North San Benito County Groundwater Sustainability Plan Administrative Draft: Monitoring Network

September 2020

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SIGNATURE PAGE

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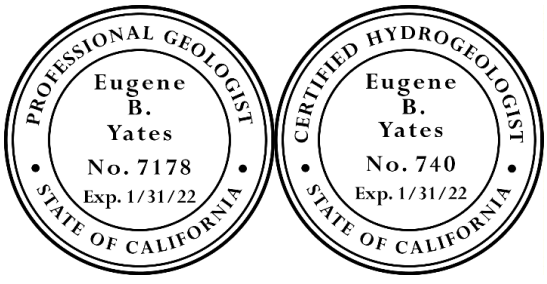

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7. MONITORING NETWORK

The overall objective of the monitoring network for this GSP is to yield representative information about water conditions as necessary to guide and evaluate GSP implementation. Specifically, monitoring network objectives are to:

- Build on the existing monitoring network and available data
- Expand the network to better represent all Management Areas
- Reduce uncertainty and provide better data to guide management actions, document the water budget, and better understand how the surface water/groundwater system works
- Monitor groundwater conditions relative to sustainability criteria
- Identify and track potential impacts on groundwater users/uses and better communicate the state of the basin.

With the intent to provide sufficient data for demonstrating short-term, seasonal, and long-term trends in groundwater and related surface conditions, this GSP builds on existing monitoring programs (summarized in Plan Area Section 2.1.4) that provide historical information and a context for monitoring. These topics also have been addressed in terms of data gaps in the December 2018 Technical Memorandum (TM), "Data to Support GSP Preparation" (in Appendix E) Data gaps are addressed in terms of information needed for understanding the basin setting, evaluation of the efficacy of Plan implementation, and the ability to assess whether the Basin is being sustainably managed.

This GSP Section describes the monitoring network as enhanced to fulfill SGMA requirements and explains how it will be implemented. This includes description of the monitoring protocols for data collection, the development and maintenance of the data management system (DMS), and the regular assessment and improvement of the monitoring program. This section also summarizes the addition of new dedicated monitoring wells, installed with funding assistance from the Sustainable Groundwater Management Round 3 Grant program (Round 3).

7.1. DESCRIPTION OF MONITORING NETWORK

Table 7-1 (following text) provides a summary of the monitoring network, which documents groundwater and related surface conditions as relevant to the sustainability indicators: groundwater levels, storage, land subsidence, water quality, and interconnected surface water[1]. The discussion of change in groundwater storage addresses monitoring for evaluation of the water budget inflows and outflows including climate, land use and cropping, surface water flows, imported water deliveries, reservoir releases for groundwater recharge, wastewater percolation and water recycling, and groundwater pumping.

The monitoring is described in the following sections relative to the sustainability criteria, including description of the monitoring network with respect to the four Management Areas (MA) and the level of monitoring and analysis appropriate for each MA.

[1] Seawater intrusion is noted, but no risk of seawater intrusion exists in this inland basin.

7.1.1. Chronic Lowering of Groundwater Levels

As described in Plan Area Section 2.1.4.1, SBCWD has had a groundwater level monitoring program since Water Year (WY) 1977; the Annual Groundwater Reports provide quarterly groundwater level data for each year. The data are the basis for groundwater level contour maps, change maps, hydrographs, groundwater level profiles, and storage change computations, which have been presented to support ongoing groundwater basin management and to fulfill requirements of portions of the San Benito County Water District Act (California Water Code Appendix 70-7.6). Historically, groundwater level monitoring efforts were focused on Zone 6, where SBCWD delivers CVP water and has maintained a relatively intensive monitoring program with additional monitoring in the adjacent Bolsa. The SBCWD monitoring program includes wells in the Pacheco Valley in Santa Clara County and SCVWD provides data for selected wells in southern Llagas Subbasin which have been used in the SBCWD annual groundwater level maps. SBCWD has provided data to the CASGEM program since 2011.

The groundwater level monitoring network currently is being improved through the following actions:

- In 2018, SBCWD initiated a program (funded by Round 2 and SBCWD cost sharing) to increase the number of existing production wells in the monitoring program. That effort involved mapping and prioritization of unmonitored areas in the Basin, identification of wells with recent access problems, identification of potential wells to add to the program, and digitization of well information. This has resulted in the resurrection or addition of about 20 production wells for monitoring as part of this GSP.
- In 2019, SBCWD developed a systematic approach to add dedicated monitoring wells to the monitoring program. This was submitted to DWR as part of the Application for Round 3 Sustainable Groundwater Management Planning grant funds. This application was approved by DWR and the Round 3 work plan was initiated in June 2020.

Data gaps in the groundwater level monitoring program are described in the December 2018 TM, "Data to Support GSP Preparation" and listed in Sustainability Criteria Section 6.2.6 along with responsive actions that include continuation of the implementation efforts above. Benefits of these efforts will accrue over the next few years and will support review and update of the monitoring program in the 2027 Five-Year GSP Update.

7.1.1.1. Spatial and Vertical Coverage

Figure 7-1 shows locations of groundwater level Key Wells, new dedicated monitoring wells, and other wells monitored as part of the SBCWD groundwater level monitoring program. Also shown are wells in the adjacent Llagas Subbasin that are monitored by Valley Water (SCVWD) and data shared with SBCWD for North San Benito. **Table 7-1** provides a summary of relevant monitoring programs.

The 22 Key wells for groundwater levels also are listed in Table 6-1 (Sustainability Criteria Section 6.2.6) with the respective Minimum Thresholds.

The scientific rationale for inclusion of wells in the SBCWD groundwater level monitoring program has involved the following:

- Spatial distribution and density of wells, accounting for variable geographic conditions including topography, hydrology, geologic structures, aquifer characteristics, confined and unconfined conditions, pumping patterns, management activities (including managed aquifer recharge), and potential impacts to beneficial uses/users
- Length, completeness, and reliability of historical groundwater level record

- Well depth, with specific information on well construction preferred
- Regular access to the well for measurements.

Well density has been a consideration in identifying new dedicated monitoring well sites and adding existing wells to the monitoring program. DWR guidance (DWR, Dec 2016 BMP, Table 1) generally recommends between one to ten monitoring wells per 100 square miles. The North San Benito program is consistent with this guidance (with an area of about 200 square miles and 2019 monitoring of more than 100 wells). More importantly, the SBCWD monitoring program has been developed to account for the variable spatial factors listed above. Monitoring program improvements as part of the GSP include identification of additional existing wells for monitoring across the entire basin with a focus on adding wells in the Bolsa and Southern MAs.

Data on vertical gradients generally are lacking (except the Nested Well in Hollister MA). As discussed in Hydrogeologic Conceptual Model Section 3.6.1, a single principal aquifer has been identified, comprising the Holocene alluvial sediments. While groundwater in the principal aquifer occurs under both unconfined and confined conditions, no distinct continuous confining layer has been identified. Vertical gradients also have not been distinguished because of the reliance of the monitoring program on production wells, which tend to have long screens. This is a data gap recognized in the Model Documentation Report (Appendix G) relative to calibration for vertical hydraulic conductivity in most areas. This data gap (among others) is addressed in the Round 3 work plan with installation of new dedicated monitoring wells (with discrete perforated intervals), including shallow wells.

With regard to the data and reporting standards described in Section 352.4., wells in the SBCWD groundwater level monitoring program have been selected on the basis of local objectives and the above rationale, with the intent to address GSP requirements for well information (e.g., unique site ID, identified reference point, well completion report if available, etc.) as part of GSP implementation. New dedicated monitoring wells (intended to provide a framework for the monitoring program) will be compliant with GSP Regulations.

It should be noted that identification of sites for new dedicated monitoring wells involves not only consideration of monitoring needs for groundwater levels, but also groundwater quality, potential subsidence, and surface water-groundwater interactions.

7.1.1.2. Monitoring Frequency

SGMA and the CASGEM program require collection of static groundwater elevation measurements at least two times per year to represent seasonal low and seasonal high groundwater conditions. The Annual Groundwater Reports provide quarterly groundwater level data, which is more frequent than required and allows tracking of seasonal and long term trends.

7.1.2. Reduction of Groundwater in Storage

As described in GSP Section 6.3, groundwater level Minimum Thresholds are used as a proxy metric for groundwater in storage. Accordingly, the monitoring of groundwater levels described above in Section 7.1.1 also pertains to tracking sustainability for groundwater in storage.

In addition, GSP Regulations require annual evaluation and reporting of change in groundwater in storage. As documented in past Annual Groundwater Reports, change in groundwater in storage has been calculated annually as the product of groundwater level change (feet), basin area (acres) and storativity. In addition, change in storage has been computed triennially using the water budget equation (inflows-outflows=change in storage).

For the GSP, the updated and expanded numerical model has been used to quantify the water budget and change in storage (see Water Budget Section 5) using available information from the SBCWD Monitoring Program. The numerical model (described in GSP Appendix G) fulfills data and reporting standards described in Section §352.4.

As described in Plan Area Section 2.1.4.1 and summarized in **Table 7-1**, the SBCWD Monitoring Program provides information needed to update the water budget and assess annual change in groundwater storage. This program compiles and reviews information on climate (rainfall and evapotranspiration), stream flow, imported CVP water deliveries, reservoir releases and CVP percolation, wastewater percolation and water recycling, and groundwater pumping (municipal and agricultural in Zone 6). Previously, change in the volume of groundwater in storage has also been assessed through water budget evaluations that utilize land use information and water demand rates. Change in groundwater in storage is quantified for each of the four Management Areas (as described in Water Budget Section 5).

The lack of reliable measurements of agricultural pumping is a primary source of uncertainty in estimating change in groundwater in storage. Groundwater pumping in Zone 6 has been evaluated since about 1990 as the product of metered hours of pump operation and average pump discharge, but the accuracy of this method has been questioned because of discrepancies with water budget evaluations (based on land use and water factors) and with numerical modeling. Beyond Zone 6, annual groundwater pumping has been assessed on a triennial basis through land use estimates and water budget evaluations.

7.1.2.1. Spatial Coverage

As indicated in **Table 7-1**, evaluation of change in groundwater in storage involves multiple monitored variables; locations of monitoring are described in the table. **Figure 7-2** shows specific locations of climate stations and stream gage locations; also shown are wastewater percolation sites and CVP percolation ponds.

As noted in the December 2018 Technical Memorandum on Data to Support GSP Preparation, only four stream gages are currently operated in the Basin and regular monitoring of surface water flows (including natural percolation along stream channels) has been identified as a data gap. The lack of a stream gage on upper Tres Pinos Creek has been identified as a priority item to extend spatial coverage.

With regard to spatial coverage, groundwater pumping for agriculture in Zone 6 (see Plan Area Figure 1-2 for extent) historically has been evaluated as the product of metered hours of pump operation and average pump discharge, while agricultural pumping beyond Zone 6 has been assessed through water budget evaluations using available land use information.

This GSP includes evaluation of options for evaluating groundwater pumping systematically throughout the basin. These options include continuation of historical methodologies, implementation of a well metering program to measure groundwater pumping, or application of remote sensing methodologies to evaluate groundwater consumption of various land use types (different crops, land covers) to evaluate groundwater use.

7.1.2.2. Monitoring Frequency

Table 7-1 describes the data interval for the monitored variables the contribute to evaluation of groundwater in storage. Groundwater in storage will be assessed annually using the numerical model, which will be recalibrated during each Five-Year Update.

7.1.3. Seawater Intrusion

There is no monitoring for seawater intrusion and no gaging of tidal influence. The NSBGB is located inland from Monterey Bay approximately 20 miles upstream from the mouth of the Pajaro River; lowest elevations (at the confluence of the San Benito River and Pajaro River) are above about 110 feet. No risk of seawater intrusion exists in the Basin given its location and therefore no monitoring is needed.

7.1.4. Subsidence

The Monitoring Program will include review of available UNAVCO monitoring and InSAR satellite-based data to identify any land subsidence in North San Benito (see **Table 7-1**). As applicable, these data will be used to monitor rate and extent with reference to the Minimum Threshold and Measurable Objective, which are described in Sustainability Criteria Sections 6.4.4 and 6.4.5, respectively. These data represent measurements of ground surface displacement and thus are directly applicable to scientific assessment of potential subsidence. Assuming continued data availability, the Monitoring Program will involve annual download of UNAVCO and InSAR data with annual review for any indications of significant, cumulative inelastic subsidence. The reporting will be consistent with GSP Regulations.

7.1.4.1. Spatial Coverage

Figure 7-3 shows the North San Benito Basin with recent InSAR information from DWR and the location of UNAVCO stations. The UNAVCO and InSAR data provide adequate coverage of the North San Benito Basin including all Management Areas. As described in Groundwater Conditions Section 4.3 and Sustainability Criteria Section 6.4, InSAR data are available for the entire Basin (and beyond). UNAVCO data are available from eight ground stations in and around the Basin. While seven of the eight stations are located around the basin and likely show tectonic movement, one station is in the Bolsa MA and shows small changes that indicate local inelastic subsidence. This UNAVCO data and InSAR data will be cross-checked, and in conjunction with local groundwater level and pumping data, will be used to assess relationships between levels, pumping, and subsidence data.

7.1.4.2. Monitoring Frequency

Assuming continued data availability, the Monitoring Program will involve annual download of UNAVCO and InSAR data with analysis for any signs (rate and extent) of cumulative inelastic subsidence. Generally, subsidence has not been noticed in North San Benito and any rates indicated by UNAVCO monitoring have been small. While data will be reviewed annually, at this time detailed analysis relative to the Minimum Threshold and Measurable Objective is planned as part of the Five-Year Update.

7.1.5. Degraded Water Quality

In addition to the general monitoring objectives listed above, specific objectives for the GSP water quality monitoring program include the following:

- Collect groundwater quality data from the principal aquifer to identify and track trends of any water quality degradation
- Map the movement of degraded water quality
- Define the three-dimensional extent of any existing degraded water quality impact
- Assess groundwater quality impacts to beneficial uses and users
- Evaluate whether management activities are contributing to water quality degradation

The existing water quality monitoring programs for North San Benito Basin are described in Plan Area Section 2.1.4.1, Groundwater Conditions Section 4.4.1, and Sustainability Criteria Section 6.6.4.1. To

summarize, the SBCWD Monitoring Program involves quarterly sampling of about 20 wells with lab analysis for general minerals, physical parameters, and selected constituents of concern. As described in Groundwater Conditions Section 4.7 and discussed in depth in Section 6.6 on the water quality sustainability criteria, a broad suite of inorganic constituents is sampled and analyzed and known regulated contamination sites are tracked. Based on understanding of the basin and tracking since 1997, TDS and nitrate have been identified as the key constituents of concern for which sustainability criteria have been defined. As described in Groundwater Conditions Section 4.5, the monitoring and reporting for the Salt and Nutrient Management Plan are conducted as part of SBCWD's water quality monitoring program and triennial update.

In addition to its regular, direct monitoring program, once every three years, SBCWD compiles and reviews all available information on water quality and summarizes it in the Annual Groundwater Report (Todd, 2019). As indicated in the 2019 Annual Groundwater Report, the Triennial Update incorporates all available data from SBCWD, the Regional Water Quality Control Board (regulated facilities and the Irrigated Lands Regulatory Program), California State Water Resources Control Board Division of Drinking Water, United States Geological Survey (USGS), City of San Juan Bautista, Tres Pinos County Water District, City of Hollister, and Sunnyslope County Water District. This is consistent with DWR guidance to use existing water quality monitoring data to the greatest degree possible.

The GSP monitoring program will continue both the SBCWD Monitoring Program and the Triennial Update. Accordingly, this data set can be used to detect a range of problems quickly, to track trends, allow geochemical investigation, and support focused management actions.

Data from the Triennial Update form the basis for the water quality Minimum Thresholds and Measurable Objectives.

7.1.5.1. Spatial and Vertical Coverage

As described in the Groundwater Conditions Section (see Figure 4-15) and summarized in **Table 7-1,** the SBCWD Monitoring Program has historically been focused on the Hollister and San Juan MAs with about 20 wells. Only two wells were monitored as part of the program in Bolsa MA and none in the Southern MA. However, the Triennial Update has involved compilation and review of all water quality data from local and state agencies, and thereby, water quality has been monitored throughout the North San Benito Basin. As documented for the key constituents of TDS and nitrate (see Table 6-6), TDS was measured in 213 wells in 2015-2017 and 256 wells were sampled for nitrate in the same years.

For the purposes of this discussion, monitoring of regulated contamination sites is distinguished from monitoring of basin-wide groundwater quality conditions. Monitoring of regulated contamination sites involves dedicated monitoring wells that often are shallow and have documented well construction and sampling depths. These regulated sites are discussed in Groundwater Conditions Section 4.6.1 and locations are shown on Figure 4-17. While some of these shallow wells could be potentially used for regional monitoring, there are important considerations. For some sites, monitoring wells would have been sited and designed for site-specific problems (e.g., gas stations) that do not necessarily have regional implications. For other sites (e.g., food processing, wastewater disposal, fertilizer handling/storage), the monitoring is potentially pertinent to regional conditions (e.g., if uncontained) and is important to track, but may not be representative of regional conditions or trends.

Figure 7-4 shows the spatial distribution of wells currently in the SBCWD Water Quality Monitoring Program, including the wells historically monitored and new dedicated monitoring wells that will be sampled regularly.

The scientific rationale for selection of wells currently in the SBCWD Water Quality has included:

- Areal distribution of wells across Zone 6, the area for distribution of CVP imported water
- Location relative to areas with water quality issues; these include natural issues (e.g., siting of the Nested Well addresses native elevated boron) and human-induced activities such as wastewater disposal and general salt loading.
- Length, completeness, and reliability of historical record
- Regular access to the well for measurements
- Well depth, with specific information on well construction preferred.

As with the groundwater level monitoring program, existing wells in the SBCWD groundwater quality monitoring program will be evaluated relative to Section 352.4. requirements for well information. Most do not have sufficient well construction information to identify the zones being monitored and this information will need to be acquired. The new dedicated monitoring wells (part of the Round 3 effort) are designed to meet requirements; these new wells address gaps not only in the water level monitoring program, but also the water quality monitoring program.

Vertical coverage is discussed in Groundwater Conditions Section 4.9, which indicates that the water quality monitoring programs in the Basin do not reveal vertical differences in water quality. The exception is the Nested Well in Hollister MA, a dedicated monitoring well that is part of the SBCWD Program and samples from five depth zones. Otherwise, vertical coverage is a recognized data gap; this reflects the facts that 1) most monitored wells (excluding the contamination site wells mentioned above) are private pumping wells with long screens and 2) well construction information is lacking for most wells.

As stated in Section 6.6, the SBCWD Monitoring Program will be improved and expanded to address spatial and vertical coverage. This will include evaluation of existing wells to add to the SBCWD monitoring program; continued review of data from local agencies and the Irrigated Lands Regulatory Program is likely to reveal candidate wells for inclusion in the SBCWD Program. Additional investigations of nitrate and salt loading may include installation of additional dedicated monitoring wells designed to evaluate loading and vertical migration of salt and nitrate, and these could be added to the Monitoring Program. Lastly, the SBCWD Monitoring Network is enhanced by addition of dedicated monitoring wells as part of the work plan for the Round 3 Sustainable Groundwater Management Planning grant.

7.1.5.2. Temporal Coverage and Monitoring Frequency

As described in Sections 2.1.4.1 and 6.6.4.1, SBCWD has been monitoring groundwater quality since 1997; the SBCWD Monitoring Program wells generally are sampled semi-annually. This is consistent with objectives to detect problems relatively quickly and to track trends in areas of variability. Semi-annual sampling is consistent with the general guidance provided in the DWR Best Management Practices for Monitoring Networks and Identification of Data Gaps (DWR, December 2016), which suggests sampling at the seasonal high and low (or more frequent as appropriate).

An evaluation of quality data indicates that seasonal fluctuations in concentrations are tracked on a biannual basis with little risk to missed changes in groundwater concentrations. As particular water quality issues are identified in local areas, more frequent monitoring could be instituted for selected wells with the regional sampling program conducted on a biannual basis.

As described in Groundwater Conditions Section 4.6.1, North San Benito Basin does include regulated contamination sites; information is compiled from these sites as part of the Triennial Update. This frequency of SBCWD review has been sufficient to evaluate potential impacts to beneficial uses and users, given that these sites are regulated by State agencies.

7.1.5.3. Monitored Constituents

As described in Section 6.6.4.1, wells in the SBCWD Program generally are sampled semiannually with lab analysis for general minerals, physical parameters, and selected constituents of concern. Sections 4.7 and 4.8 discuss specific analytes including TDS, nitrate, hardness, boron, perchlorate and metals (arsenic, chromium, manganese, and selenium). The selection of key constituents (TDS, nitrate) are based on relevance to important water quality issues (Belitz 2003).

Noting that TDS represents the sum of various constituents, some of which are a concern, the monitoring program should analyze for all major anions and cations (bicarbonate, chloride, and sulfate; and calcium, magnesium, sodium, and potassium). This is necessary for basic geochemical plotting of water types and verification of analytical accuracy. Analyses should also include boron, given its elevated concentrations in the basin and crop sensitivity issues. Boron may also assist in determining wastewater impacts as would total phosphate (DWR 1966) and surfactants (measured as methylene blue active substances –MBAS). Turbidity should be measured by the laboratory on each groundwater sample to assist evaluation of any detections of metals.

7.1.6. Depletion of Interconnected Surface Water

The minimum threshold defined for depletion of interconnected surface water is defined by groundwater levels monitored within one mile of specific stream reaches with shallow groundwater conditions. At this time, wells in the groundwater levels monitoring program are production wells with relatively deep screens that have not been sited and designed for tracking surface water-groundwater interactions. The lack of shallow monitoring wells has been a data gap.

Improvement of the surface water-groundwater monitoring program includes addition of dedicated near-stream shallow monitoring wells, implemented as part of the Round 3 Sustainable Groundwater Management Planning grant funds from DWR. At time of writing, sites for dedicated shallow groundwater monitoring wells have been identified with planned installation before 2022. Monitoring of these new dedicated wells will begin as soon as possible.

Benefits of the new wells will accrue over the next few years and support characterization of the spatial and temporal exchanges between surface water and groundwater, plus subsequent development of methods to calculate depletions of surface water caused by groundwater extractions, as required by the GSP Regulations§354.34(c)(6), and as planned as part of the 2027 Five-Year GSP Update.

Improvements of the monitoring network will be responsive to GSP Regulations that require characterization of the following:

- Flow conditions including surface water discharge, surface water head, and baseflow contribution.
- Identifying the approximate date and location where ephemeral or intermittent flowing streams and rivers cease to flow, if applicable.
- Temporal change in conditions due to variations in stream discharge and regional groundwater extraction.
- Other factors that may be necessary to identify adverse impacts on beneficial uses of the surface water.

7.1.6.1. Spatial and Vertical Coverage

Figure 7-5 is a map showing locations of key wells currently selected for monitoring shallow groundwater levels along selected stream reaches. The identification of key stream reaches is described in Sustainability Criteria Section 6.7 and has addressed all management areas. **Table 7-1** provides a summary of the monitoring.

The scientific rationale for inclusion of wells in the shallow groundwater level monitoring program has involved the following:

- Location within one mile of stream reaches where springtime depth to water is typically 20 feet or less and with no separation from the reach by a fault
- Length, completeness, and reliability of historical groundwater level record with measurements beginning before 1992 (the end-of-drought year specified in definition of the MT).
- Well depth, with specific information on well construction preferred
- Regular access to the well for measurements.

The currently-selected wells are all water supply wells with relatively deep screens and therefore do not provide the needed vertical (shallow) coverage. Accordingly, sites have been selected for installation of new dedicated shallow wells as part of the Round 3 effort. The rationale for selecting these sites includes location close to the selected stream reaches, land availability and accessibility.

As with the regional groundwater level monitoring program (see Section 7.1.1), existing wells in the groundwater monitoring program for shallow groundwater have been evaluated with regard to Section 352.4. requirements for well information, and data deficiencies (for example, lack of a unique ID) have been noted for improvement during GSP implementation. The new dedicated shallow monitoring wells are designed to fulfill Section 352.4 standards.

7.1.6.2. Temporal Coverage and Monitoring Frequency

The monitoring for groundwater levels along selected stream reaches will be implemented as part of the overall groundwater level monitoring program as described in Section 7.1.1.2. Monitoring of existing wells in the program will be continued, serving as the Key Wells for monitoring relative to the Minimum Thresholds defined in GSP Sustainability Criteria Section 6.7.6. In the meantime, the periods of record for new dedicated shallow wells will be established. Groundwater level data will be reviewed annually (for each annual report) with reference to the Minimum Threshold. Detailed analyses of the relationships among deep and shallow groundwater level data, stream flow, and riparian conditions will be provided in the Five-Year Update (or sooner if extreme drought conditions and riparian mortality occur; see GSP Section 6.7.7.1).

7.2. PROTOCOLS FOR DATA COLLECTION AND MONITORING

This section focuses on groundwater level monitoring (including regional and surface water-oriented) and groundwater quality sampling by SBCWD. Other data (e.g., climate, streamflow, municipal pumping, subsidence) are compiled by other agencies.

This section describes general procedures for documenting wells in the monitoring program and for collecting consistent high quality groundwater elevation and groundwater quality data. In general, the methods for establishing location coordinates (and reference point elevations for elevation monitoring) follow the data and reporting standards described in the GSP Regulations (Section 352.4) and the

guidelines presented by USGS Groundwater Technical Procedures. These procedures are summarized below.

7.2.1. Field Methods for Monitoring Well Data

Background data for each monitoring well is required for its inclusion in the monitoring program. These data are generally available for wells in the network described on **Table 7-1** and shown on **Figures 7-1, 7-4, and 7-5**. As part of GSP implementation, location and elevation data will be acquired where missing, revised if conditions at a monitored well change, and added when new wells are brought into the program. The methods for acquiring these data follow:

- Location coordinates will be surveyed with a survey grade GPS. The coordinates will be in Latitude/Longitude decimal degrees and reference the NAD83 datum.
- Reference point elevations will also be surveyed with a survey grade GPS with elevation accuracy of approximately 0.5 feet. During surveying, the elevations of the reference point and ground surface near the well will be measured to the nearest 0.5 foot. All elevation measurements will reference NAVD88 vertical datum.

7.2.2. Field Methods for Groundwater Elevation Monitoring

Reference points and ground surface elevations will be documented as described above prior to groundwater elevation monitoring in the field. Field methods for collection of depth-to-water measurements are described below:

1. Measurements in all wells will be collected within a three day window whenever possible.
2. Active production wells should be turned off prior to collecting a depth to water measurement.
3. The standard period of time that a well needs to be off before a static measurement is taken is 48 hours.
4. To verify that the wells are ready for measurement, SBCWD staff will coordinate with well operators and/or owners as necessary.
5. Coordination with well operators/owners should occur approximately four days prior to the expected measurement date.
6. Depth to groundwater measurements are collected by either electric sounding tape (Solinst or Powers type sounders) or by steel tape methods. These depth-to-water measurement, methods are described in DWR's *Groundwater Elevation Monitoring Guidelines* (2010a). Depth to groundwater will be measured and reported in feet to at least 0.1 foot.

7.2.3. Field Methods for Groundwater Quality Monitoring

SBCWD's current Quality Assurance Project Plan was reviewed for adequacy of data collection and analysis procedures. As described in the Salt and Nutrient Management Plan for Northern San Benito County (Todd, April 2014), wells in the SBCWD water quality monitoring program are sampled for Title 22 general physical properties and inorganics.

Groundwater sampling is conducted by trained professionals from SBCWD. Sampling follows standard monitoring well sampling guidelines such as those presented in the National Field Manual for the Collection of Water-Quality Data (USGS, 2012).

Generally, the wells have been pumped prior to sample collection, or are purged. Purging is conducted until field instruments indicate that water quality parameters (pH, ORP, specific conductance, and

temperature) have stabilized and turbidity measurements are below five Nephelometric Turbidity Unit (NTUs). The pumping or purging demonstrate that the sample collected is representative of formation water and not stagnant water in the well casing or well filter pack. For groundwater, field temperature and conductivity are recorded while the well is being purged to ensure that physical parameters have stabilized before collecting a sample.

All groundwater samples are collected in laboratory-supplied, pre-labeled containers and include prescribed preservatives.

All field measurements are recorded in a field logbook or worksheets and the sample containers are labeled correctly and recorded on the chain-of-custody form. The applicable chain-of-custody sections are completed and forwarded with the samples to the laboratory. Upon receipt of the samples at the laboratory, laboratory personnel complete the chain-of-custody.

QA/QC assessment of field sampling includes use of field blanks. Field blanks identify sample contamination that is associated with the field environment and sample handling. These samples are prepared in the field by filling the appropriate sample containers with the distilled water used for cleaning and decontamination of all field equipment. One field blank per sampling event is collected.

Samples are sent to a State-certified laboratory that has a documented analytical QA/QC program including procedures to reduce variability and errors, identify and correct measurement problems, and provide a statistical measure of data quality. The laboratory conducts all QA/QC procedures in accordance with its QA/QC program. All QA/QC data are reported in the laboratory analytical report, including: the method, equipment, and analytical detection limits, the recovery rates, an explanation for any recovery rate that is less than 80 percent, the results of equipment and method blanks, the results of spiked and surrogate samples, the frequency of quality control analysis, and the name of the person(s) performing the analyses. Sample results are reported unadjusted for blank results or spike recovery.

7.3. REPRESENTATIVE MONITORING

SBCWD has had a groundwater level monitoring program since 1977 and a comprehensive water quality monitoring program since 2004. To allow quantification and tracking of sustainability criteria, representative monitoring sites, or key wells, have been identified for 1) regional groundwater level monitoring and 2) for monitoring shallow groundwater conditions where surface water-groundwater connection is likely and tied to GDEs. These key wells are shown on **Figures 7-1** and **7-5**, respectively. These have been designated by SBCWD as the point at which sustainability indicators are monitored. Information on the quantitative values for minimum thresholds, measurable objectives, and interim milestones is included in Sustainability Criteria Sections 6.2 and 6.7, respectively.

As discussed in Sustainability Criteria Section 6.3, change in groundwater in storage is closely related to groundwater levels, which can serve as a proxy for monitoring change in storage. Moreover, groundwater level MTs and MOs are sufficiently protective to ensure prevention of significant and unreasonable results relating to storage. Accordingly, monitoring of the key wells for groundwater levels also serve to track sustainability for storage.

As discussed in Section 6.4, the definition of undesirable results and the quantification of the MT and MO are based on InSAR and UNAVCO information on vertical displacement of the ground surface; these spatial and temporal data are provided by DWR on its website.

Section 6.5 discusses seawater intrusion, which is not possible in this inland basin.

Section 6.6 describes undesirable results, outlines the SBCWD Water Quality Monitoring Program and the Triennial Update, and defines sustainability criteria for water quality. As described in Section 6.6.5, water quality MTs and MOs are defined relative to the numerous data points compiled for the Triennial Update, which includes multiple data sources including but not limited to the SBCWD Water Quality Monitoring Program. MTs and MOs are quantified in terms of the percentage of wells with concentrations exceeding the MCLs (for nitrate and TDS, respectively) based on current conditions (2015-2017).

While not serving as stand-alone representative sites for definition of water quality MTs and MOs, the SBCWD Water Quality Monitoring Program wells shown in **Figure 7-4** are sampled regularly to identify water quality problems and to track water quality trends.

7.4. DATA MANAGEMENT SYSTEM (DMS)

SBCWD has been collecting and compiling groundwater data annually including water levels, water quality, and water use for the Annual Groundwater Report. These data and data from SCVWD and other sources are being compiled in relational databases, which consists of an Access database, GIS geodatabase, and Excel workbooks and has capabilities for queries to quickly check and summarize data. As part of the GSP, the data management system has been redesigned to be practicable, usable, intuitive, and cost effective. Appendix E includes a technical memorandum that describes the final DMS. The relational database includes easy to update tables and reports that assist in comparison of real time conditions and sustainability goals. As described in Section 7.1.6 of the December 2018 TM, "Data to Support GSP Preparation," the District will develop an ID system for wells and will cross reference wells with water level data, water quality data, and wells logs.

7.5. ASSESSMENT AND IMPROVEMENT OF MONITORING NETWORK

SBCWD has actively engaged in assessment and improvement of its monitoring network. This process has been intensified as part of the GSP, given the need to identify data gaps and to assess uncertainty in setting and tracking sustainability criteria. Monitoring improvements are a major part of GSP implementation and will be reviewed and updated for each five-year assessment.

7.5.1. Identification and Description of Data Gaps

Data gaps are identified in **Table 7-2** according to major monitored variable and described in terms of insufficient number of monitoring sites and utilization of monitoring sites that are unreliable (including those that do not satisfy minimum standards). Access issues also are indicated as the cause of insufficient frequency of monitoring, in other words when issues with access to private wells prevent scheduled level monitoring or sampling and cause an interruption in the historical record. Data gaps also are described in terms of the location and reason for data gaps in the monitoring network, and local issues and circumstances that limit or prevent monitoring. Data gaps listed in **Table 7-2** do not include gaps in understanding, which build on the monitoring network but also require investigation and analysis, for example, a focused investigation of salt and nitrate loading to shallow groundwater. These planned studies are described as Management Actions in GSP Section 9.

Table 7-2. Identification and Description of Data Gaps

Monitored Variable	Insufficient Sites	Unreliable Sites	Access Issues	Location	Local Issues
Regional Groundwater levels	√	√	√	The network has focused on Zone 6 and relied on private production wells. Insufficient dedicated monitoring wells exist, especially in Bolsa and Southern MAs. Insufficient data exist on vertical gradients.	The network has relied on private production wells, many lacking well construction information. Other wells lack a unique ID, do not have an accurate reference point, and/or have access issues. Need for basin-wide funding.
Stream flow	√			Only five active gages; gage lacking on Upper Tres Pinos Creek	Cost of installing, maintaining gages
Groundwater extraction	√	√	√	Current power metering method is limited to Zone 6; need for consistent method for entire basin	Need for basin-wide funding and implementation of single, consistent method
Groundwater quality	√	√	√	Insufficient dedicated monitoring wells exist, especially in Bolsa and Southern MAs; insufficient data on vertical variations.	Network has relied on private production wells, many lacking well construction information, a unique ID, and have access issues. Additional analytes needed.
Shallow groundwater levels	√			Shallow groundwater monitoring wells lacking along stream reaches with potential surface water-groundwater connection.	

7.5.2. Description of Steps to Fill Data Gaps

As a matter of context, improvement of the groundwater monitoring network has included the SBCWD program initiated in 2018 to map and prioritize unmonitored areas in the Basin, identify wells with recent access problems, identify potential wells to add to the program and digitize well information. It also has included the siting, design, and installation of dedicated monitoring wells as part of the Round 3 work plan initiated in June 2020.

Steps to improve the monitoring program and fill data gaps include

1. Develop and implement basin-wide funding mechanism to support monitoring throughout the MAs
    - Support ongoing monitoring of regional groundwater levels and quality including shallow groundwater along selected stream reaches, monitoring associated with managed aquifer recharge, and surface water monitoring (SBCWD miscellaneous measurements and installation of additional stream gages
    - Support evaluation of groundwater extractions consistently throughout the basin
2. Improve the well inventory as part of the data management system (DMS)
    - Develop and implement a program to provide unique well identification beginning with monitored wells. This would allow discontinued use of well names as identifiers and would comply with data and reporting standards described in Section 352.4. For all monitored wells, document well information (e.g., unique site ID, identified reference point, well completion report if available, etc.) in a GIS-linked database; this is a priority task for GSP implementation.
    - Document private well locations and construction information and compile into a well inventory database; this will increase knowledge of private wells that potentially could be affected by regional groundwater level or water quality changes. This documentation can be developed incrementally beginning with more recently drilled private wells and/or a focus on data gap areas.
    - Enhance the DMS with cross-referencing of monitoring sites (groundwater and surface water) relative to location and monitoring for regional groundwater level, groundwater quality, shallow groundwater, subsidence, or managed aquifer recharge.
3. Revise the SBCWD water quality sampling program to provide regular analysis of all major anions and cations to allow basic geochemical evaluation and verification of analytical accuracy. Also consider including boron, total phosphate, surfactants (MBAS), and turbidity.
4. Continue to evaluate wells included in the SBCWD monitoring network and programs (levels and quality). This would include potential discontinuation of wells with inadequate documentation or problematic access, and wells that are deemed unnecessary, and it would include addition/installation of monitoring sites as needs are identified. This is an ongoing, adaptive effort.

7.6. REFERENCES

Belitz, Kenneth, Dubrovsky; Neil M., Burow, Karen; Jurgens, Bryant; and Johnson, Tyler, Framework for a Ground-Water Quality Monitoring and Assessment Program for California, U.S. Geological Survey, Water Resources Investigation Report 03-4166, Sacramento, California, 2003.

Department of Water Resources (DWR), Investigation of Effects of Hollister Industrial Waste Upon Underlying Ground Water, Code 4103-044, 1965-66, A Report to the Central Coastal Regional Water Pollution Control Board, July 1966.

_____, 2010b, California Statewide Groundwater Elevation Monitoring (CASGEM) Program Procedures for Monitoring Entity Reporting, December 2010.

_____, 2016, Monitoring Networks and Identification of Data Gaps, Best Management Practices for Sustainable Management of Groundwater, December 2016.

Cunningham, W.L., and Schalk, C.W., comps., 2011, Groundwater technical procedures of the U.S. Geological Survey: U.S. Geological Survey Techniques and Methods 1–A1, 151 p.

TABLE 1 AND FIGURES

Please note that the table and figures in this section are designed for printing at 11x17 inches.

We recommend printing the pdf through Adobe Acrobat and selecting *Actual Size* and *Choose paper source by PDF page size*.

Table 7.1-1. North San Benito Monitoring Program Summary

Monitored Variable	Type of Measurement	Locations	Data Interval	Data Collection Agency	Database Storage Agency	Notes
Groundwater levels						
North San Benito Basin	Depth to water, feet	> 100 wells in North San Benito Basin	Quarterly to Semiannual	SBCWD GSA	SBCWD GSA	Measured consistent with data standards and converted to elevations relative to NAVD88
Llagas Subbasin	Depth to water, feet	About 10 wells in Llagas Subbasin	Quarterly to Semiannual	Valley Water GSA	Valley Water GSA	Valley Water GSA data sharing
Groundwater storage						
Rainfall	Rain gauge, daily total, inches	CIMIS Stations # 126, 143	Daily	NCDC with local partners	NCDC	Download from web annually for annual water budget and model update
Reference ET (ET_0)	Daily ETo, inches	CIMIS Stations # 126, 143	Daily	CA DWR, CIMIS program	DWR	Download from web
Stream flow	Daily average flow, cfs	Five active and eight inactive USGS gages	Daily	USGS	USGS	Download from web
Stream flow	Instantaneous flow, cfs	Misc. flow measurements	misc / historical	SBCWD GSA	SBCWD GSA	Map of current and historical locations provided in Annual Reports (e.g., 2018)
CVP deliveries- Agricultural	Metered water deliveries, AF	Zone 6	Monthly	SBCWD GSA	SBCWD GSA	Reported by distribution subsystem; in Annual Reports as acre-feet per year (AFY), compiled by then-defined subbasin areas and Zone 6, to be updated to Management Areas
CVP deliveries- Municipal	Metered water deliveries at WTPs	Lessalt and West Hills WTP,	Monthly	SBCWD GSA	SBCWD GSA	In Annual Reports as AFY; City of Hollister, Sunnyslope County Water District, Stonegate
Reservoir water budgets	Inflows, outflows, observed and computed change in storage	Hernandez, Paicines, San Justo Reservoirs	Monthly	SBCWD GSA	SBCWD GSA	Water year budgets reported in Annual Report, AFY
Reservoir releases-percolation	Reported as acre-feet per month	Hernandez, Paicines Reservoirs	Monthly	SBCWD GSA	SBCWD GSA	Historical annual releases reported in Annual Report, AFY
CVP diversions to percolation	Reported as acre-feet per month	Pacheco, Arroyo de las Viboras, Arroyo Dos Picachos, Santa Ana Ck, Tres Pinos Creek, San, Benito River	Monthly	SBCWD GSA	SBCWD GSA	Annual percolation (AFY) since 1994 reported by stream reach in Annual Reports; percolation since 2017 only to recharge basins adjacent to listed streams
Wastewater pond water budgets	WWTP effluent discharge, evaporation, percolation, AF	Hollister domestic and industrial pond, Ridgemark I and II, Tres Pinos	Monthly	City of Hollister, Sunnyslope County Water District, Tres Pinos County Water District	SBCWD GSA	AFY reported in Annual Report; San Juan Bautista discharges not reported because wastewater exits San Juan MA without recharging
Wastewater percolation	WWTP percolation volume, AF	Hollister domestic and industrial pond, Ridgemark I and II, Tres Pinos	Monthly	City of Hollister, Sunnyslope County Water District, Tres Pinos County Water District	SBCWD GSA	Annual data reported in Annual Report; San Juan Bautista discharges not reported because wastewater exits San Juan MA without recharging; Hollister industrial ponds also percolate stormwater
Recycled water use	Recycled water delivery, AF	Hollister	Monthly	City of Hollister	SBCWD GSA	Annual data, AFY, reported in Annual Report
Crop patterns	Map of crops by field, mid-summer	San Benito Groundwater Basin	Annual	DWR (LandIQ)	DWR	Download shapefile from DWR SGMA Data Portal
Municipal Water Use	Metered water use by sector	City of Hollister, Sunnyslope County Water District, Tres Pinos County Water District, San Juan Bautista	Monthly	City of Hollister, Sunnyslope County Water District, Tres Pinos County Water District, San Juan Bautista	SBCWD GSA	Annual data reported in Annual Report: CVP, groundwater, recycled water use (AFY)
Groundwater pumping						
Agricultural, Zone 6 in Hollister and San Juan MAs	Metered hours of pump operation x average pump discharge	Irrigation wells, Zone 6	Semi-annual	SBCWD GSA	SBCWD GSA	Annual data reported in Annual Report:
Agricultural, Bolsa and Southern MAs	Estimated		Annual	SBCWD GSA	SBCWD GSA	Annual estimates provided in water budget updates of Annual Report
Municipal	Metered monthly total pumping by well	Municipal well locations	Monthly	SBCWD GSA	SBCWD GSA	Request data from cities of Hollister and San Juan Bautista, Sunnyslope County Water District
Community Water Systems	Estimated		Annual	SBCWD GSA	SBCWD GSA	Annual estimates provided in water budget updates of Annual Report
Rural domestic, commercial, industrial	Estimated		Annual	SBCWD GSA	SBCWD GSA	Annual estimates provided in water budget updates of Annual Report
Subsidence						
Subsidence	UNAVCO GPS measurements of ground surface displacement	Eight stations in and around North San Benito Basin	Real time, processed daily	UNAVCO (link on DWR SGMA Data Portal)	UNAVCO	Download annually, update graphs, evaluate for inelastic subsidence, and compare results with Minimum Threshold rate
Subsidence	InSAR satellite mapping of ground displacement	North San Benito Basin	Annual change	DWR (InSAR)	DWR SGMA Data Portal	Download annually, smooth InSAR raster data sets (see Section 6.4.4.6), compare cumulative elevation change since 2015 against Minimum Threshold criterion.
Groundwater quality						
SBCWD Groundwater Quality Monitoring Program	Specific conductance, TDS, N	About 20 wells in North San Benito Basin	Quarterly/ Semi-annual	SBCWD GSA	SBCWD GSA	Additional constituents; Title 22 and boron
Rural ag/domestic wells; community water systems	Specific conductance, N	About 20 wells in North San Benito Basin	Various	ILRP, DDW, RWQCB, USGS, DWR, DPR	SWRCB Geotracker database	Download data every three years from Geotracker as part of Triennial Upate
Interconnected Surface Water and GDEs						
Groundwater levels	Depth to water, feet	Six shallow Round 3 wells	Quarterly	SBCWD GSA	SBCWD GSA	Measured consistent with data standards and converted to elevations relative to NAVD88

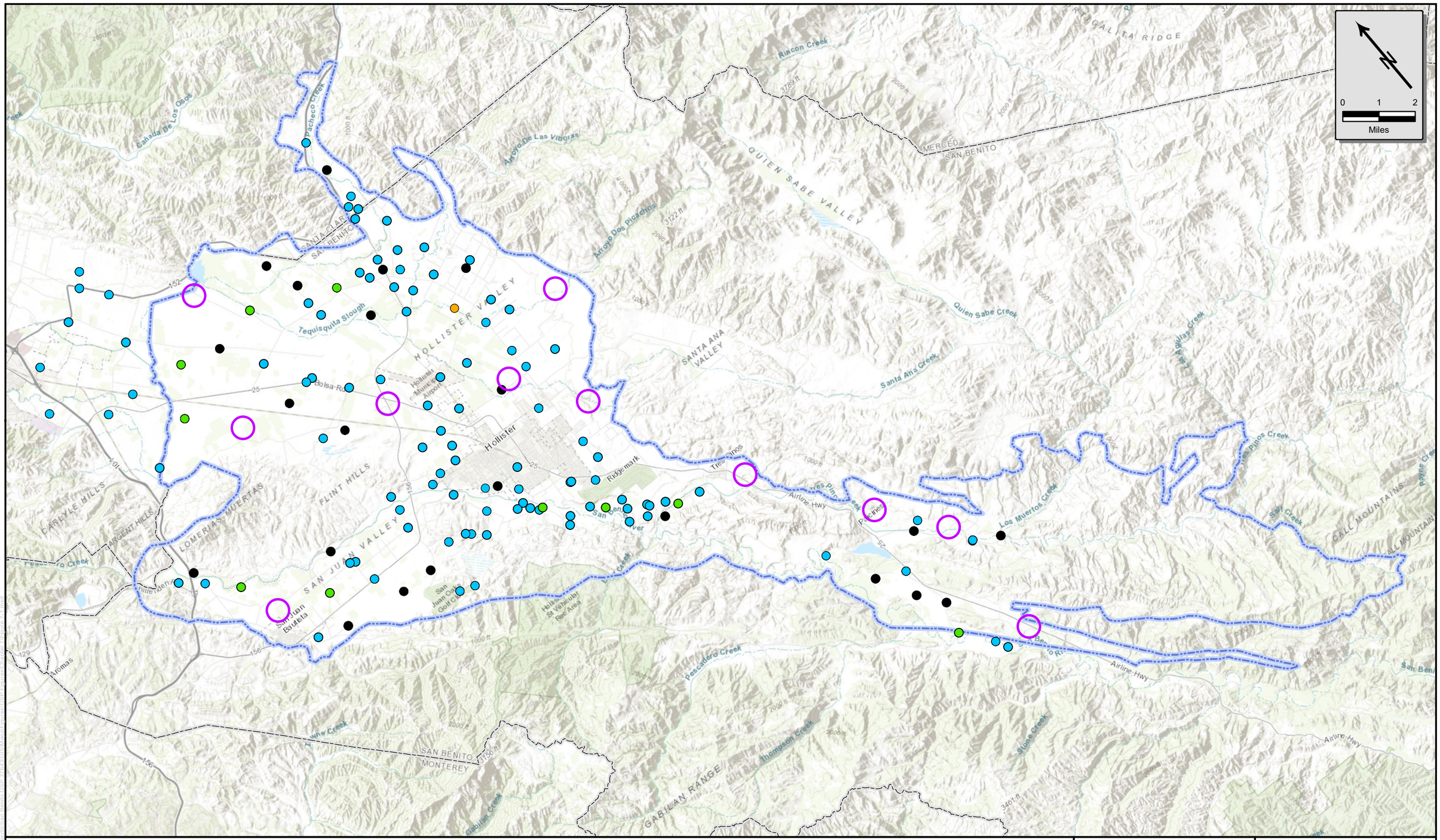


Figure 7-1
Groundwater Level Key Wells, Dedicated and Other Monitoring Wells

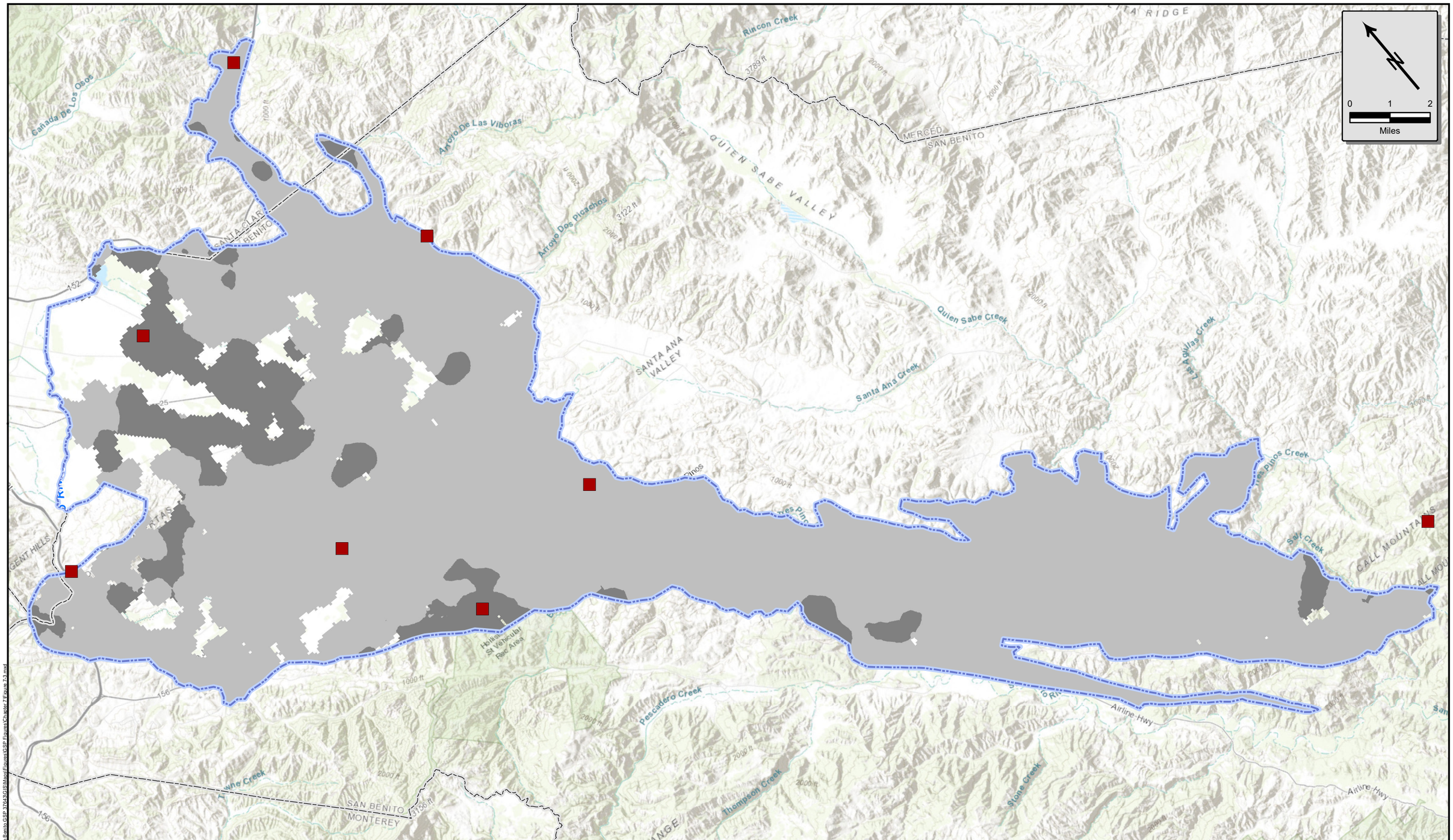
USGS Station Number	Station Name	Latitude (NAD83)	Longitude (NAD83)	Drainage Area (square miles)	Period of Record	
					Start	End
11152900	CEDAR C NR BELL STATION CA	37.04995	-121.32743	12.8	10/1/1961	9/29/1982
11156450	WILLOW C TRIB NR SAN BENITO CA	36.59024	-121.19687	1.24	7/1/1964	9/29/1969
11156700	PESCADERO C NR PAICINES CA	36.69440	-121.31076	38.3	7/1/1959	10/7/1970
11158500	SAN BENITO R NR HOLLISTER CA	36.78801	-121.37077	586	10/1/1949	9/29/1983
11153040	PACHECO C A DUNNEVILLE CA	36.95995	-121.41799	154	10/1/1981	9/25/1985
11153000	PACHECO C NR DUNNEVILLE CA	36.98000	-121.38028	146	10/1/1939	present
11157500	TRES PINOS C NR TRES PINOS CA	36.76579	-121.29965	208	12/18/1922	present
11156500	SAN BENITO R NR WILLOW CREEK SCHOOL CA	36.60941	-121.20298	249	10/1/1939	present
11158600	SAN BENITO R A HWY 156 NR HOLLISTER CA	36.85190	-121.42994	607	10/1/1970	present

Stream Gauges in Basin
Recharge Ponds
Wastewater Treatment Plant Recharge
Stream
North San Benito Basin
San Benito County

September 2020

TODD GROUNDWATER

Figure 7-2
Hydrology Monitoring Locations



Vertical Displacement (inches)

- -2 - 0 inches
- 0 - 2 inches

- Unavco Stations
- North San Benito Basin
- San Benito County

Note:
Displacement measured between 5/31/2015 and 9/19/2019

September 2020

TODD GROUNDWATER

Figure 7-3
InSAR Ground Surface Elevation Monitoring and Unavco Station Locations

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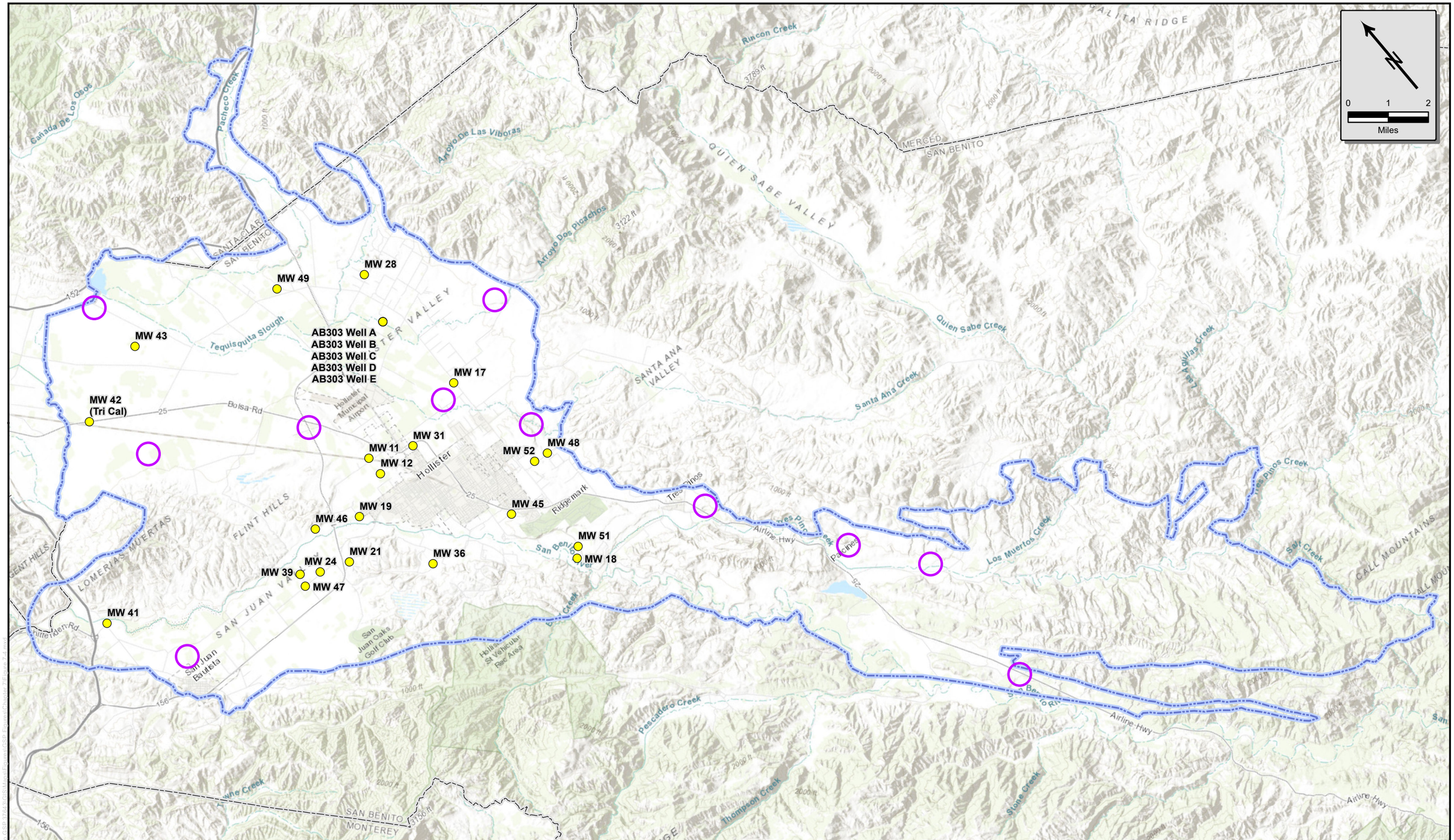
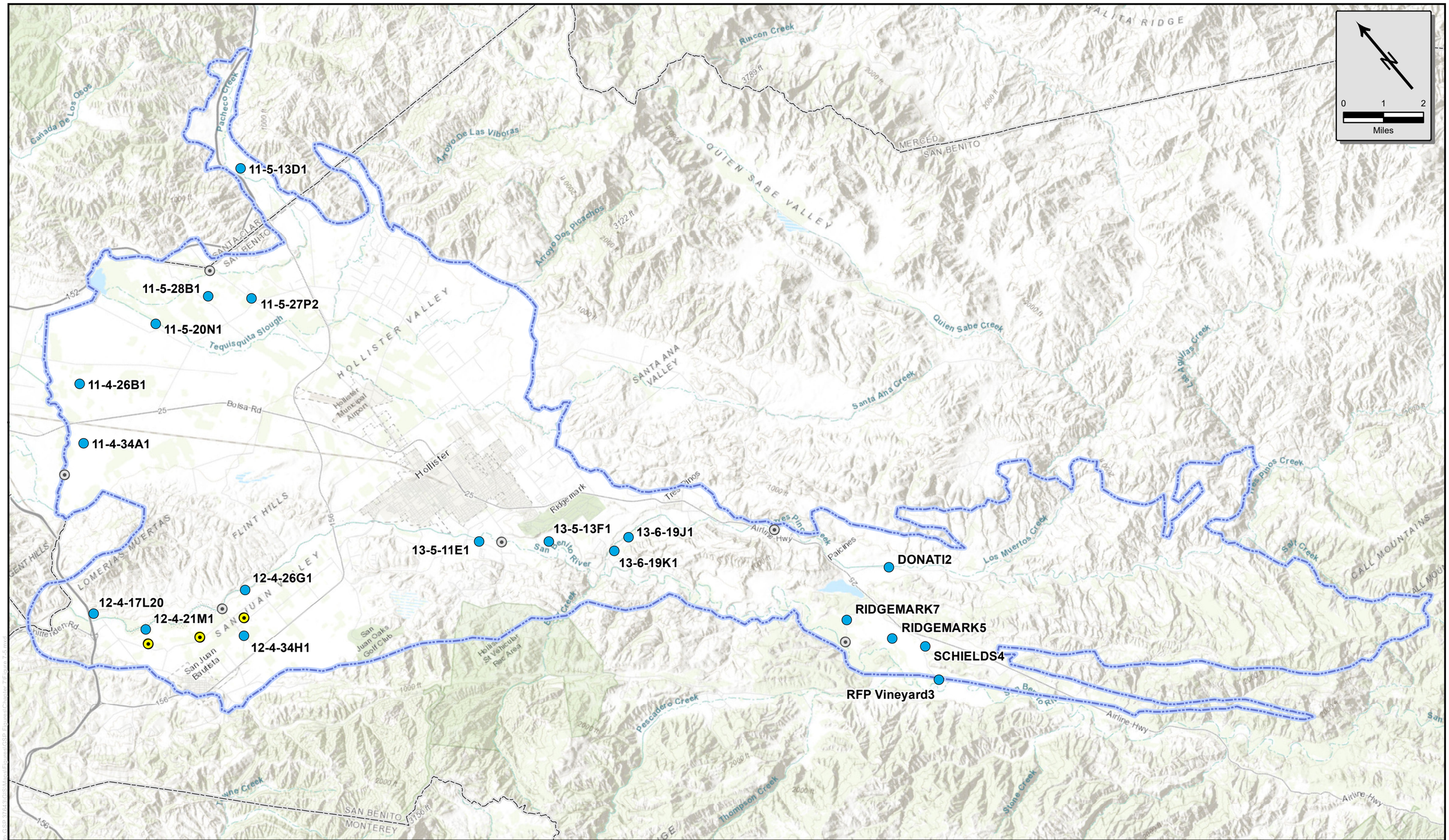

MW 28
MW 49
MW 43
AB303 Well A
AB303 Well B
AB303 Well C
AB303 Well D
AB303 Well E
MW 17
MW 42
(Tri Cal)
MW 31
MW 11
MW 12
MW 48
MW 52
MW 45
MW 19
MW 46
MW 51
MW 18
MW 21
MW 24
MW 36
MW 39
MW 47
MW 41
Hollister
SANTA CLARA
SAN BENITO
MERCED
SAN BENITO
QUIEN SABE VALLEY
SANTA ANA VALLEY
SAN JUAN VALLEY
FLINT HILLS
LOMERIAS MUERTAS
GABILAN RANGE
CALL MOUNTAINS
Rincon Creek
Arroyo De Las Viboras
Arroyo Dos Picachos
Quien Sabe Creek
Santa Ana Creek
Pacheco Creek
Cañada De Los Osos
Tequisquita Slough
Bolsa Rd
Ridgemark
Tres Pinos
Airline Hwy
Los Muertos Creek
Las Aguilas Creek
Las Pilitas Creek
Pescadero Creek
Thompson Creek
Stone Creek
Self Creek
Hollister Municipal Airport
San Juan Oaks Golf Club
San Juan Bautista
Hollister St Vehicular Rec Area
0
1
2
Miles
Water Quality Monitoring Well
Proposed Round 3 Deep Monitoring Well
North San Benito Basin
San Benito County
September 2020
TODD GROUNDWATER
Figure 7-4
Wells in the
SBCWD Water Quality
Monitoring Program



September 2020

TODD GROUNDWATER

Figure 7-5
Surface Water Key Well Locations