

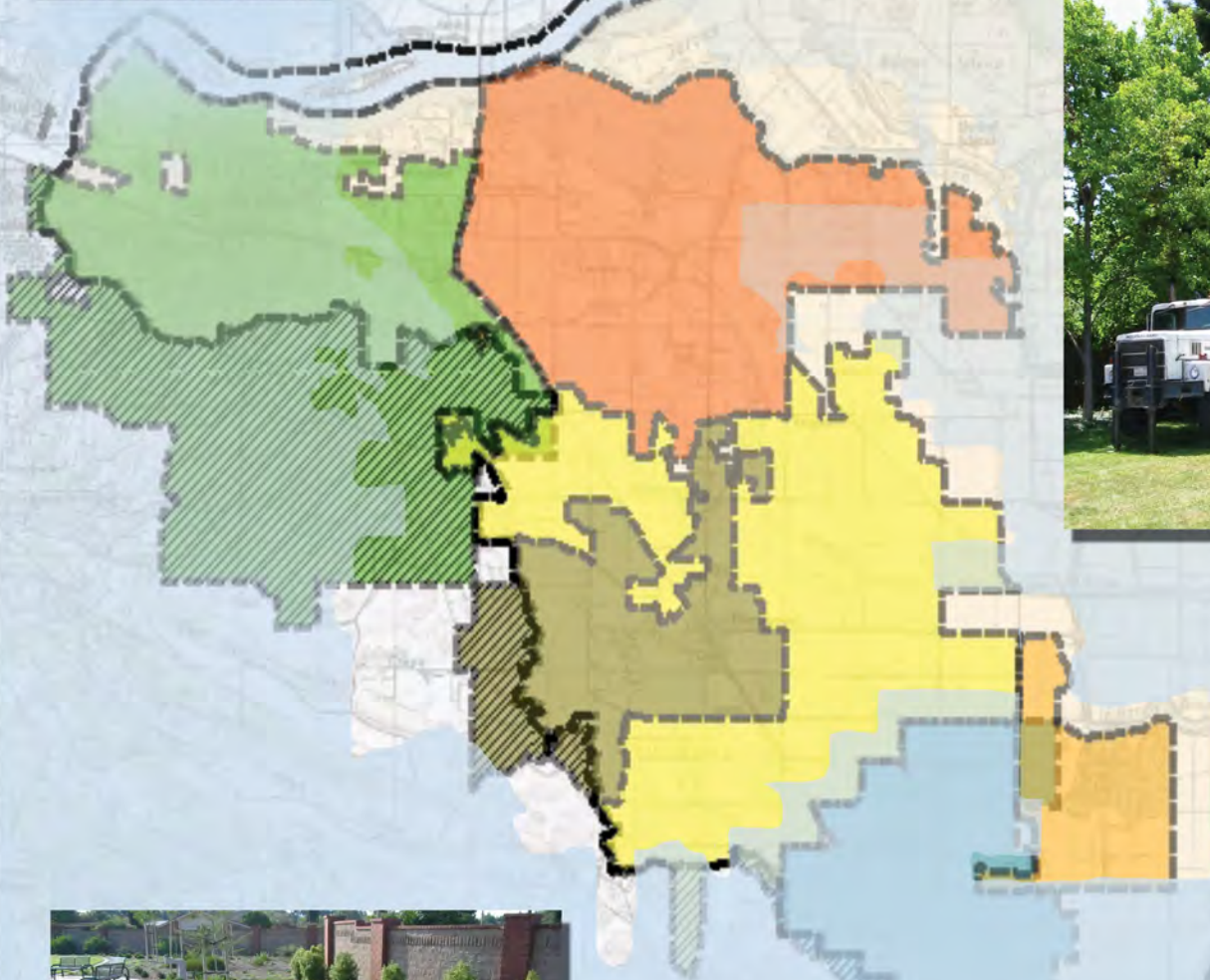


DIABLO  
WATER  
DISTRICT

ECCID



Diablo Water District, City of Brentwood  
Town of Discovery Bay, City of Antioch,  
Byron-Bethany I.D., and  
East Contra Costa Irrigation District  
California Statewide  
Groundwater Elevation Monitoring  
(CASGEM) Network Plan



December, 2011  
Updated  
July, 2014



LUHDORFF & SCALMANINI  
CONSULTING ENGINEERS

# **East Contra Costa County**

## **California Statewide Groundwater Elevation Monitoring (CASGEM) Network Plan**

**Including:**

**Diablo Water District,  
City of Brentwood,  
City of Antioch,  
Town of Discovery Bay,  
East Contra Costa Irrigation District,  
Byron-Bethany Irrigation District**

**Modified July 2014**



**LUHDORFF & SCALMANINI  
CONSULTING ENGINEERS**

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## List of Acronyms

BBID – Byron-Bethany Irrigation District

CASGEM – California Statewide Groundwater Elevation Monitoring Program

DTW – Depth to Water

DWD – Diablo Water District

DWR – California Department of Water Resources

ECCID – East Contra Costa Irrigation District

ECWMA – East County Water Management Association

ft – feet

GWMP – Groundwater Management Plan

Int – Intermediate

Irrig – Irrigation Well

LSCE – Luhdorff & Scalmanini, Consulting Engineers

Mon- Monitoring Well

Msmt – Measurement

NAVD88 – North American Vertical Datum of 1988

PDT – Pacific Daylight Time

PST – Pacific Standard Time

RPE – Reference Point Elevation

SA – Semi-Annual

WDL – Water Data Library

## 1.0 Introduction

### 1.1 CASGEM Goal

In November 2009, Senate Bill SBX7-6 mandated that the groundwater elevations in all basins and subbasins in California be regularly and systematically monitored with the goal of demonstrating seasonal and long-term trends in groundwater elevations. In accordance with the mandate, the California Department of Water Resources (DWR) developed the California Statewide Groundwater Elevation Monitoring (CASGEM) program. DWR is facilitating the statewide program which began with the opportunity for local entities to apply to DWR to assume the function of regularly and systematically collecting and reporting groundwater level data for the above purpose. These entities are referred to as Monitoring Entities. The legislature added a key aspect to SBX7-6 which was to make certain elements of the groundwater level information available to the public.

### 1.2 CASGEM Program Complements Ongoing Monitoring Programs

Wells designated for inclusion in the CASGEM program are for purposes of measuring groundwater levels on a semi-annual or more frequent basis that are representative of groundwater conditions in the state's groundwater basins and subbasins. The wells selected by a designated Monitoring Entity may be a subset of other wells monitored by that entity and need not be inclusive of the designated entity's entire monitoring network. The intent of the CASGEM program is to monitor groundwater levels in all areas of the designated subbasins. Accordingly, in 2014 the original well network plan was modified to include the entire Tracy subbasin within eastern Contra Costa County. While all of eastern Contra Costa County is within the Tracy subbasin, useable groundwater underlies only a portion of the area, primarily around Brentwood. The CASGEM program complements other pre-existing programs that have been developed throughout California by water districts, agencies, municipalities, counties, and others for purposes of understanding, managing, and sustaining groundwater resources.

Diablo Water District (District) adopted a Groundwater Management Plan (GWMP) in 2007, which included the objective of monitoring groundwater levels, among other things. A primary focus of the District's groundwater monitoring program is on monitoring groundwater levels in the vicinity of its production wells at the Glen Park and Stonecreek sites. Manual water level measurements are made monthly in monitoring network wells that include dedicated monitoring wells constructed by the District and private domestic wells. The District wells include monitoring wells at the Glen Park, Stonecreek, and Creekside sites, and the Glen Park, South Park, and Knightsen production wells.

In addition to the wells monitored by the District for groundwater levels, the District has also integrated groundwater level data collected by other entities in the eastern Contra Costa County region, including the Town of Discovery Bay, East Contra Costa Irrigation District (ECCID), Byron-Bethany Irrigation District (BBID), the City of Brentwood, and the City of Antioch. The wells in the District's current ongoing groundwater level monitoring network include shallow groundwater piezometers monitored by ECCID

since the 1950s and two deeper inactive irrigation wells monitored since 2005. Most of the ECCID wells are located south of the District's boundaries. The City of Brentwood's Wells 6, 7, 8, 9, 10A, 11, 12, 13, and 14 are also of interest for monitoring in aquifer units targeted for supply, and are typically deeper than domestic wells in the area. The area round the City of Antioch has limited useable groundwater (poor quality, low yields), however the monitoring wells cover the Tracy subbasin area in the north-west where it abuts the Pittsburg Plain Groundwater Basin. The BBID area likewise has limited useable groundwater (low yielding production wells) and the monitoring wells cover the southern end of the Tracy subbasin as it borders the hills and delta at Byron.

Coverage of groundwater wells for CASGEM monitoring is generally limited to existing wells completed in monitored aquifers and sites with suitable accessibility. Considerable effort was made to find an additional monitoring well between Oakley and the Contra Costa Canal, however no suitable production wells were found. For purposes of the CASGEM program, the selected monitoring sites are sufficient to achieve the goals of determining representative groundwater level conditions for the northwest portion of the Tracy Groundwater Subbasin. If deemed necessary, future inclusion or replacement of additional monitoring well sites will be considered.

### 1.3 Diablo Water District as Monitoring Entity

In December, 2010, the District applied to the California Department of Water Resources (DWR) to become the Monitoring Entity which would designate wells as appropriate for monitoring and reporting groundwater elevations for purposes of the CASGEM program. In anticipation of confirmation of DWR's acceptance of the District as the Monitoring Entity, the District has identified the wells to be included in the monitoring program network and prepared this CASGEM Network Plan (Plan) as required by DWR. This Plan contains the recommended components outlined by DWR, including a summary of the geology and groundwater resources in the District, Discovery Bay, Antioch, Brentwood, ECCID, and BBID areas. This Plan also identifies the planned CASGEM well network, the rationale for the selection of the wells, the field methods, and the monitoring schedule.

## 2.0 Northwest Tracy Subbasin Monitoring Network Area

### 2.1 DWR Basin/Subbasin

The District and other cooperating agencies overlie a portion of the San Joaquin Valley Groundwater Basin as designated by DWR Bulletin 118 (DWR, 2004). The District and other cooperating agencies are located in the northwestern portion of the Tracy Subbasin, which is one of sixteen subbasins in the San Joaquin Valley Groundwater Basin (**Figure 1**). The Tracy Subbasin is assigned Basin Number 5-22.15 and is described by DWR as including the northwestern most portion of the San Joaquin Valley Groundwater Basin around the Sacramento-San Joaquin Delta and extending south into the central portion of the San Joaquin Valley. Overall, population density within the Subbasin is relatively sparse, with the major cities being Tracy, Brentwood, and Oakley. Subbasin boundaries are defined by the Mokelumne and San Joaquin Rivers on the north; the San Joaquin River on the east; and the San Joaquin-Stanislaus County line on the south. The western Subbasin boundary is defined by the contact between unconsolidated sedimentary deposits and the rocks of the Diablo Range. It is noted that the groundwater

bearing zones of the Tracy Subbasin of East Contra Costa County is separated from the San Joaquin portion. Therefore, the predominant groundwater producing area in Contra Costa County near Brentwood is neither contiguous nor directly connected to the groundwater producing areas near Tracy.

## 2.2 Geology and Groundwater Resources

The geologic description of the combined monitoring network area was developed in 1999 as part of a study by Luhdorff & Scalmanini, Consulting Engineers (LSCE) in which hundreds of well logs were reviewed and interpreted to delineate hydrogeologic features in the East Contra Costa County area. In general, water resources in the region and within the monitoring network area are limited to alluvial materials to 400 or 500 feet below ground surface. On the south, starting around Kellogg Creek, aquifer units become shallower as they meet the hills curving east into the Delta beyond Byron. The deeper water bearing zones encountered around Brentwood and Discovery Bay end in this area. Below these depths, brackish to saline water has been encountered. Water quality ranges from very poor to not potable, in the shallow groundwater zones in the south and along the bay. Yields are generally below 100 gpm. As noted in the DWR Bulletin 118 and in DWR studies for Los Vaqueros Reservoir, groundwater bearing zones between Byron and San Joaquin County border are not contiguous. The characteristics of alluvium vary in the region according to the depositional environment (i.e., stream versus delta environments). The conceptual model of the alluvial material in the District area encompasses all four types of water-bearing units identified in the 1999 regional study and described below:

Fluvial Plain – Representative of the eastern portions of the Diablo Water District and southward to Discovery Bay. The depositional setting is probably similar to that which occurs in the present day area with northward flowing river channels, distributaries, and sloughs across floodplains of overbank areas. Deposits extend to depths of about 350 feet, below which occur largely fine-grained silts and clays.

Delta Islands – Representative of the northeastern portion of the District and encompasses Bethel Island and vicinity. Sand and gravel beds may correlate to the Fluvial Plain, but net sand thicknesses and the number of beds appear to increase northward. The depositional environment is interpreted as multiple stream channels meandering between islands. Channels would be active with through-flowing waters, then abandoned as new channels developed. Possibly slower stream flow and tidal fluctuations allowed thicker, fine-grained sand deposits to form.

Marginal Delta Dunes – Representative of the central to western portion of the District and defined by numerous thin to thick sand beds. The depositional environment is a mixture of delta fluvial distributary channels and possibly aeolian (wind-deposited) dune fields. Between Oakley and northern Brentwood, a surface deposit of rolling gentle hills representing relic sand dunes occurs. These sand dunes are believed to have been generated by strong winds blowing sand off the delta margins. Some deeper sand beds across the Marginal Delta Dunes area may be older dune fields.

Alluvial Plain – Representative of greater Brentwood south of the Marginal Delta Dune and City of Oakley, and west of the Fluvial Plain. The depositional environment consists of small streams draining eastward from the Coast Range foothills to the west. Flood flows of these streams spread out from the hills depositing fine-grained materials, possibly as mudflows with high sediment content. Stream flows deposited thicker sand and gravel beds that tended to stack upon each other causing the thicker bands of sand beds. The thicker stream deposited sand and gravel bands extend eastward until the sands either pinch out or have not been reached vertically by wells. In the north, the stream deposits appear to reach into the Marginal Delta Dunes area, blending into the sand units that are present there.

### 3.0 Previous Groundwater Studies

Diablo Water District has produced a Groundwater Monitoring Report (LSCE, 2011) and is also a member agency of the East Contra Costa County Regional Water Management Group called East County Water Management Association (ECWMA) with other entities included in this CASGEM program. The Groundwater Monitoring Report is described below. The ECWMA has been involved with the preparation and implementation of an East County Water Management Plan in 1996 (ECWMA, 1996), and more recently, the development and adoption of a Functionally Equivalent Integrated Regional Water Management Plan (ECWMA, 2005) in 2005 which has plans of evolving into a fully-integrated regional water management plan.

#### 3.1 Diablo Water District's 2011 Groundwater Monitoring Report

The District's Groundwater Monitoring Report (LSCE, 2011) provides an update of groundwater monitoring data compiled by the District in accordance with its 2007 GWMP. The Monitoring Report includes the following:

- District groundwater and surface water use,
- Precipitation
- Hydrographs for monitoring and production wells
- Contours of seasonal groundwater elevations,
- Land subsidence, and
- Groundwater and surface water quality

#### 3.2 Current Groundwater Conditions

For purposes of evaluating groundwater level conditions in the District area, the subsurface has been divided into two aquifer units: a shallow unconfined aquifer and a deeper confined aquifer. Most domestic wells are completed in the shallow zone while the larger municipal wells are completed in the deeper units. Wells completed in the shallow zone are typically completed to less than 200 feet in depth and often less than 100 feet in depth. Wells completed in the deep aquifer are usually high capacity supply wells that are more than 200 feet in depth.



Groundwater level conditions in the shallow aquifer are determined through a subset of domestic wells in the vicinity of the Glen Park production well and completed within the upper 60 feet of the shallow aquifer. Groundwater levels from these domestic wells indicate shallow water levels (depths to water of 10 to 15 feet below ground surface) with minimal seasonal fluctuations (less than 5 feet). The shallow aquifer is responsive to changes in water year type and decreases in precipitation. This was observed between 2007 and 2011; water levels dropped on the order of 1 to 2 feet, but are generally stable. Hydrographs indicate vertical hydraulic isolation between these shallow wells and effects from nearby municipal pumping in the deep aquifer.

An additional group of wells in the vicinity of the Glen Park production well are considered to be intermediate wells, as they are completed in the deeper portion of the shallow aquifer (between 120 and 200 feet below ground surface). Groundwater levels in these wells indicate some hydraulic connection to both shallow and deep aquifer units. Groundwater levels in these intermediate wells exhibit composite characteristics of the shallow aquifer above it and the deeper aquifer below it, with seasonal water level fluctuations between 10 to 12 feet and a slight declining trend since 2004 (of less than 5 feet), similar to trends in water levels seen in the deeper aquifer system, and are generally stable.

Groundwater level conditions in the deep aquifer reflect seasonal fluctuations from 15 to 20 feet and variations in peak water levels according to climatic trends and water year type. Seasonal fluctuations are accentuated during summer months when municipal pumping is highest, but full recovery is common during the wet winter months. Water levels in the deep aquifer are also sensitive to regional climate variability; groundwater levels have overall been stable through the somewhat limited period of record (less than a decade of record for most wells).

## **4.0 CASGEM Monitoring Network and Program – Updated 2014**

### **4.1 DWR Basin/Subbasin for CASGEM Program**

The District is proposing to monitor groundwater levels for the CASGEM program in the northwest portion of the Tracy Groundwater Subbasin of the San Joaquin Valley Groundwater Basin.

### **4.2 Diablo Water District Public Outreach**

The District recognizes that the success of the CASGEM program requires adequate spatial coverage of groundwater monitoring locations whenever possible. In an effort to gain the support of nearby water suppliers, the District conducted an informational meeting with representatives from the City of Brentwood, the Town of Discovery Bay, and ECCID in attendance. The purpose of the meeting was to inform the other entities of the District's intent to become the Monitoring Entity and to gain cooperation from the nearby water suppliers in providing the collection of groundwater levels in their respective areas. In 2014, the City of Antioch and Byron-Bethany ID agreed to monitor wells in their respective areas to extend coverage throughout eastern Contra Costa County.

### 4.3 Selected CASGEM Wells

The CASGEM monitoring network includes wells from the City of Brentwood, the City of Antioch, the Town of Discovery Bay, the District, ECCID, and BBID, with 31 wells at 22 locations of various completion depths and spatial distribution (**Figure 2**). These well locations compliment the wells that DWR has monitored and are publicly available in DWR's Water Data Library (WDL). Several of the CASGEM well locations include nested monitoring wells (i.e., multiple well casings of differing depths in a single borehole). Depending on the results of the District's evaluation, future actions may include removal and replacement of CASGEM wells with wells that are more representative of local groundwater conditions to better meet the objective of the CASGEM program and to meet multiple objectives of the District's 2007 GWMP. In addition, if deemed necessary, inclusion/replacement of different well sites will be considered by the cooperating entities to provide better coverage.

There are no local issues that prevent or limit groundwater monitoring, besides budgetary constraints on the part of the cooperating entities to acquire access and perform the monitoring. Well information that is required by DWR for the CASGEM program is summarized in detail in **Appendix A. Table 1** below lists the CASGEM monitoring wells with available construction details and aquifer designation.

**Table 1**

#### Northwest Tracy Subbasin 2011 CASGEM Monitoring Network

Well Owner	Local Well ID	State Well Number	Msmt Frequency	Well Use	Well Depth (ft)	Screened Interval (ft)	Aquifer Designation
<b>The City of Brentwood</b>	#14 MW-324	1N/3E-06E	SA	Mon	324	284-314	Deep
	#14 MW-240	1N/3E-06E	SA	Mon	240	200-210; 220-230	Int
	#14 MW-154	1N/3E-06E	SA	Mon	154	114-144	Shallow
<b>The Town of Discovery Bay</b>	1BMW-140	1N/3E-25C	SA	Mon	140	100-130	Shallow
	1BMW-343	1N/3E-25C	SA	Mon	343	270-289; 309-338	Deep
	4AMW-152	1N/3E-26M	SA	Mon	152	122-142	Shallow
	4AMW-357	1N/3E-26M	SA	Mon	357	307-347	Deep
	6MW-250	1N/3E-25L	SA	Mon	250	200-210 230-240	Int(?)
	6MW-350	1N/3E-25L	SA	Mon	350	280-290 330-340	Deep
	6MW-410	1N/3E-25L	SA	Mon	410	390-400	Deep
<b>Diablo Water District</b>	Creekside-CSMW	2N/3E-31C	SA	Mon	380	230-240	Deep
	Glen Park-GPMW	2N/3E-31L	SA	Mon	300	220-230; 260-290	Deep

Well Owner	Local Well ID	State Well Number	Msmt Frequency	Well Use	Well Depth (ft)	Screened Interval (ft)	Aquifer Designation
<b>Diablo Water District (cont'd)</b>	Stonecreek-SCMW-160	2N/3E-31G	SA	Mon	160	100-110; 140-150	Int(?)
	Stonecreek-SCMW-300	2N/3E-31G	SA	Mon	300	230-240; 280-290	Deep
	Stonecreek-SCMW-360	2N/3E-31G	SA	Mon	360	340-350	Deep
	Bethel Island	2N/3E-11	SA	Res	333	317-333	Deep
<b>ECCID</b>	MW 5-22	2N/3E-33M	SA	Mon	20	0-20	Surface
	MW 5-33	2N/3E-30J	SA	Mon	20	0-20	Surface
	MW 5-35	2N/3E-31H	SA	Mon	20	0-20	Surface
	MW 5-36	2N/3E-32M	SA	Mon	20	0-20	Surface
	MW 5-37	1N/3E-06H	SA	Mon	20	0-20	Surface
	MW 5-39	2N/3E-29Q	SA	Mon	20	0-20	Surface
	Well #11 (4.61-A)	1N/2E-24J	SA	Irrig-inactive			Deep
	Well #4 Old (4.56)	1N/3E-20L	SA	Irrig-inactive			Deep
<b>BBID</b>	1 JNJ	1N/3E-28	SA	Other	120	105-120	Int
	2 Casing	1S/3E-04	SA	Mon	163	71-163	Int
	3 Byron	1S/3E-03	SA	Res	70 (300) <sup>1</sup>	50-70	Shallow
	4 Burns	1S/3E-25	SA	Res	65 (258) <sup>1</sup>	45-65	Shallow
<b>The City of Antioch</b>	2N/2E-16 (s)	2N/2E-16	SA	Mon	81	53-81	Shallow
	2N/2E-16 (d)	2N/2E-16	SA	Mon	106	101-106	Int
	2N/2E-19J	2N/2E-19J	SA	Res	88	60-88	Shallow

1. Values in parentheses indicate borehole depth.

## 4.4 Field Methods

Reference points are established to ensure that each time the well is visited for a measurement, the depth to water is measured from the same place. In other words, the point on the well casing where the elevation was surveyed needs to be marked, easily identifiable, and noted so that the field technician tasked to measure the depth to water will be able to make the measurement in a consistent way as done before and in the future. **Appendix B** contains pictures of actual reference points on select CASGEM network monitoring wells.

The purpose of the groundwater level measurement is to obtain an accurate dated and timed measurement of the static depth to water in a well that can be converted into a water level elevation in reference to a commonly used reference datum (here, NAVD88). In this context, the term ‘static’ means that the water level in the well is not influenced by pumping of the well. There are no municipal production wells in the

CASGEM monitoring network, though several of the monitoring wells are within close proximity to municipal production wells. These production wells will ideally be shut off for a minimum of 24 hours prior to depth to water measurements, whenever possible. Any potential influence from nearby pumping or other comment would be marked on the field sheet and entered into the *Questionable Measurement* or *Comments* fields upon submittal to CASGEM's database (see example Field Sheet attached in **Appendix C**).

For comparability, measurements will be obtained according to a schedule designed to capture times of both highest and lowest seasonal water level elevations, approximately in March and October of each year. Also for comparability, measurements during a particular field campaign will be obtained consecutively and without delay within the shortest reasonable time. The following procedure outlines the steps of taking a depth to water reading using an electric sounder:

- Turn on water level indicator signaling device and check the battery by hitting the test button.
- Remove the access plug or well cap from the well cover and lower the probe (electric sounder) into the well.
- When the probe hits the water, a loud "beep" will sound and the signal light will turn red.
- Retract slightly until the tone stops.
- Slowly lower the probe until the tone sounds.
- Note depth measurement at the designated reference point to the nearest 0.01 feet and rewind the probe completely out of the well.
- Remove excess water and lower probe once again into the well and make another measurement.
- If the difference is within  $\pm 0.02$  feet of the first measurement, record the measurement.
- If the difference is greater than  $\pm 0.02$  feet, repeat the same procedure until three consecutive measurements are recorded within  $\pm 0.02$  feet.
- Rewind and remove the probe from the well and replace the access plug or well cap in the well cover.
- Clean and dry the measuring device/probe and continue to the next well.

For each well measurement, the following information should be recorded:

1. Name of field technician making the measurement
2. Unique identification of well
3. Time and date of measurement
4. Depth to water
5. Any other pertinent comments (e.g., sounder hangs up at 33 feet, thus no measurement; or: fifth measurement of ~55.68 feet in a row... residual water in end cap?; etc.)

## 4.5 Monitoring Schedule

For the CASGEM program, all wells in the monitoring network will be measured semi-annually in the spring (March/April) and fall (September/October) of each year. Historical hydrographs indicate that these periods generally represent the seasonal high and low groundwater elevations. Efforts will be made to coordinate the timing of the semi-annual measurements in network wells to be within the narrowest possible window of time, in order to ensure that the round of measurements represents a snapshot in time



for conditions in the Subbasin. The table below summarizes the approximate time and frequency each CASGEM well is planned to be monitored.

**Table 2**

**Northwest Tracy Subbasin 2011 CASGEM Monitoring Time and Frequency**

Well Owner	Local Well ID	Msmt Time*	Msmt Frequency
<b>The City of Brentwood</b>	#14 MW-324	Early Spring/Late Summer	Semi-Annual
	#14 MW-240	Early Spring/Late Summer	Semi-Annual
	#14 MW-154	Early Spring/Late Summer	Semi-Annual
<b>The Town of Discovery Bay</b>	1BMW-140	Early Spring/Late Summer	Semi-Annual
	1BMW-343	Early Spring/Late Summer	Semi-Annual
	4AMW-152	Early Spring/Late Summer	Semi-Annual
	4AMW-357	Early Spring/Late Summer	Semi-Annual
	6MW-250	Early Spring/Late Summer	Semi-Annual
	6MW-350	Early Spring/Late Summer	Semi-Annual
	6MW-410	Early Spring/Late Summer	Semi-Annual
<b>Diablo Water District</b>	Creekside-CSMW	Early Spring/Late Summer	Semi-Annual
	Glen Park-GPMW	Early Spring/Late Summer	Semi-Annual
	Stonecreek-SCMW-160	Early Spring/Late Summer	Semi-Annual
	Stonecreek-SCMW-300	Early Spring/Late Summer	Semi-Annual
	Stonecreek-SCMW-360	Early Spring/Late Summer	Semi-Annual
	Bethel Island	Early Spring/Late Summer	Semi-Annual
<b>ECCID</b>	MW 5-22	Early Spring/Late Summer	Semi-Annual
	MW 5-33	Early Spring/Late Summer	Semi-Annual
	MW 5-35	Early Spring/Late Summer	Semi-Annual
	MW 5-36	Early Spring/Late Summer	Semi-Annual
	MW 5-37	Early Spring/Late Summer	Semi-Annual
	MW 5-39	Early Spring/Late Summer	Semi-Annual
	Well #11 (5.61-A)	Early Spring/Late Summer	Semi-Annual
	Well #4 Old (4.56)	Early Spring/Late Summer	Semi-Annual
<b>BBID</b>	1 JNJ	Early Spring/Late Summer	Semi-Annual
	2 Casing	Early Spring/Late Summer	Semi-Annual
	3 Byron	Early Spring/Late Summer	Semi-Annual
	4 Burns	Early Spring/Late Summer	Semi-Annual
<b>The City of Antioch</b>	2N/2E-16 (s)	Early Spring/Late Summer	Semi-Annual
	2N/2E-16 (d)	Early Spring/Late Summer	Semi-Annual
	2N/2E-19J	Early Spring/Late Summer	Semi-Annual

\*DWD wells are also sometimes monitored on a monthly basis, but for the purpose of mandatory CASGEM monitoring, semi-annual measurements will be consistently measured and reported. Other wells in this table may be monitored for water levels more frequently than semi-annually, and those measurements will be submitted to the CASGEM database in addition to the semi-annual measurements.

## 4.6 Groundwater Elevation Data Management and CASGEM Data Submittal

As part of the District's 2007 GWMP, a database of groundwater level and water quality data was compiled. That database is updated with monitoring results after data collection events. Per DWR's CASGEM program reporting requirements, the following information related to each of the designated CASGEM monitoring network wells will be submitted online at the end of each calendar year:

- Well identification number (DWR state well number in online format)
- Measurement dates
- Reference point elevation of the well (feet) using NAVD88 vertical datum
- Elevation of land surface at the well (feet) using NAVD88 vertical datum
- Depth to water below reference point (feet) (unless no measurement was taken)
- Method of measuring water depth
- Measurement quality codes<sup>1</sup>
- Measuring agency identification (Diablo Water District as the Monitoring Entity, City of Brentwood, etc.)
- Measurement time (PST/PDT with military time/24 hour format)
- Comments about measurement, if applicable

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<sup>1</sup> Measurement quality codes examples include: 1) If no measurement is taken, a specified "no measurement" code, must be recorded. 2) If the quality of a measurement is uncertain, a "questionable measurement" code can be recorded. Standard codes will be provided by DWR's online system.

## 5.0 References

California Department of Water Resources (DWR), San Joaquin Valley Groundwater Basin, Tracy Subbasin, California's Groundwater, Bulletin 118, 2004.

East County Water Management Association (ECWMA), 1996. East County Water Management Plan.

ECWMA, 2005. Functionally Equivalent Integrated Regional Water Management Plan.

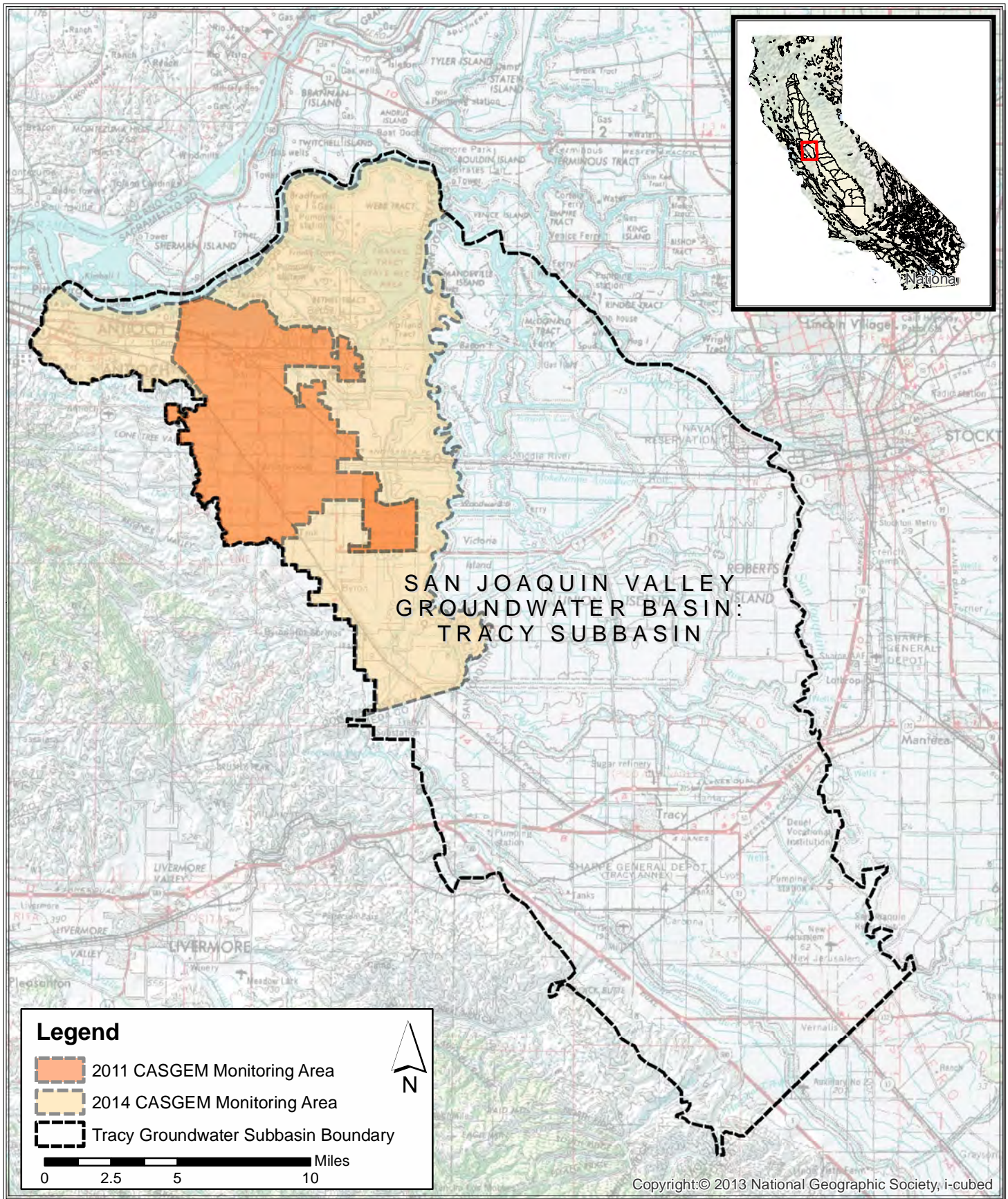
Luhdorff & Scalmanini, Consulting Engineers (LSCE), 1999. Investigation of Ground-Water Resources in the East Contra Costa Area. Woodland, CA.

LSCE, 2007. Diablo Water District Groundwater Management Plan for AB3030. Woodland, CA.

LSCE, 2011. Groundwater Monitoring Report, Diablo Water District. Woodland, CA.

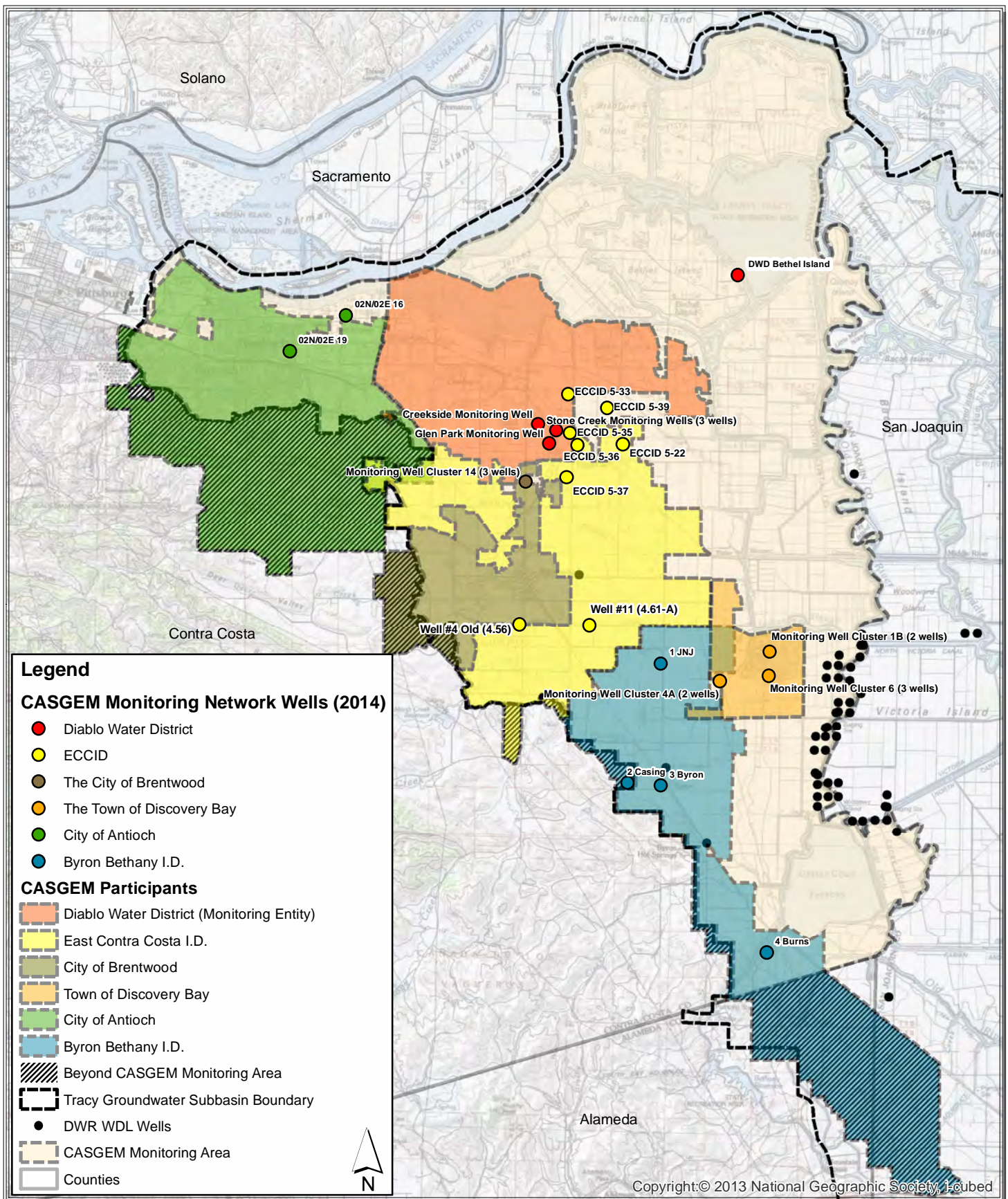
# FIGURES





X:\2011 Job Files\11-115\GIS\Casgem\_LocationSubbasin.mxd





X:\2011 Job Files\11-115\GIS\Casgem\_MonWellLocation2014.mxd

0 1 2 4 Miles

**Appendix A**  
**Diablo Water District**  
**2014 CASGEM Network**  
**Well Information**

Appendix A  
Diablo Water District 2014 CASGEM Network Well Information

Local Well Designation	State Well Number	RP Elevation	RP Description	GS Elevation	Measurement Method	Measurement Accuracy	Well Use	Well Status	Latitude [N]	Longitude [W]	Coordinates Method	Coordinates Accuracy	Well Completion Type	Total Well Depth	Well Completion Report #	Associated Basin	Associated Basin Portion	Well Location Desc	Additional Comments	Is Voluntary Well	County	Screen Interval 1 Top	Screen Interval 1 Bottom	Screen Interval 2 Top	Screen Interval 2 Bottom
#14 MW-324	1N/3E-06E	72.8	Top of Casing	71.76	Digital Elevation Model	Unknown	Observation	active	37.9620	121.6957	USGS quad	Unknown	Part of a nested/multi-completion well	324		5-22.15-Tracy	northwest	~130 ft east and ~170 ft north of intersection between Brentwood Blvd & Lone Tree Way		No	Contra Costa	284.00	314.00		
#14 MW-240	1N/3E-06E	72.8	Top of Casing	71.76	Digital Elevation Model	Unknown	Observation	active	37.9620	121.6957	USGS quad	Unknown	Part of a nested/multi-completion well	240		5-22.15-Tracy	northwest	~130 ft east and ~170 ft north of intersection between Brentwood Blvd & Lone Tree Way		No	Contra Costa	200.00	210.00	220.00	230.00
#14 MW-154	1N/3E-06E	72.8	Top of Casing	71.76	Digital Elevation Model	Unknown	Observation	active	37.9620	121.6957	USGS quad	Unknown	Part of a nested/multi-completion well	154		5-22.15-Tracy	northwest	~130 ft east and ~170 ft north of intersection between Brentwood Blvd & Lone Tree Way		No	Contra Costa	114.00	144.00		
1BMW-140	1N/3E-25C	4.376	Top of Casing	3.78	GPS with WAAS	0.1 ft.	Observation	active	37.9103	121.5994	Surveyed	30 ft.	Part of a nested/multi-completion well	140		5-22.15-Tracy	northwest	~400 ft east and ~300 ft south of intersection between Laguna Ct & Discovery Bay Blvd		No	Contra Costa	100.00	130.00		
1BMW-343	1N/3E-25C	4.376	Top of Casing	3.78	GPS with WAAS	0.1 ft.	Observation	active	37.9103	121.5994	Surveyed	30 ft.	Part of a nested/multi-completion well	343		5-22.15-Tracy	northwest	~400 ft east and ~300 ft south of intersection between Laguna Ct & Discovery Bay Blvd		No	Contra Costa	270.00	289.00	309.00	338.00
4AMW-152	1N/3E-26M	11.671	Top of Casing	12.14	GPS with WAAS	0.1 ft.	Observation	active	37.9010	121.6188	Surveyed	30 ft.	Part of a nested/multi-completion well	152		5-22.15-Tracy	northwest	~190 ft west and ~20 south of intersection between Newport Dr & Bolinas Pl		No	Contra Costa	122.00	142.00		
4AMW-357	1N/3E-26M	11.537	Top of Casing	12.04	GPS with WAAS	0.1 ft.	Observation	active	37.9010	121.6188	Surveyed	30 ft.	Part of a nested/multi-completion well	357		5-22.15-Tracy	northwest	~190 ft west and ~20 south of intersection between Newport Dr & Bolinas Pl		No	Contra Costa	307.00	347.00		
6MW-250	1N/3E-25L	6.602	Top of Casing	6.83	GPS with WAAS	0.1 ft.	Observation	active	37.9028	121.5995	Surveyed	30 ft.	Part of a nested/multi-completion well	250		5-22.15-Tracy	northwest	~790 ft east and ~580 ft north of intersection between Discovery Bay Blvd & Willow Lake Rd		No	Contra Costa	200.00	210.00	230.00	240.00
6MW-350	1N/3E-25L	6.597	Top of Casing	6.83	GPS with WAAS	0.1 ft.	Observation	active	37.9028	121.5995	Surveyed	30 ft.	Part of a nested/multi-completion well	350		5-22.15-Tracy	northwest	~790 ft east and ~580 ft north of intersection between Discovery Bay Blvd & Willow Lake Rd		No	Contra Costa	280.00	290.00	330.00	340.00
6MW-410	1N/3E-25L	6.535	Top of Casing	6.83	GPS with WAAS	0.1 ft.	Observation	active	37.9028	121.5995	Surveyed	30 ft.	Part of a nested/multi-completion well	350		5-22.15-Tracy	northwest	~790 ft east and ~580 ft north of intersection between Discovery Bay Blvd & Willow Lake Rd		No	Contra Costa	390.00	400.00		
Creekside-CSMW	2N/3E-31C	34.51	Black Mark on TOC	32.11	GPS with WAAS	0.1 ft.	Observation	active	37.9799	121.6911	Surveyed	30 ft.	Single Well	380		5-22.15-Tracy	northwest	~80 ft east and ~70 ft north of intersection between Honey Ln & Creekside Way		No	Contra Costa	230.00	240.00		



Appendix A  
Diablo Water District 2014 CASGEM Network Well Information

Local Well Designation	State Well Number	RP Elevation	RP Description	GS Elevation	Measurement Method	Measurement Accuracy	Well Use	Well Status	Latitude [N]	Longitude [W]	Coordinates Method	Coordinates Accuracy	Well Completion Type	Total Well Depth	Well Completion Report #	Associated Basin	Associated Basin Portion	Well Location Desc	Additional Comments	Is Voluntary Well	County	Screen Interval 1 Top	Screen Interval 1 Bottom	Screen Interval 2 Top	Screen Interval 2 Bottom
Glen Park-GPMW	2N/3E-31L	35.536	Black Mark on TOC	33.68	GPS with WAAS	0.1 ft.	Observation	active	37.9741	121.6867	Surveyed	30 ft.	Single Well	300		5-22.15-Tracy	northwest	~80 ft south and ~220 ft east of intersection between Diane Ct & Hill Ave		No	Contra Costa	220.00	230.00	260.00	290.00
Stonecreek-SCMW-160	2N/3E-31G	31.656	Black Mark on TOC	29.98	GPS with WAAS	0.1 ft.	Observation	active	37.9781	121.6840	Surveyed	30 ft.	Part of a nested/multi-completion well	160		5-22.15-Tracy	northwest	~1,000 ft south and ~600 ft east of intersection between Tuolumne Way & Teton Rd		No	Contra Costa	100.00	110.00	140.00	150.00
Stonecreek-SCMW-300	2N/3E-31G	31.572	Black Mark on TOC	29.98	GPS with WAAS	0.1 ft.	Observation	active	37.9781	121.6840	Surveyed	30 ft.	Part of a nested/multi-completion well	300		5-22.15-Tracy	northwest	~1,000 ft south and ~600 ft east of intersection between Tuolumne Way & Teton Rd		No	Contra Costa	230.00	240.00	280.00	290.00
Stonecreek-SCMW-360	2N/3E-31G	31.597	Black Mark on TOC	29.98	GPS with WAAS	0.1 ft.	Observation	active	37.9781	121.6840	Surveyed	30 ft.	Part of a nested/multi-completion well	360		5-22.15-Tracy	northwest	~1,000 ft south and ~600 ft east of intersection between Tuolumne Way & Teton Rd		No	Contra Costa	340.00	350.00		
MW 5-22	2N/3E-33M	17.2	Top of Casing	17.19	Unknown	Unknown	Observation	active	37.9741	121.6579	USGS quad	Unknown	Single Well	20		5-22.15-Tracy	northwest	~470 ft east and ~700 ft north of intersection between Blaine Ln & Bartels Dr		No	Contra Costa	0.00	20.00		
MW 5-33	2N/3E-30J	13.3	Top of Casing	12.62	Unknown	Unknown	Observation	active	37.9894	121.6794	USGS quad	Unknown	Single Well	20		5-22.15-Tracy	northwest	~600 ft west and ~500 ft south of intersection between E Cypress Rd & Sellers Ave		No	Contra Costa	0.00	20.00		
MW 5-35	2N/3E-31H	24.3	Top of Casing	24.92	Unknown	Unknown	Observation	active	37.9773	121.6785	USGS quad	Unknown	Single Well	20		5-22.15-Tracy	northwest	~300 ft west and ~1,400 ft south of intersection between Sellers Ave & Wildhouse Rd		No	Contra Costa	0.00	20.00		
MW 5-36	2N/3E-32M	27.4	Top of Casing	29.95	Unknown	Unknown	Observation	active	37.9737	121.6756	USGS quad	Unknown	Single Well	20		5-22.15-Tracy	northwest	~600 ft east and ~1,760 ft north of intersection between Sellers Ave & Delta Rd		No	Contra Costa	0.00	20.00		
MW 5-37	1N/3E-06H	40.6	Top of Casing	44.28	Unknown	Unknown	Observation	active	37.9635	121.6797	USGS quad	Unknown	Single Well	20		5-22.15-Tracy	northwest	~600 ft west and ~1,940 ft south of intersection between Sellers Ave & Delta Rd		No	Contra Costa	0.00	20.00		
MW 5-39	2N/3E-29Q	12.5	Top of Casing	7.72	Unknown	Unknown	Observation	active	37.9853	121.6641	USGS quad	Unknown	Single Well	20		5-22.15-Tracy	northwest	~1,200 ft east and ~270 ft south of intersection between Knightsen Ave & Palmwood		No	Contra Costa	0.00	20.00		
Well #11 (4.61-A)	1N/2E-24J	55.0	Unknown	55.00	USGS quad	20 ft.	Irrigation	Inactive	37.9178	121.6700	USGS quad	Unknown	Single Well			5-22.15-Tracy	northwest	~2,300 ft east and ~500 ft north of intersection between Church Rd & Sellers Ave		No	Contra Costa				
Well #4 Old (4.56)	1N/3E-20L	87.0	Unknown	87.00	USGS quad	20 ft.	Irrigation	Inactive	37.9178	121.6973	USGS quad	Unknown	single Well			5-22.15-Tracy	northwest	~200' south and ~300 ft west of intersection between Walnut Blvd & Armstrong Rd		No	Contra Costa				

Appendix A  
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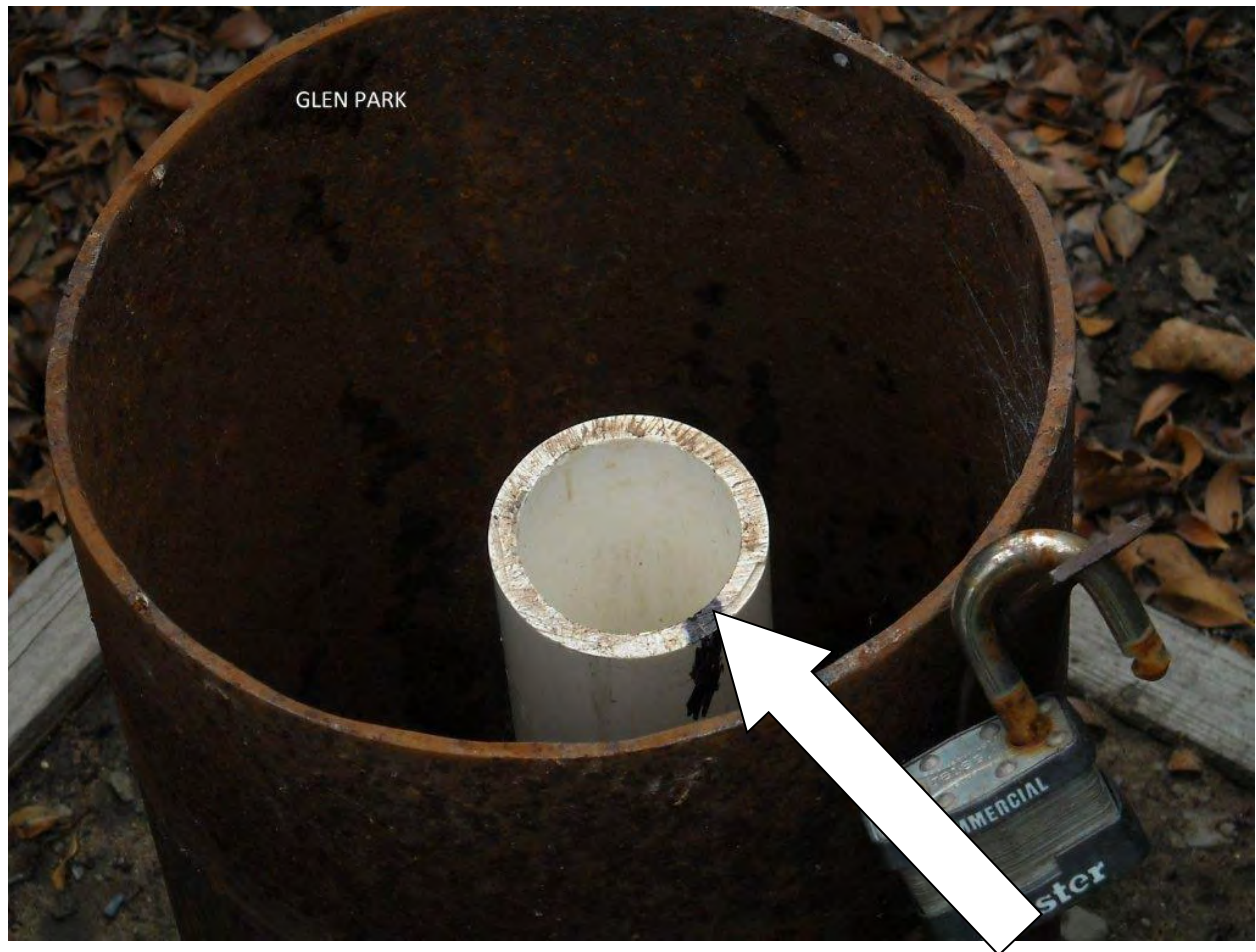
Local Well Designation	State Well Number	RP Elevation	RP Description	GS Elevation	Measurement Method	Measurement Accuracy	Well Use	Well Status	Latitude [N]	Longitude [W]	Coordinates Method	Coordinates Accuracy	Well Completion Type	Total Well Depth	Well Completion Report #	Associated Basin	Associated Basin Portion	Well Location Desc	Additional Comments	Is Voluntary Well	County	Screen Interval 1 Top	Screen Interval 1 Bottom	Screen Interval 2 Top	Screen Interval 2 Bottom
1 JNJ	1N/3E-28	27.5	Top of Casing	26.00	USGS quad	Unknown	Other	Active	37.8196	121.6001	USGS quad	Unknown	Single Well	120		5-22.15-Tracy	northwest	~164' west of Byn Hwy, ~0.4 mi south of Point of Timber & Byron Hwy junction	Values fr driller log before sent to DWR, so no DWR log #	No	Contra Costa	105.00	120.00		
2 Casing	1S/3E-04	44.00	Top of Casing	44.00	USGS quad	Unknown	Observation	Inactive	37.9073	121.6445	USGS quad	Unknown	Single Well	163		5-22.15-Tracy	northwest	~520' north of Camino Diablo, ~0.7 mi west of Holway & Camino Diablo junction	No DWR log - valuses from recent driller rehab	No	Contra Costa	71.00	163.00		
3 Byron	1S/3E-03	To be Obtained	Top of Casing	32.00	USGS quad	Unknown	Residential	Active	37.8703	121.6407	USGS quad	Unknown	Single Well	70	225015	5-22.15-Tracy	northwest	~82' east of Holway, ~0.05 mi north of Holway & Camino Diablo junction		No	Contra Costa	50.00	70.00		
4 Bruns	1S/3E-25	To be Obtained	Top of Casing	36.00	USGS quad	Unknown	Residential	Active	37.8690	121.6484	USGS quad	Unknown	Single Well	65	556620	5-22.15-Tracy	northwest	~100' east of Bruns Rd ~0.4 mi south of Byron Rd & Bruns Rd junction		No	Contra Costa	45.00	65.00		
DWD Bethel	2N/3E-11	61.1	Top of Casing	60.00	USGS quad	Unknown	Residential	Inactive	38.0270	121.6136	USGS quad	Unknown	Single Well	333	51028	5-22.15-Tracy	northwest	~17' south of Willow R ~400' west of Sugar Barge Rd & Willow Rd junction		No	Contra Costa	317.00	333.00		
2N/2E-16 (s)	2N/2E-16	To be Obtained	Top of Casing	61.00	USGS quad	Unknown	Observation	Inactive	38.0129	121.7670	USGS quad	Unknown	Part of a nested/multi-completion well	81	e0138090 A-B	5-22.15-Tracy	northwest	To Be Obtained	Engineered monitoring well - screened in top of two zones	No	Contra Costa	53.00	81.00		
2N/2E-16 (d)	2N/2E-16	To be Obtained	Top of Casing	61.00	USGS quad	Unknown	Observation	Inactive	38.0129	121.7670	USGS quad	Unknown	Part of a nested/multi-completion well	106	e0138090 A-B	5-22.15-Tracy	northwest	To Be Obtained	Engineered monitoring well-screened in bottom of two zones	No	Contra Costa	101.00	106.00		
2N/2E-19J	2N/2E-19J	To be Obtained	Top of Casing	61.00	USGS quad	Unknown	Residential	Active	38.0021	121.7883	USGS quad	Unknown	Single Well	88	107227	5-22.15-Tracy	northwest	To Be Obtained		No	Contra Costa	60.00	88.00		

**Appendix B**  
**Reference Point Photos on DWD**  
**Network Monitoring Wells**



**Picture 1 Creekside Monitoring Well Reference Point**





**Picture 2 Glen Park Monitoring Well Reference Point**



**Picture 3 Stone Creek Monitoring Well Cluster**





**Picture 4 Stonecreek Monitoring Well SCMW-160 Reference Point**



**Picture 5 Stonecreek Monitoring Well SCMW-300 Reference Point**





**Picture 6 Stonecreek Monitoring Well SCMW-360 Reference Point**

**Appendix C**  
**Example Field Sheet for**  
**Groundwater Level Measurements**

<i>Example Monitoring Entity Name</i>				<b>Date:</b> <u>2-25-2012</u>
<b>Groundwater Level Monitoring</b>				
<b>Well Address/Name</b>	<b>Time</b>	<b>Depth to Water (ft)</b>	<b>Nearby Pump On?</b>	<b>Comments/Initial</b>
<i>Example Well ABCD</i>	<i>12:00</i>	<i>12.64</i>	<i>No</i>	<i>None/J.D.</i>
<i>Example Well EFGH</i>	<i>12:20</i>	<i>11.47</i>	<i>No</i>	<i>None/J.D.</i>

*(Italics are indicated where cooperating entity would enter specific data.)*