190	42	26	33	<0.91	0.15	26	11	39	<0.020	<1.9
Cemetary Well	4/13/2016 9:10	7.37	334	0.334	268	96	108	96	27.3	9.7	353[1]	<0.037	1.74	41	44.5	7.5	NA	<0.01
Swainson Well	4/21/2016 8:10	7.37	426	0.426	288	114	198	114	63.1	9.89	159	0.49	0.33	38.1	50.1	8.5	NA	<0.01
Transition Zone																		
CVMW-1B	09/17/2015 14:30:00	7.7	410	0.41	280	87	89	87	20	9.3	45	2.1	0.18	66	6.2	1.2	<0.020	<1.9
CVMW-1B	5/10/2011		440	0.44	NA				19	9	51		0.23	65	7.1	<1		
SVMW West-1B	09/16/2015 14:20:00	7.6	500	0.5	340	70	110	70	22	12	54	2.6	0.20	97	15	3.9	<0.020	<1.9
SVMW West-1B	5/18/2011		510	0.51	NA				20	12	57		0.27	91	15	4.1		
F14MWB (387 ft)	09/21/2015 12:55:00	7.8	410		290	84	93	84	21	10	51	<0.91	0.17	70	9.7	3.1	<0.020	<1.9
F14MWD (445 ft)	09/21/2015 13:15:00	7.8	290		230	81	89	81	18	11	26	<0.91	0.23	37	5.8	4.4	<0.020	<1.9
Upper Mehrten																		
WPMW-1B	09/29/2015 08:55:00	7.7	430	0.43	140	81	85	81	18	9.7	53	2.1	0.20	76	9.1	2.5	<0.020	<1.9
WPMW-1B	4/13/2011		420	0.42	NA				18	9.5	53		0.27	72	11	3		
SVMW East-2B	9/16/2015 11:00	7.5	600	0.6	410	68	130	68	28	14	66	2.3	0.23	120	21	5.5	<0.020	<1.9
SVMW East-2B	6/9/2011		600	0.6	NA				27	14	65		0.26	110	21	4.7		
WPMW-10C	09/30/2015 15:00:00	7.1	280	0.28	200	130	110	130	26	11	17	<0.91	<0.042	9.7	8.9	<0.44	<0.020	<1.9
W77-A	09/23/2015 11:25:00	7.6	460	0.46	310	87	90	87	20	9.9	59	2.3	0.15	84	7.1	2.0	<0.020	<1.9
F14MWC (508 ft)	09/21/2015 11:03:00	7.8	540	0.54	360	98	120	98	27	12	65	2.3	0.16	110	6.9	<0.44	<0.020	<1.9
Sheridan Old Well 2	3/28/2016 9:30	7.49	725	0.725	350	66	63	66	16	5.6	61.8	1	NA	66	38	5.4	NA	<0.01

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		General Mineral Analyses																
MCLs		**6.5-8.5**	**900**		**500***								**2**	**250***	**250***	**45**		**6**
WELL NAME	**DATE SAMPLED**	**pH**	**EC (uS/cm)**	**EC (dS/m)**	**TDS (mg/L)**	**Alk (mg/L as CaCO3)**	**Hardness (mg/L)**	**Bicarb (mg/L)**	**Ca (mg/L)**	**Mg (mg/L)**	**Na (mg/L)**	**K (mg/L)**	**F mg/L**	**Cl (mg/L)**	**SO4 (mg/L)**	**NO3 as NO3 (mg/L)**	**Nitrite as N (mg/L)**	**Perchlorate (ug/L)**
Lower Mehrten																		
WPMW-1C	09/29/2015 10:45:00	7.7	540	0.54	350	100	110	100	24	13	64	2.4	0.18	100	5.0	<0.44	<0.020	<1.9
WPMW-1C	4/13/2011		520	0.52	NA				23	12	63		0.24	100	6.7	<1		
WPMW-2B	09/24/2015 10:55:00	7.6	430	0.43	310	84	92	84	20	10	53	<0.91	<0.083	70	9.6	3.5	<0.039	<1.9
WPMW-2B	6/9/2011		430	0.43	NA				22	11	56		0.26	70	11	3.5		
WPMW-3A	09/24/2015 12:50:00	7.6	**2900**	**2.9**	**2000**	97	610	97	170	43	370	4.3	0.20	**740**	210	<0.44	<0.020	<1.9
WPMW-3A	4/13/2011		**3200**	**3.2**	NA				190	49	370		0.26	**880**	200	<10		
WPMW-4A	09/22/2015 15:23:00	7.4	250	0.25	220	110	91	110	23	8.2	17	<0.91	0.15	7.1	9.1	15	<0.020	<1.9
WPMW-4A	4/26/2011		270	0.27	NA				23	7.5	24		0.2	8.2	9.1	15		
CVMW-1C	09/17/2015 16:40:00	8.2	380	0.38	270	100	82	100	21	7.1	49	<0.91	0.18	60	<0.40	<0.50	<0.020	<1.9
CVMW-1C	5/10/2011		370	0.37	NA				18	6.4	46		0.21	51		<1		
SVMW West-1C	09/17/2015 10:20:00	8.0	630	0.63	370	120	110	120	28	9.7	81	2.5	0.17	120	1.1	<0.44	<0.020	<1.9
SVMW West-1C	5/18/2011		610	0.61	NA				27	10	74		0.24	110	3.3	<1		
SVMW East-2C	09/15/2015 12:40:00	7.8	**1900**	**1.9**	**1400**	87	350	87	110	21	240	4.1	0.17	**530**	<0.40	<0.44	<0.020	<1.9
SVMW East-2C	6/9/2011		**1900**	**1.9**	NA				93	19	230		0.23	**470**	10	<5		
MW 1-1	09/28/2015 11:10:00	7.8	480	0.48	330	120	91	120	22	8.4	66	2.2	0.18	58	35	<0.44	<0.020	<1.9
MW 1-1	12/28/2004		800	0.8	**590**				39	10	120		0.27	55	200	ND		
MW 3-1	09/29/2015 12:50:00	7.5	660	0.66	420	120	140	120	26	19	80	<0.91	0.22	77	75	23	<0.020	<1.9
MW 3-1	1/3/2005		410	0.41	300				9.9	7	70		0.34	43	22	19		
MW 2-2	09/28/2015 11:47:00	7.7	240	0.24	190	98	77	98	16	8.8	23	<0.91	0.21	10	7.7	2.8	<0.020	<1.9
MW 2-2	12/29/2004		330	0.33	210				17	9.2	37		0.27	16	12	2.1		
MW 4	09/28/2015 14:33:00	7.4	**2500**	**2.5**	**1400**	410	670	410	120	90	330	<1.8	<0.21	**570**	91	<2.2	<0.098	<1.9
MW 4	12/21/2004		**1890**	**1.89**	**1100**				50	36	310		NA	**380**	96	NA		
MW 5-2	09/29/2015 10:30:00	7.5	470	0.47	310	170	200	170	37	25	22	<0.91	0.12	30	30	3.8	<0.020	<1.9
MW-5-2	1/4/2005		550	0.55	380				31	20	59		0.18	44	41	11		
SLC-1, 170 ft	10/19/2015 13:00:00	9.4	170	0.17	120	41	38	12	12	2.0	20	2.5	0.14	15	17	<0.44	0.68	<1.9
SLC-1	9/20/2003		310	0.31	NA				47	13	33		<1	15	14	13		
WPMW-5B	11/12/2015 13:00:00	7.9	**1500**	**1.5**	**880**	110	180	110	57	8.3	230	3.1	0.22	**400**	<0.40	<0.44	<0.020	<1.9
WPMW-7A	09/22/2015 09:30:00	6.9	280	0.28	200	110	120	110	30	12	14	<0.91	<0.042	12	7.2	2.2	<0.020	<1.9
WPMW-8A	09/22/2015 11:53:00	7.2	390	0.39	270	160	170	160	43	14	18	<0.91	<0.042	14	13	13	<0.020	<1.9
WPMW-8B	09/22/2015 13:30:00	8.0	430	0.43	300	220	53	220	14	4.4	89	<0.91	1.8	6.7	8.3	<0.44	<0.020	<1.9
W77-B	09/23/2015 11:30:00	7.5	**1400**	**1.4**	**970**	110	320	110	72	33	140	4.4	0.14	**370**	<0.40	<0.44	<0.020	<1.9
DCMW1	10/15/2015 12:10:00	7.3	**930**	**0.93**	**630**	53	240	53	54	26	86	2.8	0.20	230	36	5.4	<0.020	<1.9
DCMW2	10/15/2015 13:45:00	7.2	**1100**	**1.1**	**740**	55	280	55	63	29	98	3.0	0.18	**270**	42	5.9	<0.020	<1.9
DCMW3	10/15/2015 15:20:00	7.5	250	0.25	210	42	33	42	7.2	3.7	38	<0.91	0.29	41	10	1.7	<0.020	<1.9
DCMW3	11/12/2015 17:00:00 (Retest)	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table D-1 Water Quality Analytical Results

		General Mineral Analyses																	
MCLs		**6.5-8.5**	**900**		**500***								**2**	**250***	**250***	**45**		**6**
WELL NAME	**DATE SAMPLED**	**pH**	**EC (uS/cm)**	**EC (dS/m)**	**TDS (mg/L)**	**Alk (mg/L as CaCO3)**	**Hardness (mg/L)**	**Bicarb (mg/L)**	**Ca (mg/L)**	**Mg (mg/L)**	**Na (mg/L)**	**K (mg/L)**	**F mg/L**	**Cl (mg/L)**	**SO4 (mg/L)**	**NO3 as NO3 (mg/L)**	**Nitrite as N (mg/L)**	**Perchlorate (ug/L)**
Ione																		
WPMW-3B	09/24/2015 14:20:00	7.7	**5000**	**5**	**2700**	52	480	52	170	10	890	5.9	0.64	**1400**	**280**	<0.44	<0.020	<3.8
WPMW-3B	4/13/2011		**4900**	**4.9**	NA				160	11	920		0.65	**1500**	**280**	<50		
WPMW-4B	09/22/2015 15:07:00	7.5	370	0.37	260	140	29	140	8.9	1.6	77	<0.91	0.41	23	15	<0.44	<0.020	<1.9
WPMW-4B	4/26/2011		380	0.38	NA				7.9	1.6	77		0.44	23	13	<1		
MW 2-1	09/28/2015 10:45:00	7.6	370	0.37	250	110	23	110	4.7	2.6	75	<0.91	0.88	38	17	<0.44	<0.020	<1.9
MW 2-1	12/29/2004		450	0.45	270				8.5	4.2	82		0.78	46	22	ND		
MW 5-1	09/29/2015 09:00:00	7.4	480	0.48	310	140	140	140	26	17	45	<0.91	0.15	47	18	17	<0.020	<1.9
MW 5-1	1/4/2005		480	0.48	340				19	12	65		0.23	50	22	12		
WPMW-6A	09/24/2015 14:10:00	8.3	**3500**	**3.5**	**1900**	250	36	250	9.9	2.7	760	5.8	**3.6**	**830**	200	<0.44	<0.020	<3.8
Multiple Aquifers																		
SLC-2, 225 ft	10/19/2015 13:45:00	7.8	860	0.86	**570**	97	200	97	49	18	100	2.4	0.20	180	42	10	<0.020	<1.9
SLC-2	9/20/2003		600	0.6	NA				32	8.5	68		<1	85	19	7.9		
SLC-3, 146 ft	10/19/2015 11:20:00	**8.8**	240	0.24	170	88	81	62	20	7.6	22	<0.91	0.14	22	6.5	<0.44	0.24	<1.9
SLC-3, 210 ft	10/19/2015 11:30:00	**8.8**	260	0.26	170	94	86	70	23	6.8	23	<0.91	0.14	22	6.5	<0.44	<0.020	<1.9
SLC-3, 247 ft	11/10/2015 14:23:00	8.4	290	0.29	170	95	75	95	20	6.3	31	<0.91	0.18	23	7.4	<0.44	<0.020	<1.9
SLC-3, 298 ft	10/19/2015 12:10:00	**8.5**	270	0.27	170	95	82	82	23	6.3	26	<0.91	0.16	24	6.6	<0.44	<0.020	<1.9
SLC-3	9/19/2003		340	0.34	NA				14	7.3	34		<1	19	9.4	6.3		
Airport Well 4 MW	10/19/2015 09:20:00	7.5	230	0.23	200	86	78	86	15	10	20	<0.91	0.32	15	7.1	5.5	<0.020	<1.9

[1] Laboratory reported Na concentration of 353 mg/l. This concentration is questionable due to reported TDS of 268 mg/l.

* Secondary MCL

No Sample Collected

Concentration above MCL

Concentration above 1/2 the MCL

Elevated Concentrataion, no MCL for constituent

Baseline Study Sample

Existing water quality sample

Placer County Spring 2016 Sample

NA: Not analyzed

ND: Not detected (no reporting limit was provided)

Table D-1 Water Quality Analytical Results

	Metals and Volatile Organic Compounds Analyses																						
MCLs		**1**	**10**	**50**	**1000**	**4**	**5**	**1300**	**300**	**2**	**50**	**100**	**15**	**6**	**50**	**2**		**5***	**50**	**10**			
WELL NAME	**Ag** mg/L	**Al** mg/L	**As** (ug/L)	**B** mg/L	**Ba** (ug/L)	**Be** (ug/L)	**Cd** (ug/L)	**Cu** (ug/L)	**Fe** (ug/L)	**Hg** (ug/L)	**Mn** (ug/L)	**Ni** (ug/L)	**Pb** (ug/L)	**Sb** (ug/L)	**Se** (ug/L)	**Tl** (ug/L)	**V** (ug/L)	**Zn** mg/L	**Total Cr** (ug/L)	**Cr 6+** (ug/L)	**SAR**	**Turbidity** Field (NTU)	**VOCs** Detection
Alluvium - Dry Creek																							
WPCMW 9A (Lincoln Estates)																					-		
WPMW-10A	<0.0045	0.28	<1.2	<0.046	48	<0.45	<0.45	<2.3	**450**	<0.091	35	<4.5	<2.3	<0.91	<0.91	<0.45	<4.5	<0.023	<4.5	<0.029	0.73	4.00	
Riverbank																							
MW 1-4	<0.0045	<0.023	<1.2	<0.046	78	<0.45	<0.45	9.1	<14	<0.091	15	<4.5	<2.3	<0.91	<0.91	<0.45	14	<0.023	<4.5	2.7	0.81	7.8	
MW 1-4			2.2	ND					ND		10								ND	NA	1.38		
Turlock Lake/Laguna																							
CVMW-1A	<0.0045	<0.023	4.4	0.15	75	<0.45	<0.45	<2.3	<14	<0.091	<4.5	<4.5	<2.3	<0.91	<0.91	<0.45	33	<0.023	10	8.4	1.08	0.65	
CVMW-1A			4.1	NA					<50		**220**								<5	3.4	1.83		
WPMW-1A																							
WPMW-1A			**48**	NA					**140000**		**3300**								17	2.7	3.50		
WPMW-2A	<0.0045	<0.023	2.9	0.18	70	<0.45	<0.45	<2.3	<14	<0.091	<4.5	<4.5	<2.3	<0.91	<0.91	<0.45	25	<0.023	<4.5	6.0	1.57	0.77	
WPMW-2A			4.4	NA					<50		**300**								<5	5.3	1.65		
SVMW West-1A	<0.0045	<0.023	6.0	<0.046	34	<0.45	<0.45	<2.3	<14	<0.091	<4.5	<4.5	<2.3	<0.91	<0.91	<0.45	37	<0.023	17	**15**	1.77	0.40	
SVMW West-1A			<2	NA					**310**		**140**								17	**13**	2.26		
SVMW East-2A	<0.0045	<0.023	2.4	<0.046	58	<0.45	<0.45	<2.3	71	<0.091	<4.5	<4.5	<2.3	<0.91	<0.91	<0.45	17	<0.023	11	5.3	1.02	38	Chloroform: 2.6 ug/l
SVMW East-2A			<2	NA					<50		**150**								<5	9	2.52		
MW 1-3	<0.0045	<0.023	<1.2	<0.046	35	<0.45	<0.45	<2.3	<14	<0.091	<4.5	<4.5	<2.3	<0.91	<0.91	<0.45	30	<0.023	<4.5	6.7	0.99	9.30	
MW 1-3			3	ND					ND		ND								ND	NA	1.65		
MW 1-2	<0.0045	<0.023	5.1	0.26	31	<0.45	<0.45	<2.3	<14	<0.091	<4.5	<4.5	<2.3	<0.91	<0.91	<0.45	27	<0.023	<4.5	4.3	1.56	0.60	
MW 1-2			3	0.23					ND		17								ND	NA	2.71		
MW 2-3	<0.0045	<0.023	<1.2	<0.046	33	<0.45	<0.45	<2.3	<14	<0.091	<4.5	<4.5	<2.3	<0.91	<0.91	<0.45	14	<0.023	<4.5	2.4	0.50	0.27	
MW 2-3			ND	ND					ND		14								ND	NA	0.29		
MW 3-2	<0.0045	<0.023	<1.2	<0.046	100	<0.45	<0.45	<2.3	<14	<0.091	<4.5	<4.5	<2.3	<0.91	<0.91	<0.45	19	<0.023	<4.5	1.0	0.93	1000	Chloroform: 0.63 ug/l
MW 3-2			2.1	0.11					ND		24								ND	NA	2.30		
WPCMW 5A (Walegra)																					-		
WPMW-10B	<0.0045	<0.023	<1.2	<0.046	52	<0.45	<0.45	<2.3	<14	<0.091	32	<4.5	<2.3	<0.91	<0.91	<0.45	<4.5	<0.023	<4.5	<0.029	0.72	1.6	
F14MWA (279 ft)	<0.0045	<0.023	3.7	0.40	77	<0.45	<0.45	<2.3	<14	<0.091	**110**	<4.5	<2.3	<0.91	<0.91	<0.45	21	<0.023	<4.5	1.7	2.47	1.8	
Tinker	<0.0045	<0.023	<1.2	0.24	81	<0.45	<0.45	<2.3	<14	<0.091	<4.5	<4.5	<2.3	<0.91	<0.91	<0.45	<4.5	<0.023	<4.5	1.2	0.97	0.10	
Reason Farms	<0.0045	<0.023	3.8	<0.046	130	<0.45	<0.45	<2.3	<14	<0.091	<4.5	<4.5	<2.3	<0.91	<0.91	<0.45	31	<0.023	<4.5	4.3	0.99	0.40	
Cemetary Well	<0.0037	0.0711	<1.67	0.228	28.2	0.28	<0.2	2.75	**1520**	<0.1	**134**	<0.28	<1.4	<1.88	<3.88	<3.21	<4.92	0.0492	3.3	<0.01	14.78	NA	
Swainson Well	<0.0037	0.166	<1.67	0.0738	102	<0.2	<0.2	6.4	**601**	<0.1	**1544**	25.8	<1.4	<1.88	<3.88	<3.21	<4.92	0.0063	<0.28	<0.01	4.91	NA	1,2,4-Trichlorobenzene 1.9 ug/l Toluene 0.3 ug/l
Transition Zone																							
CVMW-1B	<0.0045	<0.023	3.7	0.43	60	<0.45	<0.45	<2.3	<14	<0.091	33	<4.5	<2.3	<0.91	<0.91	<0.45	19	<0.023	<4.5	0.57	2.08	4.83	
CVMW-1B			<2	NA					<50		**250**								<5	0.25	2.41		
SVMW West-1B	<0.0045	<0.023	<1.2	0.58	110	<0.45	<0.45	<2.3	53	<0.091	**74**	<4.5	<2.3	<0.91	<0.91	<0.45	16	<0.023	10	1.2	2.30	1.00	
SVMW West-1B			<2	NA					<50		**210**								<5	1.6	2.49		
F14MWB (387 ft)	<0.0045	<0.023	2.6	0.41	100	<0.45	<0.45	<2.3	<14	<0.091	**150**	<4.5	<2.3	<0.91	<0.91	<0.45	23	<0.023	<4.5	2.1	2.29	0.33	
F14MWD (445 ft)	<0.0045	<0.023	3.5	0.16	65	<0.45	<0.45	<2.3	<14	<0.091	10.0	<4.5	<2.3	<0.91	<0.91	<0.45	28	<0.023	<4.5	7.2	1.19	0.20	
Upper Mehrten																							
WPMW-1B	<0.0045	<0.023	3.8	0.41	79	<0.45	<0.45	<2.3	<14	<0.091	**120**	<4.5	<2.3	<0.91	<0.91	<0.45	18	<0.023	<4.5	1.1	2.50	0.60	
WPMW-1B			<2	NA					150		**530**								<5	0.28	2.52		
SVMW East-2B	<0.0045	<0.023	<1.2	1.1	75	<0.45	<0.45	<2.3	47	<0.091	<4.5	<4.5	<2.3	<0.91	<0.91	<0.45	18	<0.023	<4.5	1.7	2.54	1.0	
SVMW East-2B			<2	NA					<50		**310**								<5	1.5	2.53		
WPMW-10C	<0.0045	<0.023	<1.2	<0.046	76	<0.45	<0.45	<2.3	<14	<0.091	**130**	<4.5	<2.3	<0.91	<0.91	<0.45	<4.5	<0.023	<4.5	<0.029	0.70	5.1	
W77-A	<0.0045	<0.023	2.8	0.43	41	<0.45	<0.45	<2.3	<14	<0.091	<4.5	<4.5	<2.3	<0.91	<0.91	<0.45	24	<0.023	<4.5	1.1	2.70	2.9	
F14MWC (508 ft)	<0.0045	<0.023	3.7	0.41	74	<0.45	<0.45	<2.3	51	<0.091	**270**	<4.5	<2.3	<0.91	<0.91	<0.45	<4.5	<0.023	<4.5	<0.029	2.62	0.52	
Sheridan Old Well 2	<0.0037	<0.0011	<1.67	0.469	18.3	<0.2	<0.2	2.8	**427**	<0.1	**71**	<0.28	<1.4	<1.88	<3.88	<3.21	<4.92	0.0015	2	1	3.39	NA	

Table D-1 Water Quality Analytical Results

	Metals and Volatile Organic Compounds Analyses																						
MCLs		**1**	**10**	**50**	**1000**	**4**	**5**	**1300**	**300**	**2**	**50**	**100**	**15**	**6**	**50**	**2**		**5***	**50**	**10**			
WELL NAME	**Ag** mg/L	**Al** mg/L	**As** (ug/L)	**B** mg/L	**Ba** (ug/L)	**Be** (ug/L)	**Cd** (ug/L)	**Cu** (ug/L)	**Fe** (ug/L)	**Hg** (ug/L)	**Mn** (ug/L)	**Ni** (ug/L)	**Pb** (ug/L)	**Sb** (ug/L)	**Se** (ug/L)	**Tl** (ug/L)	**V** (ug/L)	**Zn** mg/L	**Total Cr** (ug/L)	**Cr 6+** (ug/L)	**SAR**	**Turbidity** Field (NTU)	**VOCs** Detection
Lower Mehrten																							
WPMW-1C	<0.0045	<0.023	3.8	0.44	74	<0.45	<0.45	<2.3	48	<0.091	**200**	<4.5	<2.3	<0.91	<0.91	<0.45	<4.5	<0.023	<4.5	<0.029	2.61	0.40	
WPMW-1C			2.9	NA					<50		**380**								<5	<0.05	2.65		
WPMW-2B	<0.0045	<0.023	<1.2	0.48	89	<0.45	<0.45	<2.3	<14	<0.091	<4.5	<4.5	<2.3	<0.91	<0.91	<0.45	22	<0.023	<4.5	2.9	2.42	0.21	
WPMW-2B			6.2	NA					<50		**180**								<5	2.3	2.43		
WPMW-3A	<0.0045	<0.023	4.8	4.1	46	<0.45	<0.45	6.7	190	<0.091	**280**	<4.5	<2.3	<0.91	8.5	<0.45	<4.5	<0.023	<4.5	<0.029	6.57	0.52	
WPMW-3A			<2	NA					140		**360**								<5	<0.05	6.19		
WPMW-4A	<0.0045	<0.023	<1.2	<0.046	37	<0.45	<0.45	<2.3	<14	<0.091	<4.5	<4.5	<2.3	<0.91	<0.91	<0.45	13	<0.023	<4.5	1.2	0.77	0.60	
WPMW-4A			<2	NA					290		**130**								<5	0.81	1.11		
CVMW-1C	<0.0045	<0.023	<1.2	0.35	37	<0.45	<0.45	<2.3	<14	<0.091	**84**	<4.5	<2.3	<0.91	<0.91	<0.45	<4.5	<0.023	<4.5	<0.029	2.36	2.4	
CVMW-1C			2.9	NA					<50		**100**								<5	<0.05	2.37		
SVMW West-1C	<0.0045	<0.023	<1.2	0.79	62	<0.45	<0.45	<2.3	82	<0.091	**130**	<4.5	<2.3	<0.91	<0.91	<0.45	<4.5	<0.023	<4.5	<0.029	3.36	1.2	
SVMW West-1C			5.9	NA					<50		**160**								<5	<0.05	3.09		
SVMW East-2C	<0.0045	<0.023	<1.2	1.4	260	<0.45	<0.45	<2.3	**370**	<0.091	**420**	<4.5	<2.3	<0.91	5.6	<0.45	<4.5	<0.023	<4.5	<0.029	5.50	0.60	
SVMW East-2C			2	NA					63		**340**								10	<0.05	5.68		
MW 1-1	<0.0045	<0.023	9.4	0.39	38	<0.45	<0.45	<2.3	<14	<0.091	**260**	<4.5	<2.3	<0.91	<0.91	<0.45	<4.5	<0.023	<4.5	<0.029	3.04	100	
MW 1-1			**10**	0.38					ND		**300**								ND	NA	4.44		
MW 3-1	<0.0045	<0.023	<1.2	0.91	56	<0.45	<0.45	<2.3	<14	<0.091	<4.5	<4.5	<2.3	<0.91	<0.91	<0.45	18	<0.023	<4.5	2.7	2.91	0.60	
MW 3-1			3.2	0.45					ND		ND								ND	NA	4.16		
MW 2-2	<0.0045	<0.023	2.3	0.24	14	<0.45	<0.45	<2.3	<14	<0.091	<4.5	<4.5	<2.3	<0.91	<0.91	<0.45	15	<0.023	<4.5	2.1	1.15	0.64	
MW 2-2			2.4	0.33					ND		18								ND	NA	1.80		
MW 4	<0.0090	<0.045	**32**	1.5	190	<0.91	<0.91	<4.5	<27	<0.18	**840**	33	<4.5	4.9	<1.8	<0.91	46	<0.045	<9.1	<0.029	5.55	421	
MW 4			NA	NA					NA		**180**								NA	NA	8.16		
MW 5-2	<0.0045	<0.023	<1.2	<0.046	63	<0.45	<0.45	<2.3	<14	<0.091	<4.5	<4.5	<2.3	<0.91	<0.91	<0.45	<4.5	<0.023	<4.5	<0.029	0.69	170	
MW-5-2			2.6	0.16					ND		**220**								ND	NA	2.03		
SLC-1, 170 ft	<0.0045	<0.023	<1.2	0.12	21	<0.45	<0.45	<2.3	<14	<0.091	<4.5	<4.5	<2.3	<0.91	<0.91	<0.45	<4.5	<0.023	<4.5	<0.029	1.41	31	
SLC-1			4.4	NA					**850**		<40								<20	NA	1.10		
WPMW-5B	<0.0045	<0.023	<1.2	1.8	140	<0.45	<0.45	<2.3	<14	<0.091	**210**	<4.5	<2.3	<0.91	4.2	<0.45	<4.5	<0.023	<4.5	<0.029	7.53	10	
WPMW-7A	<0.0045	<0.023	<1.2	<0.046	39	<0.45	<0.45	<2.3	<14	<0.091	24	<4.5	<2.3	<0.91	<0.91	<0.45	<4.5	<0.023	<4.5	<0.029	0.55	2.9	
WPMW-8A	<0.0045	0.071	<1.2	<0.046	44	<0.45	<0.45	<2.3	<14	<0.091	**64**	<4.5	<2.3	<0.91	<0.91	<0.45	<4.5	<0.023	<4.5	0.22	0.61	3.9	
WPMW-8B	<0.0045	0.11	5.0	1.5	45	<0.45	<0.45	<2.3	45	<0.091	**56**	<4.5	<2.3	<0.91	<0.91	<0.45	<4.5	<0.023	<4.5	<0.029	5.32	8.8	
W77-B	<0.0045	<0.023	<1.2	0.80	180	<0.45	<0.45	<2.3	**420**	<0.091	**300**	<4.5	<2.3	<0.91	5.4	<0.45	<4.5	<0.023	<4.5	<0.029	3.43	6.4	
DCMW1	<0.0045	<0.023	<1.2	1.3	130	<0.45	<0.45	<2.3	<14	<0.091	<4.5	<4.5	<2.3	<0.91	<0.91	<0.45	<4.5	<0.023	<4.5	3.0	2.41	0.72	Chloroform: 5.6 ug/l, TTHMs: 5.6 ug/l
DCMW2	<0.0045	<0.023	<1.2	1.8	150	<0.45	<0.45	<2.3	<14	<0.091	<4.5	<4.5	<2.3	<0.91	2.4	<0.45	12	<0.023	<4.5	2.7	2.56	0.31	Chloroform: 3.2 ug/l, TTHMs: 3.2 ug/l
DCMW3	<0.0045	<0.023	4.8	0.47	18	<0.45	<0.45	<2.3	<14	<0.091	<4.5	<4.5	<2.3	<0.91	<0.91	<0.45	39	<0.023	<4.5	1.7	2.87	0.42	Bromodichloromethane: 2.1 ug/l, Chloroform: 40 ug/l, TTHMs: 42 ug/l
DCMW3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Bromodichloromethane: 2.4 ug/l, Chloroform: 46 ug/l, TTHMs: 48 ug/l

Table D-1 Water Quality Analytical Results

	Metals and Volatile Organic Compounds Analyses																					
MCLs		**1**	**10**	**50**	**1000**	**4**	**5**	**1300**	**300**	**2**	**50**	**100**	**15**	**6**	**50**	**2**		**5***	**50**	**10**			
WELL NAME	**Ag mg/L**	**Al mg/L**	**As (ug/L)**	**B mg/L**	**Ba (ug/L)**	**Be (ug/L)**	**Cd (ug/L)**	**Cu (ug/L)**	**Fe (ug/L)**	**Hg (ug/L)**	**Mn (ug/L)**	**Ni (ug/L)**	**Pb (ug/L)**	**Sb (ug/L)**	**Se (ug/L)**	**Tl (ug/L)**	**V (ug/L)**	**Zn mg/L**	**Total Cr (ug/L)**	**Cr 6+ (ug/L)**	**SAR**	**Turbidity Field (NTU)**	**VOCs Detection**
Ione																							
WPMW-3B	<0.0045	<0.023	<1.2	12	43	<0.45	<0.45	14	100	<0.091	**120**	<4.5	<2.3	<0.91	18	<0.45	<4.5	<0.023	<4.5	<0.029	17.95	0.10	
WPMW-3B			<2	NA					89		**160**								<5	<0.05	18.98		
WPMW-4B	<0.0045	0.059	<1.2	1.1	29	<0.45	<0.45	<2.3	120	<0.091	**94**	<4.5	<2.3	<0.91	<0.91	<0.45	<4.5	<0.023	<4.5	<0.029	6.24	0.77	
WPMW-4B			5.7	NA					190		**66**								<5	<0.05	6.53		
MW 2-1	<0.0045	<0.023	<1.2	1.5	7.4	<0.45	<0.45	<2.3	50	<0.091	15	<4.5	<2.3	<0.91	<0.91	<0.45	<4.5	<0.023	<4.5	<0.029	6.89	0.34	
MW 2-1			5	1.6					ND		**64**								ND	NA	5.75		
MW 5-1	<0.0045	<0.023	<1.2	0.30	67	<0.45	<0.45	<2.3	<14	<0.091	<4.5	<4.5	<2.3	<0.91	<0.91	<0.45	<4.5	<0.023	<4.5	3.2	1.69	3.3	
MW 5-1			2.6	0.34					ND		**53**								ND	NA	2.87		
WPMW-6A	<0.0045	0.075	<1.2	17	28	<0.45	<0.45	6.7	96	<0.091	16.00	<4.5	<2.3	<0.91	10	<0.45	<4.5	<0.023	<4.5	<0.029	55.25	31.7	
Multiple Aquifers																							
SLC-2, 225 ft	<0.0045	<0.023	<1.2	1.3	79	<0.45	<0.45	<2.3	<14	<0.091	<4.5	<4.5	<2.3	<0.91	<0.91	<0.45	<4.5	<0.023	<4.5	0.30	3.10	98	
SLC-2			2.1	NA					**380**		<40								<20	NA	2.76		
SLC-3, 146 ft	<0.0045	<0.023	<1.2	<0.046	38	<0.45	<0.45	<2.3	<14	<0.091	<4.5	<4.5	<2.3	<0.91	<0.91	<0.45	<4.5	<0.023	<4.5	<0.029	1.06	53	
SLC-3, 210 ft	<0.0045	<0.023	<1.2	<0.046	51	<0.45	<0.45	<2.3	<14	<0.091	<4.5	<4.5	<2.3	<0.91	<0.91	<0.45	<4.5	<0.023	<4.5	<0.029	1.08	45	
SLC-3, 247 ft	<0.0045	<0.023	<1.2	0.13	42	<0.45	<0.45	<2.3	86	<0.091	<4.5	<4.5	<2.3	<0.91	<0.91	<0.45	<4.5	<0.023	<4.5	<0.029	1.55	48	
SLC-3, 298 ft	<0.0045	<0.023	<1.2	<0.046	48	<0.45	<0.45	<2.3	<14	<0.091	<4.5	<4.5	<2.3	<0.91	<0.91	<0.45	<4.5	<0.023	<4.5	<0.029	1.24	95	
SLC-3			3.2	NA					62		<40								<20	NA	1.84		
Airport Well 4 MW	<0.0045	<0.023	<1.2	<0.046	25	<0.45	<0.45	<2.3	<14	<0.091	17.00	<4.5	<2.3	<0.91	<0.91	<0.45	36	<0.023	<4.5	5.7	0.98	15	

[1] Laboratory reported Na concent

* Secondary MCL

No Sample Collected

Concentration above MCL

Concentration above 1/2 the MCl

Elevated Concentrataion, no MCl

Baseline Study Sample

Existing water quality sample

Placer County Spring 2016 Samp

NA: Not analyzed

ND: Not detected (no reporting lir

<< Original Analytical Results Included as Separate File Due to Size >>