Sutter County

California Statewide Groundwater Elevation Monitoring Program

CASGEM Monitoring Plan

October 2015

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1. Introduction

This monitoring plan has been developed by Sutter County (County) to meet requirements of the California Department of Water Resources (DWR) California Statewide Groundwater Elevation Monitoring (CASGEM) program. This plan covers the high and medium priority alluvial subbasins identified in DWR Bulletin 118 located within the County which a Monitoring Entity has not yet been designated. This plan provides information on the subbasins within the County, the wells to be monitored, and the monitoring schedule and methods.

1.1. Background

On November 4, 2009 the State Legislature amended the Water Code with Senate Bill SBx7-6, which mandates a statewide groundwater elevation monitoring program to track seasonal and long-term trends in groundwater elevations in California's groundwater basins. To achieve that goal, the amendment requires collaboration between local monitoring entities and DWR to collect groundwater elevation data. Collection and evaluation of such data on a statewide scale is an important fundamental step toward improving management of California's groundwater resources.

In accordance with this amendment to the Water Code, DWR developed the CASGEM program. The intent of the CASGEM program is to establish a permanent, locally-managed program of regular and systematic monitoring in all of California's alluvial groundwater basins. The CASGEM program will rely and build on the many, established local long-term groundwater monitoring and management programs. DWR's role is to coordinate the CASGEM program, to work cooperatively with local entities, and to maintain the collected elevation data in a readily and widely available public database. DWR will also continue its current network of groundwater monitoring as funding allows.

The law required local entities to notify DWR in writing by January 1, 2011 if the local agency or party seeks to assume groundwater monitoring functions in accordance with the law (Water Code §10928). Local entities that submit complete Monitoring Entity notifications and adequate groundwater monitoring plans and well networks will be officially designated by DWR to be the Monitoring Entities for their respective subbasin or portion of a subbasin for the purposes of the CASGEM Program. However, if no local monitoring entity volunteers or is identified for a particular area or groundwater basin, DWR may assume the monitoring and reporting duties and certain entities in the basin may not be eligible for water grants or loans administered by the state.

Sutter County is severely limited in its ability to take a lead in groundwater monitoring because of budget and staff shortages. The County owns and monitors a few groundwater

monitoring wells, however they are associated with the Robbins wastewater treatment plant which is managed by the County's General Services department. The community of Robbins falls within Reclamation District 1500's monitoring entity boundaries. The County does not own or monitor any other groundwater monitoring well throughout the County. For this reason, Sutter County did not seek to assume groundwater monitoring functions under California Water Code §10920 et seq. and did not file to become a monitoring entity. However, the County does promote the coordinated collection of groundwater elevation data through its Groundwater Monitoring Program.

1.2. Purpose

The purpose of the CASGEM program is to monitor groundwater elevations that demonstrate seasonal and long-term trends in California's groundwater basins and to make this information available to the public. A Monitoring Entity is a designated entity that conducts or coordinates the monitoring of groundwater elevations for groundwater basins.

As of Governor Brown's April 1, 2015 Drought Executive Order B-29-15, "Local water agencies in high and medium priority groundwater basins shall immediately implement all requirements of the CASGEM program pursuant to Water Code section 10933." Sutter County's intent for preparing this CASGEM Monitoring Plan is to comply with the Governor's Executive Order and become the CASGEM Monitoring Entity for the unmonitored portions within the County.

1.3. Monitoring Area

Sutter County encompasses approximately 607 square miles (389,443 acres) in the central portion of the Sacramento Valley. As shown in Figure 1, the County is bound by Butte County to the north, Colusa and Yolo Counties to the west, Yuba and Placer Counties to the east, and Sacramento County to the south. Land elevations range between 80 and 20 feet above sea level throughout the County with the exception of the Sutter Buttes, where elevations are more than 2,100 feet above sea level. The lowest land elevations are located towards the southern portion of the County.

Sutter County overlies the south central part of the Sacramento Valley Groundwater Basin, and specifically the Sutter Subbasin and portions of the East Butte and North American Subbasins, as shown in Figure 2.

Table 1: DWR Bulletin 118 Basin Nomenclature, Numbering and Prioritization.

Subbasin Name	*Subbasin Number*	*Basin Prioritization*
East Butte	5-21.59	Medium
Sutter	5-21.62	Medium
North American	5-21.64	High

As of August 2015, there are four existing Monitoring Entities within the County actively participating in the CASGEM program:

- Feather Water District,
- Reclamation District 1500 (including Pelger Mutual Water Company and Sutter Mutual Water Company),
- South Sutter Water District, and
- Sutter Extension Water District.

The County's Monitoring Entity boundary, as shown in Figure 3, contains the unmonitored portion of the County, which excludes the areas managed by the four existing Monitoring Entities. Existing Monitoring Entity boundaries are also shown in Figure 3.

1.4. Cooperating Agencies

A Cooperating Agency can monitor and upload groundwater elevation data in CASGEM for the Monitoring Entity to submit to DWR. The following agencies have agreed to become Cooperating Agencies to support the County's CASGEM Monitoring Entity efforts:

- Butte Slough Irrigation District,
- Butte Water District,
- City of Live Oak,
- City of Yuba City,
- Department of Water Resources,
- Garden Highway Mutual Water Company,
- Meridian Farms Water Company,
- Natomas Central Mutual Water Company,
- Pleasant Grove-Verona Mutual Water Company, and
- Tisdale Irrigation District.

Each of the cooperating agencies listed above will monitor groundwater elevations and report groundwater elevation data to the County and DWR for CASGEM. Therefore it is not necessary for County staff to conduct groundwater monitoring for the wells proposed in this plan. Contact information for each cooperating agency is provided in Attachment B. Cooperating agency boundaries are shown in Figure 9.

2. Groundwater Basin Description and Hydrogeology

Information contained within this section has been taken directly from the Sutter County Groundwater Management Plan (GWMP) (2012) which is available at: http://www.co.sutter.ca.us/doc/government/depts/cs/pw/wr/gmp/gmphome

2.1. Groundwater Basins and Subbasins

Sutter County is underlain by the Sacramento Valley Groundwater Basin. The Sacramento Valley Groundwater Basin covers a vast area and encompasses the alluvial deposits under the valley floor from the Sierra Nevada Mountains to the east, the Coast Range mountains to the west, the Sacramento-San Joaquin Delta to the south, and the Klamath and Cascade Ranges to the north. The Sacramento Valley Groundwater Basin covers over 5,900 square miles and 10 counties, and has been divided into 18 subbasins. The County is underlain by three groundwater subbasins (Figure 2) as defined by the DWR in Bulletin 118, Update 2003. These subbasins are: the East Butte Subbasin, the Sutter Subbasin, and the North American Subbasin.

2.2. Hydrogeology

2.2.1. Overview of Groundwater and Geology

Groundwater is water that is underground and below the water table (saturated zone), as opposed to surface water, which flows across the ground surface. There are three main types of subsurface geology where groundwater can exist:

- Hard Rock – Groundwater can be present in cracks or fractures in the rocks.
- Underground Caverns – Groundwater can fill these underground voids.
- Porous Sediments – Groundwater can fill the pore spaces between grains of sand and gravel.

In Sutter County, groundwater exists in porous sediments, alluvial aquifers, or fractured volcanic rock such as in the vicinity of the Sutter Buttes. Figure 4 shows a simplified surface geologic map with the major faults in the County. Sutter County is situated along the axial portion of the Sacramento Valley Groundwater Basin. The subsurface aquifers

consist generally of layers of gravel, sand, clay, and in some cases volcanic ash. The characteristics of different aquifers, and zones within each aquifer, are related to the aquifer materials (sands, gravels, clays, etc.). Within a single aquifer zone, nearby wells with similar construction can have very similar well yields and water quality. It should be noted that many of the geologic formations that make up the alluvial aquifers are continuous units that are also present in other counties as discussed.

In the northern portion of Sutter County, the geologic setting changes rapidly from the stratigraphic succession observed in the rest of the County. A thick sequence of volcaniclastic sediments derived from the Sutter Buttes volcanic epoch form a volcanic fan apron of alluvial deposits around its perimeter. These deposits have been characterized recently by DWR as consisting largely of gravel, sand, silt, and clay. These deposits are observed at ground surface around the buttes, and may extend up to a 15 mile radius in the subsurface (Springhorn 2008). Sediments deposited under marine sedimentary processes are also observed at ground surface and at shallow depths in the subsurface around the Buttes. These deposits were elevated from depth to their current position during the emplacement of the volcanic intrusion which formed the Sutter Buttes. Water quality in these sediments is generally poor and deteriorates with depth.

There is a large amount of hydrogeologic data available in the Sacramento Valley which has been widely studied, and groundwater is continuous within specific aquifer zones (although discontinuous between different aquifer zones) over large areas within the Sacramento Valley.

2.2.2. Status of Understanding of Regional and Local Geology

The geology of the Sacramento Valley has been studied for at least 95 years, and much has been learned over this time. However, there are still many areas of active study and debate. In Sutter County, areas that are not well-understood and/or are actively being studied include:

- The connection between the Coast Range-sourced Tehama Formation and the analogous Sierra Nevada-sourced deposits, and where this interaction occurs.
- The possible existence of subsurface barriers to groundwater flow within the County.
- The source of poor water quality in parts of the County.

2.2.3. Regional Geology and Structure

The Sacramento Valley Groundwater Basin is a north-south trending structural trough which is filled with layers of sediments. The stratigraphic succession of the basin

deposits, from oldest to youngest (deep to shallow), depict a regional change in depositional environment from one dominated by marine sedimentary processes to that of continental (alluvial) processes. The deepest portions of the basin generally consist of marine sedimentary rocks, ranging in age from Late Jurassic to early Miocene (160 million years ago to 24 million years ago). These marine deposits are overlain by younger alluvial and locally prominent volcanic rocks of early Miocene to Holocene age (Harwood and Helley 1987). Within the Basin, these deposits are disrupted by deformational stresses derived from east-west compressional forces associated with regional uplift along the western margin of the valley and extensional forces to the east, within the Basin and Range Provenance (Harwood and Helley 1987). Over time, these forces have applied great stresses and strain on valley deposits, creating complex and diversely-oriented fold and fault structures.

The prominent fault system that occurs in Sutter County is the Willows Fault. The Willows Fault is an active northwest-trending fault that dips steeply to the east and shows reverse displacement, meaning the ground east of the fault has moved up relative to the west side. The Willows Fault enters into the County from Colusa County southwest of the Sutter Buttes and extends to the southeast portion of the County towards Sacramento.

The most prominent and recognizable geologic feature in Sutter County are the Sutter Buttes. The Sutter Buttes are composed of late Cenozoic volcanic rocks that rise over 2,000 feet above the Sacramento Valley floor. The Sutter Buttes formed between 2.4 and 1.4 million years ago as magma at depth was injected into the overlying Cretaceous and Tertiary rocks, causing deformation in the form of faulting, folding, and uparching (Harwood and Helley 1987).

2.2.4. Regional Stratigraphy

The prominent non-marine, fresh water-bearing stratigraphic units found within the East Butte, Sutter, and North American Subbasins include (from youngest to oldest):

- Recent Alluvial Deposits (stream channel, basin, and flood plain);
- the Modesto Formation;
- the Riverbank Formation;
- the Sutter Buttes Rampart;
- the Victor Formation;
- the contiguous Laguna, Tuscan, and the Tehama Formations;

- the Mehrten Formation;
- and the informally named Sutter Formation (Springhorn 2008).

Except for the Sutter Formation, the stratigraphic descriptions presented herein are based upon the California Department of Water Resources "Bulletin 118 – California's Groundwater" and are shown in the geologic cross-sections (Figure 5). The location of the cross-section is shown in Figure 4.

Locally, the stratigraphic succession observed in each subbasin differs slightly; therefore, each subbasin and its associated geologic setting are described separately with regard to their relative positions and occurrences in the specific subbasin.

2.2.4.1. East Butte Subbasin (Basin Number 5-21.59)

The northern section of Sutter County is underlain by the East Butte Subbasin. The East Butte Subbasin is bounded by the Sutter Buttes to the south, Butte Creek to the west and northwest, the Cascade Mountain range to the northeast, and the Feather River to the southeast. The East Butte Subbasin aquifer system consists of late Tertiary to Quaternary aged deposits comprised of Sierra and Cascade sourced material, and in the southern portion of the subbasin around the Sutter Buttes, by volcanic and volcaniclastic rocks. The geologic formations that comprise the East Butte Subbasin are (from youngest to oldest):

- Recent Alluvial Deposits;
- the Pleistocene aged Modesto and Riverbank Formations;
- the Sutter Buttes Rampart;
- and the Tertiary aged Laguna and Tuscan Formations.

Recent Alluvial Deposits

Stream channel deposits are Holocene in age and were deposited between 11,000 years ago and present day. The stream channel deposits occur along the current and ancestral paths of streams and rivers in Sutter County. Where present, the stream channel deposits extend from ground surface up to a depth of 80 feet below ground surface (Helley and Harwood 1985). The stream channel deposits consist of unconsolidated gravels, sand, silt, and clay, derived from the erosion and reworking of the Modesto and Riverbank Formations (described below). This unit is moderately to highly permeable, but because of its shallow depth and limited thickness, it possesses limited water-bearing capacity.

Basin deposits are Holocene in age and, like the stream channel deposits, were deposited between 11,000 years ago and present day. Basin deposits occur where sediment-laden floodwaters breached natural stream and river levees and spread across lower-lying topography. Where present, the basin deposits extend from ground surface up to a depth of 150 feet. The basin deposits consist mainly of silt and clay. These units have low permeability and generally yield small quantities of water to wells.

The Modesto Formation

The Modesto Formation is Pleistocene in age and is a stream terrace deposit that was deposited between 12,000 to 50,000 years ago (Helley and Harwood, 1985). Within this subbasin, the Modesto Formation consists of poorly indurated gravel and cobbles, sand, and clay and is derived from the reworking and deposition of the Riverbank Formation, Laguna Formation, and Tuscan Formation (DWR 2004). The Modesto Formation was likely deposited by the same stream and river systems that flow today, because it generally borders existing channels (Blake et. al. 1999). This formation may extend across the entire subbasin and where present, may range in thicknesses from 50 to 150 feet (DWR 2000). The sediments of the Modesto Formation are moderately to highly permeable and can yield moderate quantities of water to wells.

The Riverbank Formation

The Riverbank Formation is Pleistocene in age and was deposited between 120,000 and 500,000 years ago (Helley and Harwood, 1985). The Riverbank Formation consists of gravel and small cobbles, and is interbedded with reddish-clay, sand and silt. Like the Modesto Formation, the Riverbank Formation is a stream terrace deposit. However, the Riverbank Formation is older than the Modesto Formation. The Riverbank Formation may extend across the entire subbasin, underlying the Modesto Formation, with thicknesses ranging from 50 to 200 feet. The Riverbank Formation is poorly to highly permeable and can yield moderate quantities of water to wells.

Sutter Buttes Rampart

The Sutter Buttes Rampart was deposited during the Middle to Lower Pleistocene period and is encountered in the southern portion of the subbasin. This unit is up to 600 feet thick in the subsurface (DWR 2000). In several studies (William and Curtis 1977, Springhorn 2008) the Sutter Buttes Rampart has been separated into two distinct units: the Rhyolitic Rampart and the Andesitic Rampart. The Andesitic Rampart phase of volcanism was much larger than the Rhyolitic phase. All the large peaks of the Sutter Buttes are andesitic domes and comprise the majority of the Rampart on the surface and the subsurface. The Sutter Buttes Rampart consists

largely of gravel, sand, silt, and clay sediments which were deposited circumferentially around the Buttes as a geologic apron. These sediments may extend up to 15 miles north of the Sutter Buttes and west beyond the Sacramento River. Certain zones within these units yield large quantities of water (DWR 2004).

Laguna Formation

The Laguna Formation is Plio-Pleistocene in age and was deposited between 4 million and 2 million years ago. The Laguna Formation is comprised of Sierra Nevada sourced sediments, consisting of consolidated alluvial gravel, sand, and silt, comprised of granitic, metamorphic, and volcanic material. Estimates of the thickness of the Laguna Formation range from 180 feet (Helley and Harwood 1985) to 1,000 feet (Olmstead and Davis 1961). The Laguna Formation is characterized as being moderately consolidated and poorly to moderately cemented. Because of this, the permeability of formation is generally low to moderate. Wells completed in this formation have been observed to yield only moderate quantities of water (DWR 2003).

Tuscan Formation

The Tuscan Formation has been the subject of much interest in recent years. The Tuscan Formation is a regional aquifer system wholly or in parts of Tehama, Butte, Glenn, Colusa, and Sutter County. Within Sutter County, there has been limited analysis done on the subsurface extent of the Tuscan Formation. It is likely that the Tuscan Formation is only present in the northern portion of the County and consequently is not a major water resource for the County.

The Tuscan Formation is Plio-Pleistocene in age and was deposited between 4 million and 2 million years ago. The Tuscan Formation was derived by alluvial deposition associated with the erosion of volcanic material derived from Cascade volcanism. The formation outcrops from Red Bluff, in the northern part of the Sacramento Valley, to Oroville, southeast of Chico, and has been recognized in the subsurface at a distance of about 15 miles west of the Sacramento River (DWR 2003a). The deposits of the Tuscan Formation thin from east to west, from about 1,600 feet thick in the foothills of the Sierra Nevada to about 300 feet thick in the subsurface of the Sacramento Valley (Lydon 1969). In surface outcrops, the exposures of the Tuscan Formation are described as four separate, but lithologically similar units: Units A through D (Helley and Harwood 1985). Units A, B, and C are found within the subsurface in the northern part of the subbasin and units A and B are found in the southern part of the subbasin (DWR 2004). All of the units of the Tuscan Formation contain stratigraphic sequences of volcanic mudflows, volcanic conglomerates, volcanic sandstones, siltstones, and tuff deposits. In the subsurface, the Tuscan Formation consists largely

of black volcanic sand and gravel, with interbedded layers of tuff breccias and tuffaceous clays (Ferriz, H. 2001). Unit A is the oldest (deepest) water-bearing unit and is distinguished from Units B and C by the presence of metamorphic clasts. Unit B contains equal distributions of volcanic mudflows, conglomerates, and tuffaceous sandstones. Units A and B are referred to as the "Lower Tuscan Formation". Unit C is capped by massive volcanic mudflows with some interbedded conglomerates and sandstones. In the subsurface, the volcanic mudflows of Unit C act as a confining layer to groundwater flow, separating the more permeable deposits of the Lower Tuscan Formation (Helley and Harwood 1985).

2.2.4.2. Sutter Subbasin (Basin Number 5-21.62)

The Sutter Subbasin underlies the central portion of Sutter County and is wholly within the boundaries of the County. The subbasin is bound by the confluence of Butte Creek with the Sacramento River and the Sutter Buttes to the north, by the Feather River to the east, by the confluence of the Sutter Bypass and Sacramento River to the south, and by the Sacramento River to the west. The Sutter Subbasin aquifer system consists of late Tertiary to Quaternary aged deposits comprised of Sierra-sourced (Sierra Nevada) detritus and volcanic and clastic rocks in the northern portion of the subbasin around the Sutter Buttes. The identified geologic formations that comprise the Sutter Subbasin are (from youngest to oldest):

- Recent Alluvial Deposits;
- the Pleistocene aged Sutter Buttes Rampart and Victor Formation;
- the Pliocene Laguna Formation; and
- the informally named Sutter Formation.

Recent Alluvial Deposits

The Holocene aged stream channel and flood plain deposits occur along the current and ancestral paths of streams and rivers in Sutter County. The stream channel and flood plain deposits consist of unconsolidated gravel, sand, silt, and clay. Both thickness and grain size decrease as the distance increases from their source. Where present, the stream channel and flood plain deposits extend from ground surface to an estimated depth of 100 feet (Helley and Harwood 1985). These units are highly permeable and provide for large amounts of groundwater recharge within the subbasin. This unit is highly permeable, and yields significant quantities of water to wells (DWR 2000).

Sutter Buttes Rampart

The Sutter Buttes Rampart is Middle to Lower Pleistocene aged alluvial deposit that is encountered in the northern portion of the subbasin. This unit can be up to 600 feet thick in the subsurface (DWR 2000). In several studies (William and Curtis 1977, Springhorn 2008), the Sutter Buttes Rampart has been separated into two distinct units: The Sutter Buttes Rhyolitic Rampart and the Sutter Buttes Andesitic Rampart. The deposition and composition of Rhyolitic Rampart reflects the initial stages of volcanism and deposition around the Sutter Buttes, while the Andesitic Rampart reflects the later stages. These fan deposits form an apron around the Buttes and consist largely of gravel, sand, silt, and clay, and may extend up to 15 miles north of the Sutter Buttes and west beyond the Sacramento River. Certain zones within these units yield large quantities of water (DWR 2004).

Victor Formation

The Pleistocene aged Victor Formation is comprised of alluvial fan deposits composed of Sierra-sourced loosely consolidated gravel, sand, and silt. The Victor Formation has an estimated thickness of 100 feet (DWR 2004). This unit is observed to have an impermeable surface due to the presence of hardpan and clay pan soils (DWR 2003). At its base, the Victor Formation has been observed to have moderate permeability and provides most of the groundwater for domestic and shallow irrigation wells in Sutter County (DWR 2003). Wells completed in this unit have been reported to have yields as high as 1,000 gallons per minute.

Laguna Formation

The Laguna Formation is comprised of Sierra sourced, consolidated alluvial gravel, sand, and silt, which consist of granitic, metamorphic, and volcanic material. Estimates of the formations thickness range from 180 feet (Helley and Harwood 1985) to 1,000 feet (Olmstead and Davis 1961). The Laguna Formation is characterized as being moderately consolidated and being poorly-to-moderately cemented, because of this, the formation generally has a low to moderate permeability. Wells completed in this formation have been observed to yield only moderate quantities of water (DWR 2003).

Sutter Formation

The Mio-Pliocene aged Sutter Formation is an informally named stratigraphic unit that underlies the area around the Sutter Buttes and the central portion of Sutter County. The extent of the deposits have been characterized on a local to sub-regional

scale and have been generally classified as volcanic and epiclastic[1] sediments derived from volcanic sources located to the east in the Sierra Nevada, western Nevada, and the southern Cascade Volcanic Province (Springhorn 2008). Due to the complexity of identifying distinguishable characteristics within these deposits, informal and formal stratigraphic units within this region have been grouped together. Some of the major regional stratigraphic units that have been included in the Sutter Formation (from youngest to oldest) are the Tuscan, Mehrten, and Princeton Valley fill deposits.

2.2.4.3. North American Subbasin (Basin Number 5-21.65)

A portion of the North American Subbasin underlies the southeastern section of Sutter County. The North American subbasin is bound by the Bear River to the north, the Feather River to the west, the Sacramento River to the south, and in the east by a north-south trending line that represents the approximate edge of the alluvial basin (DWR 2004). The North American Subbasin is dominated by late Tertiary to Quaternary aged deposits consisting of Sierra-sourced volcanic sediments and alluvial derived sediments. The identified geologic formations that comprise the North American Subbasin are (from youngest to oldest):

- Recent Alluvial Deposits;
- Older alluvial deposits (the Pleistocene aged Modesto, Riverbank, Victor, and Laguna Formations); and
- the Mio-Pliocene aged Mehrten Formation.

Recent Alluvial Deposits

Stream channel deposits are Holocene in age and were deposited between 11,000 years ago and present day. The stream channel deposits occur along the current and ancestral paths of streams and rivers in Sutter County. The stream channel deposits consist of unconsolidated gravels, sand, silt, and clay, derived from active stream deposition, overbank sedimentation, and the erosion and deposition of existing Quaternary stream terrace deposits such as the Modesto and Riverbank Formations. Where present, the stream channel deposits extend from ground surface to a depth of 100 feet (Helley and Harwood 1985). This unit is highly permeable, and yields significant quantities of water to wells (DWR 2000).

The flood plain deposits consist primarily of silt and clay size sediments, with intermittent lenses of stream channel deposits. These deposits are generally observed along the flanks of existing and ancestral stream and river systems. These deposits

[1] Consisting of fragments of preexisting rocks

have an estimated thickness up to 100 feet. Being that this unit is primarily comprised of finer-grained material, permeability is generally poor and generally yields low quantities of water. Brackish water is commonly encountered within this unit (DWR 2000).

Older Alluvial Deposits

Within this subbasin, a number of geologic formations have been assigned to the category "older alluvium" including: the Modesto, Riverbank, Victor, and Laguna Formations (DWR 2004). These deposits generally underlie the Recent Alluvial Deposits and consist of loosely to moderately compacted gravel, sand, silt, and clay size sediments that were derived and deposited under alluvial conditions. The thickness of these units ranges from approximately 100 to 650 feet (DWR 2004).

Mehrten Formation

The Mehrten Formation is Mio-Pliocene in age and consists of a sequence of volcaniclastic and volcanic rocks. In the subsurface, the Mehrten Formation ranges in thickness from 200 feet to 1,000 feet along the axis of the Sacramento Valley (DWR 2003). The Mehrten Formation is comprised of two distinct geologic units. The first unit consists of sediments deposited under alluvial and fluvial conditions and are comprised of gravel, sand, silt, and clay size sediments. This unit is highly permeable and wells constructed within this unit have been observed to produce yields exceeding 1,000 gallons per minute (DWR 2003). The second unit consists of dense volcanic flows of tuff breccias with some interbedded conglomerates and sandstones. This unit acts as a confining layer between sand intervals and has a thickness that ranges from 200 to 1,200 feet in the subsurface (DWR 2003).

2.2.5. Areas Outside a Designated Groundwater Basin

The only part of the County that is not within a designated groundwater basin is the area consisting of the Sutter Buttes. Groundwater is likely found in the subsurface in fractures of the volcanic rock; however, historic groundwater levels and water quality were not reviewed in the preparation of the County GWMP (2012). There are no local entities, aside from private domestic water users, that utilize groundwater resources in this area.

2.3. History of Groundwater in Sutter County

2.3.1. Historic Well Construction

According to DWR records, 6,742 well completion reports have been filed for wells constructed in Sutter County from 1928 to 2007. Well completion reports are not always filed with DWR, even though they are required by law, so the number of reports likely

under-represent the actual total for the County. According to County records, an additional 758 permits have been filed for new wells to be constructed in Sutter County from 2008 to September 2015. Well completion reports have been submitted for about half of the of the well permits on file. Between DWR and County records from 1928 to September 2015, well completion reports have been filed for:

- 3,404 domestic wells
- 1,353 irrigation wells
- 16 test wells
- 399 monitoring wells
- 82 municipal wells
- 37 industrial wells
- 872 unknown or other use wells
- 7 stock-watering wells
- 13 fire or frost protection wells
- 3cathodic protection wells

Domestic wells were constructed at a rate of approximately five per year from 1941 through 1950, but have been constructed at a rate of approximately 59 per year since then. Based on County well permit applications, domestic well construction has decreased significantly since 2007, averaging about 13 new well permit application submittals per year.

Irrigation wells tend to be constructed more frequently during drought periods which include the mid-1970s, early 1990s, and the current drought which began in 2012. On average, 16 irrigation wells are constructed per year during non-drought years. Based on County well permit applications, over 250 irrigation well permit application have been submitted since 2012 during the current drought period.

Municipal well construction averaged two-and-a-half wells per year prior to 2011. There have not been any municipal well permit applications submitted in the County since 2011. Of the wells for which DWR records exist, approximately 700 wells are classified as either abandoned or destroyed. Sutter County has processed an additional 400 applications for abandoned or demolished well permits since 2007.

The average depth of domestic wells has fluctuated since the 1930's, but has generally been about 100 feet deep. The average depth of irrigation wells has fluctuated significantly, but has been about 160 feet deeper than the average depth of domestic wells in any given year, or an average of about 260 feet deep. Municipal well depths are inconsistent and vary widely in depth, from about 50 to 700 feet deep. More information and figures are available in the Sutter County GWMP.

2.3.2. Historic Groundwater Monitoring

Sutter County does not have a history of managing or monitoring groundwater. As stated in the County 2012 GWMP, "Sutter County's intended role in groundwater management…is to help coordinate the various groundwater users in the County, and

encourage them to be responsible stewards of the water resources. The County does not have the budget or staff to act as an "enforcer" with regards to groundwater use, and does not indent to do so."

Numerous water purveyors have their own AB 3030 Groundwater Management Plans and actively monitor groundwater within their boundaries. Purveyors with active management and/or monitoring plans include:

- Butte Water District
- Feather Water District
- Natomas Central Mutual Water Company
- Reclamation District 1500 (including Pelger Mutual Water Company and Sutter Mutual Water Company)
- Sutter Extension Water District
- South Sutter Water District

In order to comply with Governor Brown's April 1, 2015 Executive Order as described in Section 1.2, Sutter County relies on cooperative agencies to collect groundwater levels to support the County's Monitoring Entity CASGEM program. The majority of the County's cooperating agencies have a history of groundwater level monitoring within their boundaries, including:

- Butte Water District,
- City of Live Oak,
- City of Yuba City,
- Garden Highway Mutual Water Company,
- Natomas Central Mutual Water Company, and
- Pleasant Grove Verona-Mutual Water Company.

The remaining cooperating agencies: Butte Slough Irrigation District, Meridian Farm Water Company, and Tisdale Irrigation District have agreed to establish monitoring programs to contribute to the County's CASGEM network.

2.3.3. Historic Groundwater Levels

As detailed in the County's GWMP, DWR does not consider the County's subbasins to be in overdraft. A number of groundwater wells were analyzed in the GWMP over a long-term period for water level measurements. Hydrographs are available in Figure 6 which illustrates historic groundwater levels within the County through 2012. In addition,

Figure 7 depicts changes in groundwater levels from 1912-1913 to 2007, demonstrating that the direction of groundwater flow has not significantly changed within the County with the exception of the North American Subbasin. In most areas within the County, groundwater levels were not dramatically different in 2007 than they were in 1912-1913, as seen in Figure 8 with contour data from 2010. In the central portion of the County, an increase in groundwater levels is observed in the data, which may be likely due to applied surface water for irrigation. In the southeastern portion of the County, a significant decline in groundwater levels is observed, which can be related to the high usage of ground water for irrigation of crops, and the influence of the large pumping depression in the northern portion of Sacramento County.

Current groundwater levels are available via CASGEM for locations throughout the County which have been submitted by existing monitoring entities, voluntary well owners and DWR. Current hydrographs provide a few more years of data to those show in Figure 6, however the trend lines have not significantly changed. Groundwater contour lines have not been assessed since the development of the County's GWMP, therefore current contour data maps are not available.

3. The Monitoring Well Network

There is an extensive network of DWR monitored wells, both dedicated monitoring wells and wells with other uses, within Sutter County. Additionally, several water purveyors within the County monitor groundwater levels within their service areas by means of dedicated monitoring wells and production wells. There is an extensive inventory of wells with groundwater measurements within Sutter County. Historically, DWR and its partners have monitored 172 wells in Sutter County, including 15 dedicated monitoring wells. The earliest recorded DWR water level measurement in Sutter County took place in 1929. Wells accessible to DWR are typically agricultural or domestic wells in which the land owners have previous agreements with DWR to allow access for measurements. Overall, the County has adequate spatial distribution of its current network to obtain groundwater level measurements.

Sutter County does not currently have funding to support installation of additional monitoring wells to support the CASGEM program. If additional wells are recommended by DWR to address data gaps, County staff will work with DWR to identify existing wells to add to the County's monitoring entity network.

According to DWR's Groundwater Elevation Monitoring Guidelines (2010), between 2 and 10 groundwater monitoring wells are recommended per 100 square miles. Sutter County contains 607 square miles, therefore between 12 and 61 groundwater wells are assumed to be expected for the County's CASGEM program. Existing monitoring entities in combination

with Sutter County's proposed well network utilize a total of 106 groundwater wells for the CASGEM program throughout Sutter County.

Table 2: Recommended Monitoring Well Network Density by Subbasin

Subbasin name	***Subbasin Area in Sutter County (mi^2)***	***Wells Needed for Recommended Density (10 wells per 100 mi^2)***
East Butte	92	9
Sutter	372	37
North American	143	14
Total	607	60

3.1. Selection of Wells for CASGEM

Sutter County proposes to add a number of wells to CASGEM through cooperating agencies in order to expand the current CASGEM monitoring well network. The County's CASGEM monitoring program will utilize 62 wells through ten cooperating agencies. Figure 9 shows the locations of the wells associated with the County's Monitoring Entity network and each cooperating agency boundary.

As shown in Table 3, the combined number of wells provided by each existing monitoring entity is compared to the number of wells recommended to meet minimum density requirements. The recommended density requirements will be fulfilled by the County's Monitoring Entity network.

Table 3: CASGEM Network compared to Recommended Network Density

Subbasin name	***Recommended Density (10 wells per 100 mi^2)***	***Existing Monitoring Entity CASGEM wells***	***Remaining wells to meet Recommended Density***	***Sutter County Monitoring Entity CASGEM Wells***
East Butte	9	0	9	9
Sutter	37	24	13	42
North American	14	20	0	11
Total	60	44	22	62

3.2. East Butte Subbasin

The East Butte Subbasin contains 92 square miles within Sutter County, the remainder of the subbasin falls within Butte County. Based on the recommended density of ten (10) wells per 100 square miles, this subbasin should have nine (9) monitoring wells to meet the needs of the CASGEM program. There are no existing monitoring entities within the Sutter County portion of this subbasin. The Butte County Water and Resource Conservation monitors the remaining portion of the East Butte Subbasin which falls within Butte County.

Sutter County, through three cooperating agencies, proposes to add 9 groundwater wells to the CASGEM network within the East Butte Subbasin, 3 of which are dedicated monitoring wells. The horizontal distribution appears to be sufficient with monitoring being conducted at seven geographic locations. Although depths for two of DWR's associated groundwater wells are unknown, the vertical distribution also appears to be sufficient. Additional wells will be coordinated with DWR to improve the network in the East Butte Subbasin as needed.

Table 4: County East Butte Subbasin Cooperating Agency CASGEM Wells

Cooperating Agency	*Number of CASGEM Wells*	*Well Depths (feet)*
Butte Water District	3	127-591
Department of Water Resources	5	30-540
City of Live Oak	1	399

3.3. Sutter Subbasin

The Sutter Subbasin is fully contained within Sutter County and includes about 372 square miles of land, suggesting that the subbasin should have 37 monitoring wells to meet the CASGEM program recommended density. The three existing monitoring entities within this subbasin maintain a combined total of 24 monitoring wells, as follows:

- Feather Water District utilizes 4 wells,
- Reclamation District 1500 utilizes 11 wells, and
- Sutter Extension Water District utilizes 9 wells.

Therefore, 13 wells remain to meet the CASGEM well density recommendation.

Sutter County, through six (6) cooperating agencies, proposes to add 42 additional wells to the CASGEM network within the Sutter Subbasin, 15 of which are dedicated monitoring wells. The wells range from 60 to 1,021 feet deep and 34 geographical locations are covered. While the vertical distribution appears to be sufficient, the horizontal distribution for Sutter County's network alone may contain some gaps. However, when considering the CASGEM network from neighboring existing Monitoring Entities within the subbasin, specifically from Sutter Extension Water District and Feather Water District, gaps in the horizontal distribution are accounted for. When combined with the existing monitoring entity networks, the subbasin utilizes 66 wells for the CASGEM network.

Table 5: Sutter Subbasin Cooperating Agency CASGEM Wells

Cooperating Agency	*Number of CASGEM Wells*	*Well Depths (feet)*
Butte Slough Irrigation District	2	300-370
City of Yuba City	5	190-600
Department of Water Resources	8	60-1,021
Meridian Farms Water Company	4	190-320
Tisdale Irrigation District	2	195-250*
Garden Highway Mutual Water Company	21	150-1,005

*Estimated depth.

3.4. North American Subbasin Data Gaps

The North American Subbasin contains 143 square miles within Sutter County, the remainder of the subbasin falls within Placer and Sacramento Counties. It is suggested that the Sutter County portion of the subbasin should have 14 groundwater wells to meet the CASGEM program recommended density. South Sutter Water District, the sole existing monitoring entity within the Sutter County portion of the subbasin, reports groundwater levels from 20 wells within the County to CASGEM.

Sutter County, through three cooperative agencies, proposes to add an additional 11 wells to the CASGEM network. The wells meet the desired horizontal distribution for the County's portion of the subbasin. Well depths range from 170 to 1,225 feet below grade, therefore vertical distribution is also sufficient. The unknown well depths and screen details will be added to CASGEM as soon as they are made available. When combined with the existing monitoring entity network, the Sutter County portion of the subbasin will utilize a total of 31 wells for the CASGEM program.

Table 6: County North American Subbasin Cooperating Agency CASGEM Wells

Cooperating Agency	*Number of CASGEM Wells*	*Well Depths (feet)*
Department of Water Resources	4	170-1,225
Natomas Central Mutual Water Company	5	220-690
Pleasant Grove-Verona Mutual Water Company	2	unknown

4. Groundwater Well Monitoring

4.1. Monitoring Well Schedule

Water level measurements will be monitored twice per year, in spring and fall. Some cooperating agencies monitor groundwater wells more frequently and may provide additional groundwater level data. Twice-annual (spring/fall) water level measurements have been recommended by DWR and are generally sufficient to determine changes in overall groundwater conditions over time by reflecting the annual high (spring) and low (fall) water levels. More frequent (i.e. at most monthly) measurements can be used to confirm that the months chosen for spring and fall measurements reflect the months with the highest and lowest groundwater elevations, on average.

Sutter County will depend on updates from DWR who monitors additional groundwater wells throughout the County regarding any required changes to the twice-annual (spring/fall) monitoring schedule.

4.2. Description of Field Methods

The latitude, longitude and elevations of the wells associated with all cooperating agencies except Butte Water District, the City of Yuba City, the Department of Water Resources, and Garden Highway Mutual Water Company were collected by Sutter County staff using a surveying GPS unit, which as an accuracy to within three (3) inches. The City of Yuba City collected location and elevation details from the City Surveyor who used a GPS unit, which is accurate to within one (1) foot. The wells utilized by Butte Water District, the Department of Water Resources, and Garden Highway Mutual Water Company were already listed in CASGEM, therefore had been previously surveyed by others. A list of wells with location, elevations, and identification details is available in Attachment C.

Sutter County's cooperating agencies will monitor groundwater levels and collect elevation data to be consistent with the field methodology procedures described in the DWR's Groundwater Elevation Monitoring Guidelines (2010). Groundwater elevations will be measured by hand a minimum of two times per-year to record seasonal high (spring) and seasonal low (fall) groundwater levels. Best efforts will be made to ensure elevations are obtained to reflect static conditions. Groundwater levels will be reported in feet above mean sea level. DWR's field guidelines for CASGEM water-level measurements will be followed, as provided in Attachment D.

Each cooperating agency will be responsible for monitoring the groundwater wells within their respective boundaries. They will report groundwater elevation data in one of two ways, 1) directly to CASGEM through their own CASGEM log-in account, or 2) to Sutter County Staff. Groundwater elevation data submitted to Sutter County Staff will be provided to CASGEM through Sutter County's monitoring entity CASGEM account.

Data will be submitted to the CASGEM website twice per year, no later than January 1st for fall monitoring fieldwork, and no later than July 1st for spring monitoring fieldwork, per CASGEM program guidelines or as required by DWR. Biannual CASGEM submittal data will include the following for each well in the network:

- Well identification number
- Measurement date
- Reference point and land surface elevation (in feet using NAVD 88 datum)
- Depth to water (in feet)
- Method of measuring water depth

- Measurement quality codes
- Measuring agency identification
- Any additional comments about the measurement, as needed.

4.3. Plan Implementation

Sutter County intends to implement this CASGEM Monitoring Program to be consistent with DWR's procedures and Water Code 2.11. This plan is intended to be a living document and will be revised to address program updates and/or data gaps as needed. Revisions will be submitted to DWR as wells are added or removed from the monitoring network or when other significant changes to this plan are necessary.

5. References

Butte County Department of Water and Resource Conservation, "Butte County Monitoring Plan for the California Statewide Groundwater Elevation (CASGEM) Program," September 2011.

California Department of Water Resources, "California's Groundwater Bulletin 118, Sacramento River Hydrologic Region, Sacramento Valley Groundwater Basin, East Butte Subbasin," January 2006.

California Department of Water Resources, "California's Groundwater Bulletin 118, Sacramento River Hydrologic Region, Sacramento Valley Groundwater Basin, North American Subbasin," January 2006.

California Department of Water Resources, "California's Groundwater Bulletin 118, Sacramento River Hydrologic Region, Sacramento Valley Groundwater Basin, Sutter Subbasin," January 2006.

California Department of Water Resources, "California Statewide Groundwater Elevation Monitoring (CASGEM) Program, Procedures for Monitoring Entity Reporting," December 2010.

California Department of Water Resources, "Groundwater Elevation Monitoring Guidelines," December 2010.

Monterey County Water Resources Agency, "CASGEM Monitoring Plan for High and Medium Priority Basins in the Salinas Valley Groundwater Basin," March 2015.

Wood Rodgers, "Sutter County Groundwater Management Plan," March 2012.

6. Figures

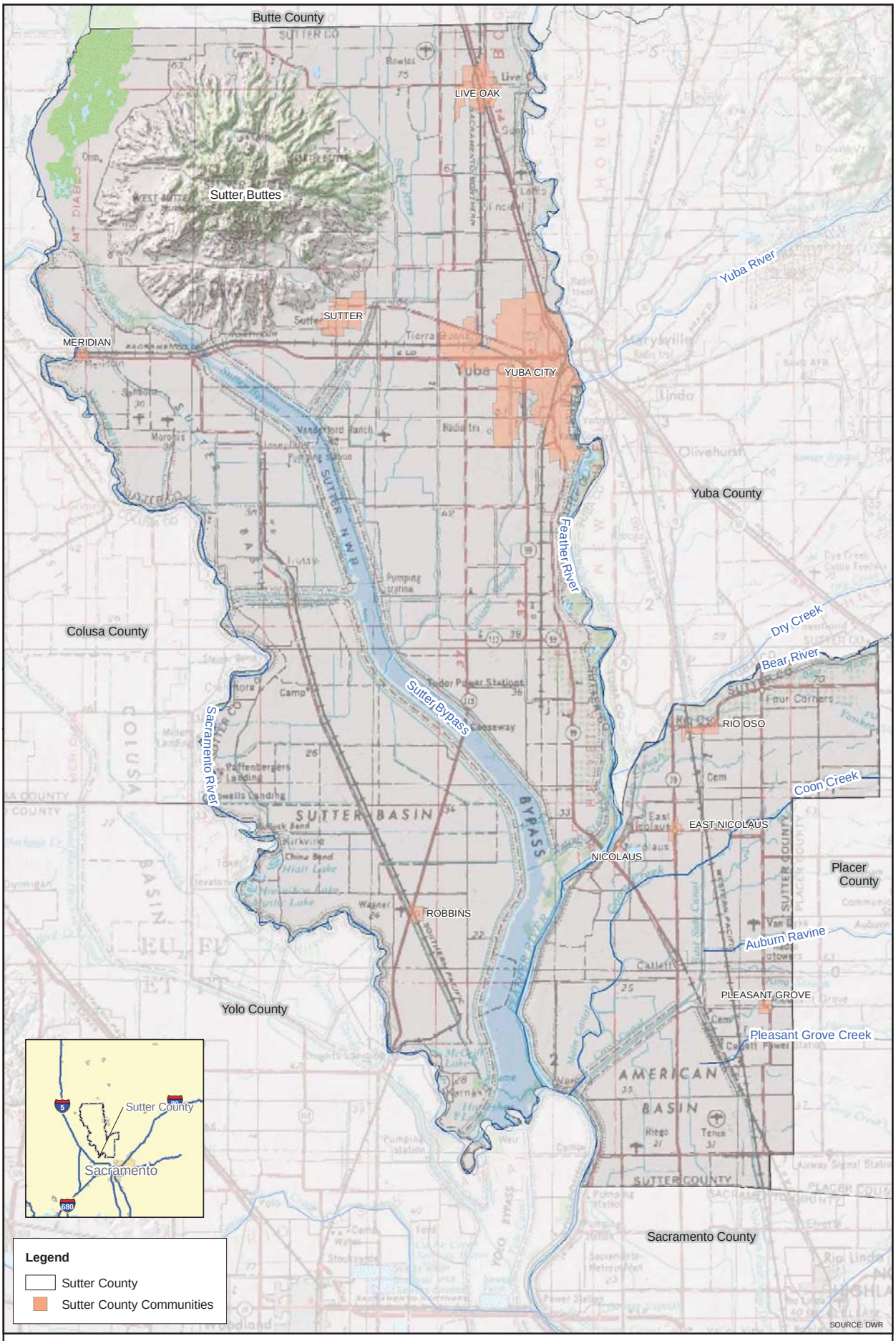

FIGURE 1
PHYSICAL FEATURES
SUTTER COUNTY GROUNDWATER MANAGEMENT PLAN
FEBRUARY 2012

NORTH
0 1.5 3
MILES

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J:\Jobs\8337_SutterCounty\GIS\Tasks\20120116 Final Draft\Figure 5 Sutter County Physical Features.mxd 2/7/2012 12:47:54 PM bdemucha

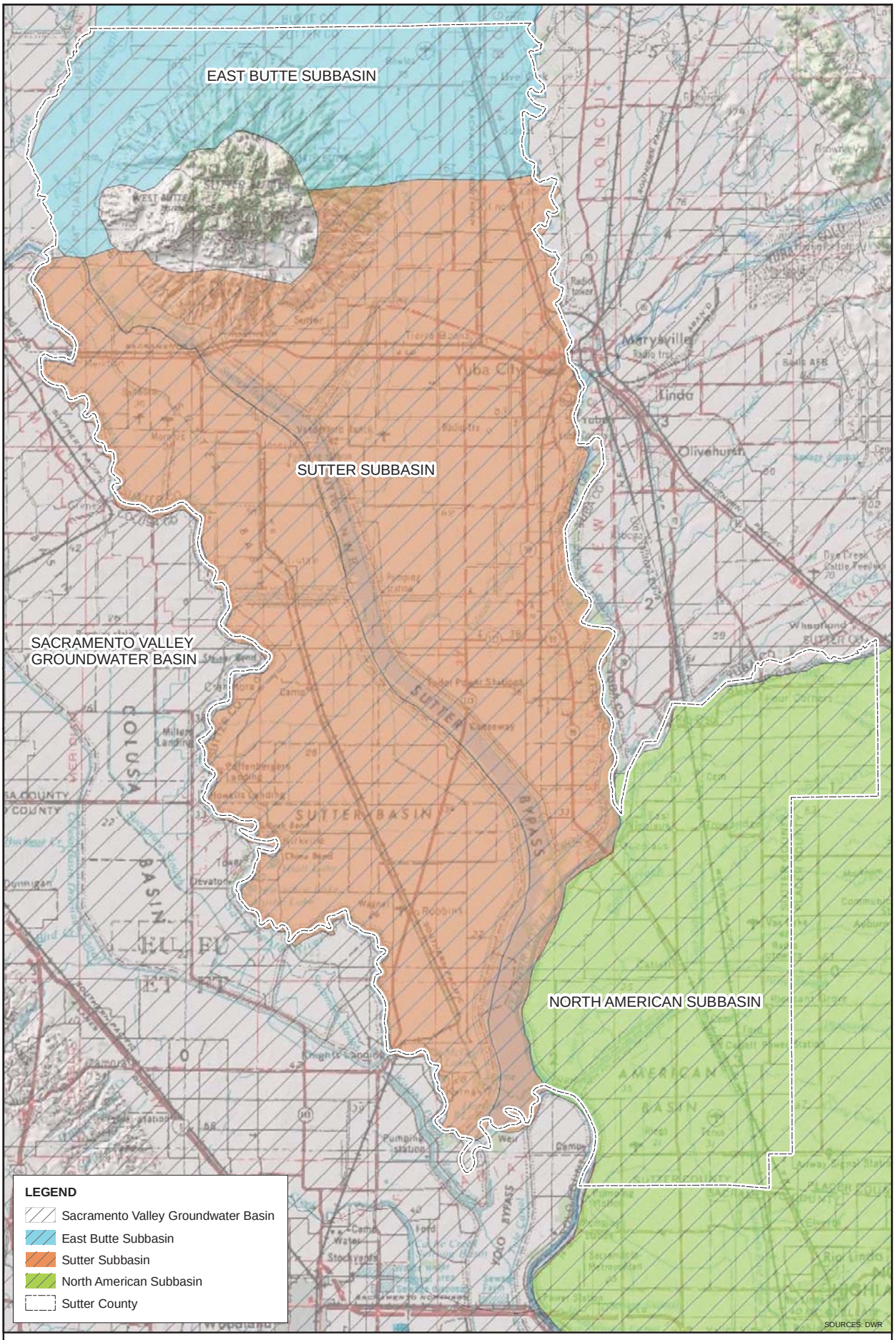

FIGURE 2
GROUNDWATER BASIN AND SUBBASINS
SUTTER COUNTY GROUNDWATER MANAGEMENT PLAN
FEBRUARY 2012

NORTH
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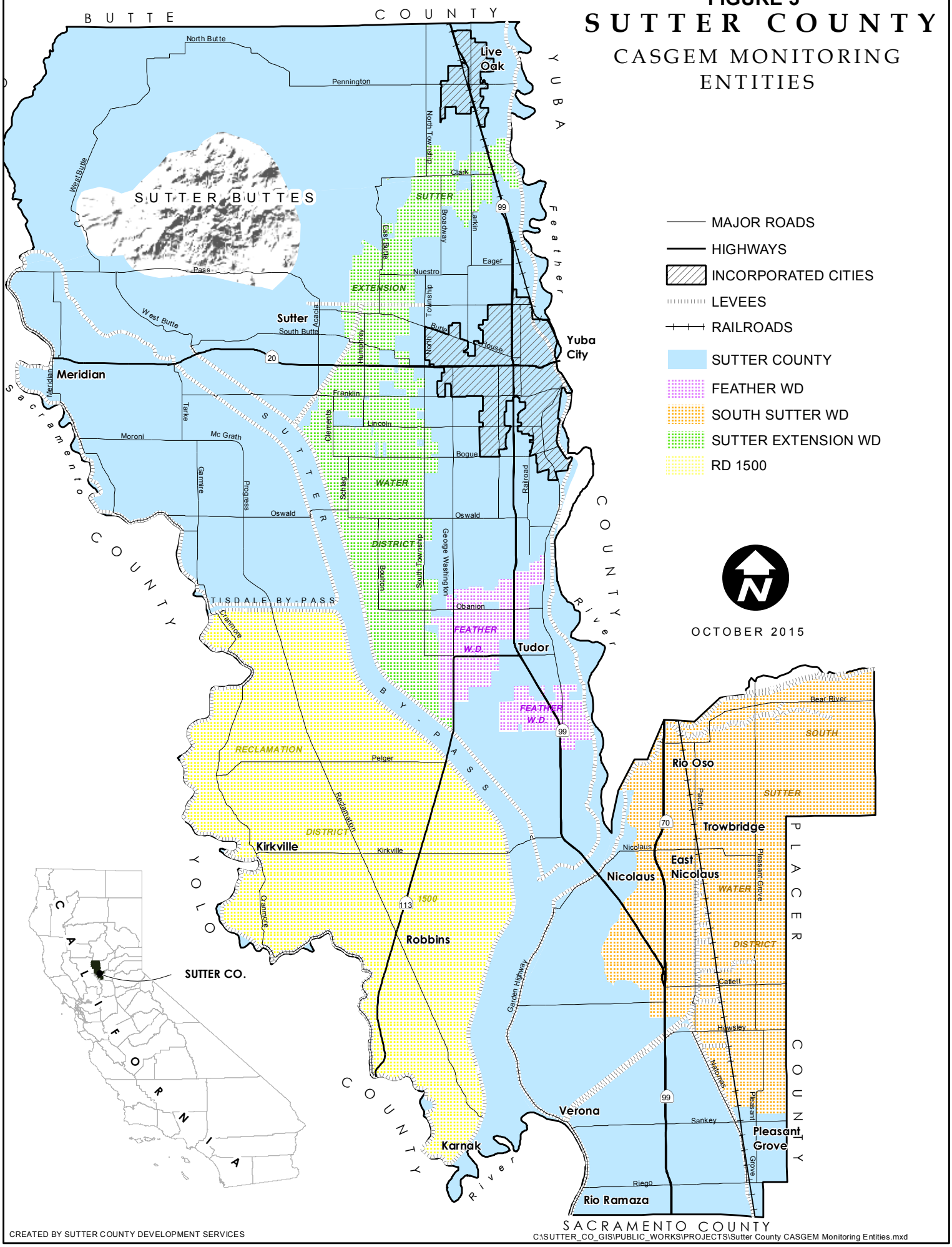
J:\Jobs\8337_SutterCounty\GIS\Tasks\20120201 Final Draft Figure Comments\Figure 1 Groundwater Subbasins.mxd 2/7/2012 12:50:01 PM bdemucha

FIGURE 3
SUTTER COUNTY
CASGEM MONITORING ENTITIES



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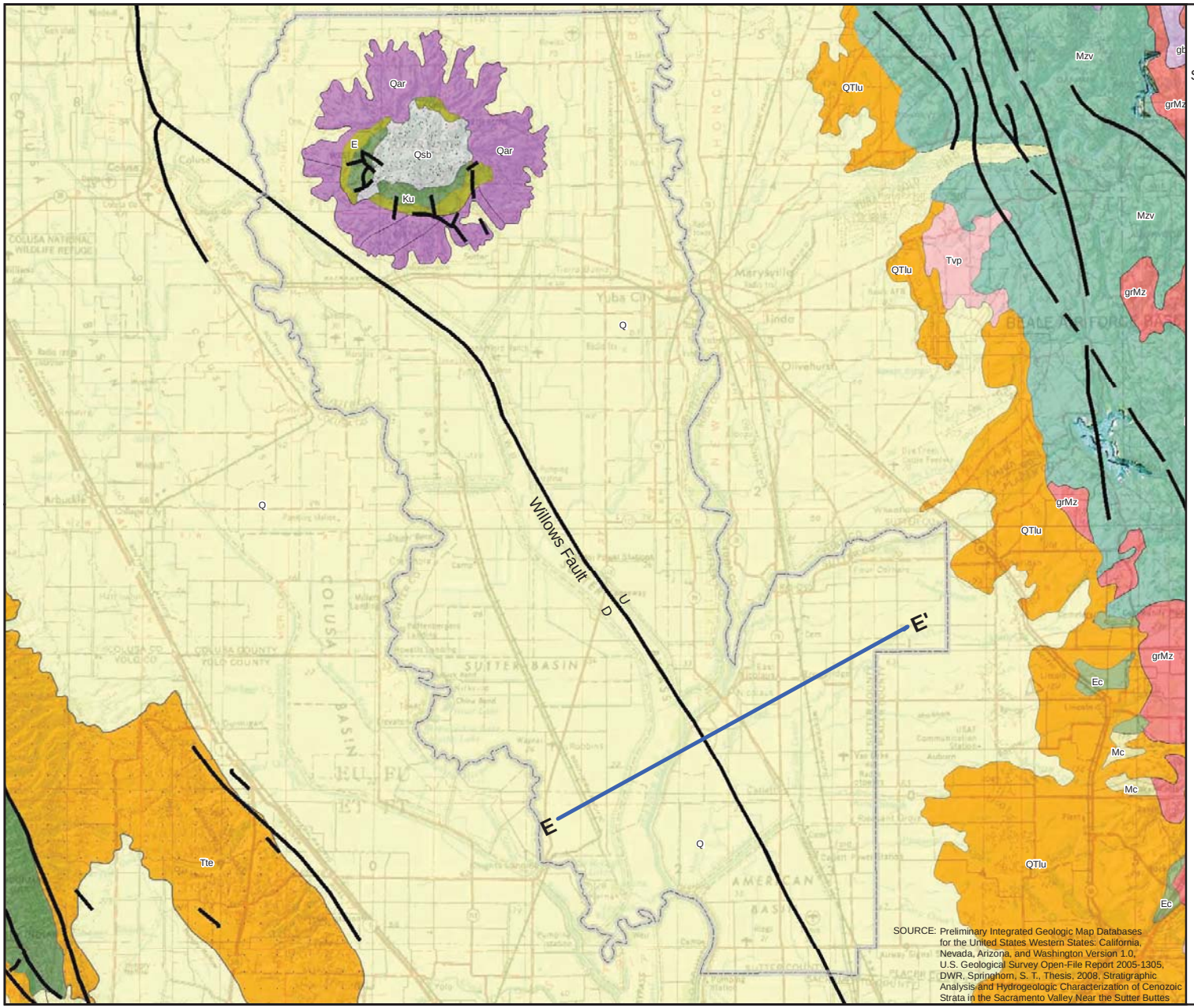

FIGURE 4

SIMPLIFIED SURFACE GEOLOGY AND FAULTS

SUTTER COUNTY GROUNDWATER MANAGEMENT PLAN

FEBRUARY 2012

NORTH

0 2 4

MILES

LEGEND

- Q - Recent Deposits
  - Qb - Basin Deposits
  - Qm - Modesto Formation
  - Qr - Riverbank Formation
- Qsb - Sutter Buttes Igneous Rocks
- Qar - Sutter Buttes Andesitic Rampart
- QTlu - Laguna Formation
- Tte - Tehama Formation
- Tvp - Andesite, Rhyolite
- Mc - Sandstone, Conglomerate
- Ec - Conglomerate, Sandstone
- E - Mudstone, Sandstone
- Ku - Sandstone, Mudstone
- J - Mudstone, Sandstone, & Slate
- um - Serpentinite
- Mzv - Volcanic, Metavolcanic
- gb - Gabbro, Diorite
- grMz - Granodiorite
- Fault
- Fault Displacement (U / D) - U, upthrown side; D, downthrown side
- Counties
- Simplified Conceptual Geologic Cross Section Line (See Figure 8)

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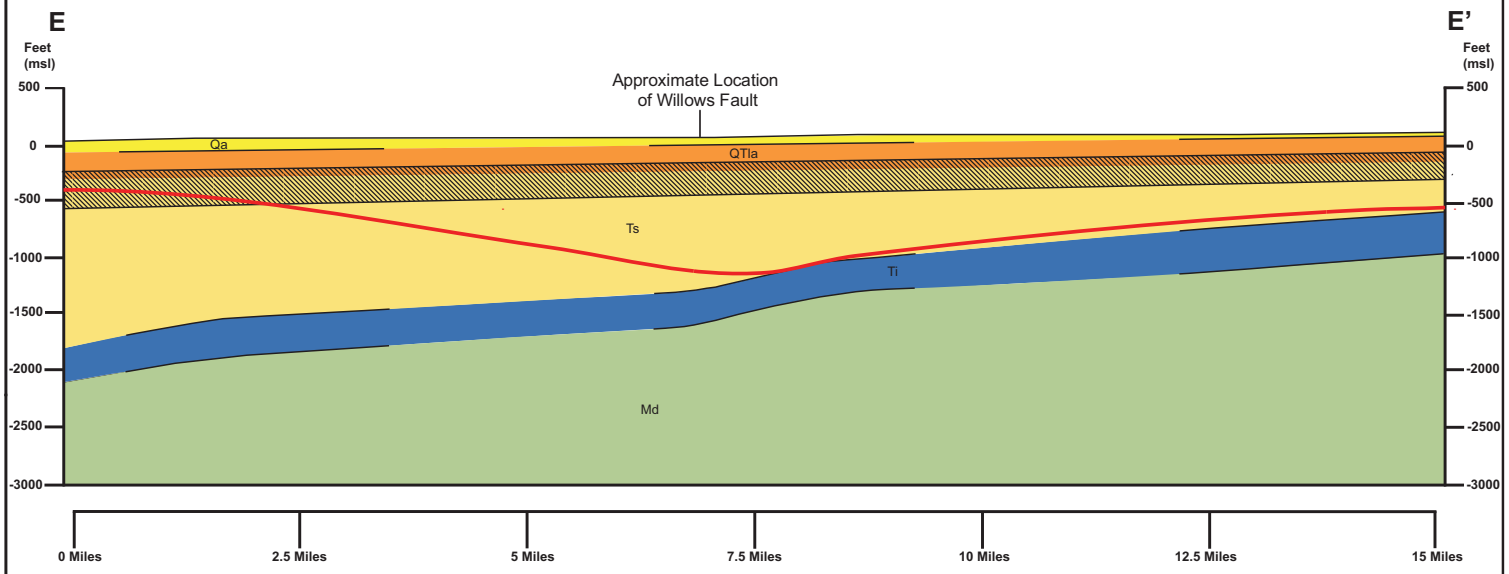
J:\Jobs\8337_SutterCounty\GIS\Tasks\20120116 Final Draft\Figure 7 Simplified Surface Geology and Faults.mxd 2/7/2012 12:54:14 PM bdemucha



Cross Section Scale

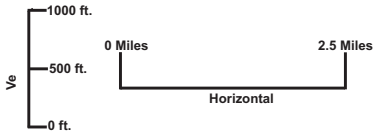


FIGURE 5
SIMPLIFIED CONCEPTUAL GEOLOGIC CROSS SECTION
SUTTER COUNTY GROUNDWATER MANAGEMENT PLAN
FEBRUARY 2012

Explanation

- Qa — Alluvial Deposits
- QTla — Laguna Formation
- Laguna and Sutter Formation Transition (approximate depth)
- Ts — Sutter Formation (map unit, Williams and Curtis, 1977; Helley and Harwood, 1985)
- Tt — Tuscan Formation (map unit, Helley and Harwood, 1985)
- Tm — Mehrten Formation (map unit, Helley and Harwood, 1985)
- Ti — Ione Formation (map unit, Helley and Harwood, 1985)
- Md — Marine Deposits
- Inferred Geologic Contact
- Approximate Base of Fresh Water. Line represent depths at which Specific Conductance levels exceed approximately 3,000 umhos/cm

SOURCES: DOGGR; DWR; Springhorn, S. T., Thesis, 2008, Stratigraphic Analysis and Hydrogeologic Characterization of Cenozoic Strata in the Sacramento Valley Near the Sutter Buttes; Berkstresser, C.F. Jr. 1973. Base of Fresh Ground-Water -- Approximately 3,000 micromhos in the Sacramento Valley and Sacramento-San Joaquin Delta, California. U.S. Geological Survey Water-Resource Inv. 40-73; Helley, E. J. and Harwood, D. S., 1985, Geologic Map of Late Cenozoic Deposits of the Sacramento Valley and Northern Sierran Foothills, California.

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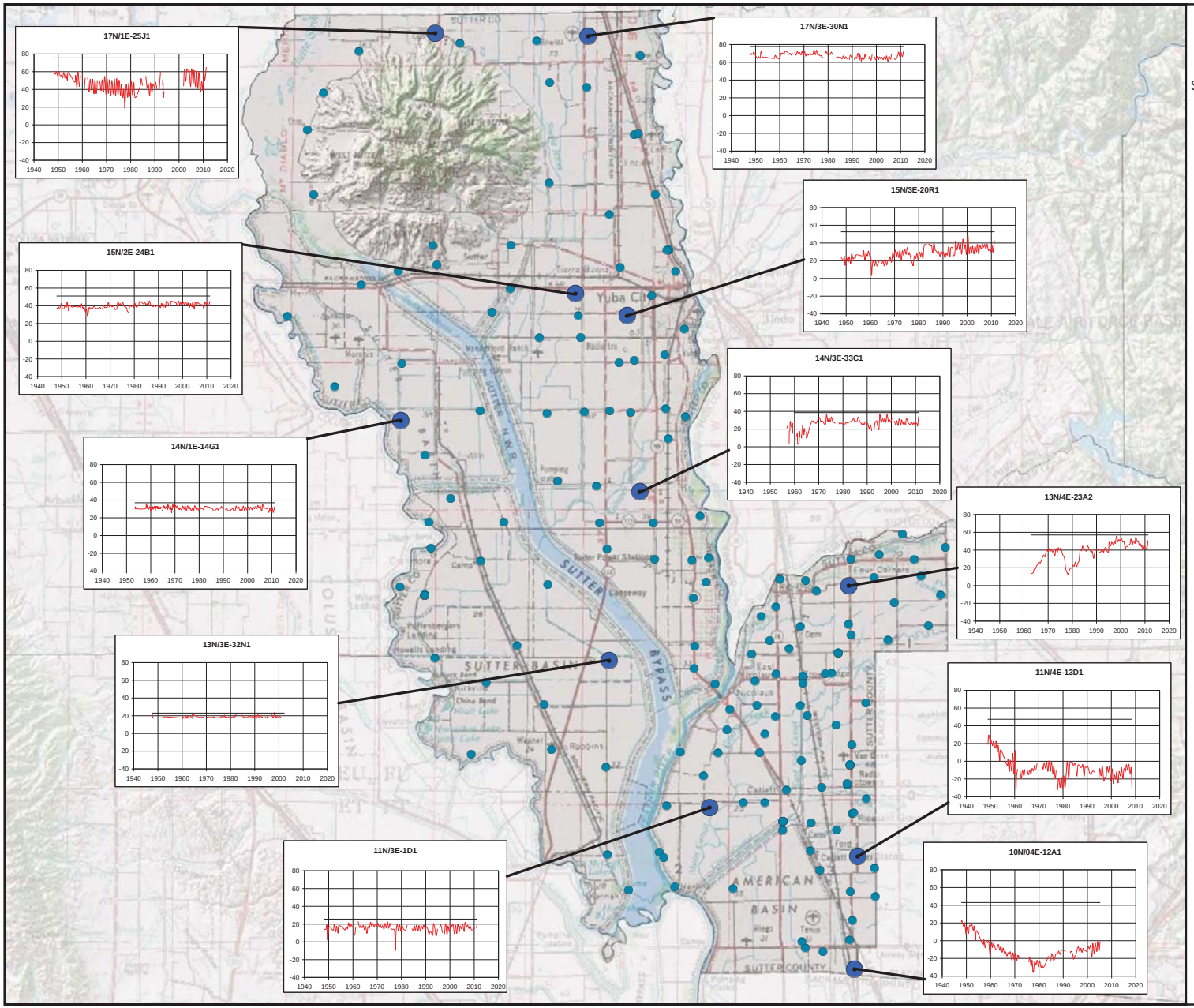


FIGURE 6
HISTORIC GROUNDWATER ELEVATIONS IN SUTTER COUNTY
SUTTER COUNTY GROUNDWATER MANAGEMENT PLAN
FEBRUARY 2012

NORTH

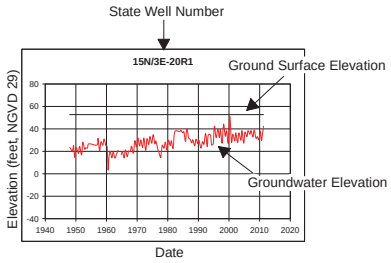
0 2 4
MILES

Legend

- Well with Hydrograph Shown
- Well with Water Level Measurement since 2004

Note: This figure represents wells with historic water level and current measurements either submitted to or obtained by the California Department of Water Resources and may not represent current monitoring activities. Groundwater elevations are in feet above mean sea level.

SOURCE: DWR



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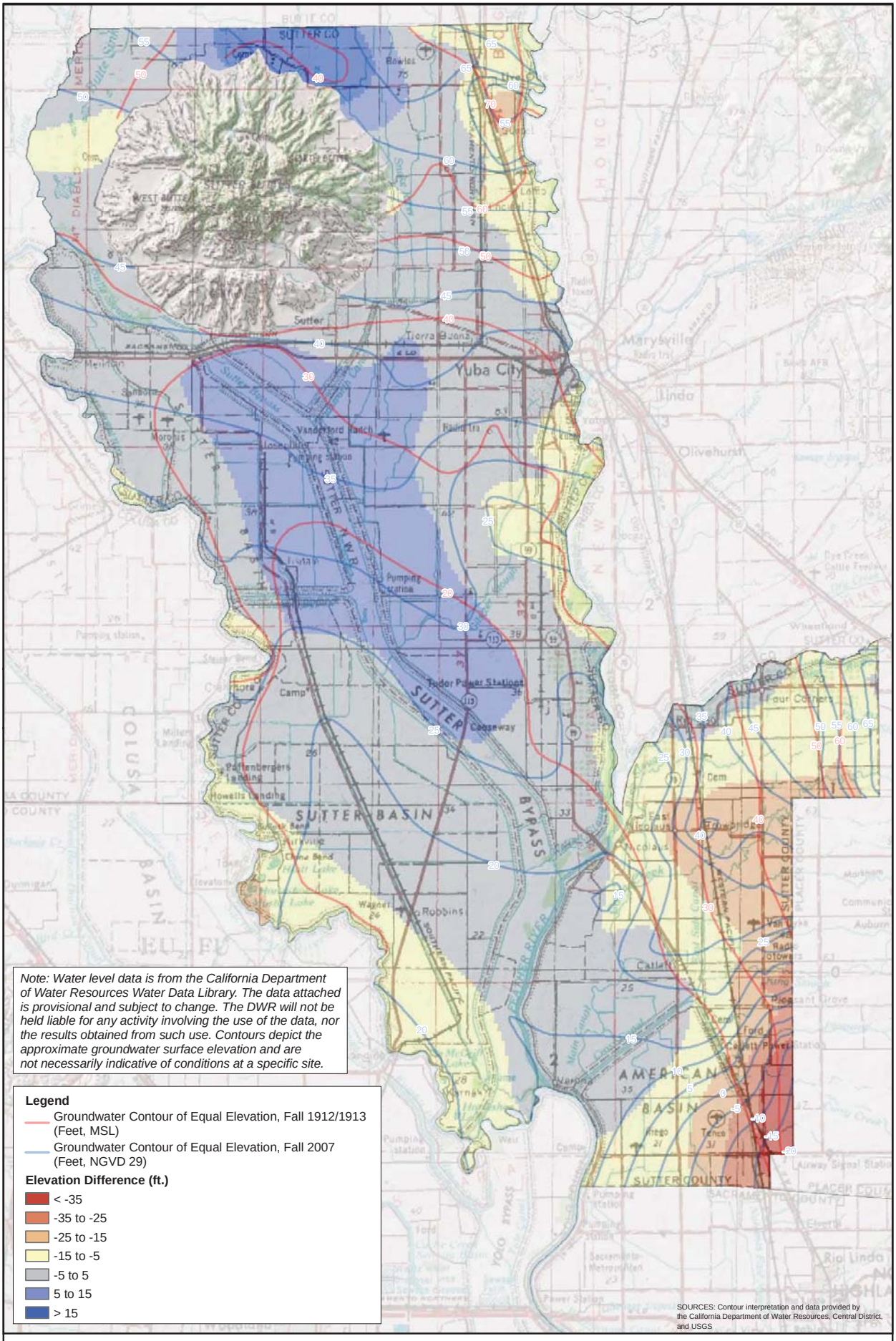

FIGURE 7
GROUNDWATER LEVEL CHANGE MAP
FALL 2007 AND FALL 1912/1913
SUTTER COUNTY GROUNDWATER MANAGEMENT PLAN
FEBRUARY 2012

NORTH
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MILES

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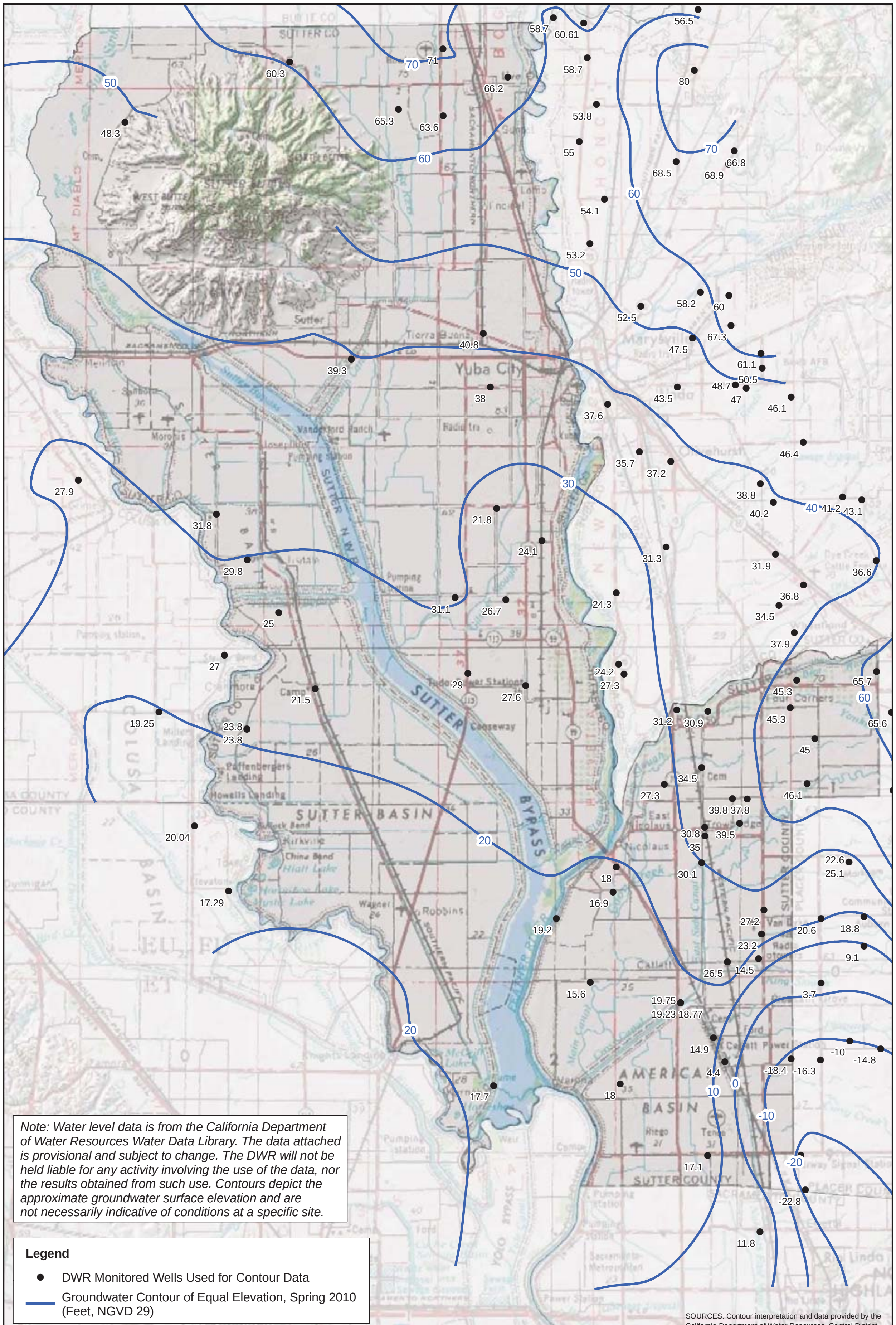

Note: Water level data is from the California Department of Water Resources Water Data Library. The data attached is provisional and subject to change. The DWR will not be held liable for any activity involving the use of the data, nor the results obtained from such use. Contours depict the approximate groundwater surface elevation and are not necessarily indicative of conditions at a specific site.

Legend

- ● DWR Monitored Wells Used for Contour Data
- ▬ Groundwater Contour of Equal Elevation, Spring 2010 (Feet, NGVD 29)

FIGURE 8
GROUNDWATER ELEVATION CONTOUR MAP
SPRING, 2010

SUTTER COUNTY GROUNDWATER MANAGEMENT PLAN
FEBRUARY 2012

NORTH

0 1.5 3
MILES

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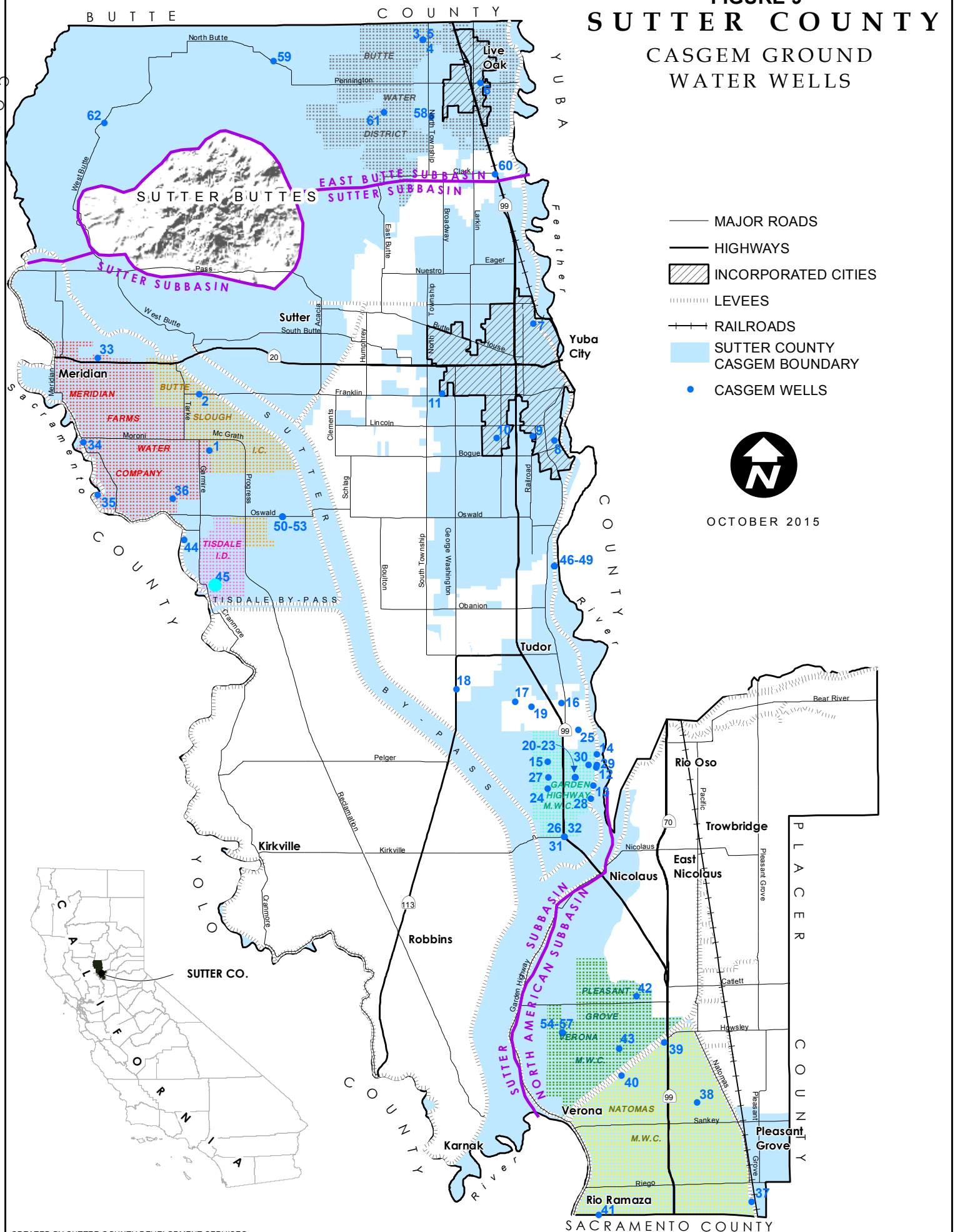
FIGURE 9
SUTTER COUNTY
CASGEM GROUND WATER WELLS



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ID #	Local Well Description	CASGEM Well Number	Assocated Subbasin	Well Use
Butte Slough Irrigation District				
1	BS1-McClatchy	391012N1218222W001	5-21.62 Sutter	Irrigation
2	BS2-Franklin	391283N1218286W001	5-21.62 Sutter	Irrigation
Butte Water District				
3	BWD MW-1A	392970N1216907W001	5-21.59 East Butte	Observation
4	BWD MW-1B	392970N1216907W002	5-21.59 East Butte	Observation
5	BWD MW-1C	392970N1216907W003	5-21.59 East Butte	Observation
City of Live Oak				
6	Live Oak Well 5	392762N1216556W001	5-21.59 East Butte	Inactive Municipal
City of Yuba City				
7	WTP Well	391613N1216236W001	5-21.62 Sutter	Observation
8	WWTF Well	391057N1216114W001	5-21.62 Sutter	Inactive Municipal
9	La Grande	391078N1216244W001	5-21.62 Sutter	Inactive Municipal
10	Edwin	391068N1216464W001	5-21.62 Sutter	Inactive Municipal
11	Lyndsey	391282N1216799W001	5-21.62 Sutter	Irrigation
Garden Highway Mutual Water Company				
12	GH Well 22	389495N1215863W001	5-21.62 Sutter	Irrigation
13	GH Well 18	389410N1215884W001	5-21.62 Sutter	Irrigation
14	GH Well 23	389560N1215860W001	5-21.62 Sutter	Irrigation
15	GH Well 1	389525N1216161W001	5-21.62 Sutter	Irrigation
16	13N03E14C002M	389805N1216074W001	5-21.62 Sutter	Irrigation
17	13N03E16A001M	389813N1216356W001	5-21.62 Sutter	Irrigation
18	13N03E08M002M	389875N1216718W001	5-21.62 Sutter	Irrigation
19	13N03E15C003M	389786N1216259W001	5-21.62 Sutter	Unknown
20	Sutter County MW-4A	389452N1215992W001	5-21.62 Sutter	Observation
21	Sutter County MW-4C	389452N1215992W003	5-21.62 Sutter	Observation
22	Sutter County MW-4B	389452N1215992W002	5-21.62 Sutter	Observation
23	Sutter County MW-4D	389452N1215992W004	5-21.62 Sutter	Observation
24	GH Well 3	389398N1216162W001	5-21.62 Sutter	Irrigation
25	GH Rouse Ranch Well	389677N1215974W001	5-21.62 Sutter	Irrigation
26	012N003E02G001M	389167N1216061W002	5-21.62 Sutter	Observation
27	GH Well 2	389453N1216159W001	5-21.62 Sutter	Irrigation
28	GH Well 19	389347N1215897W001	5-21.62 Sutter	Irrigation
29	GH Well 4	389509N1215863W001	5-21.62 Sutter	Irrigation
30	GH Well 17	389510N1215913W001	5-21.62 Sutter	Irrigation
31	012N003E02G002M	389167N1216061W003	5-21.62 Sutter	Observation
32	012N003E02G003M	389167N1216061W004	5-21.62 Sutter	Observation
Meridian Farms Water Company				
33	MFWC PROP50	391456N1218904W001	5-21.62 Sutter	Irrigation
34	MFWC S Meridian	391052N1218994W001	5-21.62 Sutter	Irrigation
35	MFWC Park-Miller	390803N1218906W001	5-21.62 Sutter	Irrigation
36	MFWC Park2	390784N1218450W001	5-21.62 Sutter	Irrigation
Natomas Central Mutual Water Company				
37	L3	387422N1214929W001	5-21.64 North American	Irrigation
38	L-12	387898N1215259W001	5-21.64 North American	Irrigation
39	Morrison MW2	388185N1215461W001	5-21.64 North American	Irrigation
40	TNBC Lucich North	388028N1215720W001	5-21.64 North American	Irrigation
41	TNBC-Atkinson	387363N1215862W001	5-21.64 North American	Irrigation
Pleasant Grove-Verona Mutual Water Company				
42	S&O #17	388406N1215627W001	5-21.64 North American	Irrigation
43	Willey #2	388159N1215728W001	5-21.64 North American	Irrigation
Tisdale Irrigation District				
44	TID Park-Windship	390587N1218380W001	5-21.62 Sutter	Irrigation
45	TID Park-Lonon	390369N1218189W001	5-21.62 Sutter	Irrigation
Department of Water Resources				
46	Feather River MW-1A	390458N1216114W001	5-21.62 Sutter	Observation
47	Feather River MW-1B	390458N1216114W002	5-21.62 Sutter	Observation
48	Feather River MW-1C	390458N1216114W003	5-21.62 Sutter	Observation
49	Feather River MW-1D	390458N1216114W004	5-21.62 Sutter	Observation
50	Sutter County MW-1A	390696N1217778W001	5-21.62 Sutter	Observation
51	Sutter County MW-1B	390696N1217778W002	5-21.62 Sutter	Observation
52	Sutter County MW-1C	390696N1217778W003	5-21.62 Sutter	Observation
53	Sutter County MW-1D	390696N1217778W004	5-21.62 Sutter	Observation
54	Sutter County MW-5A	388235N1216079W001	5-21.64 North American	Observation
55	Sutter County MW-5B	388235N1216079W002	5-21.64 North American	Observation
56	Sutter County MW-5C	388235N1216079W003	5-21.64 North American	Observation
57	Sutter County MW-5D	388235N1216079W004	5-21.64 North American	Observation
58	16N03E07D002M	392603N1216860W001	5-21.59 East Butte	Single
59	17N02E31A001M	392867N1217825W001	5-21.59 East Butte	Single
60	16N03E21D002M	392328N1216469W001	5-21.59 East Butte	Unknown
61	16N02E02Q001M	392634N1217141W001	5-21.59 East Butte	Single
62	16N01E08C001M	392575N1218863W001	5-21.59 East Butte	Single

Attachment A: Qualification and Compliance Notification Statements

SUTTER COUNTY
DEVELOPMENT SERVICES DEPARTMENT

Building Inspection
Code Enforcement
Planning
Environmental Health
Fire Services
Engineering
Road Maintenance
Water Resources

November 3, 2015

Mark Souverville
Department of Water Resources
Geology and Groundwater Investigations
3500 Industrial Boulevard
West Sacramento, CA 96691

RE: Statement of Qualifications to become a CASGEM Monitoring Entity

Dear Mr. Souverville,

The County of Sutter (County) is qualified to act as a designated monitoring entity for the California Statewide Groundwater Elevation Monitoring (CASGEM) program. The three subbasins within the county are currently reported by DWR as being partially unmonitored. The County of Sutter is prepared to become the designated monitoring entity for the unmonitored areas within the County's portion of each subbasin. The County of Sutter has provided a CASGEM Monitoring Plan to include an understanding of the groundwater underlying the county, details regarding an established monitoring network and field methodologies consistent with DWR Guidelines. Sutter County as a monitoring entity will be responsible for coordinating the monitoring of groundwater elevations with ten cooperating agencies.

Bulletin 118 designates three Sacramento Valley Groundwater Subbasins within Sutter County: East Butte Subbasin (5-21.59), Sutter Subbasin (5-21.62) and North American Subbasin (5-21.64). The East Butte and Sutter Subbasins have been listed as medium priority while the North American Subbasin is listed a high priority. Four existing monitoring entities have been designated within Sutter County and are actively monitoring groundwater for CASGEM: (1) Reclamation District 1500, (2) Sutter Extension Water District, (3) South Sutter Water District, and (4) Feather Water District. Sutter County's monitoring entity boundary will not include the four existing monitoring entity areas.

The following local agencies will serve as Cooperating Agencies to the County's monitoring entity program:

- Butte Slough Irrigation District,
- Butte Water District,
- City of Live Oak,
- City of Yuba City,
- Department of Water Resources,

- Garden Highway Mutual Water Company,
- Meridian Farms Mutual Water Company,
- Natomas Central Mutual Water Company,
- Pleasant Grove-Verona Mutual Water Company, and
- Tisdale Irrigation District.

Each of these cooperating agencies will monitor the groundwater wells within their boundaries to report groundwater elevation levels to CASGEM. Each of these agencies has taken an active role in monitoring and managing groundwater within the County. Of the 57 wells Sutter County proposes to add to the CASGEM network, 50 are currently being monitored and new groundwater monitoring programs are being established for the remaining seven wells. 23 of these wells are dedicated observation wells. As a Monitoring Entity, Sutter County will coordinate with the above agencies to ensure groundwater level data is collected and reported in accordance with DWR's guidelines.

Sincerely,

Albert Sawyer, P.E.
Assistant Director of Development Services
Sutter County

SUTTER COUNTY
DEVELOPMENT SERVICES DEPARTMENT

Building Inspection
Code Enforcement
Planning
Environmental Health
Fire Services
Engineering
Road Maintenance
Water Resources

November 3, 2015

Mark Souverville
Department of Water Resources
Geology and Groundwater Investigations
3500 Industrial Boulevard
West Sacramento, CA 96691

RE: Statement to comply with WC2.11

Dear Mr. Souverville,

Sutter County as a CASGEM Monitoring Entity intends to comply with all CASGEM program requirements per Water Code 2.11.

Sincerely,

Albert Sawyer
Assistant Director of Development Services
Sutter County

P:\WR WATER RESOURCES\Groundwater\CASGEM\Sutter County ME Notification\WC2.11 Notification.docx

Attachment B: Cooperating Agency Contact List

Butte Slough Irrigation Company
P. O. Box 187
Meridian, CA 95957
Phone: 696-2456
Fax: 696-2551
Andy Duffey, Manager
Email: aduffey@succeed.net

Butte Water District
735 Virginia Street
Gridley, CA 95948
Phone: 530-846-3100
Fax: 530-846-2519
Mark Orme, Manager
Email: morme@buttewater.net

City of Live Oak
9955 Live Oak Blvd.
Live Oak, CA 95953
Phone: 530-695-2112
Ron Walker, Public Works Facilities Manager
Email: rwalker@liveoakcity.org

City of Yuba City
302 Burns Drive
Yuba City, CA 95991
Phone: 530-822-7695
Mike Paulucci, Deputy Public Works Director - Utilities
Email: mpaulucc@yubacity.net

Department of Water Resources
North Central Region
3500 Industrial Blvd
West Sacramento, CA 96691
Phone: 916-376-9657
Bill Brewster, Senior Engr. Geologist
Email: Bill.Brewster@water.ca.gov

Garden Highway Mutual Water Company
12755 Garden Highway
Yuba City, CA 95991
Phone: 530-330-2827
Fax: 671-4740
Jon Munger
Email: jon@montnafarms.com

Meridian Farms Water Company
P. O. Box 187
Meridian, CA 95957
Phone: 696-2456
Fax: 696-2551
Andy Duffey, Manager
Email: aduffey@succeed.net

Natomas Central Mutual Water Company
2601 West Elkhorn Boulevard
Rio Linda, CA 95673
Fax: 916-419-8691
Phone: 916-419-5936
Brett Gray, General Manager
Email: bgray@natomaswater.com

Pleasant Grove-Verona Mutual Water Company
1510 W. Catlett Road
Pleasant Grove, CA 95668
Phone: 916-655-3419
Brett Scheidel, President
Email: scheidelranches@succeed.net

Tisdale Irrigation & Drainage Company
7611 S. Township Rd.
Yuba City, CA 95993
Chris Capaul
Phone: 530-632-7761
Andy Duffey, Manager
Phone: 530-696-2456
Email: aduffey@succeed.net

Attachment C: Sutter County CASGEM Well Network

Assocated Subbasin	Figure 9 ID #	CASGEM Well Number	Local Well Description	Latitude (DD North)	Longitude (DD East)	Reference Point Elevation (ft, NAVD88)	Ground Surface Elevation (ft, NAVD88)	Well Use	Well Completion Type	Total Well Depth (ft)
Butte Slough Irrigation District										
5-21.62 Sutter	1	391012N1218222W001	BS1-McClatchy	39.101189	-121.822224	40.8	39.5	Irrigation	Single	370
5-21.62 Sutter	2	391283N1218286W001	BS2-Franklin	39.128300	-121.828562	40.9	39.7	Irrigation	Single	300
Butte Water District										
5-21.59 East Butte	3	392970N1216907W001	BWD MW-1A	39.297051	-121.690699	80.0	78.0	Observation	Nested	591
5-21.59 East Butte	4	392970N1216907W002	BWD MW-1B	39.297051	-121.690699	79.5	78.0	Observation	Nested	370
5-21.59 East Butte	5	392970N1216907W003	BWD MW-1C	39.297051	-121.690699	79.5	78.0	Observation	Nested	127
City of Live Oak										
5-21.59 East Butte	6	392762N1216556W001	Live Oak Well 5	39.276234	-121.655720	79.7	78.5	Inactive Municipal	Single	399
City of Yuba City										
5-21.62 Sutter	7	391613N1216236W001	WTP Well	39.161337	-121.623642	65.8	66.0	Observation	Single	600
5-21.62 Sutter	8	391057N1216114W001	WWTF Well	39.105656	-121.611411	51.5	52.0	Inactive Municipal	Single	unknown
5-21.62 Sutter	9	391078N1216244W001	La Grande	39.107792	-121.624433	54.2	55.5	Inactive Municipal	Single	254
5-21.62 Sutter	10	391068N1216464W001	Edwin	39.106828	-121.646445	51.3	52.0	Inactive Municipal	Single	190
5-21.62 Sutter	11	391282N1216799W001	Lyndsey	39.128176	-121.679928	51.5	52.0	Irrigation	Single	unknown
Garden Highway Mutual Water Company										
5-21.62 Sutter	12	389495N1215863W001	GH Well 22	38.949516	-121.586310	44	42	Irrigation	Single	200
5-21.62 Sutter	13	389410N1215884W001	GH Well 18	38.941048	-121.588446	43	42	Irrigation	Single	150
5-21.62 Sutter	14	389560N1215860W001	GH Well 23	38.956000	-121.586000	44	43	Irrigation	Single	280
5-21.62 Sutter	15	389525N1216161W001	GH Well 1	38.952470	-121.616130	39	38	Irrigation	Single	unknown
5-21.62 Sutter	16	389805N1216074W001	13N03E14C002M	38.980500	-121.607400	38	38	Irrigation	Single	unknown
5-21.62 Sutter	17	389813N1216356W001	13N03E16A001M	38.981300	-121.635600	37	37	Irrigation	Single	unknown
5-21.62 Sutter	18	389875N1216718W001	13N03E08M002M	38.987500	-121.671800	36	35	Irrigation	Single	unknown
5-21.62 Sutter	19	389786N1216259W001	13N03E15C003M	38.978600	-121.625900	28	27	Unknown	Single	unknown
5-21.62 Sutter	20	389452N1215992W001	Sutter County MW-4A	38.945159	-121.599150	37	37	Observation	Nested	175
5-21.62 Sutter	21	389452N1215992W003	Sutter County MW-4C	38.945159	-121.599150	37	37	Observation	Nested	610
5-21.62 Sutter	22	389452N1215992W002	Sutter County MW-4B	38.945159	-121.599150	37	37	Observation	Nested	445
5-21.62 Sutter	23	389452N1215992W004	Sutter County MW-4D	38.945159	-121.599150	37	37	Observation	Nested	1005
5-21.62 Sutter	24	389398N1216162W001	GH Well 3	38.939750	-121.616170	41	40	Irrigation	Single	unknown
5-21.62 Sutter	25	389677N1215974W001	GH Rouse Ranch Well	38.967710	-121.597430	39	38	Irrigation	Single	unknown
5-21.62 Sutter	26	389167N1216061W002	012N003E02G001M	38.916700	-121.606100	33	33	Observation	Single	unknown
5-21.62 Sutter	27	389453N1216159W001	GH Well 2	38.945290	-121.615940	40	39	Irrigation	Single	unknown
5-21.62 Sutter	28	389347N1215897W001	GH Well 19	38.934747	-121.589735	44	43	Irrigation	Single	365
5-21.62 Sutter	29	389509N1215863W001	GH Well 4	38.950886	-121.586258	44	42	Irrigation	Single	225
5-21.62 Sutter	30	389510N1215913W001	GH Well 17	38.951044	-121.591276	42	41	Irrigation	Single	248
5-21.62 Sutter	31	389167N1216061W003	012N003E02G002M	38.916700	-121.606100	33	33	Observation	Single	721
5-21.62 Sutter	32	389167N1216061W004	012N003E02G003M	38.916700	-121.606100	33	33	Observation	Single	321
Meridian Farms Water Company										
5-21.62 Sutter	33	391456N1218904W001	MFWC PROP50	39.145593	-121.890434	46.2	43.0	Irrigation	Single	320
5-21.62 Sutter	34	391052N1218994W001	MFWC S Meridian	39.105238	-121.899377	52.9	51.0	Irrigation	Single	310
5-21.62 Sutter	35	390803N1218906W001	MFWC Park-Miller	39.080257	-121.890599	50.8	49.1	Irrigation	Single	320
5-21.62 Sutter	36	390784N1218450W001	MFWC Park2	39.078389	-121.844966	39.7	39.8	Irrigation	Single	190

Assocated Subbasin	Figure 9 ID #	CASGEM Well Number	Local Well Description	Latitude (DD North)	Longitude (DD East)	Reference Point Elevation (ft, NAVD88)	Ground Surface Elevation (ft, NAVD88)	Well Use	Well Completion Type	Total Well Depth (ft)
Natomas Central Mutual Water Company										
5-21.64 North American	37	387422N1214929W001	L3	38.742161	-121.492904	41.6	40.8	Irrigation	Single	370
5-21.64 North American	38	387898N1215259W001	L-12	38.789810	-121.525843	28.5	28.6	Irrigation	Single	690
5-21.64 North American	39	388185N1215461W001	Morrison MW2	38.818511	-121.546065	29.7	29.5	Irrigation	Single	220
5-21.64 North American	40	388028N1215720W001	TNBC Lucich North	38.802799	-121.572048	28.9	28.3	Irrigation	Single	226
5-21.64 North American	41	387363N1215862W001	TNBC-Atkinson	38.736305	-121.586196	31.4	28.9	Irrigation	Single	288
Pleasant Grove-Verona Mutual Water Company										
5-21.64 North American	42	388406N1215627W001	S&O #17	38.840601	-121.562699	33.2	31.7	Irrigation	Single	unknown
5-21.64 North American	43	388159N1215728W001	Willey #2	38.815720	-121.573406	30.3	29.6	Irrigation	Single	unknown
Tisdale Irrigation District										
5-21.62 Sutter	44	390587N1218380W001	TID Park-Windship	39.058697	-121.837965	43.3	42.5	Irrigation	Single	195
5-21.62 Sutter	45	390369N1218189W001	TID Park-Lonon	39.036908	-121.818910	42.4	41.8	Irrigation	Single	unknown
Department of Water Resources										
5-21.62 Sutter	46	390458N1216114W001	Feather River MW-1A	39.045800	-121.611400	54.8	52.1	Observation	Nested	65
5-21.62 Sutter	47	390458N1216114W002	Feather River MW-1B	39.045800	-121.611400	54.5	52.1	Observation	Nested	260
5-21.62 Sutter	48	390458N1216114W003	Feather River MW-1C	39.045800	-121.611400	54.4	52.1	Observation	Nested	689
5-21.62 Sutter	49	390458N1216114W004	Feather River MW-1D	39.045800	-121.611400	52.5	50.7	Observation	Nested	1021
5-21.62 Sutter	50	390696N1217778W001	Sutter County MW-1A	39.069600	-121.777800	34.9	35.1	Observation	Nested	60
5-21.62 Sutter	51	390696N1217778W002	Sutter County MW-1B	39.069600	-121.777800	34.9	35.1	Observation	Nested	245
5-21.62 Sutter	52	390696N1217778W003	Sutter County MW-1C	39.069600	-121.777800	34.9	35.1	Observation	Nested	425
5-21.62 Sutter	53	390696N1217778W004	Sutter County MW-1D	39.069600	-121.777800	34.9	35.1	Observation	Nested	755
5-21.64 North American	54	388235N1216079W001	Sutter County MW-5A	38.823235	-121.607630	26.5	24.7	Observation	Nested	170
5-21.64 North American	55	388235N1216079W002	Sutter County MW-5B	38.823235	-121.607630	26.3	24.7	Observation	Nested	675
5-21.64 North American	56	388235N1216079W003	Sutter County MW-5C	38.823235	-121.607630	26.2	24.7	Observation	Nested	930
5-21.64 North American	57	388235N1216079W004	Sutter County MW-5D	38.823500	-121.607900	26.1	24.7	Observation	Nested	1225
5-21.59 East Butte	58	392603N1216860W001	16N03E07D002M	39.260300	-121.686000	75.8	75.29	Irrigation	Single	196
5-21.59 East Butte	59	392867N1217825W001	17N02E31A001M	39.286700	-121.782500	90.4	88.4	Irrigation	Single	540
5-21.59 East Butte	60	392328N1216469W001	16N03E21D002M	39.232800	-121.646900	72.3	72.3	Residential	Single	30
5-21.59 East Butte	61	392634N1217141W001	16N02E02Q001M	39.262386	-121.715042	74.1	73.3	Residential	Single	unknown
5-21.59 East Butte	62	392575N1218863W001	16N01E08C001M	39.257500	-121.886300	61.4	60.38	Stockwatering	Single	unknown

Attachment D: DWR Groundwater Elevation Monitoring Guidelines