Solano County Water Agency

California Statewide Groundwater Elevation Monitoring (CASGEM) Network Plan

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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 Other 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. Thus, 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.

An AB303 Groundwater Investigation Project was conducted on behalf of SCWA to develop a better understanding of the deeper portion of the aquifer system. It has included the construction of 7 cross-sections, and review of 252 of wells logs, and construction of a database of more than 700 wells with water level data. This effort was also coordinated with the installation of 12 deep monitoring wells at four locations throughout northeastern Solano County under the Groundwater Monitoring Facilities (GMF) program. The SCWA GMF project expanded the subsurface characterization of the regional aquifer system and provides facilities for ongoing groundwater level and quality monitoring of different zones of the aquifer system.

1.3 SCWA Monitoring Entity

On December 19, 2011, SCWA applied to DWR to become the countywide Monitoring Entity which would designate wells as appropriate for monitoring and reporting groundwater elevations for purposes of the CASGEM program. Following confirmation of DWR's acceptance of SCWA as the Monitoring Entity, SCWA proceeded to identify wells to be included in the

monitoring program network and to prepare 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 Solano County. 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 SOLANO COUNTY AREA

2.1 DWR Basins and Subbasins

The CASGEM program largely refers to DWR's depiction of the major groundwater basins and subbasins in and around Solano County, including a major portion of the Sacramento Valley Basin (Solano Subbasin), the Suisun-Fairfield Valley Basin, and a portion of the Napa-Sonoma Valley Basin (Napa-Sonoma Lowlands Subbasin) (**Figure 1**). These basins and subbasins are generally defined based on boundaries to groundwater flow and the presence of water-bearing geologic units. The groundwater basins defined by DWR are not confined within county boundaries, and DWR-designated "basin" or "subbasin" designations do not cover all of Solano County. In particular, the Napa-Sonoma Lowlands Subbasin, as delineated by DWR, is present in both Napa County and Solano County. However, there are no currently monitored wells in the Solano County portion of this subbasin. Further, Napa County, as the designated Monitoring Entity for this subbasin and the rest of the Napa-Sonoma Valley Basin, is expected to continue the representative monitoring for the basin. The SCWA CASGEM Monitoring Plan includes only the Sacramento Valley Basin (Solano Subbasin), and the Suisun-Fairfield Valley Basin.

The Solano Subbasin includes the southernmost portion of the Sacramento Valley Groundwater Basin and extends into the northern portion of the Sacramento-San Joaquin Delta. The Solano Subbasin boundaries are defined by Putah Creek on the north, the Sacramento River on the East (from Sacramento to Walnut Grove), the North Mokelumne River on the southeast (from Walnut Grove to the San Joaquin River), the San Joaquin River on the South (from the North Mokelumne River to the Sacramento River), the Lower Members of the Great Valley Group on the Northwest, and the Suisun-Fairfield Valley Basin on the Southwest. The Solano Subbasin underlies the Cities of Vacaville, Dixon and Rio Vista, and is pumped extensively for local agricultural and municipal uses.

The Suisun-Fairfield Valley Basin, underlying the cities of Fairfield, Suisun, and Benicia, extends southerly from the Napa-Solano County line to the Suisun Marsh. The Basin is situated adjacent to and west of the Solano Subbasin, and east of the outcrop of the Great Valley Group, Sonoma Volcanics and other Mesozoic Age bedrock. This basin is not used in a significant capacity due to low yield and poor water quality (USGS, 1960).

2.2 Geology and Groundwater Resources

The Solano Subbasin of the Sacramento Valley Groundwater Basin occurs over the eastern half of Solano County in the southern Sacramento Valley, a portion of the larger Central or Great Valley geologic province of California. It has been reported on by federal, state and local entities, including the U.S. Geological Survey (USGS), United States Bureau of Reclamation, DWR and various hydrogeologic consulting firms as contracted by local municipalities for local investigations.

The Sacramento Valley has had tectonically subsiding sedimentary deposits through most of Cenozoic time. Within these sedimentary deposits, fresh groundwater extends to an elevation of -3,000 feet mean sea level (msl) along the axis of the basin. The freshwater aquifer system in the Solano Subbasin, includes a relatively thin alluvial aquifer underlain by the pre-Holocene Tehama formation. The Tehama formation has been differentiated into three segments, including upper, middle and basal zones. Each of these is characterized by patterns of lithology that reflect the processes that influenced their formation (LSCE, 2010). The majority of current municipal groundwater production in the northern Solano Subbasin, including that of the City of Vacaville and Rural North Vacaville Water District (RNVWD), occurs from the basal zone of the Tehama formation. The middle and upper zones of the Tehama formation as well as the overlying alluvial aquifer are utilized on a more distributed basis by individual agricultural and domestic wells, outside of the municipal service areas. It is not currently understood the degree of confinement in the Alluvium and the upper zones of the Tehama, and this will continue to be investigated with further monitoring. The basal zone of the Tehama formation is a confined aquifer system and pumping from this zone results in rapid groundwater level responses.

Recharge of the alluvium comes from direct percolation of rainfall and return flows of applied water by agricultural and municipal users. Recharge of the Tehama Formation is believed to occur in the northwestern area of the County where the formation outcrops (LSCE, 2010). A portion of the recharge to the basal Tehama may be due to leakage from the overlying Quaternary alluvium and upper zones of the Tehama Formation in the outcrop areas. Due to the limited groundwater level record, the ability of recharge from this area to replenish the larger regional basal zone in a timely manner is uncertain.

The Suisun-Fairfield Valley consists of younger and older alluvial deposits from Suisun and Legewood Creeks and the underlying and older sedimentary and volcanic rocks. The alluvium deposited in the Basin, at a maximum thickness of 200 feet, was deposited during the same geologic time periods as the corresponding alluvium in the Putah Creek Fan. Suisun and Ledgewood Creeks are however quite a bit smaller than Putah Creek resulting in deposits of finer grained and less permeable sedimentary material. Beneath the alluvium to the east of Suisun Creek lie undifferentiated sedimentary rocks that are primarily Cretaceous in age. They are composed of mostly marine sedimentary rocks that include medium to fine-grained sandstone interbedded with siltstone and shale and thin lenses of limestone. Yields from wells in these units are typically small and the water is generally of poor quality (USGS, 1960).

In the southwestern edge of the County, the Sonoma Volcanics in the Suisun-Fairfield Valley typically consist of interbedded pumice tuff, tuff breccia, agglomerate, and flow rocks. The majority of groundwater in the Sonoma volcanics is contained in the predominating tuffs. Although flows in the predominating tuffs are typically dense and impermeable, the fractured portions may yield appreciable quantities of water to wells. Deep penetrating wells of the Sonoma Volcanics contain the largest discharge compared to wells in the alluvium. However, the average permeability of the volcanic rocks is substantially less than that of the alluvium.

This Valley is a narrow trough that broadens towards the marshlands to the south. In the area to the south, the alluvium of Suisun-Fairfield valley merges with the marshlands. The drainage in the Suisun-Fairfield Valley is all generally southward into Suisun Bay. Suisun and Ledgewood Creek drain the main central portion of Suisun-Fairfield Valley. Green Valley and Laurel Creeks drain the areas to the west and east of Suisun-Fairfield Valley, respectively (USGS, 1960).

3.0 GROUNDWATER MONITORING

3.1 Solano County Groundwater Monitoring

Historical monitoring has been done by local agencies, DWR and the USGS and generally focused on the upper portions of the aquifer system and on the northern half of the Solano Subbasin, where the majority of groundwater is pumped for municipal and agricultural uses. While groundwater use in the southern Solano Subbasin and in the Suisun-Fairfield Valley Basin, has been less prevalent, groundwater level monitoring has been extensive and ongoing since the early 1900s (USGS, 1960). More recently, monitoring in the deeper portions of the aquifer has been expanded as those deeper units have been defined and utilized.

Much of the existing water level data in Solano County has been made available through the Water Data Library (WDL), where cooperators had submitted their data to DWR for public sharing; a lesser amount of data is available on the USGS' National Water Information System website. As part of the recent efforts by SCWA and in cooperation with other entities in the county, a Data Management System (DMS) was developed for SCWA to establish a centralized repository for recording and archiving countywide groundwater wells including construction data (as related to groundwater monitored wells), historical groundwater level and quality measurements, and the development of tools for analyzing data on a programmatic basis. The DMS contains more than 700 wells with historical groundwater data and more than 63,000 associated water levels that include more than 90 years of records through 2013.

Recent efforts by SCWA to map and study the deeper parts of the system and the southern areas of the County have expanded the knowledge of substantial components of the groundwater system. Additional efforts to connect well construction and lithology from Well Completion

Reports to wells with existing water level data were completed last year, and aquifer zone designations were determined for 134 wells (LSCE, 2013b).

Groundwater data collected by the local cooperators (including data collected as part of the CASGEM program and other County programs) can be input into the DMS. It is expected that there will be regular updates from internal Agency monitoring and external agencies of new data for new and existing wells/sites already in the DMS. Quality control of the data and data entry procedures are described in the documentation for the DMS (LSCE, 2012).

3.2 Current Countywide Groundwater Level Monitoring

Currently, SCWA is involved in the joint public agency management of the groundwater basin, composed of overlying users and potential users. The joint users of the groundwater basins in the County (primarily of the Solano Subbasin and to a lesser extent the Suisun-Fairfield Valley Basin) monitor and report groundwater levels for state and local management purposes. The public agencies include: SCWA, City of Vacaville, City of Dixon, Solano Irrigation District, Rural North Vacaville Water District, Maine Prairie Water District, and Reclamation District 2068. CA DWR North Central Region Office (NCRO) also monitors several wells throughout the county including the Suisun-Fairfield Valley Basin. About 170 wells in Solano County are currently monitored by these entities (shown in **Figure 2**); these wells and the associated water levels are contained within the DMS.

The SCWA GMF project, as described herein, established deep, nested monitoring well sites in the Allendale, Dixon, Maine Prairie, and Elmira areas in 2008/2009. The deepest monitoring wells at the four sites range in depth from 1,680 to 2,370 feet. These wells are equipped with pressure transducers for continuous water level monitoring and are manually measured on a quarterly basis.

The City of Vacaville has 11 monitoring wells in addition to 13 production wells that primarily target the basal Tehama member of the aquifer system. The City performs a system-wide shutdown on a semi-annual basis to measure high and low static groundwater conditions during the spring and fall. They have also equipped the production wells and 5 of the monitoring wells with pressure transducers for continuous monitoring throughout the year.

Current monitoring by other entities including SID, DWR, and RD 2068 is mostly inferred by data that has been available on the DWR's Water Data Library (WDL). SCWA is newly familiar with some parts of these monitoring networks and hopes to obtain a more direct understanding of the existing monitoring networks. They will be taking steps to integrate them more fully into the DMS and the CASGEM Monitoring Plan. Solano Irrigation District currently monitors an extensive network of wells throughout the County on an annual to quarterly basis. As part of that current network, data for 29 wells are available on the state WDL, and there are many additional wells within the SID network that are not currently part of the DMS. DWR NCRO field personnel monitor 46 wells throughout the County on an annual to semi-annual basis. And

RD 2068 (USBR) monitors 40 wells in the County on an annual to semi-annual basis. These wells are of varying shallow or deep completion depths and were recently reviewed for SCWA and assigned an aquifer zone for future analysis on a zonal basis. Other monitoring by the Cities of Dixon and Rio Vista is not currently known but will be documented as a first step toward incorporating those entities and their respective areas.

3.3 Current Groundwater Conditions

Groundwater level data have been primarily reviewed for the northern half of Solano County. Water level hydrographs and contours were most recently presented to the Agency in a technical memorandum that described deep groundwater conditions in 2013 for northern Solano County (LSCE, 2013c). Following a pattern since 2005 and 2008 conditions, flow in the Basal Tehama is generally towards a cone of depression around the City of Vacaville production wells. The magnitude of the cone of depression has been reduced in recent years.

Analysis of groundwater conditions for the South and West areas of the County has not been done recently. However, through the recent effort to correlate existing wells that have water level data to a specific aquifer unit, a review of hydrographs for shallow and intermediate depth wells indicate generally stable groundwater levels. Since the 1950s, and since the Solano Project (Lake Berryessa) has provided a substantial amount of water for agricultural purposes, and where previously a heavy reliance on groundwater resulted in groundwater level declines in some places, those declines have mostly leveled off or recovered to early high historic levels.

SCWA is currently considering the timing and budget for preparation of an expanded and updated report on groundwater conditions for the whole County to possibly be undertaken in 2014/2015.

4.0 CASGEM MONITORING NETWORK AND PROGRAM – 2014

4.1 Selected Wells for CASGEM Program

The current CASGEM well network includes 27 wells that have full well construction information available and routine monitoring schedules in place by the local entities that monitor them (**Table 1**); and an additional 17 wells incorporated as voluntary wells. As shown on **Figure 3**, these wells are located in the Solano Subbasin in the northern half of Solano County, and the Suisun-Fairfield Valley Basin; they represent various parts of the multi-zone aquifer systems as described in Table 1. The addition of more wells to obtain representative monitoring coverage for both of these basins will be considered upon completion of the expanded groundwater conditions report. Well information, where available, such as required and/or suggested by DWR for the CASGEM program wells is summarized in detail in **Appendix A**.

In the Solano Subbasin, SCWA (12 wells), RD 2068 (3 wells, monitored by DWR) and City of Vacaville (11 wells) wells are specially designed monitoring wells that target discrete zones within the aquifer system. Of the 26 wells with designated aquifer zones, 15 wells target the Basal Tehama, and the remaining are screened in either the upper units of the Tehama Formation or the overlying Quaternary Alluvium. SID has 17 wells incorporated as voluntary wells that do not currently have an assigned aquifer zone. Complete construction information is needed for these wells and will be identified in future tasks or the inclusion of these wells in the network will be reconsidered.

In the Suisun-Fairfield Valley Basin, one well owned and monitored by SID since the 1970s[1] has been identified and incorporated into the CASGEM network. While a Well Completion Report is not available for this well, basic construction information is available, and it has been determined that the well is screened in both the alluvium and in the underlying undifferentiated Cretaceous Age rocks.

Many of the selected CASGEM wells have been recently surveyed for accurate horizontal and vertical components. The determination of the horizontal coordinates and vertical elevation of the depth-to-water reference point was made by a GPS survey in May 2009 for all of the SCWA (except the Dixon cluster that was surveyed in 2010/2011) and City of Vacaville monitoring wells. The precision for the vertical measurement was to within 0.1 feet relative to the NAVD88 vertical datum (LSCE, 2013a).

4.2 Field Methods

SCWA and local cooperators have established field procedures for the collection of groundwater level measurements. In addition to the detailed procedural discussion, an example form for recording water level measurements is also included here (**Appendix B**). SCWA and its cooperators will use the procedure outlined in **Appendix B** for the CASGEM program.

4.3 Monitoring Schedule

Historically, the wells have been measured semi-annually in the spring (generally April) and fall (generally October) of each year. Historical hydrographs show that these measurement periods generally correspond to the seasonal high and low groundwater elevations observed in their respective county subareas. The local cooperators will continue to measure the CASGEM wells semi-annually during similar periods.

Additionally, all of the SCWA monitoring wells and five of the City of Vacaville's monitoring wells are presently equipped with pressure transducers that record multiple measurements per day. These data are currently maintained in the DMS and reviewed on a regular basis for management purposes and to ensure all equipment is functioning properly.

[1] Water level data is available back to 2004.

4.4 Groundwater Elevation Data Management and CASGEM Data Submittal

Per DWR's CASGEM program reporting requirements, the following information related to each of the designated wells monitored will be submitted online following the spring and fall measurement by July 1st and January 1st, respectively.

- CASGEM Well identification number
- Measurement date
- Measurement time (PST/PDT with military time/24 hour format)
- Reference point elevation of the well (feet) using NAVD88 vertical datum
- Elevation of land surface datum 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[2]
- Measuring agency identification
- Comments about measurement, if applicable

5.0 Monitoring Plan Rationale

The current CASGEM well network is described herein; however, SCWA is considering additional wells that are currently being monitored for inclusion in CASGEM. The purpose of adding additional wells would be for:

- Improving horizontal and/or vertical spatial distribution of data;
- Include wells for under-represented areas of the groundwater basins;
- Identifying appropriate monitoring sites to evaluate surface water-groundwater recharge/discharge mechanisms; and
- Establishing additional basic data needed to accomplish groundwater level monitoring objectives as described above.

Further examination of the suitability of existing wells for groundwater monitoring (including their location and construction and relevance to meet SCWA's and/or CASGEM's monitoring objectives) is necessary to determine if any existing wells would be suitable for ongoing evaluation of groundwater conditions. Additional public and private wells that are currently monitored will be considered, and approval from the property owners to participate in the CASGEM program will be solicited.

[2] 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.

5.1 Address Data Gaps and Future Efforts

Presently, the SCWA CASGEM Plan does not have well coverage in the southern part of the Solano Subbasin. Recent work done on behalf of SCWA has identified more than 30 currently monitored wells with well construction information and aquifer designation that may be suitable for inclusion in CASGEM (**Figure 4**). As most of these wells are individually and privately owned, obtaining permission from property owners for these wells' participation will involve a substantial outreach effort, but it is recommended that SCWA undertake this task to expand coverage. Similarly for the Suisun-Fairfield Valley Basin, additional wells may be considered for inclusion in CASGEM, and 12 potential candidates are shown in **Figure 4**.

Further consideration of the existing network is needed to evaluate which wells (included in CASGEM or not yet currently) are necessary to provide a representative network of water levels for each of the basins and aquifer zones within the County. Future actions may include removal and/or replacement of current CASGEM wells with wells that are more representative of local groundwater conditions to better meet the objective of the CASGEM program.

For SID wells currently in CASGEM without construction information, the well completion reports need to be identified, if available, to evaluate the screened interval and aquifer designation(s). These wells should be reconsidered for continued inclusion in the CASGEM dependent on whether they provide necessary representative groundwater level information for the basin(s). It is also understood that SID maintains a network of even more wells in the county that may be considered for incorporation to CASGEM as appropriate.

Additionally, the Cities of Rio Vista, Dixon, and Benicia may have groundwater monitoring facilities that have not been identified, and these will also be considered.

6.0 References

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Thomasson Jr., H.G., F.H. Olmsted, and E.F. LeRoux. 1960. Geology, Water Resources and Usable Ground-Water Storage Capacity of Part of Solano County, California. U.S. Geological Survey Water Supply Paper WSP 1464.

TABLES

TABLE 1

WELL INFORMATION

Solano County Water Agency

Groundwater Monitoring Program

CASGEM Program Wells with Measurement Frequency

2013-2014

GW Basin/ Subbasin	State Well Number	Local Well Designation	Owned by	Measuring Agency	Well Use	Sampling Frequency	Aquifer Designation
Sacramento Valley/ Solano	07N01W15A001M	Allendale 1235	SCWA	SCWA	Observation	Quarterly	Basal Tehama
	07N01W15A002M	Allendale 1345	SCWA	SCWA	Observation	Quarterly	Basal Tehama
	07N01W15A003M	Allendale 1925	SCWA	SCWA	Observation	Quarterly	Basal Tehama
	07N01E11G001M	Dixon 1200	SCWA	SCWA	Observation	Quarterly	Undifferentiated Tehama
	07N01E11G002M	Dixon 2212	SCWA	SCWA	Observation	Quarterly	Basal Tehama
	07N01E11G003M	Dixon 2370	SCWA	SCWA	Observation	Quarterly	Basal Tehama
	06N01E10J002M	Maine Prairie 840	SCWA	SCWA	Observation	Quarterly	Undifferentiated Tehama
	06N01E10J003M	Maine Prairie 1960	SCWA	SCWA	Observation	Quarterly	Basal Tehama
	06N01E10J004M	Maine Prairie 2170	SCWA	SCWA	Observation	Quarterly	Basal Tehama
	06N01E30N001M	Meridian 400	SCWA	SCWA	Observation	Quarterly	Undifferentiated Tehama
	06N01E30N002M	Meridian 825	SCWA	SCWA	Observation	Quarterly	Undifferentiated Tehama
	06N01E30N003M	Meridian 1680	SCWA	SCWA	Observation	Quarterly	Basal Tehama
	07N02E35D001M	07N02E35D001M	RD 2068	DWR	Observation	Semi-Annual	Quaternary Alluvium
	07N02E35D002M	07N02E35D002M	RD 2068	DWR	Observation	Semi-Annual	Upper Tehama
	07N02E35D003M	07N02E35D003M	RD 2068	DWR	Observation	Semi-Annual	Upper Tehama
	07N01E04R001M	DW-11	SID	SID	Observation	Semi-Annual	Unknown
	07N01E03D001M	DW-12	SID	SID	Irrigation	Semi-Annual	Unknown
	07N01E25J001M	DW-15	SID	SID	Irrigation	Semi-Annual	Unknown
	07N01E10L001M	DW-21	SID	SID	Irrigation	Semi-Annual	Unknown
	07N01E25M001M	DW-22	SID	SID	Irrigation	Semi-Annual	Unknown
	07N01E21Q001M	DW-27	SID	SID	Irrigation	Semi-Annual	Unknown
	08N01E32N001M	DW-35	SID	SID	Irrigation	Semi-Annual	Unknown
	08N01W35R001M	DW-36	SID	SID	Irrigation	Semi-Annual	Unknown
	08N01E35K001M	DW-45	SID	SID	Irrigation	Semi-Annual	Unknown
	07N01E26G001M	DW-49	SID	SID	Irrigation	Semi-Annual	Unknown
	07N01E07M001M	DW-50	SID	SID	Irrigation	Semi-Annual	Unknown
	07N01E25K001M	DW-51	SID	SID	Irrigation	Semi-Annual	Unknown
	07N01E26N001M	DW-53	SID	SID	Irrigation	Semi-Annual	Unknown
	07N01E35C002M	DW-58	SID	SID	Irrigation	Semi-Annual	Unknown
	08N01E36Q002M	DW-59	SID	SID	Irrigation	Semi-Annual	Unknown
	07N01E12G001M	DW-8	SID	SID	Irrigation	Semi-Annual	Unknown
	07N01E03K003M	DW-60	SID	SID	Irrigation	Semi-Annual	Unknown
	NA	MW-98A	City of Vacaville	City of Vacaville	Observation	Semi-Annual	Basal Tehama
	NA	MW-98B	City of Vacaville	City of Vacaville	Observation	Semi-Annual	Basal Tehama
	NA	MW-98C	City of Vacaville	City of Vacaville	Observation	Semi-Annual	Basal Tehama
	NA	DeMello MW-95ft	City of Vacaville	City of Vacaville	Observation	Semi-Annual	Quaternary Alluvium
	NA	MW-14	City of Vacaville	City of Vacaville	Observation	Semi-Annual	Basal Tehama
	NA	MW-15-188ft	City of Vacaville	City of Vacaville	Observation	Semi-Annual	Quaternary Alluvium/Upper Tehama
	NA	MW-15-508ft	City of Vacaville	City of Vacaville	Observation	Semi-Annual	Upper Tehama
	NA	MW-15-1815ft	City of Vacaville	City of Vacaville	Observation	Semi-Annual	Basal Tehama
	NA	MW-16-117ft	City of Vacaville	City of Vacaville	Observation	Semi-Annual	Upper Tehama
	NA	MW-16-1166ft	City of Vacaville	City of Vacaville	Observation	Semi-Annual	Basal Tehama
	NA	MW-16-1430ft	City of Vacaville	City of Vacaville	Observation	Semi-Annual	Basal Tehama
Suisun-Fairfield Valley Basin	NA	DW-38	SID	SID	Observation	Quarterly	Quaternary Alluvium/Undifferentiated Cretaceous

FIGURES

Legend

- City Areas
- Solano County Boundary
- Solano Irrigation District
- Reclamation District No. 2068
- Maine Prairie Water District

Solano County Groundwater Basins

- Sacramento Valley
- Napa-Sonoma Valley
- Suisun-Fairfield Valley

N

Miles

0 2 4

NAPA
SOLANO

YOLO
SOLANO

SACRAMENTO VALLEY BASIN
SOLANO SUBBASIN

SUISUN-FAIRFIELD VALLEY BASIN

NAPA-SONOMA VALLEY BASIN
NAPA-SONOMA LOWLANDS SUBBASIN

SOLANO

SACRAMENTO

SOLANO

CONTRA COSTA

Sources: Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2012

Figure 1
Solano County
Groundwater Basins

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File: Z:\Clerical\2013 Job Files\13-045\CASGEM Assistance\Regional Location Map.mxd Date: 3/12/2014

Legend

Currently Monitored Well (by Measuring Agency)

- Solano County Water Agency
- City of Vacaville
- Solano Irrigation District
- US Bureau of Reclamation
- CA Department of Water Resources

- City Areas
- Solano County Boundary
- Reclamation District No. 2068
- Maine Prairie Water District
- Solano Irrigation District
- Rural North Vacaville Water District

Solano County Groundwater Basins

- Napa-Sonoma Valley
- Sacramento Valley
- Suisun-Fairfield Valley

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Miles
0 2 4

Figure 2
Current Groundwater Level Monitoring Well Location Map

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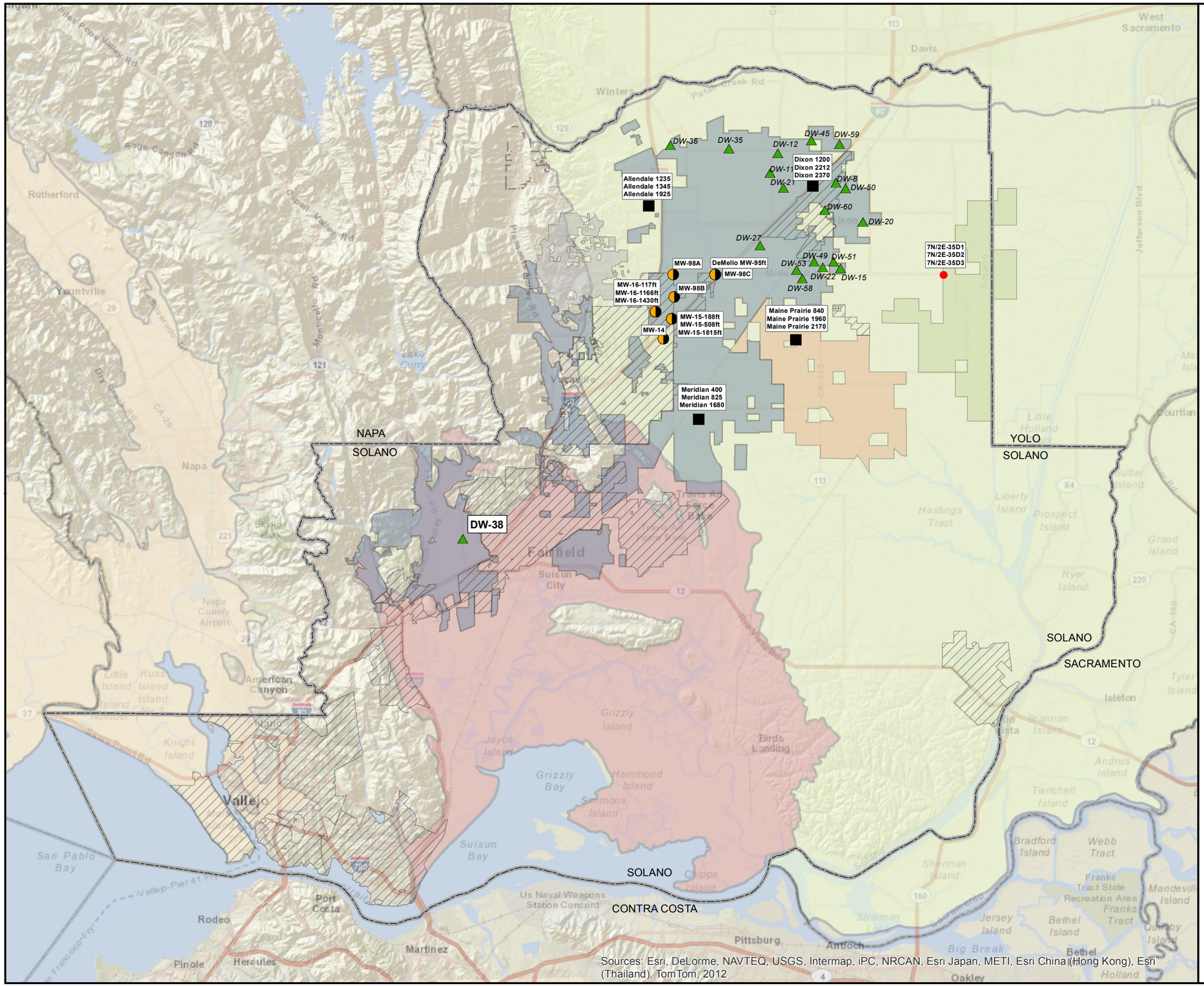
Sources: Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2012

File: Z:\Clerical\2013 Job Files\13-045\CASGEM Assistance\Current WL Monitoring Well Location Map.mxd Date: 3/27/2014



Sources: Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2012

Legend

CASGEM Well (by Measuring Agency)*

- Solano County Water Agency
- City of Vacaville
- Solano Irrigation District
- CA Department of Water Resources
- City Areas
- Solano County Boundary
- Reclamation District No. 2068
- Maine Prairie Water District
- Solano Irrigation District
- Rural North Vacaville Water District

Solano County Groundwater Basins

- Napa-Sonoma Valley
- Sacramento Valley
- Suisun-Fairfield Valley

**CASGEM Wells are labeled with boxes around Well ID; Voluntary wells are labeled in italics without a box*

N

Miles

0 2 4

Figure 3
CASGEM Well Location Map

LUHDORFF & SCALMANINI CONSULTING ENGINEERS

File: Z:\Clerical\2013 Job Files\13-045\CASGEM Assistance\Well Location Map.mxd Date: 3/27/2014

Legend

Potential CASGEM Wells (by Monitoring Entity)

- Solano Irrigatin District
- CA Department of Water Resources
- US Bureau of Reclamation
- City Areas
- Solano County Boundary
- Reclamation District No. 2068
- Maine Prairie Water District
- Solano Irrigation District
- Rural North Vacaville Water District

Solano County Groundwater Basins

- Napa-Sonoma Valley
- Sacramento Valley
- Suisun-Fairfield Valley

8N/1W-24D1
8N/1W-22P1
8N/1W-33B2
8N/1E-33Q2
8N/1E-33Q3
8N/1E-35K1
8N/2E-32N1
8N/2E-21L1
8N/3E-31N1
7N/2E-06N1
7N/1E-16D1
7N/2E-17E2
7N/1E-21H3
7N/1E-30M1
7N/1E-29P1
7N/1W-33J2
6N/1E-06D1
6N/1E-05A1
7N/1E-33R1
6N/1E-02B1
6N/1E-12M1
6N/1W-13R1
6N/1E-18N1
6N/1E-24L3
6N/1W-24N1
6N/1W-36C4
6N/1E-33L1
5N/2W-08G3
5N/1W-07E1
5N/1W-15D1
5N/2E-07R1
5N/2W-19H4
5N/2E-25K1
5N/1W-35E1
5N/2E-36N1
4N/3W-01D1
4N/2W-04D2
4N/2W-04F3
4N/1E-02E1
4N/1E-02G1
4N/2E-09A1
4N/3W-12G1
4N/1E-17Q2
4N/1E-20F1
4N/2E-22P1
4N/1W-32G1

NAPA
SOLANO
YOLO
SOLANO
SOLANO
SACRAMENTO
SOLANO
CONTRA COSTA

Sources: Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2012

N

Miles
0 2 4

Figure 4
Potential CASGEM Well Location Map

LUHDORFF & SCALMANINI CONSULTING ENGINEERS

File: Z:\Clerical\2013 Job Files\13-045\CASGEM Assistance\Potential Well Location Map Mar2014.mxd Date: 3/27/2014

APPENDIX A

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
SCWA-Meridian MW-400	06N01E30N001M	77.27	TOC mark north side	76.3	GPS	0.1 ft.	Observation	Active	38.33055189	121.9147507	GPS	1 ft.	Part of a nested/multi-completion well	400	e075820	5-21.66-Solano	
SCWA-Meridian MW-825	06N01E30N002M	77.19	TOC mark north side	76.3	GPS	0.1 ft.	Observation	Active	38.33055167	121.9147489	GPS	1 ft.	Part of a nested/multi-completion well	824	e075820	5-21.66-Solano	
SCWA-Meridian MW-1680	06N01E30N003M	77.98	TOC mark north side	76.3	GPS	0.1 ft.	Observation	Active	38.33055403	121.9147502	GPS	1 ft.	Part of a nested/multi-completion well	1680	e075820	5-21.66-Solano	
SCWA-MainePrairie MW-840	06N01E10J002M	52.76	TOC mark north side	52.3	GPS	0.1 ft.	Observation	Active	38.37731427	121.841692	GPS	1 ft.	Part of a nested/multi-completion well	840	e075056	5-21.66-Solano	
SCWA-MainePrairie MW-1960	06N01E10J003M	53.35	TOC mark north side	52.3	GPS	0.1 ft.	Observation	Active	38.37731487	121.8416908	GPS	1 ft.	Part of a nested/multi-completion well	1960	e075056	5-21.66-Solano	
SCWA-MainePrairie MW-2170	06N01E10J004M	53.58	TOC mark north side	52.3	GPS	0.1 ft.	Observation	Active	38.37731344	121.8416904	GPS	1 ft.	Part of a nested/multi-completion well	2170	e075056	5-21.66-Solano	
SCWA-Dixon MW-1200	07N01E11G001M	79.38	TOC mark north side	77.5	GPS	0.1 ft.	Observation	Active	38.46858864	121.828616	GPS	1 ft.	Part of a nested/multi-completion well	1200	e0098903	5-21.66-Solano	
SCWA-Dixon MW-2212	07N01E11G002M	79.53	TOC mark north side	77.5	GPS	0.1 ft.	Observation	Active	38.46858864	121.828616	GPS	1 ft.	Part of a nested/multi-completion well	2212	e0098903	5-21.66-Solano	
SCWA-Dixon MW-2370	07N01E11G003M	79.23	TOC mark north side	77.5	GPS	0.1 ft.	Observation	Active	38.46858864	121.828616	GPS	1 ft.	Part of a nested/multi-completion well	2370	e0098903	5-21.66-Solano	
SCWA-Allendale MW-1235	07N01W15A001M	132.81	TOC mark north side	130.8	GPS	0.1 ft.	Observation	Active	38.45684998	121.9522428	GPS	1 ft.	Part of a nested/multi-completion well	1235	e067404	5-21.66-Solano	
SCWA-Allendale MW-1345	07N01W15A002M	132.31	TOC mark north side	130.8	GPS	0.1 ft.	Observation	Active	38.45685097	121.9522433	GPS	1 ft.	Part of a nested/multi-completion well	1345	e067404	5-21.66-Solano	
SCWA-Allendale MW-1925	07N01W15A003M	131.79	TOC mark north side	130.8	GPS	0.1 ft.	Observation	Active	38.45685069	121.9522417	GPS	1 ft.	Part of a nested/multi-completion well	1925	e067404	5-21.66-Solano	
MW-98A		104.02	TOC mark north side	102.2	GPS	0.1 ft.	Observation	Active	38.41643549	121.9339883	GPS	1 ft.	Single Well	1850	823437/823438	5-21.66-Solano	
MW-98B		95.28	TOC mark north side	93.3	GPS	0.1 ft.	Observation	Active	38.4032715	121.9331305	GPS	1 ft.	Single Well	1819	823439/823440	5-21.66-Solano	
MW-98C		81.07	TOC mark north side	79.7	GPS	0.1 ft.	Observation	Active	38.41625096	121.9022882	GPS	1 ft.	Single Well	2326	823441/823442	5-21.66-Solano	
DeMello MW-95ft		79.78	TOC mark north side	78	GPS	0.1 ft.	Observation	Active	38.41625278	121.9022889	GPS	1 ft.	Single Well	95	726580	5-21.66-Solano	
MW-14		92.98	TOC mark north side	93	GPS	0.1 ft.	Observation	Active	38.3782058	121.9412833	GPS	1 ft.	Single Well	1655	457452/457453	5-21.66-Solano	
MW-15-188ft		95.40	TOC mark north side	95	GPS	0.1 ft.	Observation	Active	38.3900311	121.9348052	GPS	1 ft.	Part of a nested/multi-completion well	188		5-21.66-Solano	
MW-15-508ft		95.39	TOC mark north side	95	GPS	0.1 ft.	Observation	Active	38.39003159	121.9348052	GPS	1 ft.	Part of a nested/multi-completion well	508		5-21.66-Solano	
MW-15-1815ft		94.97	TOC mark north side	95	GPS	0.1 ft.	Observation	Active	38.38999651	121.9347828	GPS	1 ft.	Single Well	1815	823445	5-21.66-Solano	
MW-16-117ft		103.30	TOC mark north side	103	GPS	0.1 ft.	Observation	Active	38.39449833	121.9472705	GPS	1 ft.	Part of a nested/multi-completion well	117		5-21.66-Solano	
MW-16-1166ft		103.33	TOC mark north side	103	GPS	0.1 ft.	Observation	Active	38.39449899	121.947271	GPS	1 ft.	Part of a nested/multi-completion well	1166		5-21.66-Solano	
MW-16-1430ft		103.52	TOC mark north side	103	GPS	0.1 ft.	Observation	Active	38.39450105	121.9472718	GPS	1 ft.	Part of a nested/multi-completion well	1430		5-21.66-Solano	
SID DW-11	07N01E04R001M	81.20	Sounding Tube	80.80	Surveyed to a benchmark	0.1 ft.	Observation	Inactive	38.4803	121.8661	GPS	10 ft.	Single Well	204		5-21.66-Solano	
SID DW-12	07N01E03D001M	84.50	Gap in West Pad	84.00	Surveyed to a benchmark	0.1 ft.	Irrigation	Active	38.4931	121.8594	GPS	10 ft.	Single Well	406		5-21.66-Solano	
SID DW-15	07N01E25J001M	48.00	Sounding Tube	47.00	Surveyed to a benchmark	0.1 ft.	Irrigation	Active	38.4244	121.8106	GPS	10 ft.	Single Well	730		5-21.66-Solano	
SID DW-21	07N01E10L001M	83.10	Hole in Concrete Pad	83.10	Surveyed to a benchmark	0.1 ft.	Irrigation	Inactive	38.4814	121.8553	GPS	10 ft.	Single Well	216		5-21.66-Solano	
SID DW-22	07N01E25M001M	51.00	Hole in Base East side	51.00	Surveyed to a benchmark	0.1 ft.	Irrigation	Active	38.4261	121.8264	GPS	10 ft.	Single Well	308		5-21.66-Solano	
SID DW-27	07N01E21Q001M	72.50	Nut on South side	72.00	Surveyed to a benchmark	0.1 ft.	Irrigation	Inactive	38.4444	121.8768	GPS	10 ft.	Single Well	780		5-21.66-Solano	
SID DW-35	08N01E32N001M	106.00	Sounding Tube	104.50	Surveyed to a benchmark	0.1 ft.	Irrigation	Inactive	38.4940	121.8950	GPS	10 ft.	Single Well	600		5-21.66-Solano	
SID DW-36	08N01W35R001M	112.00	S. Sounding Tube	110.00	Surveyed to a benchmark	0.1 ft.	Irrigation	Active	38.4974	121.9376	GPS	10 ft.	Single Well	598		5-21.66-Solano	
SID DW-45	08N01E35K001M	72.90	Hole in Base	72.60	Surveyed to a benchmark	0.1 ft.	Irrigation	Active	38.5074	121.8411	GPS	10 ft.	Single Well	815		5-21.66-Solano	
SID DW-49	07N01E26G001M	56.60	Hole in Base	55.60	Surveyed to a benchmark	0.1 ft.	Irrigation	Active	38.4287	121.8348	GPS	10 ft.	Single Well	600		5-21.66-Solano	
SID DW-50	07N01E07M001M	59.00	Sounding Tube	57.00	Surveyed to a benchmark	0.1 ft.	Irrigation	Active	38.4972	121.8061	GPS	10 ft.	Single Well	915		5-21.66-Solano	
SID DW-51	07N01E25K001M	51.70	Sounding Tube	49.00	Surveyed to a benchmark	0.1 ft.	Irrigation	Active	38.4283	121.8213	GPS	10 ft.	Single Well	1230		5-21.66-Solano	
SID DW-53	07N01E26N001M	61.50	Sounding Tube	60.00	Surveyed to a benchmark	0.1 ft.	Irrigation	Active	38.4205	121.8461	GPS	10 ft.	Single Well	880		5-21.66-Solano	
SID DW-58	07N01E35C002M	64.60	Sounding Tube	64.00	Surveyed to a benchmark	0.1 ft.	Irrigation	Active	38.4231	121.8386	GPS	10 ft.	Single Well	950		5-21.66-Solano	
SID DW-59	08N01E36Q002M	66.80	Sounding Tube	65.00	Surveyed to a benchmark	0.1 ft.	Irrigation	Active	38.5003	121.8139	GPS	10 ft.	Single Well	1000		5-21.66-Solano	
SID DW-8	07N01E12G001M	61.50	Large nut on East side	60.00	Surveyed to a benchmark	0.1 ft.	Irrigation	Active	38.4734	121.8218	GPS	10 ft.	Single Well	105		5-21.66-Solano	
SID DW-60	07N01E03K003M	61.00	Sounding Tube	60.00	Surveyed to a benchmark	0.1 ft.	Irrigation	Active	38.4543	121.8196	GPS	10 ft.	Single Well	705		5-21.66-Solano	
RD2068 MW-1A	07N02E35D001M	34.35	Unknown	33	Unknown	Unknown	Observation	Active	38.4159	121.7303	Unknown	Unknown	Part of a nested/multi-completion well	43	726965A	5-21.66-Solano	
RD2068 MW-1B	07N02E35D002M	34.29	Unknown	33	Unknown	Unknown	Observation	Active	38.4159	121.7303	Unknown	Unknown	Part of a nested/multi-completion well	243	726965B	5-21.66-Solano	
RD2068 MW-1C	07N02E35D003M	35.40	Unknown	33	Unknown	Unknown	Observation	Active	38.4159	121.7303	Unknown	Unknown	Part of a nested/multi-completion well	445	726965C	5-21.66-Solano	
SID-38		60.7	Access hole on east side of casing	60	Unknown	0.1 ft.	Observation	Active	38.2590	122.0922	Determined from map	100 ft	Single Well	349	NA	2-3 Suisun-Fairfield Valley	

Local Well Designation	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	Screen Interval 3 Top	Screen Interval 3 Bottom	Screen Interval 4 Top	Screen Interval 4 Bottom
SCWA-Meridian MW-400	2450' South of Fry Road; 150' East of Meridian Road	Coordinates determined by RTK GPS survey	No	Solano	360.00	370.00	380.00					
SCWA-Meridian MW-825	2450' South of Fry Road; 150' East of Meridian Road	Coordinates determined by RTK GPS survey	No	Solano	794.00	814.00						
SCWA-Meridian MW-1680	2450' South of Fry Road; 150' East of Meridian Road	Coordinates determined by RTK GPS survey	No	Solano	1650.00	1670.00						
SCWA-MainePrairie MW-840	1.3 miles North of Hawkins Road; 85' West of Pitt School Road	Coordinates determined by RTK GPS survey	No	Solano	811.00	831.00						
SCWA-MainePrairie MW-1960	1.3 miles North of Hawkins Road; 85' West of Pitt School Road	Coordinates determined by RTK GPS survey	No	Solano	1930.00	1950.00						
SCWA-MainePrairie MW-2170	1.3 miles North of Hawkins Road; 85' West of Pitt School Road	Coordinates determined by RTK GPS survey	No	Solano	2140.00	2160.00						
SCWA-Dixon MW-1200	1900' West of North 1st Street; 400' North of North Lincoln Road; Access road is 150' Southeast of I-80	Coordinates determined by RTK GPS survey	No	Solano	1180.00	1190.00						
SCWA-Dixon MW-2212	1900' West of North 1st Street; 400' North of North Lincoln Road; Access road is 150' Southeast of I-80	Coordinates determined by RTK GPS survey	No	Solano	2182.00	2202.00						
SCWA-Dixon MW-2370	1900' West of North 1st Street; 400' North of North Lincoln Road; Access road is 150' Southeast of I-80	Coordinates determined by RTK GPS survey	No	Solano	2340.00	2360.00						
SCWA-Allendale MW-1235	Access road is 3500' west of I-505; 1300' North of Allendale Road; 75' Southeast of Putah South Canal along Canal Rd	Coordinates determined by RTK GPS survey	No	Solano	1205.00	1225.00						
SCWA-Allendale MW-1345	Access road is 3500' west of I-505; 1300' North of Allendale Road; 75' Southeast of Putah South Canal along Canal Rd	Coordinates determined by RTK GPS survey	No	Solano	1315.00	1335.00						
SCWA-Allendale MW-1925	Access road is 3500' west of I-505; 1300' North of Allendale Road; 75' Southeast of Putah South Canal along Canal Rd	Coordinates determined by RTK GPS survey	No	Solano	1877.00	1917.00						
MW-98A	200' South of Midway Road; 50' West of Leisure Town Road	Coordinates determined by RTK GPS survey	No	Solano	1727.00	1745.00	1790.00	1830.00				
MW-98B	Access road is 2850' North of Ellsworth Rd; 160' East of Leisure Town Rd	Coordinates determined by RTK GPS survey	No	Solano	1559.00	1579.00	1700.00	1710.00	1720.00	1730.00	1778.00	1798.00
MW-98C	260' South of Midway Rd; Access road is 850' East of Demello Lane	Coordinates determined by RTK GPS survey	No	Solano	2152.00	2192.00	2234.00	2264.00	2285.00	2305.00		
DeMello MW-95ft	150' South of Midway Rd; Access road is 850' East of Demello Lane	Coordinates determined by RTK GPS survey	No	Solano	65.00	85.00						
MW-14	South end of Auto Center Drive; 1.1 miles East of Nut Tree Road; 575' Southwest of Orange Drive	Coordinates determined by RTK GPS survey	No	Solano	1100.00	1650.00						
MW-15-188ft	Access road is 350' South of Quinn Road; 300' West of Leisure Town Road	Coordinates determined by RTK GPS survey	No	Solano	158.00	178.00						
MW-15-508ft	Access road is 350' South of Quinn Road; 300' West of Leisure Town Road	Coordinates determined by RTK GPS survey	No	Solano	438.00	498.00						
MW-15-1815ft	Access road is 350' South of Quinn Road; 300' West of Leisure Town Road; SE of shallower MW cluster	Coordinates determined by RTK GPS survey	No	Solano	1207.00	1227.00	1252.00	1262.00	1338.00	1348.00	1414.00	1444.00
MW-16-117ft	250' East of NB I-505 offramp stop sign; 300' North of Vaca Valley Parkway	Coordinates determined by RTK GPS survey	No	Solano	97.00	107.00						
MW-16-1166ft	250' East of NB I-505 offramp stop sign; 300' North of Vaca Valley Parkway	Coordinates determined by RTK GPS survey	No	Solano	1136.00	1162.00						
MW-16-1430ft	250' East of NB I-505 offramp stop sign; 300' North of Vaca Valley Parkway	Coordinates determined by RTK GPS survey	No	Solano	1264.00	1374.00						
SID DW-11	SW corner Schroeder Rd & Thissell Rd		Yes	Solano								
SID DW-12	S side Sievers Rd, between Schroeder Rd & Pitt School Rd		Yes	Solano								
SID DW-15	0.375 mi N of Midway Rd, 0.15 mi W of Pedrick Rd		Yes	Solano								
SID DW-21	N side Silveyville Rd & 0.5 mi E of Schroeder Rd		Yes	Solano								
SID DW-22	E side of Hwy 113, 0.375 mi N of Midway Rd		Yes	Solano								
SID DW-27	0.25 mi W of Batavia Rd & 1.25 mi N of Midway Rd		Yes	Solano								
SID DW-35	N side Vaughn Canal, N side Sievers Rd, Between Garnett Ln & Sparks Ranch Rd		Yes	Solano								
SID DW-36	S side Vaughn Canal, between Tubbs Rd & Halley Rd		Yes	Solano								
SID DW-45	0.75 mi N of Sievers Rd & 0.5 mi W Currey Rd		Yes	Solano								
SID DW-49	0.25 mi W of Hwy 113, 0.5 mi N of Midway Rd		Yes	Solano								
SID DW-50	SE corner Vaughn Rd & Pedrick Rd		Yes	Solano								
SID DW-51	0.5 mi N of Midway Rd, 0.375 W of Pedrick Rd		Yes	Solano								
SID DW-53	0.15 mi N of Midway Rd, E side of Pitt School Rd		Yes	Solano								
SID DW-58	0.25 mi S of Midway Rd, 0.25 mi E of Pitt School Rd		Yes	Solano								
SID DW-59	0.25 mi N of Sievers Rd & 0.5 mi W Pedrick Rd		Yes	Solano								
SID DW-8	0.5 N of Vaughn Rd & 0.5 mi W of Pedrick Rd		Yes	Solano								
SID DW-60	0.5 mi W of Pedrick Rd & 0.5 mi N of Dixon Ave East		Yes	Solano								
RD2068 MW-1A	Unknown		No	Solano	28	38						
RD2068 MW-1B	Unknown		No	Solano	218	238						
RD2068 MW-1C	Unknown		No	Solano	430	440						
SID-38	Southwest corner of Abernathy Road and Andrews Lane		No	Solano	150	349						

Local Well Designation	Screen Interval 5 Top	Screen Interval 5 Bottom	Screen Interval 6 Top	Screen Interval 6 Bottom	Screen Interval 7 Top	Screen Interval 7 Bottom	Screen Interval 8 Top	Screen Interval 8 Bottom	Screen Interval 9 Top	Screen Interval 9 Bottom	Screen Interval 10 Top	Screen Interval 10 Bottom
SCWA-Meridian MW-400												
SCWA-Meridian MW-825												
SCWA-Meridian MW-1680												
SCWA-MainePrairie MW-840												
SCWA-MainePrairie MW-1960												
SCWA-MainePrairie MW-2170												
SCWA-Dixon MW-1200												
SCWA-Dixon MW-2212												
SCWA-Dixon MW-2370												
SCWA-Allendale MW-1235												
SCWA-Allendale MW-1345												
SCWA-Allendale MW-1925												
MW-98A												
MW-98B												
MW-98C												
DeMello MW-95ft												
MW-14												
MW-15-188ft												
MW-15-508ft												
MW-15-1815ft	1546.00	1566.00	1582.00	1602.00	1673.00	1693.00	1765.00	1785.00				
MW-16-117ft												
MW-16-1166ft												
MW-16-1430ft												
SID DW-11												
SID DW-12												
SID DW-15												
SID DW-21												
SID DW-22												
SID DW-27												
SID DW-35												
SID DW-36												
SID DW-45												
SID DW-49												
SID DW-50												
SID DW-51												
SID DW-53												
SID DW-58												
SID DW-59												
SID DW-8												
SID DW-60												
RD2068 MW-1A												
RD2068 MW-1B												
RD2068 MW-1C												
SID-38												

APPENDIX B

PROCEDURE FOR MEASURING
THE DEPTH TO WATER IN MONITORING AND PRODUCTION WELLS

Purpose

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 (e.g., NAVD 1988). In this context, static means that the water level in the well is not influenced by pumping of the well. For comparability, measurements should be obtained according to an established schedule designed to capture times of both highest and lowest seasonal water level elevations. Also for comparability, measurements during a particular field campaign should be obtained consecutively and without delay within the shortest reasonable time.

Measurement Procedure

- If a well is being pumped, do not measure; return later, but not sooner than 60 minutes and preferably after 24 hours.
- Turn on water level indicator signaling device and check battery by hitting the test button.
- Remove access plug or well cap from the well cover and lower probe (electric sounder) into the well.
- When probe hits water a loud "beep" will sound and signal light will turn red.
- Retract slightly until the tone stops.
- Slowly lower the probe until the tone sounds.
- Note depth measurement at rim (i.e., the surveyed reference point for water level readings) of well to the nearest 0.01 foot and rewind probe completely out of well.
- Remove excess water and lower probe once again into well and measure again.
- If difference is within ±0.02 foot of first measurement, record measurement.
- If difference is greater repeat the same procedure until three consecutive measurements are recorded within ± 0.02 foot. If not able to obtain three consecutive measurements, either record a 'No Measurement' with a notation that well is pumping, or record the measurement with 'Questionable Measurement' notation to indicate either pumping or recently pumping.
- Rewind and remove probe from well and replace the access plug or well cap in the well cover.
- Clean and dry the measuring device/probe and continue to next well.

Special Circumstance – Oil Encountered in Well

If oil is detected in the well structure, the depth to the air-oil interface is measured. To obtain such a measurement, the electric sounder is used similar to the way chalked steel tapes were traditionally used for depth-to-water measurements.

1. Lower the cleaned probe well below the air-oil interface (e.g., 1 foot). Read and record the depth at the reference point (since this depth is chosen somewhat arbitrarily by the field technician, an even number can be chosen, e.g., 37.00 feet). This measurement is the length of cable lowered into the well and corresponds to a line that the oil leaves on the probe or cable (i.e., the oil inundation line). Above this line, smudges of oil may appear on the cable. Below this line, the cable/probe is completely covered with oil. If the probe is lowered too far, completely penetrates the oil, and is far submerged in the water below the oil, parts of the probe/cable below the oil inundation line may also appear smudgy.
2. Retrieve probe, identify and record the oil inundation line on the cable (e.g., 2.72 feet). This measurement does not reflect the thickness of the oil. It reflects the length of the cable below the air-oil interface.
3. Compute the depth to oil by subtracting the length of line below the air-oil interface from the corresponding measurement at the reference point: Depth to oil = 37.00 feet – 2.72 feet = 34.28 feet.

Since oil has a slightly smaller density than water, a depth-to-oil measurement will always be smaller than a corresponding depth-to-water measurement in the same well if oil were not present. Depth-to-oil measurements yield a reasonable approximation to depth-to-water measurements unless the oil thickness is great. For each foot of oil in the well casing, the depth-to-oil measurement will be approximately 0.12 foot smaller than a corresponding depth-to-water measurement if oil were not present.

Recordation

1. Name of field technician
2. Unique identification of well
3. Weather and site conditions (e.g., clear, sunny, strong north wind, intense dust blowing over wellhead from nearby plowed field; dry ground, easy access)
4. Condition of well structure (e.g., well cap cracked – replaced with new one; wasp hive between well casing and well housing; no action, discuss with project manager)
5. Time and date of depth-to-water reading

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?; or: oil in well…measurement is depth to oil; or: intense sulphur odor upon opening well cap; or: nearby (west ~100 feet) irrigation well pumping)

CALIFORNIA STATEWIDE GROUNDWATER ELEVATION MONITORING
(CASGEM)

STATE OF CALIFORNIA DEPARTMENT OF WATER RESOURCES

GROUND WATER LEVEL MEASUREMENTS

Monitoring Entity: Solano County Water Agency
Monitoring Period:_____
Measuring Agency Number: _____
Measured By:_____

STATE WELL NUMBER	COUNTY WELL ID	MSRMNT DATE	R.P. ELEVATION (ft)	DIST. R.P. TO WATER	METHOD OF WATER DEPTH MSRMNT	MSRMNT QUALITY CODES[1]	MSRMNT TIME	COMMENTS

1 MEASUREMENT QUALITY CODES:

- If **no** measurement is taken, a specified "no measurement" code, must be recorded.
  0. Discontinued 1. Pumping 2. Pumphouse locked 3. Tape hung up 4. Can't get tape in casing 5. Unable to locate well 6. Well destroyed 7. Special 8. Casing leaking or wet 9. Temporarily inaccessible D. Dry well F. Flowing well
- If the quality of a measurement is **uncertain**, a "questionable measurement" code can be recorded.
  0. Caved or deepened 1. Pumping 2. Nearby pump operating 3. Casing leaking or wet 4. Pumped recently 5. Air or pressure gauge measurement 6. Other 7. Recharge operation at nearby well 8. Oil in casing 9. Acoustical sounder measurement