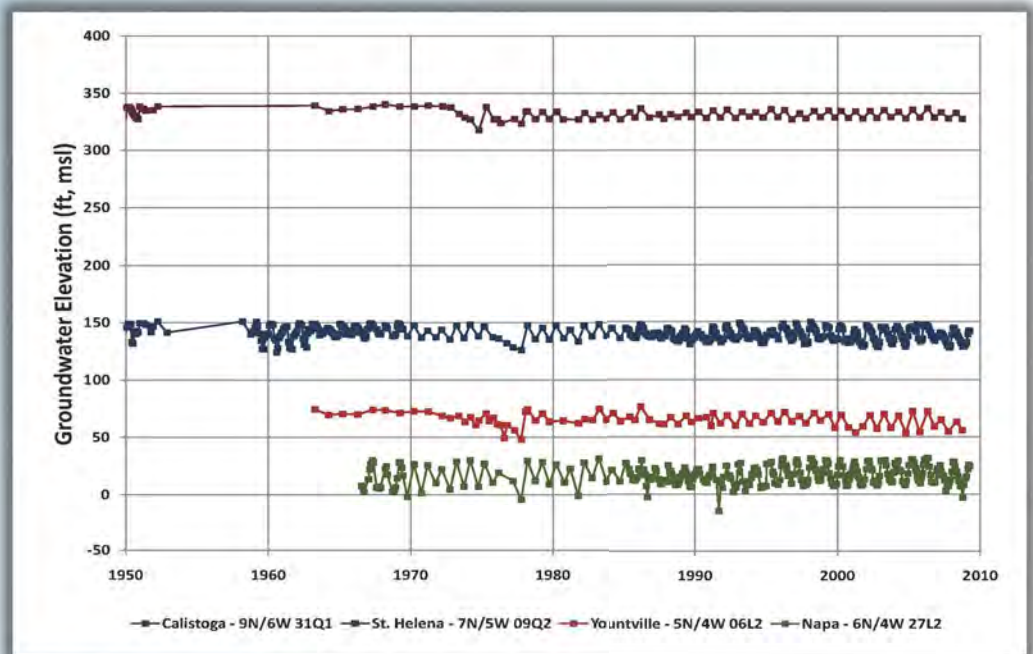




Napa County California Statewide Groundwater Elevation Monitoring (CASGEM) Network Plan

Originally Prepared in
September 2011

Updated in
August 2014



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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.

In 2009, Napa County implemented a Comprehensive Groundwater Monitoring Program to meet identified action items in Napa County's 2008 General Plan update (Napa County, 2008). This program covers the continuation and expansion of countywide groundwater level monitoring efforts (including many basins, subbasins and/or subareas throughout the county) for the purpose of understanding groundwater conditions (i.e., seasonal and long-term groundwater level trends and also quality trends) and availability to enable integrated water resources planning and dissemination of water resources information. Napa County's combined efforts through the Comprehensive Groundwater Monitoring Program along with the related AB 303 Public Outreach Project (CCP, 2010) and the efforts of the Watershed Information Center & Conservancy (WICC) of Napa County (www.napawatersheds.org) create a foundation for the County's continued efforts to increase public outreach and participation. An informed and engaged public enables support of planned water resources projects and programs proposed by the County and others.

1.3 Napa County Monitoring Entity

On December 29, 2010, the County of Napa 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 the County as the Monitoring Entity, the County proceeded to identify the

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 Napa 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.

1.4 County Outreach

In August 2011¹, the County sent a letter to other entities in the county informing them of the County's role as the CASGEM Monitoring Entity, efforts underway to prepare a CASGEM Plan, and planned groundwater elevation data submittal by the January 2012 deadline. The County explained the process underway to evaluate the suitability of the wells that have historically been monitored by the County for inclusion in the CASGEM program/plan. The County also explained to other entities that it is seeking property owner interest and participation in the CASGEM program from those owners whose wells may be suitable and have historically been monitored by the County. Additional outreach was conducted from 2012 to present through public workshops and meetings with industry, environmental, and community groups.

2.0 NAPA COUNTY AREA

2.1 DWR Basins/Subbasins and County Subareas

The CASGEM program largely refers to DWR's depiction of the major groundwater basins and subbasins in and around Napa County, including the Napa-Sonoma Valley (which in Napa County includes the Napa Valley and Napa-Sonoma Lowlands Subbasins), Berryessa Valley, Pope Valley, and a small part of the Suisun-Fairfield Valley Groundwater Basins (**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 Napa County.

The Suisun-Fairfield Valley Basin and the Napa-Sonoma Lowlands Subbasin are two examples of basins that do not conform to county boundaries, and they are also basins with a DWR low priority designation.² While these two basins have low groundwater utilization and less extensive monitoring than other basins, they are situated adjacent to the bay and delta water ways and are important areas to monitor for protection against saltwater intrusion. The Suisun-Fairfield Valley Basin, which is mostly in Solano County and has only a very small area (less than 0.3% of the total basin area) in Napa County, is being monitored in its entirety by Solano County Water Agency as the CASGEM Monitoring Entity for Solano County. The monitoring of

¹ The original Napa County CASGEM Network Plan was submitted to DWR in September 2011. This Plan provides updated information especially as related to two low priority groundwater basins as discussed in Section 5.

² As part of the CASGEM Program, DWR has developed the Basin Prioritization process. The California Water Code (§10933 and §12924) requires DWR to prioritize California's groundwater basins and subbasins statewide. As such, DWR developed the CASGEM Groundwater Basin Prioritization Process. Details are available at http://www.water.ca.gov/groundwater/casgem/basin_prioritization.cfm.

Napa-Sonoma Lowlands Subbasin, whose area is shared with Solano County in more equitable portions (63% in Napa County, 37% in Solano County), is anticipated to have monitoring that is coordinated between the two respective Monitoring Entities in the future. Currently, all monitoring is within the Napa County portion of the subbasin; in the future, monitoring in this subbasin will expand as necessary to ensure representative coverage and as coordinated between the two Monitoring Entities.

Groundwater conditions outside of the DWR-designated areas are also very important in Napa County. An example of such an area is the Milliken-Sarco-Tulucay (MST) area, a locally identified groundwater deficient area. For purposes of the County's CASGEM Plan, and prior groundwater studies, the county has been subdivided into a series of subareas (**Figure 2**). These subareas were delineated based on the main watersheds, groundwater basins, and the County's planning areas. These include the Knoxville, Livermore Ranch, Pope Valley, Berryessa, Angwin, Central Interior Valleys, Eastern Mountains, Southern Interior Valleys, Jameson/American Canyon, Napa River Marshes, Carneros, and Western Mountains Subareas and five Napa Valley Floor Subareas (i.e., Calistoga, St. Helena, Yountville, Napa, and MST).

2.2 Geology and Groundwater Resources

The geology of Napa County can be divided into three broad geologic units based on their ages and geologic nature. These units are: 1) Mesozoic Basement Rocks (pre-65 million years (my)), which underlie all of Napa County, but they are primarily exposed in the Eastern County area and the Western Mountains Subarea, 2) Older Cenozoic Volcanic and Sedimentary Deposits (65 my to 2.5 my), including Tertiary Sonoma Volcanics (Miocene and Pliocene; 10 my to 2.5 my) which are found throughout the county, especially in the mountains surrounding Napa Valley, and 3) Younger Cenozoic Volcanic and Sedimentary Deposits (post 2.6 my to present), including the Quaternary alluvium of the Valley Floor. The two primary water-bearing units in the county are the tuffaceous member of the Sonoma Volcanics and the Quaternary alluvium.

Outside of the Napa Valley Floor, percolation of surface water appears to be the primary source of recharge. The rate of recharge within areas such as the MST Subarea has been shown to be significantly higher where streams and tributaries cross highly permeable outcrops (e.g., the tuffaceous member of the Sonoma Volcanics or shallow alluvium). Direct infiltration of precipitation is a major component of recharge in the main Napa Valley. Recharge throughout much of the county is generally limited by underlying shallow bedrock of low permeability. An additional component of groundwater recharge is deep percolation through fractured rock and fault zones. This type of recharge can be very difficult to quantify due to the highly variable size and distribution of faults, fractures, and joints in a given area.

3.0 PREVIOUS GROUNDWATER STUDIES

3.1 Napa County's Comprehensive Groundwater Monitoring Program

Napa County's Comprehensive Groundwater Monitoring Program involved many tasks that led to the preparation of five technical memorandums and a report on *Napa County Groundwater Conditions and Groundwater Monitoring Recommendations* (LSCE, 2011). A subsequent report, *Updated Hydrogeologic Conceptualization and Characterization of Conditions* (LSCE, 2013a)

was completed with the assistance of the Napa County Groundwater Resources Advisory Committee (GRAC) in 2013. Additionally, the County has led the development of an updated *Napa County Groundwater Monitoring Plan 2013* (LSCE, 2013b). This Plan extends previous groundwater monitoring efforts, identifies areas where additional monitoring is needed to improve the understanding of groundwater resources and availability, summarizes groundwater monitoring priorities, and provides recommendations for addressing those priorities. These reports document existing knowledge of countywide groundwater conditions and establish a framework for the monitoring and reporting of groundwater levels and groundwater quality on a periodic basis. These reports and other related documents can be found at the County's groundwater webpage: <http://www.countyofnapa.org/bos/grac>.

3.2 Current Countywide Groundwater Level Monitoring

As part of the County's Comprehensive Groundwater Monitoring Program, groundwater level data were examined and groundwater data gaps identified by county subareas (LSCE, 2011 and 2013b). Historical groundwater level measurements have been recorded at a total of 676 wells (173 wells/sites) through at least 2005. Currently³, 89 wells are monitored for water levels.

There are many areas in the county where further efforts to establish groundwater monitoring, using existing or new monitoring facilities, will improve the understanding of groundwater conditions and availability. Primary objectives for addressing groundwater level monitoring include:

- Evaluate groundwater levels in the various county subareas to describe the occurrence and movement of groundwater and identify vertical hydraulic head differences in the aquifer system;
- Detect the occurrence of, and factors attributable to, natural (e.g., direct infiltration of precipitation, surface water seepage to groundwater, groundwater discharge to streams) or induced (e.g., pumping, purposeful recharge operations) factors that affect groundwater conditions and trends;
- Identify where data gaps occur and provide infill, replacement, and/or project-specific monitoring (e.g., such as may occur for planned projects or expansion of existing projects) as needed;
- Develop and/or refine water budgets for key subareas, including recharge, extraction, and change in storage in the aquifer(s); and
- Employ methods to better estimate groundwater basin conditions, assess local current and future water supply availability and reliability, and update analyses as additional data become available.

Napa County has been monitoring and reporting groundwater level measurements to DWR for many years. Reported wells are primarily located in the five subareas of the Napa Valley Floor (i.e., Calistoga, MST, Napa, St. Helena, and Yountville Subareas). As of 2011, a total of 39 wells were being recurrently measured by the County semi-annually in the spring and fall. Of those 39 wells, level measurements in 26 wells were being reported to DWR for inclusion in DWR's

³ "Current" refers to monitored sites with wells measured for levels with a period of record extending to 2011 or later.

Water Data Library, and the remaining 13 wells are measured for County information. Since 2011, the County has continued these monitoring activities while conducting outreach to additional well owners in under-represented areas of the County. The updated Groundwater Monitoring Plan 2013 further prioritizes the designated subareas and identifies groundwater/surface water monitoring sites and 18 areas of interest to be added to the groundwater level monitoring network. Construction of 5 monitoring wells for evaluating surface water/groundwater interaction is planned to begin in early Fall 2014.

3.3 Current Groundwater Conditions

Groundwater level data are primarily available for the subareas in the Napa Valley Floor. Most of these data are not able to be correlated to specific aquifer units due to a lack of associated well construction and lithologic log information. As a result, evaluation of groundwater levels and conditions specific to individual aquifer zones is limited at this time.

Based on available groundwater level data, levels in the county are generally stable, with the exception of the MST Subarea. Groundwater in the Napa Valley Floor generally flows toward the axis of the valley and south when not influenced by local pumping depressions. The MST Subarea, however, has shown significant declines in groundwater levels, especially in the central portion of the subarea. Contemporaneous changes in water level trends are possible to discern throughout the MST. The variation and timing of groundwater level declines and trends in the north, central, and southern areas of the MST that have historically occurred may be attributable to increased pumping and/or variations in geologic conditions. Wells in the immediate vicinity of the MST Subarea may also be vulnerable to these variations as seen from limited data in the eastern portion of the Napa Valley Floor-Napa (NVF-Napa) Subarea and the southwestern part of the Eastern Mountains Subarea. Most wells elsewhere in the Napa Valley Floor with a sufficient record indicate that groundwater levels are more affected by climatic conditions, are within historic levels, and seem to recover from dry periods during subsequent wet or normal periods.

Groundwater level conditions outside of the Napa Valley Floor are much less known. Lithology, terrain, and monitoring well distribution in areas outside of the Napa Valley Floor combine to make it difficult to characterize groundwater resources in other subareas of the county. Subareas south of the Valley have very limited water level data, making it difficult to impossible to assess any potential for historical or current saltwater intrusion from San Pablo Bay. Subareas east and west of the Valley Floor have limited data or are lacking groundwater level data entirely (as seen in Livermore Ranch, Southern Interior Valleys, and Western Mountains Subareas). Where data are available, most records are short, spanning a few years at most. Though the data are limited and spatially distributed, it appears that groundwater level conditions in these areas are stable. Additional details on historical monitoring, groundwater data availability, the occurrence of groundwater, and groundwater level trends is reported in *Napa County Groundwater Conditions and Groundwater Monitoring Recommendations* (LSCE, 2011), *Updated Hydrogeologic Conceptualization and Characterization of Conditions* (LSCE, 2013a), and *Napa County Groundwater Monitoring Plan 2013* (LSCE, 2013b). These reports document existing knowledge of countywide groundwater conditions, establish a framework for the monitoring and reporting of groundwater levels and quality, and provide an update on current groundwater monitoring efforts. These reports and other related documents can be found at the County's

groundwater webpage: <http://www.countyofnapa.org/bos/grac>. Immediate plans in 2014/2015 involve the preparation of the first in an ongoing series of Annual Groundwater Conditions Reports/Updates.

4.0 CASGEM MONITORING NETWORK AND PROGRAM

4.1 DWR Basins/Subbasins and County Subareas for CASGEM Program

While the focus of DWR's CASGEM program is largely on DWR-designated groundwater basins and subbasins, groundwater conditions outside of these DWR-designated areas are also very important in Napa County. One such example in Napa County is the NVF-MST Subarea. As the County's Comprehensive Groundwater Monitoring Program and also the CASGEM program evolve, the County has continued to seek resources and property owner consent to have representative groundwater monitoring in all the DWR-designated basins and subbasins and most if not all county subareas.

4.2 Napa County Public Outreach

Napa County has been conducting groundwater monitoring for many years. Since the CASGEM program includes public disclosure of information in addition to measured water levels, the County conducted public outreach to property owners to confirm their interest in participating in the CASGEM program. In July 2011, the County sent letters to 25 property owners whose wells have been historically monitored by the County. In August 2011, the County sent reminder letters to those owners who had not responded to the County's initial inquiry about their interest in participating in the program, and also telephoned property owners. Additional letters about CASGEM participation were also sent in August 2011 to 6 property owners whose wells have been monitored by DWR for water quality, water levels, or both. As a result, the County received responses from thirteen owners interested in participating (for a total of 14 wells) and 4 owners not interested in participating in the CASGEM program. Monitoring of all wells previously monitored by the County will continue as before; however, only groundwater level data collected from these 14 wells will be reported to DWR through the CASGEM online submittal system. One of the 14 wells has been historically monitored by DWR only for water quality, so the monitoring of this well will be coordinated with DWR so that water quality and water elevation will be conducted concurrently. The remainder of the wells that are not part of the CASGEM program will continue to be monitored by the County and a subset reported to DWR via the CASGEM online system (as volunteer wells) for display and use in the Water Data Library. (Note: Also see Section 5.0 - CASGEM Monitoring Network – Future, for additional public outreach and well monitoring network update information).

4.3 Selected CASGEM Wells

As described below, further public outreach and evaluation of wells suitable for the County's Comprehensive Groundwater Monitoring Program and the CASGEM program are being conducted. The County plans to expand its countywide groundwater monitoring program, including the CASGEM well network as public awareness expands and resources become available. The CASGEM well network is described in detail below along with other efforts to continue to expand the countywide monitoring program.

Napa County CASGEM Network

During the initial CASGEM monitoring year (beginning 2011), the County continued to monitor 14 wells that had already been part of the group of wells where groundwater levels are measured by the County and reported to DWR semi-annually, or are measured directly by DWR. The current 2014 CASGEM network wells are located primarily on the Napa Valley Floor, Carneros, and in the MST Subarea (**Figure 3**). Some of these wells do not have sufficient construction details to define which portion of the aquifer system is represented by measured water levels. Additional data gathering and surveying will be performed, and such information will be provided in future annual reports as it becomes available. Depending on the results of the County's evaluation, future actions may include removal and replacement of CASGEM wells with wells that are more representative of local groundwater conditions to better meet the objectives of the CASGEM program and also overall objectives of the County's Comprehensive Groundwater Monitoring Program. The Napa County CASGEM network meets the objectives for:

- Providing representative groundwater conditions in Napa County groundwater basins, subbasins, and/or county subareas; and
- Providing systematic groundwater elevations for purposes of demonstrating seasonal and long-term trends.

For a detailed summary of the County's CASGEM network well information⁴, see **Appendix A**.

4.4 Field Methods

Napa County has documented field procedures for the collection of groundwater level measurements which were updated as part of the County's Comprehensive Groundwater Monitoring Program (**Appendix B**; LSCE, 2010a). An example form for recording water level measurements is also included here. The County will use these procedures for the CASGEM program (CASGEM wells) as well as continued monitoring of wells where water level data are submitted to DWR semi-annually for inclusion in DWR's Water Data Library (Volunteer Wells), and the monitoring of other wells measured for internal County-only information.

4.5 Monitoring Schedule

Historically, the County has measured the newly designated CASGEM wells semi-annually in the spring (April) and fall (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 County will continue to measure the CASGEM network wells semi-annually during similar periods.

⁴ Figure 3 and Appendix A provide details for the original CASGEM program. The County's public outreach program has resulted in additionally volunteered wells that are being considered. The updated CASGEM network will be described in the County's Annual Groundwater Conditions Report and CASGEM Update (to be prepared in winter 2014/2015).

4.6 Groundwater Elevation Data Management and CASGEM Data Submittal

As part of the Comprehensive Groundwater Monitoring Program, a Data Management System (DMS) was developed for the County to establish a centralized repository for recording and archiving countywide well construction data (for monitored wells), cataloging historical groundwater level and quality measurements, and developing procedures for analyzing data on a programmatic basis. Groundwater data collected by the County (including data collected as part of the CASGEM program and other County programs) will be input into the DMS in a systematic way through a centralized person or department to ensure data accuracy and consistency. It is expected that there will be regular updates from internal County sources and external agencies of new data for new and existing wells/sites tracked in the DMS. Consistent quality control of the data and data entry are described in the documentation for the DMS (LSCE, 2010b).

Per DWR's CASGEM program reporting requirements, the following information related to each of the designated wells monitored will be submitted online at the end of each calendar year:

- Well identification number (DWR state well number in online format)
- Measurement dates
- Reference point elevation of the well (feet) using NAVD88 vertical datum
- Elevation of land surface 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 codes⁵
- Measuring agency identification (Napa County as the Monitoring Entity)
- Measurement time (PST/PDT with military time/24 hour format)
- Comments about measurement, if applicable

5.0 CASGEM MONITORING NETWORK – FUTURE

In addition to the CASGEM well network described herein, the County is currently exploring the availability of a monitoring well in the Pope Valley Groundwater Basin⁶. Public outreach is underway at this time through community organizations and other contacts. The Berryessa Valley Groundwater Basin has a very low DWR priority and extremely small utilization of groundwater⁷. Per discussions with DWR, outreach will continue but no monitoring is planned in this groundwater basin at this time. The County has submitted detailed information to DWR to support consideration of the removal of this basin through a Bulletin 118 update or other appropriate process. Additional wells in the seven County subareas (including the NVF-Calistoga, NVF-MST, NVF-Napa, NVF-St. Helena, NVF-Yountville, Carneros, and Pope Valley Subareas) are also being added as a part of the County's Comprehensive Groundwater

⁵ 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.

⁶ DWR Overall Basin Ranking Score is "0.0"; the very low priority basin ranking range is 0-5.4. http://www.water.ca.gov/groundwater/casgem/pdfs/basin_prioritization/NCRO%2074.pdf

⁷ DWR Overall Basin Ranking Score is "0.0"; the very low priority basin ranking range is 0-5.4. http://www.water.ca.gov/groundwater/casgem/pdfs/basin_prioritization/NCRO%2062.pdf

Monitoring Program and Updated Groundwater Monitoring Plan 2013. The Napa Valley Floor subareas are given a higher priority based on factors of current and/or projected land and water use. Additional wells in these subareas are of interest for (LSCE, 2013b):

- Improving horizontal and/or vertical spatial distribution of data;
- 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 in **Section 3.2**.

Further examination of the suitability of existing wells for groundwater monitoring (including their location and construction and relevance to meet County and/or CASGEM monitoring objectives) is necessary to determine if any existing wells would be suitable for ongoing evaluation of groundwater conditions. If existing private wells are considered, approval from the property owners to participate in the CASGEM program would be sought. Additional wells may be added to provide better spatial and/or vertical distribution of monitored locations within County subareas and to enhance the understanding of localized groundwater conditions and availability.

On June 28, 2011, the County Board of Supervisors adopted a resolution establishing a Groundwater Resources Advisory Committee (GRAC). Two of the tasks assigned to the GRAC included: 1) assisting with the synthesis of the existing groundwater information and identifying critical data needs, and 2) providing input on the furtherance of the ongoing countywide groundwater monitoring program. Input from this committee was coordinated to optimize additional groundwater monitoring locations that serve to meet the objectives of the County's Comprehensive Groundwater Monitoring Program and the CASGEM monitoring program.

The first meeting of the GRAC was held in October 2011. Over the past 2 ½ years, the County has conducted additional public outreach with the assistance of the GRAC to inform more private well owners of the value of understanding the groundwater resources in the County and to encourage their participation in the Comprehensive Groundwater Monitoring Program and/or CASGEM program. This effort has resulted in more than 40 additional volunteered wells, with a number of those being considered for the CASGEM program. Wells will continue to be included based upon the availability of well logs and other information that will contribute to meeting the objectives of the County's Comprehensive Groundwater Monitoring Program and the CASGEM program.

5.1 Address Data Gaps

Eight of the twenty proposed CASGEM wells have incomplete construction information due to the lack of either well depth or screened interval depths (see **Appendix A**). The County is actively pursuing this missing construction information through searches of historical records, additional meetings with well owners, and other investigative methods. Due to the limitation of construction details for these eight wells there will be a temporary gap of detailed aquifer information in the central and southern portion of the Napa Valley Subbasin that will be corrected once the construction documentation is complete, or as other wells are recruited into the monitoring program and added to the County's CASGEM network. The County is actively

pursuing additional CASGEM wells in all identified DWR basins and in other areas of local concern through on-going outreach efforts and grant applications to fund new monitoring well construction as described herein.

5.2 Reporting

The County, in accordance with the GRAC's recommendation, intends to prepare an annual report summarizing the results and findings of the current CASGEM program. Each annual report will describe any changes to the current monitoring network and program, including recommended additions to the CASGEM program network to meet the County's stated objectives for its Comprehensive Groundwater Monitoring Program. The first Annual Groundwater Conditions Report and CASGEM Update will be prepared in Winter 2014/2015.

6.0 REFERENCES

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Luhdorff & Scalmanini, Consulting Engineers (LSCE). 2010a. Task 2, Review and evaluation of data collection procedures and recommendations for improvement. Technical Memorandum.

LSCE. 2010b. Task 1, Napa County data management system. Technical Memorandum.

LSCE. 2011. Napa County groundwater conditions and groundwater monitoring recommendations. Task 4, Report.

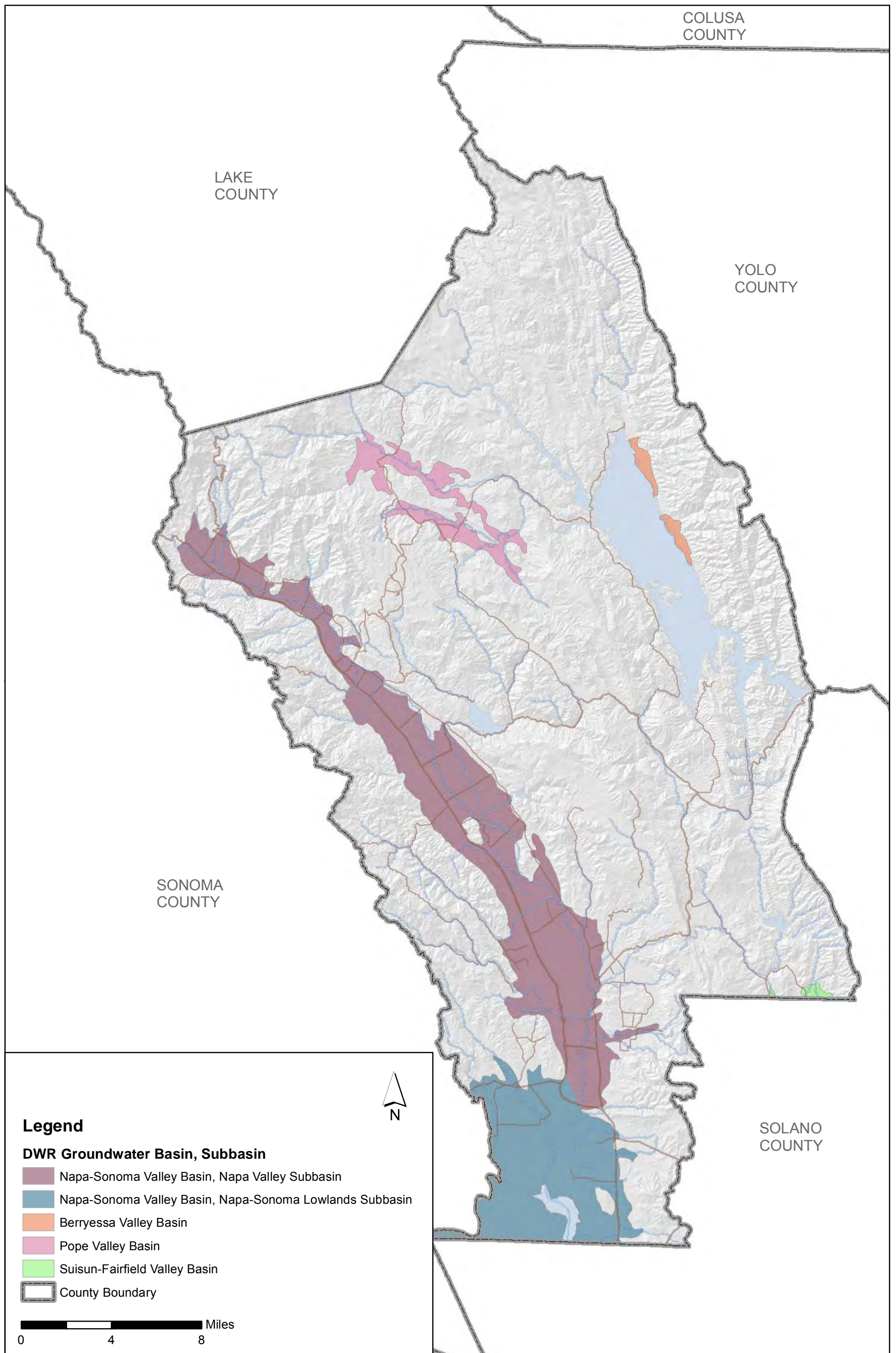
LSCE. 2013a. Updated Hydrogeologic Conceptualization and Characterization of Conditions January 2013.

LSCE. 2013b. Napa County Groundwater Monitoring Plan. January 2013.

Napa County. 2008. Napa County general plan. (Amended June 23, 2009.)

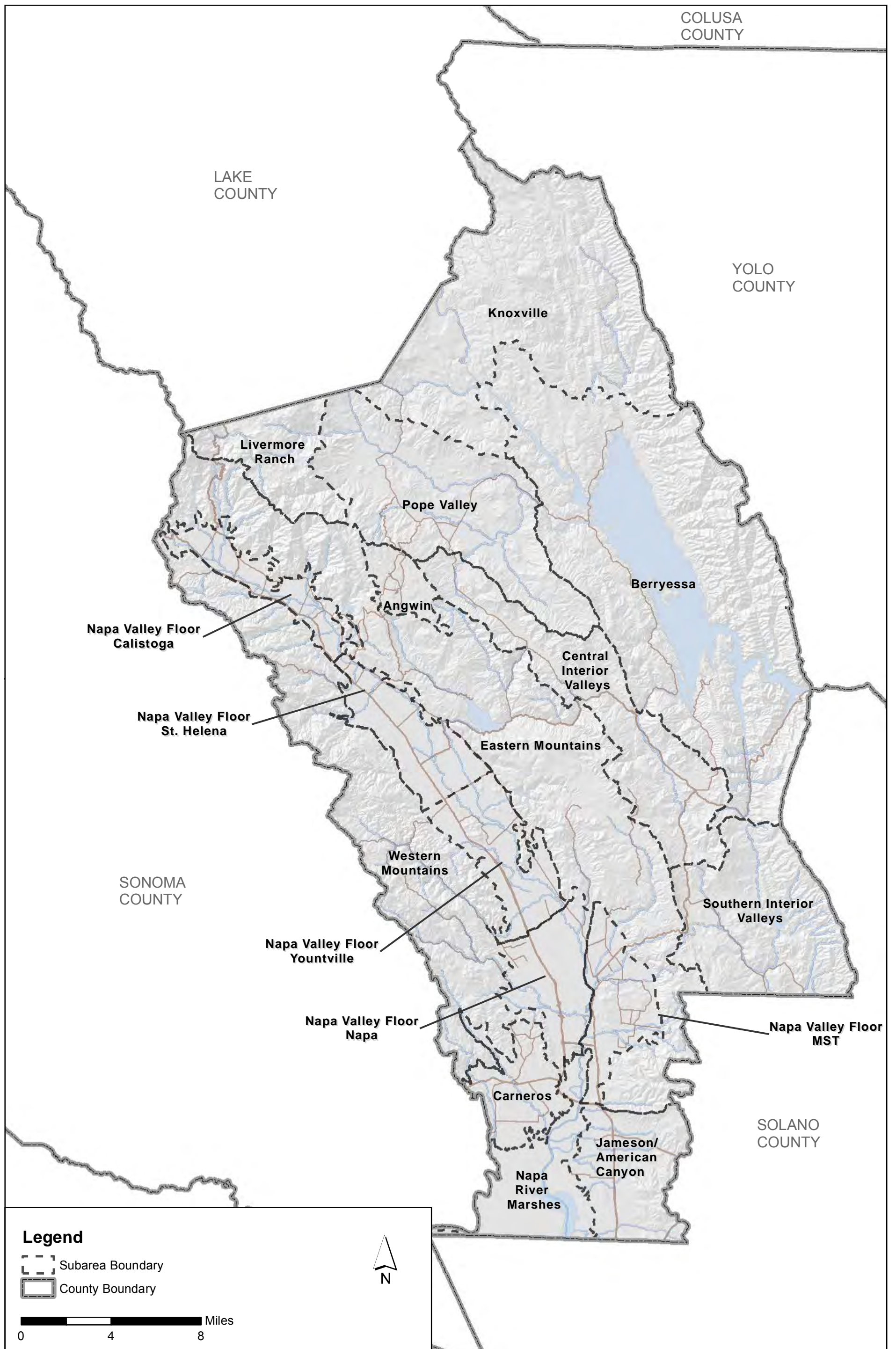
Napa County Web Site. 2014.

FIGURES

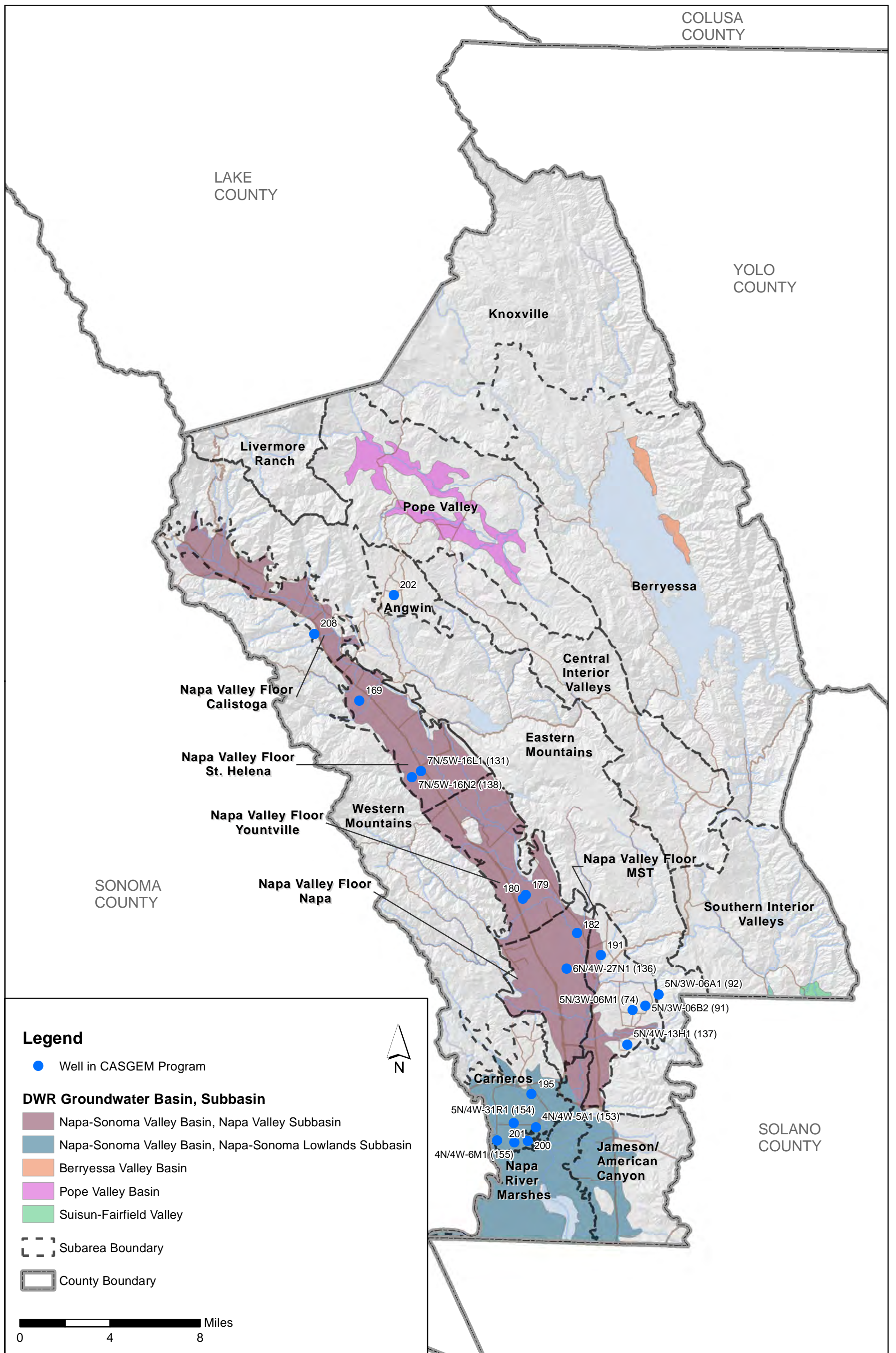


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Figure 1
Napa County Groundwater Basins
Napa County, CA



Z:\Clerical\2011 Job Files\11-067\GIS\Well Map.mxd



Z:\Clerical\2011 Job Files\11-067\GIS\Well Map (updated Jun2014).mxd

APPENDIX A

Napa County CASGEM Network Well Information

**Appendix A
Napa County CASGEM Network Well Information**

General Well Information									Well Location					Well Elevation					Well Construction					
Napa County Subarea	DWR GW Basin Number ¹	State Well Number (County Well ID)	Water Level Period of Record	Msmt Frequency	# of Msmts	Aquifer Designation	Well Use	Operational Status	Latitude	Longitude	Coordinate Method	Horizontal Datum	Coordinate Accuracy (feet)	RPE Description	Reference Point Elevation (feet)	Ground Surface Elevation (feet)	Elevation Method	Vertical Datum	Elevation Accuracy (feet)	Well Completion Report Number	Date	Well Depth (feet)	Well Completion Type	Screened Interval (feet)
NVF-MST	--	5N/3W-06B2 (91)	1992-2014	SA	55	SV	Dom	Active	38.308600	122.234300	USGS Quad map approx.	NAD83	150	top of casing access NW	282.2	283	USGS Quad approx.	NAVD88	10	119632	Aug-1986	415	Single	315-415
NVF-MST	--	5N/3W-06A1 (92)	1999-2014	SA	18842	Qal/SV?	Dom	Active	38.316065	122.223740	GPS	NAD83	10	top of casing access East	298.7	298	GPS	NAVD88	5	Unk	1992	368	Single	148-368
NVF-MST	--	5N/3W-06M1 (74)	1999-2014	SA	14140	Qal/SV?	Dom	Active	38.305707	122.244377	GPS	NAD83	10	top of casing access South	133.2	132	GPS	NAVD88	5	Unk	Aug-1988	300	Single	100-120, 180-300
NVF-MST	--	5N/4W-13H1 (137)	1979-2014	SA	66	Qal/SV?	Irr	Active	38.283400	122.248300	USGS Quad map approx.	NAD83	150	top of casing access North	135.9	135	USGS Quad approx.	NAVD88	10	Unk	Jul-1962	364	Single	Unk
NVF-Napa	2-2.01	6N/4W-27N1 (136)	1979-2014	SA	70	Qal?	Dom/Irr	Active	38.331300	122.299400	USGS Quad map approx.	NAD83	150	top of casing access East	53.5	53	USGS Quad approx.	NAVD88	10	Unk	1962	120	Single	Unk
NVF-St. Helena	2-2.01	7N/5W-16L1 (131)	1963-2014	SA	102	Qal	Dom	Active	38.455700	122.422500	USGS Quad map approx.	NAD83	150	top of casing hole as elec. N	174.8	174	USGS Quad approx.	NAVD88	10	28434	Jul-1939	221	Single	7 lengths, depths unk
NVF-St. Helena	2-2.01	7N/5W-16N2 (138)	1949-2014	SA	104	Qal/SV?	Dom/Irr	Active	38.451800	122.429900	USGS Quad map approx.	NAD83	150	top of casing access South	196.1	196	USGS Quad approx.	NAVD88	10	Unk	1923 approx	321	Single	Unk
Carneros	2-2.03	4N/4W-5A1 (153)	2012-2014	SA	5	QTh	Dom/Stk	Active	38.228926	122.321256	USGS Quad map approx.	NAD83	150	top of casing	47.65	47	GPS	NAVD88	10	121508	May-1978	200	Single	60-200
Carneros	2-2.03	5N/4W-31R1 (154)	2012-2014	SA	5	QTh?	Dom/Irr	Active	38.231151	122.339426	USGS Quad map approx.	NAD83	150	top of casing	98.3	96.65	GPS	NAVD88	10	370535	Aug-1990	300	Single	60-295
Carneros	2-2.03	4N/4W-6M1 (155)	2012-2014	SA	5	QTh?	Dom	Active	38.219695	122.352540	USGS Quad map approx.	NAD83	150	top of casing	25.3	23.8	GPS	NAVD88	10	770075	Aug-2003	220	Single	80-160, 200-220
NVF-St. Helena	2-2.01	unk (169)	2014	SA	1	TBD	Dom	Active	38.499996	122.474434	GPS	NAD83	150	top of casing	273.4	274.0	GPS	NAVD88	10	949202	Apr-2010	400	Single	60-80, 100-120, 140-160, 180-200, 220-240, 260-280, 300-320, 340-360, 380-400
NVF-Yountville	2-2.01	unk (179)	2014	SA	1	TBD	Irr	Active	38.377940	122.334177	GPS	NAD83	150	top of casing	74.3	72.0	GPS	NAVD88	10	323994	Jul-1997	255	Single	55-255
NVF-Yountville	2-2.01	unk (180)	2014	SA	1	TBD	Dom	Active	38.375357	122.336649	GPS	NAD83	150	top of casing	76.9	76.0	GPS	NAVD88	10	unk	unk	TBD	Single	TBD
NVF-Napa	2-2.01	unk (182)	2014	SA	1	TBD	Dom	Active	38.354305	122.291443	GPS	NAD83	150	top of casing	48.1	45.0	GPS	NAVD88	10	unk	Oct-1971	400	Single	100-400
NVF-MST	--	unk (191)	2014	SA	1	TBD	Dom	Active	38.340202	122.271438	GPS	NAD83	150	top of casing	63.1	63.0	GPS	NAVD88	10	unk	unk	150	Single	TBD

**Appendix A
Napa County CASGEM Network Well Information**

General Well Information									Well Location					Well Elevation					Well Construction					
Napa County Subarea	DWR GW Basin Number ¹	State Well Number (County Well ID)	Water Level Period of Record	Msmt Frequency	# of Msmts	Aquifer Designation	Well Use	Operational Status	Latitude	Longitude	Coordinate Method	Horizontal Datum	Coordinate Accuracy (feet)	RPE Description	Reference Point Elevation (feet)	Ground Surface Elevation (feet)	Elevation Method	Vertical Datum	Elevation Accuracy (feet)	Well Completion Report Number	Date	Well Depth (feet)	Well Completion Type	Screened Interval (feet)
Carneros	2-2.03	unk (195)	2014	SA	1	TBD	Irr	Active	38.250044	122.325496	GPS	NAD83	150	top of casing	94.8	94.0	GPS	NAVD88	10	unk	Sep-1983	TBD	Single	TBD
Napa River Marshes	2-2.03	unk (200)	2014	SA	1	TBD	Irr	Active	38.219940	122.327430	GPS	NAD83	150	top of casing	15.7	14.0	GPS	NAVD88	10	unk	unk	TBD	Single	TBD
Napa River Marshes	2-2.03	unk (201)	2014	SA	1	TBD	Irr	Active	38.218668	122.338546	GPS	NAD83	150	top of casing	50.4	50.0	GPS	NAVD88	10	unk	unk	TBD	Single	TBD
Angwin	--	unk (202)	2014	SA	1	TBD	Dom	Active	38.568436	122.448517	GPS	NAD83	150	top of casing	1728.2	1728.0	GPS	NAVD88	10	384966	Nov-1991	280	Single	100-280
NVF-Calistoga	2-2.01	unk (208)	2014	SA	1	TBD	Dom	Active	38.542145	122.512863	GPS	NAD83	150	top of casing	503.4	502.0	GPS	NAVD88	10	unk	unk	320	Single	300-320

Definitions: SA (Semi-annual); Dom (Domestic); Irr (Irrigation); Stk (Stock); Unus (Unused); Unk (Unknown); TBD (to be determined); Qal (Quaternary Alluvium); SV (Sonoma Volcanics); QTh (Quaternary and Tertiary Huichica formation)

¹DWR Groundwater Basin Number: 2-2.01 (Napa-Sonoma Valley GW Basin, Napa Valley Subbasin), 2-2.03 (Napa-Sonoma Valley GW Basin, Napa-Sonoma Lowlands Subbasin)

APPENDIX B

Napa County Procedure for Measuring Groundwater Levels

NAPA COUNTY 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 (see below “Special Circumstances” for additional instructions).
- 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.
- 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 Circumstances

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: $\text{Depth to oil} = 37.00 \text{ feet} - 2.72 \text{ feet} = 34.28 \text{ feet}$.

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.

Pumping Water Level on Arrival

If well is being pumped, do not measure. Return later when the water level has stabilized. Using past field notes, the field technician will use his/her experience to determine the appropriate duration necessary for static measurements. Upon returning to the well site (at a location where pumping was previously noted on the same day), the technician will measure the water level. The technician will have available historical water level data to determine whether the measurement is consistent with past measurements. If the initial measurement appears anomalous, the technician will measure water levels every 10 minutes over a period of 30 minutes.⁸ If measurements vary significantly from past measurements (taking into account seasonal variations), the technician will note the circumstances (i.e., the date and time when the well was first visited, total time it was pumping (if known), when it was shutoff, when the technician returned, and subsequent water level measurements [on the same day, or as the case may be based on experience, the day immediately following]). Subsequent consideration of pumping effects at a site-specific well location will be addressed as necessary.

⁸ During this period, if the groundwater level difference is greater [than +/- 0.02 feet], repeat the same procedure until three consecutive measurements are recorded within ± 0.02 foot.

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
6. 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 sulfur odor upon opening well cap; or: nearby (west ~100 feet) irrigation well pumping)