Appendix 3-A. Data Gap Assessment

Contents

Introduction

Multiple datasets were utilized during development of this GSP to characterize current and historical Basin conditions. Monitoring networks were designed to support the evaluation of Basin conditions throughout GSP implementation, particularly with respect to the six sustainability indicators. The representative monitoring points (RMPs) in these monitoring networks are sites at which quantitative values for minimum or maximum thresholds, measurable objectives, and interim milestones are defined. New RMPs will be considered for the 5-years update based on the suggested expanded monitoring network. Data gaps that were identified throughout the GSP development process can be categorized into:

I. Data gaps in information used to characterize current and historical basin conditions.
II. Data gaps in monitoring networks developed to evaluate future Basin conditions which will be used in reporting and tracking Basin sustainability.
III. Additional data or information valuable for measuring progress towards the Basin's sustainability goal. This information has been identified as information that may be useful but has not been confirmed as a data gap.

These data gaps were identified based on spatial coverage of data, the period for which data are available, frequency of data collection, and representativeness of Basin conditions. An overview of data gaps in the first category is provided in Chapter 2, as part of the characterization of past and current Basin conditions, and the data gaps in the second and third categories are in Chapter 3 as part of descriptions of the monitoring networks. This appendix details the identification of data gaps and uncertainties in each of the categories and the associated strategies for addressing them. The process of data gap identification, and development of strategies to fill data gaps is illustrated in Figure 1 below, sourced from the Monitoring Networks and Identification of Data Gaps Best Management Practice (BMP), provided by DWR (2016). Data gaps and monitoring networks may be revised during continued development of the numerical model.

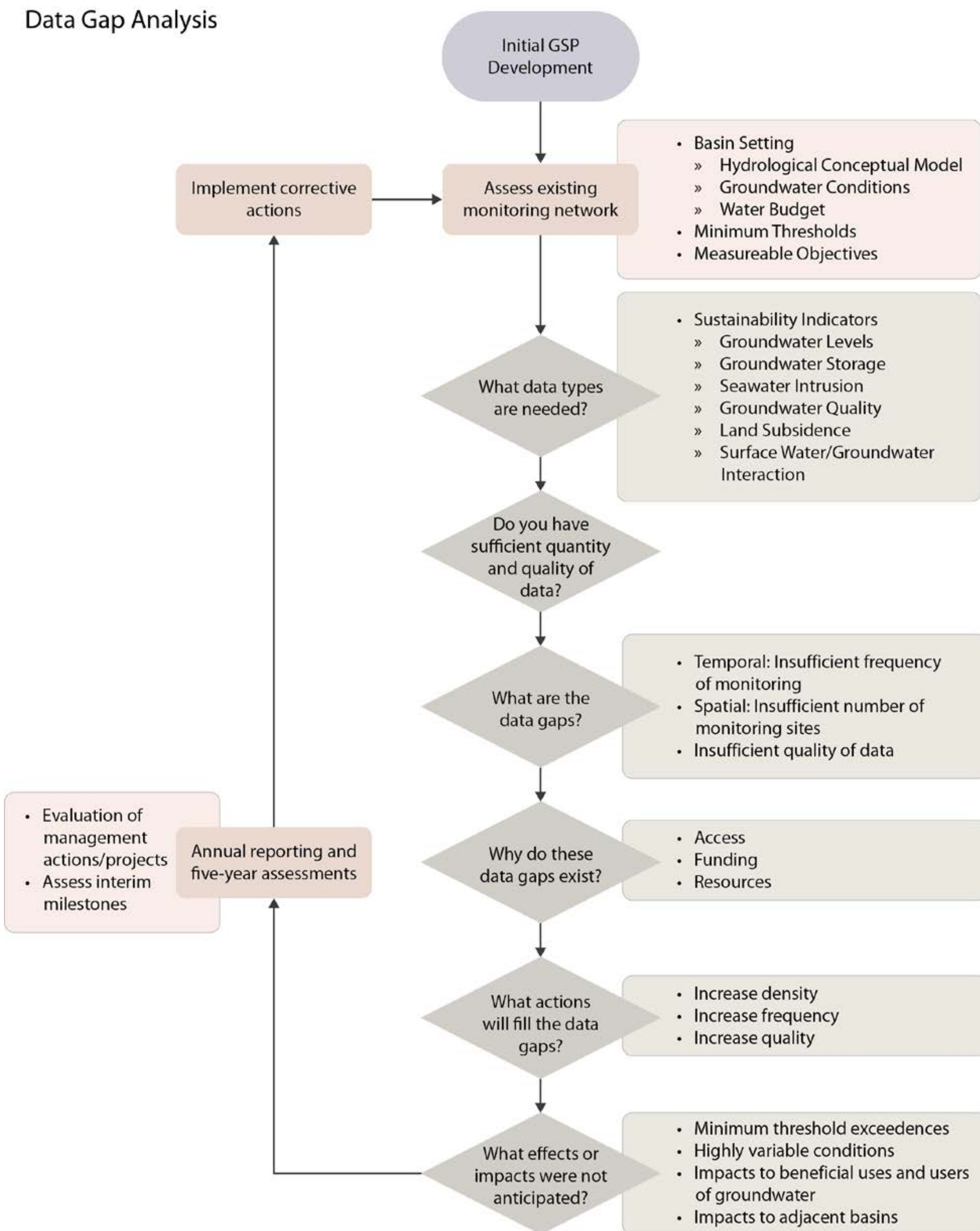

Figure 1: Data Gap Analysis Flowchart (DWR 2016).

I. Data Gaps in Existing Information Used for Basin Characterization

Definition of the hydrogeological conceptual model (HCM) is a key requirement for understanding the Basin setting and characterizing existing and historical Basin conditions. An accurate assessment of the physical setting and processes that control groundwater occurrence in the Basin is foundational to development of the sustainable management criteria and monitoring networks in Chapter 3 and identification of projects and management actions in Chapter 4.

Identification of data gaps and uncertainty within the HCM is a requirement per 23 CCR 354.14 (b)(5) and is important to choosing locations and types of additional monitoring that reduce these gaps and uncertainties.

Identification of Data Gaps

The HCM is detailed in Chapter 2 of this GSP. Data gaps and uncertainties were identified throughout development of the HCM and are briefly discussed in Chapter 2 under applicable subsections. A discussion of the components of the HCM for which key datasets were used, associated data gaps, and uncertainties is provided below. The following sections also discuss the current data networks (Table 1).

Table 1: All monitoring locations and data in Shasta Valley Groundwater Basin.

Site ID	Network	Station Name	Operator
BZR	Atmosphere	BRAZIE RANCH	CA Dept of Forestry and Fire Protection
LSH	Atmosphere	LITTLE SHASTA	Goosenest Ranger District
PRK	Atmosphere	PARKS CREEK	Mount Shasta Ranger District
SVB	Atmosphere	BOLAM	Shasta Valley Resource Conservation District
SVG	Atmosphere	GOOSENEST	Shasta Valley Resource Conservation District
SWT	Atmosphere	SWEETWATER	Mount Shasta Ranger District
WED	Atmosphere	WEED AIRPORT	CA Dept of Forestry and Fire Protection
YRK	Atmosphere	YREKA	US Forest Service
CIMIS_260	Atmosphere	260	SVRCD
CIMIS_261	Atmosphere	261	SVRCD
MPD	Diversion	MWCD PARKS CK DIVERSION NR EDGEWOOD	CA Dept of Water Resources/North Region Office

Table 1: All monitoring locations and data in Shasta Valley Groundwater Basin. *(continued)*

Site ID	Network	Station Name	Operator
SPU	River Flow	SHASTA R AT GRENADA PUMP PLANT	CA Dept of Water Resources/North Region Office
SRE	River Flow	SHASTA R NR EDGEWOOD	CA Dept of Water Resources/North Region Office
SRM	River Flow	SHASTA RIVER NEAR MONTAGUE	US Geological Survey
SRY	River Flow	SHASTA RIVER NEAR YREKA	US Geological Survey
WW	River Flow	Water Wheel	NA
SHA_01	GWL - continuous	WestOfWeed	GSA
SHA_02	GWL - continuous	BigSprings Rockhouse	GSA
SHA_03	GWL - continuous	AirportSouth	GSA
SHA_04	GWL - continuous	OberlinRd	GSA
SHA_05	GWL - continuous	Justin Holmes	GSA
SHA_06	GWL - continuous	LSCSD	GSA
SHA_08	GWL - continuous	Steve Mains	GSA
SHA_09	GWL - continuous	Ray Casterline	GSA
SHA_10	GWL - continuous	Blair Hart	GSA
SHA_11	GWL - continuous	A28	GSA
SHA_17	GWL - continuous	OldWestsideRd	GSA
SHA_18	GWL - continuous	BigSpringsStockWell	GSA
SHA_24	GWL - continuous	EastOfBigSprings	GSA
SHA_172	GWL - continuous	FrontierRd	GSA
SHA_174	GWL - continuous	Ginger	GSA
LL-LBF	GWL - transects	LSR-LL-LBF	SVRCD
LL-LBN	GWL - transects	LSR-LL-LBN	SVRCD
LL-RBF	GWL - transects	LSR-LL-RBF	SVRCD
LL-RBN	GWL - transects	LSR-LL-RBN	SVRCD
LL-SWE	GWL - transects	LSR-LL-SWE	SVRCD
A12-LBF	GWL - transects	SR-A12-LBF	SVRCD
A12-LBN	GWL - transects	SR-A12-LBN	SVRCD
A12-RBF	GWL - transects	SR-A12-RBF	SVRCD
A12-RBN	GWL - transects	SR-A12-RBN	SVRCD
A12-SWE	GWL - transects	SR-A12-SWE	SVRCD
A28-LBF	GWL - transects	SR-A28-LBF	SVRCD
A28-LBN	GWL - transects	SR-A28-LBN	SVRCD
A28-RBF	GWL - transects	SR-A28-RBF	SVRCD

Table 1: All monitoring locations and data in Shasta Valley Groundwater Basin. *(continued)*

Site ID	Network	Station Name	Operator
A28-RBN	GWL - transects	SR-A28-RBN	SVRCD
A28-SWE	GWL - transects	SR-A28-SWE	SVRCD
SV04	GWL - periodic	414686N1222830W001	GSA
42N05W20J001M	GWL - periodic	414719N1224394W001	GSA
42N06W10J001M	GWL - periodic	414987N1225202W001	GSA
42N05W08E001M	GWL - periodic	415017N1224564W001	GSA
43N06W33C001M	GWL - periodic	415351N1225474W001	GSA
SV03	GWL - periodic	415444N1225387W001	GSA
43N05W19F002M	GWL - periodic	415601N1224718W001	GSA
43N06W22A001M	GWL - periodic	415637N1225176W001	GSA
43N06W15F003M	GWL - periodic	415748N1225300W001	GSA
43N05W07K001M	GWL - periodic	415867N1224630W001	GSA
43N05W11A001M	GWL - periodic	415952N1223848W001	GSA
SV03A	GWL - periodic	416083N1223932W001	GSA
44N05W34H001M	GWL - periodic	416191N1223997W001	GSA
44N05W32C002M	GWL - periodic	416237N1224524W001	GSA
44N06W27B001M	GWL - periodic	416397N1225224W001	GSA
44N05W21H001M	GWL - periodic	416462N1224190W001	GSA
44N06W18Q001M	GWL - periodic	416563N1225813W001	GSA
44N05W14M002M	GWL - periodic	416595N1223971W001	GSA
44N06W10F001M	GWL - periodic	416774N1225301W001	GSA
SV02	GWL - periodic	417096N1225453W001	GSA
45N06W30E001M	GWL - periodic	417220N1225928W001	GSA
45N06W26C002M	GWL - periodic	417258N1225083W001	GSA
27D002M	GWL - periodic	417258N1225337W001	GSA
45N05W07H002M	GWL - periodic	417638N1224574W001	GSA
SV01	GWL - periodic	417660N1224811W001	GSA
45N06W10A001M	GWL - periodic	417704N1225126W001	GSA
46N05W33J001M	GWL - periodic	417916N1224217W001	GSA
46N05W31F001M	GWL - periodic	417941N1224710W001	GSA
DWN	Lake Storage	DWINNELL	US Bureau of Reclamation
Kettle	Monthly Spring Discharge	Kettle Spring	SVRCD
Clear	Monthly Spring Discharge	Clear Spring	SVRCD
HIG	Monthly Spring Discharge	Hole in the Ground Spring	SVRCD
BS	Monthly Spring Discharge	Big Springs Creek	SVRCD
LS	Monthly Spring Discharge	Little Springs Creek	SVRCD

Table 1: All monitoring locations and data in Shasta Valley Groundwater Basin. *(continued)*

Site ID	Network	Station Name	Operator
Evans	Monthly Spring Discharge	Evans Spring	SVRCD
LSR	River Flow	LITTLE SHASTA R NR MONTAGUE	Nature Conservancy
PBS	River Stage	PARKS CK NR BIG SPRINGS	CA Dept of Water Resources/North Region Office
PME	River Stage	PARKS CK BLW MWCD DIVERSION NR EDGEWOOD	CA Dept of Water Resources/North Region Office
SAG	River Stage	SHASTA R ABV CTY RD A-12 NR GRENADA	CA Dept of Water Resources/North Region Office
SBG	River Stage	SHASTA R BLW CTY RD A-12 NR GRENADA	CA Dept of Water Resources/North Region Office
SRG	River Stage	SHASTA R NR GRENADA	CA Dept of Water Resources
DFB	Superceded	DWINNELL DAM INSTREAM FLOW RELEASES	CA Dept of Water Resources/North Region Office
DRE	Superceded	DWINNELL RESERVOIR NEAR EDGEWOOD	CA Dept of Water Resources/North Region Office
DSW	Superceded	DWINNELL DAM SEEPAGE WEIR	CA Dept of Water Resources/North Region Office
SRX	Superceded	SHASTA R CROSS CNL WEIR AT DWINNELL DAM	CA Dept of Water Resources/Div of Environmental Services
YCK	Superceded	YREKA CREEK AT ANDERSON GRADE ROAD	Shasta Valley Resource Conservation District

Climate

Long-term records are available from National Oceanic and Atmospheric Administration (NOAA) weather stations in and around Shasta Valley. A list of the applicable NOAA weather stations used in development of the climate component of the HCM can be found in Section 2.2.1.2. Data from these stations were used to evaluate historical and current precipitation (including snow pack measurements) and evaluate spatial and temporal (seasonal and long-term) trends in precipitation. The new HyDAS station installed through contribution of the SVRCD will provide the missing information about snow pack on the Shasta mountain.

Current and historical climate data is readily available for the Shasta watershed (Watershed) and has sufficient spatial coverage, frequency of measurement and length of record to evaluate current and historical conditions and identify trends. Based on an initial assessment of the data, a rainfall gradient is suspected but not confirmed in the Watershed.

Geology

Gaps in geological information are the largest component of the data gap for the HCM. As fully described in Chapter 2, geology of the Shasta valley is extremely complex and more data are critical to fully understand flow path in the aquifer. Through an effort by DWR, AEM surveys were conducted in Fall 2021, the geophysical analysis by DWR will be complete in six months, and will complement the geophysical study presented in Appendix 2-G.

Aquifer tests and isotopes data collection will further support the refinement of the geological understanding of the basin.

Soils

A 1983 soil survey of central Siskiyou County (USDA 1983) was the primary source used for development of this component of the HCM. Additionally, soil properties as they relate to groundwater recharge were characterized through the Soil Agricultural Banking Index (SAGBI) ratings for the soil series in the Shasta Valley area can be viewed on a web application, developed by the California Soil Resource Lab at the University of California at Davis and University of California Agriculture and Natural Resources (UC Davis Soil Resource Lab and University of California Agriculture and Natural Resources 2019).

No data gaps were identified in the development of this section.

Hydrology and Identification of Interconnected Surface Water Systems

Significant data gaps have been identified regarding the hydrology of the Basin, including limited streamflow and spring flow data, which severely limit the ability to simulate surface waters in the Shasta Watershed Groundwater Model (SWGM) and to define sustainability management criteria (SMCs) for interconnected surface waters (ISWs). New stream gages will be installed along the main stem of the Shasta River and its tributaries, particularly in the upper watershed. Continuous monthly spring flow monitoring, completed by the Shasta Valley Resource Conservation District in conjunction with the GSA, began in July 2020 at six springs (see Section 2.2.2.6 and Figure 3). Establishing a historical record at all new stream gages and spring flow monitoring is critical for improving hydrology data gaps. The number of new instruments and frequency and length of measurements will depend on funding. Current instrumentation is shown in Figure 2. Improved communication and cooperation between the GSA and agencies operating within the Basin should lead to the release of additional relevant streamflow data.

While interconnected surface water systems were identified in Section 2.2.2.6, there are uncertainties in this identification. A continuous saturated zone between the stream and aquifer is assumed for all locations that were identified as interconnected surface waters, as no locations are known to be separated from the water table by thick unsaturated zones, but this has not been physically confirmed. Data gaps concern the connection of Big Springs, how quickly it responds to groundwater pumping, and day to day variations are attempting to be addressed before setting SMC criteria on Big Springs Creek. New stream gages and monitoring wells with continuous data collection at springs and tributaries may allow additional ISWs SMCs to be set and enable better calibration of the Shasta Watershed Groundwater Model (SWGM). The Big Springs Complex will be the primary target of improved monitoring and data collection.

The current data set only allows for preliminary ISW SMCs on the main Shasta River. For other locations (springs and tributaries) there is insufficient groundwater and surface water monitoring data. The numerical groundwater-surface water model cannot be used for this calculation because there is insufficient surface water and groundwater monitoring data near the river to calibrate the model to better represent the flow exchange. After calibration the SWGM will also be used to evaluate groundwater contributions during the entire year.

The current ISW SMC temporary approach will be updated with new surface water, spring, and groundwater data that started collection in 2019 to quantify baseflow over more reaches and times. This will be combined with the updated model to create new SMCs for Big Springs and Shasta River tributaries. The UC Davis Center for Watershed Sciences (CWS) is in the process of developing an in-stream flow assessment of the Little Shasta River (LSR) and have been sharing information that will support the GSA in eventually creating ISW criteria for the LSR as currently there is insufficient data to quantify streamflow depletions or more specifically streamflow depletions due to groundwater extraction. A PMA in Chapter 4 addresses the ISW data gap.

Identification of Groundwater Dependent Ecosystems

Data from the The Nature Conservancy, and other sources (as detailed in Section 2.2.2.7) was used to identify groundwater dependent ecosystems (GDEs) in the Basin. While the results of the initial GDE inventory were evaluated by the Surface Water Ad-Hoc Committee, physical verification has not been completed. Uncertainty exists regarding habitat maps and presence of certain species in the Basin. Additionally, groundwater levels near the GDEs are poorly constrained and the groundwater level monitoring network must be expanded appropriately. There is therefore some uncertainty between riparian and non-riparian GDEs that were mapped and the existence and extent of these GDEs on the ground.

A PMA in Chapter 4 addresses the GDE data gap. Satellite images evaluated twice per year would provide information on the health of GDEs over time and would be critical to fully understand their seasonal cycles.

Current and Historical Groundwater Conditions

Groundwater Elevation Data

Groundwater elevation data is sourced primarily from the California Statewide Groundwater Elevation Monitoring Program (CASGEM), and from DWR. Well data is available dating back to the 1960s and wells have adequate spatial coverage of the Basin, measurement frequency and period of record Figure 4. There are three water level networks: continuous, periodic, and transects. Continuous wells are measured at 10 minute intervals continuously all year, and provide the best data sets for monitoring and model calibration Figure 5. Periodic wells are measured bi-annually. Generally these frequencies are sufficient to enable determination of seasonal, short-term, and long-term trends Figure 6. However they do not provide insights on season high and low values

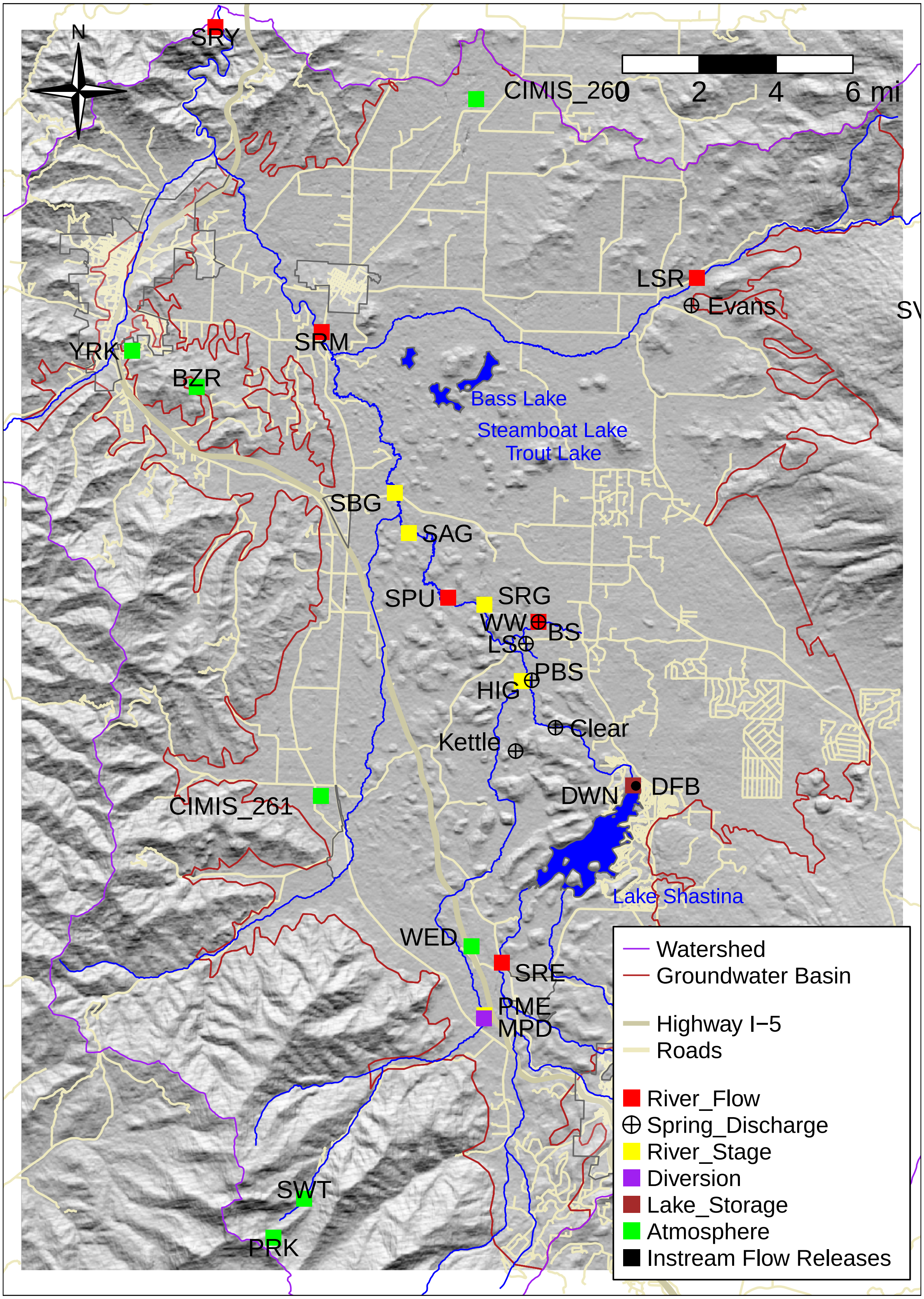

Figure 2: Hydrology and Surface Water Monitoring Networks.

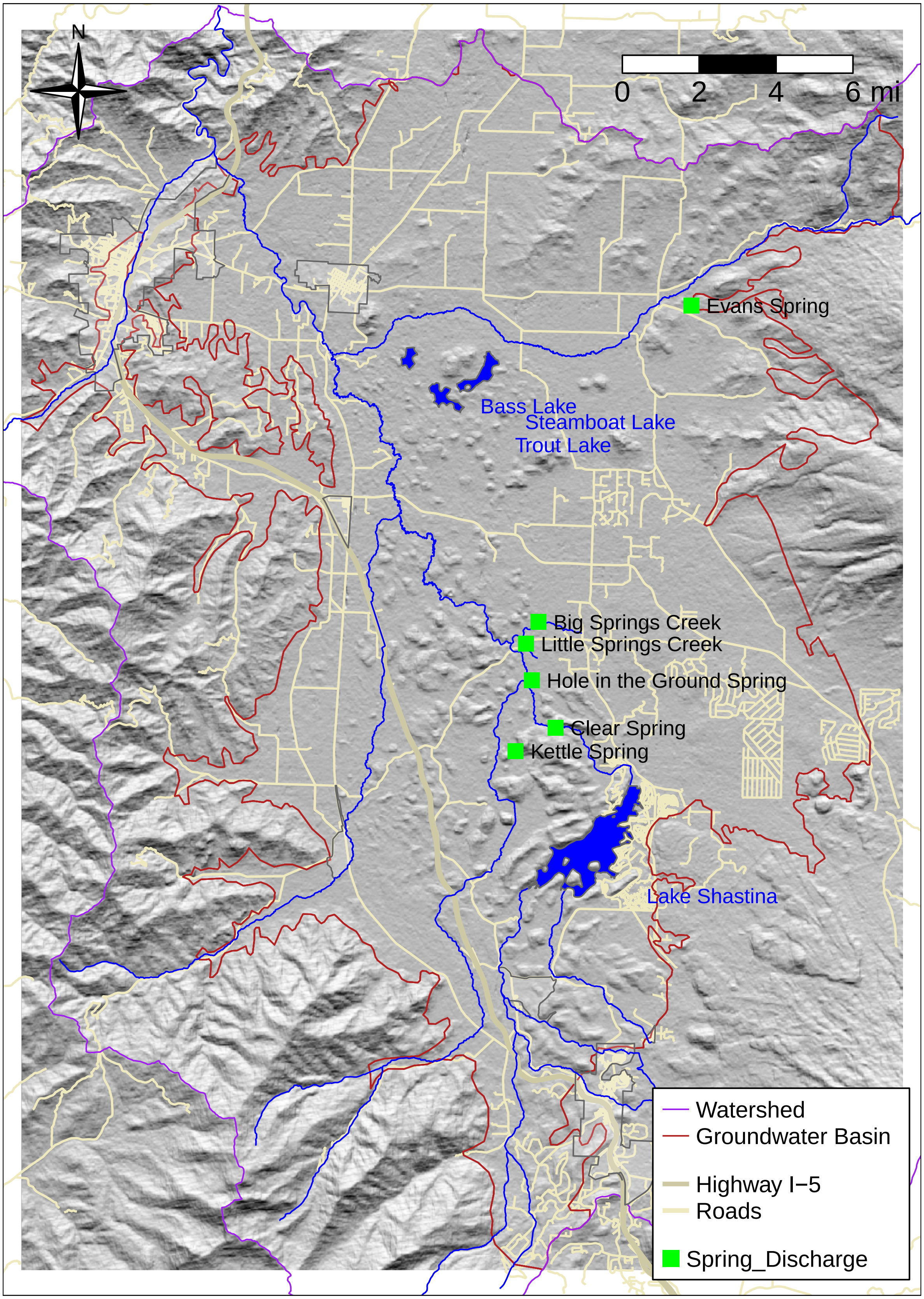

Figure 3: Monthly Spring Monitoring Networks.

and on the response of the system to precipitation, the start of the irrigation season, and seasonal changes to ISWs and GDEs. Transect wells are part of the piezometer transect program for measuring interconnections between surface waters and groundwater (see ISW section) (Figure 7.

Estimate of Groundwater Storage

Groundwater storage data is available from the foundational geological report (Mack 1960) and specific yield and storativity were estimated using the Shasta Watershed Groundwater Model (SWGM).

Groundwater Extraction Data

No pumping monitoring program currently exists in the Basin and this data is not available for any of the wells with groundwater elevation data. This has been identified as a data gap.

Groundwater Quality

Groundwater quality data was obtained from the California Groundwater Ambient Monitoring and Assessment (GAMA) Program Database. As detailed in Appendix 2-B, available water quality data were compared to regulatory standards and locations mapped within the Basin. Constituents of concern were identified through visual analysis of recent data (within the past 30 years) of the generated maps and timeseries for each constituent (available in Appendix 2-B). As seen on these maps, and noted in Section 2.2.2.3, there are multiple data gaps in the groundwater quality information used to develop the HCM. Spatially, groundwater quality data is not equally distributed throughout the Basin, with a general lack of data in the eastern side of the valley. Additionally, most of the groundwater quality data used in the assessment did not have a long record with consistent measurements, or measurements with a frequency that would be sufficient for determination of historical trends in groundwater quality. Further data gap discussion and the strategy for filling these data gaps is discussed with the groundwater quality monitoring network and Chapter 3.

In the North Coast Hydrologic Region, dairy operators are required to monitor and report groundwater data to the NCRWQCB, making them good candidates for network expansion. Annual groundwater monitoring of nitrate was first required in 2012 as a part of Waste Discharge Requirements for Dairies (Order No. R1-2012-0002). Order No. R1-2019-0001 extends the monitoring program but increases sampling frequency to every three years after the year 2022.

Land Subsidence Conditions

Land subsidence data is entirely sourced from the DWR contracted TRE Altamira Interferometric Synthetic Aperture Radar (InSAR) dataset, which provides estimates of vertical displacement from January 2015 to June 2015. Data gaps include the short historical record.

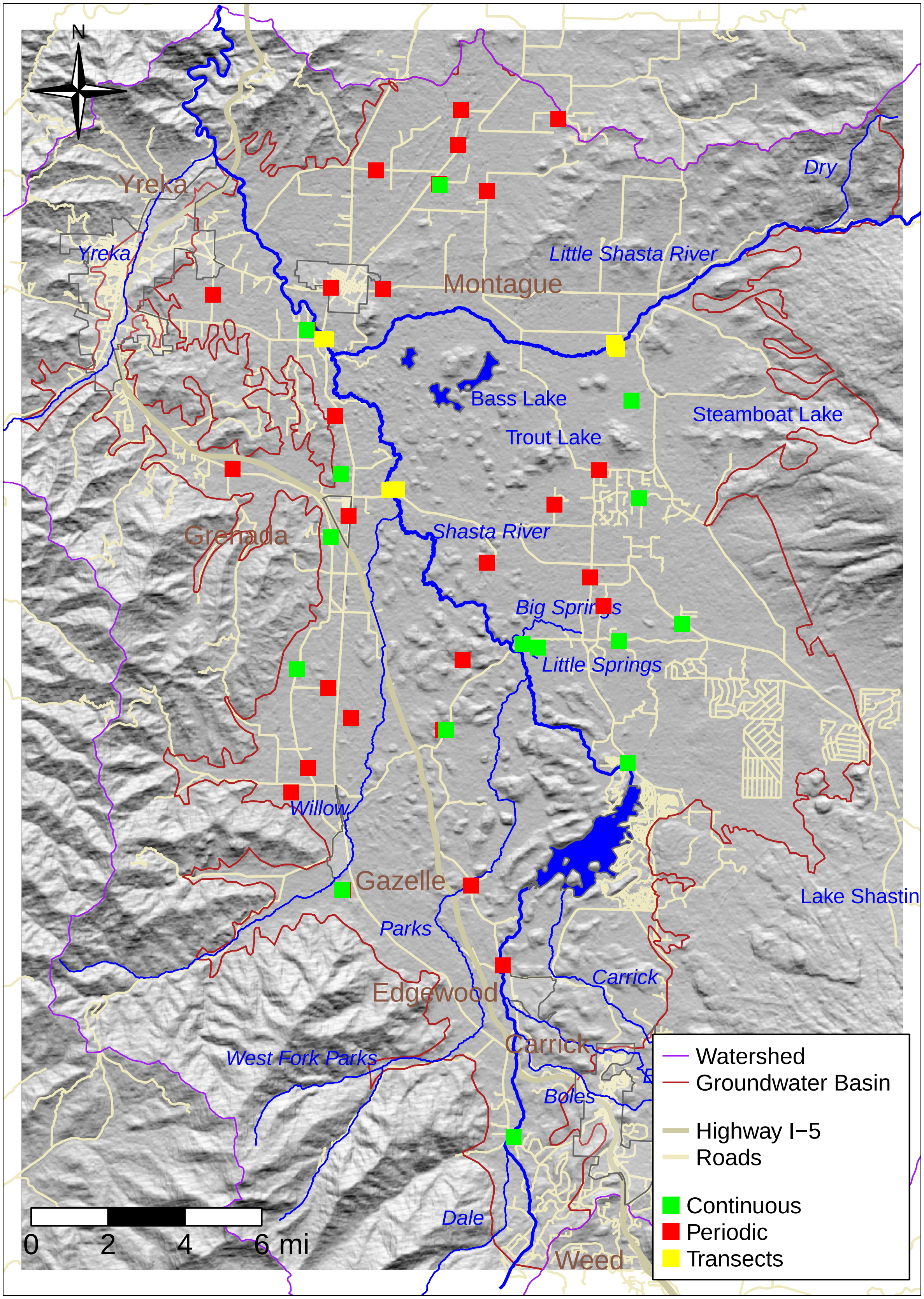

Figure 4: Groundwater Level Monitoring Network.

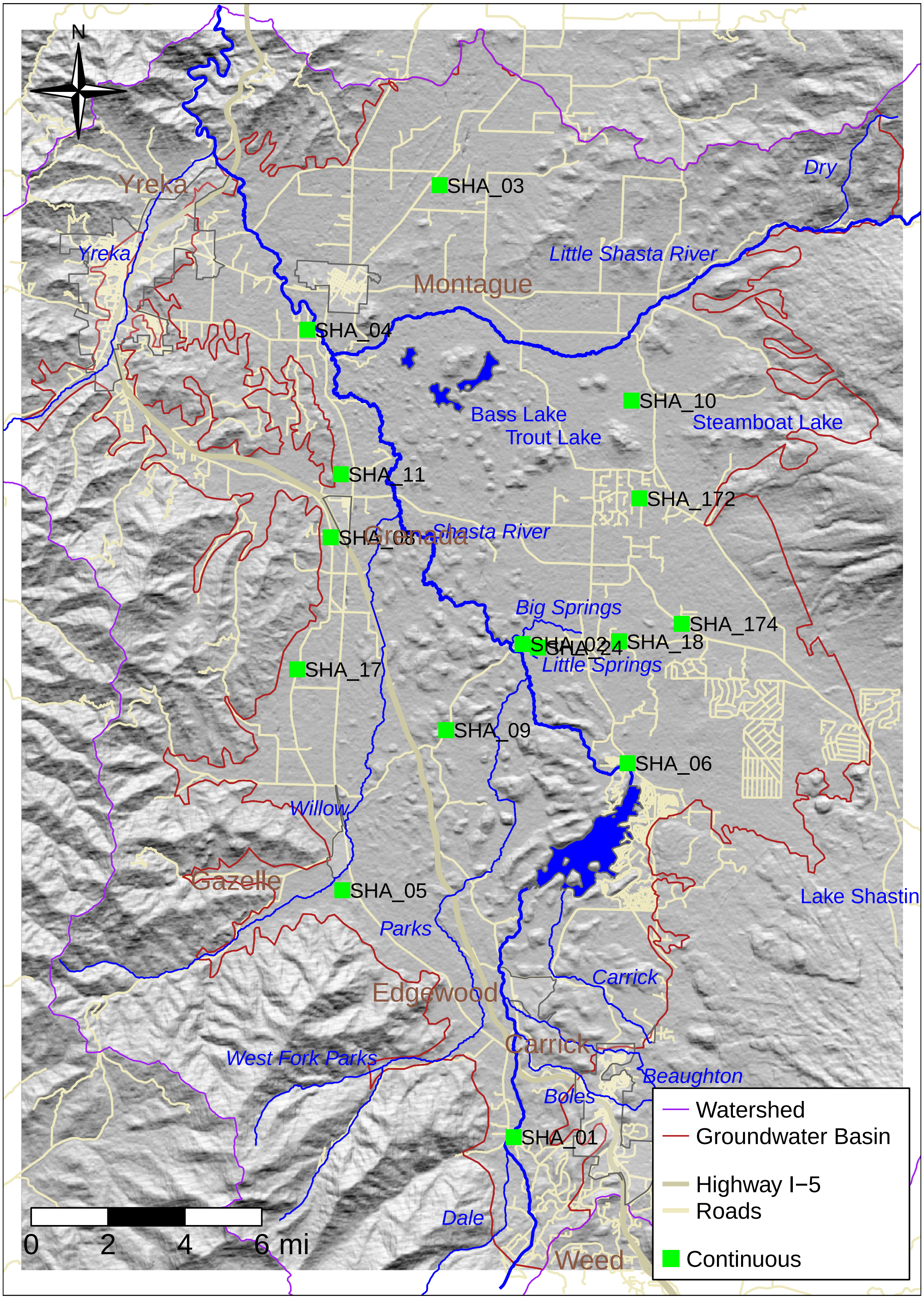

Figure 5: Groundwater Level Continuous Monitoring Network.

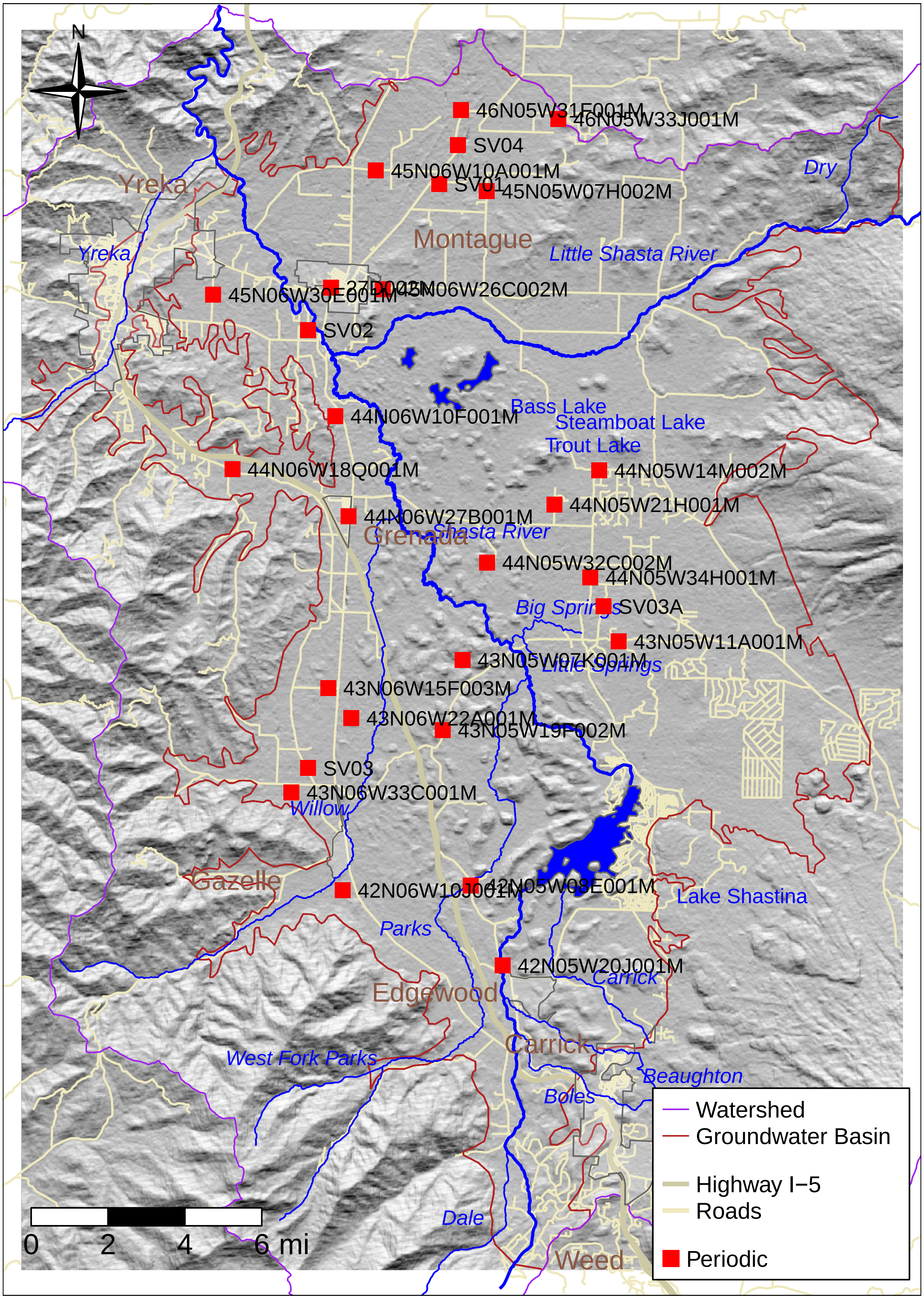

Figure 6: Groundwater Level Periodic Monitoring Network.

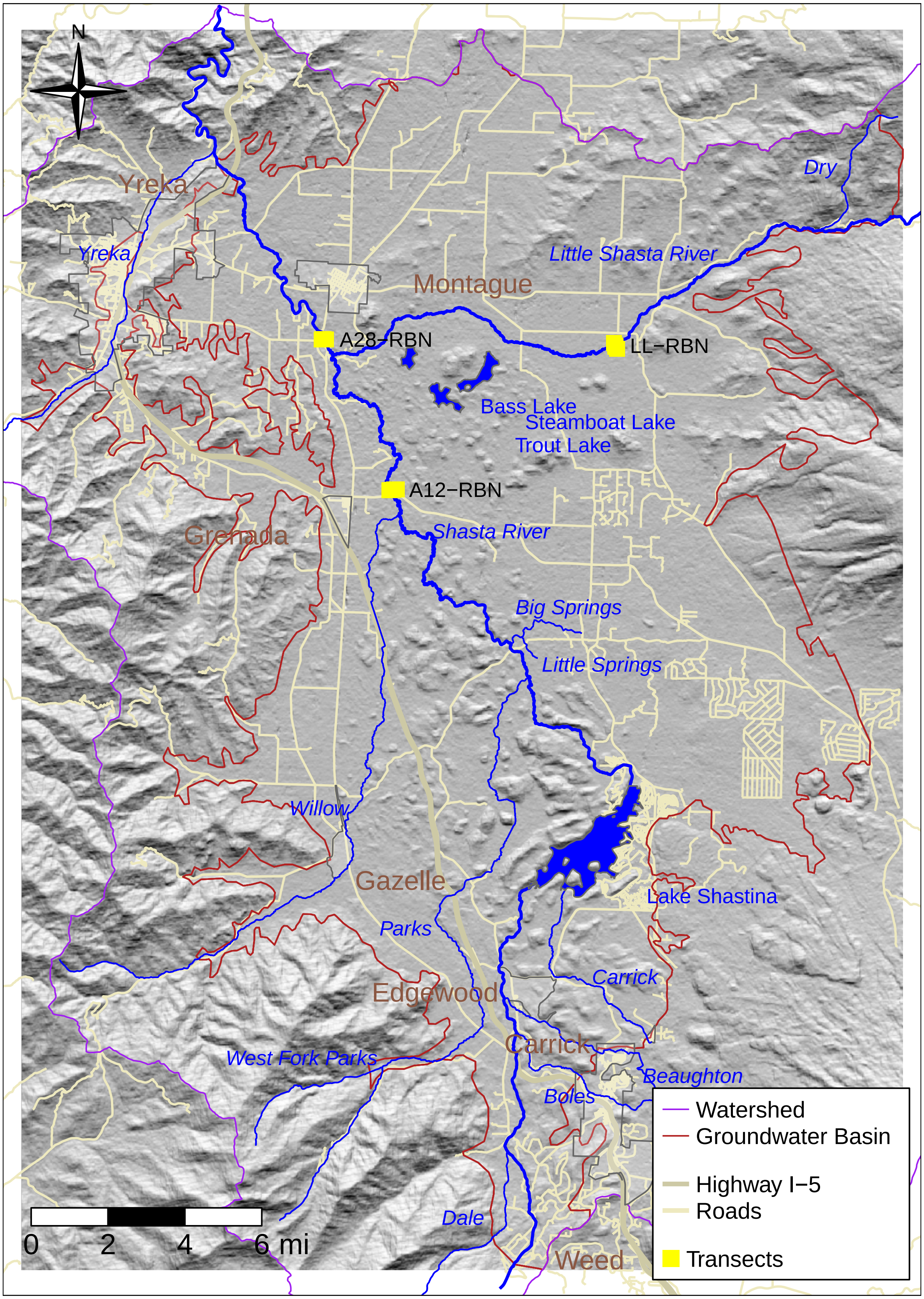

Figure 7: Groundwater Level Transect Monitoring Network.

Water Budget

The water budget is dependent on monitoring data inputs. For data gaps in the water budget see previous sections on climate and hydrology data gaps.

II. Data Gaps Monitoring Networks

Requirements

Multiple data gap requirements are relevant to the definition of monitoring networks for sustainability indicators. Per 23 CCR 354.38 (“Assessment and Improvement of Monitoring Network”):

(a) Each Agency shall review the monitoring network and include an evaluation in the Plan and each five-year assessment, including a determination of uncertainty and whether there are data gaps that could affect the ability of the Plan to achieve the sustainability goal for the basin.

(b) Each Agency shall identify data gaps wherever the basin does not contain a sufficient number of monitoring sites, does not monitor sites at a sufficient frequency, or utilizes monitoring sites that are unreliable, including those that do not satisfy minimum standards of the monitoring network adopted by the Agency

(c) If the monitoring network contains data gaps, the plan shall include a description of the following:

   i. The location and reason for data gaps in the monitoring network
   ii. Local issues and circumstances that prevent monitoring

(d) Each Agency shall describe steps that will be taken to fill the data gaps before the next five-year assessment, including the location and purpose of newly added or installed monitoring sites.

The following discussion summarizes the identified data gaps, description, and strategy to fill the identified data gaps.

Groundwater Level and Storage Monitoring Network

The current network is dominated by bi-annually sampled monitoring wells with a handful of continuous monitored wells (Figure 8 and Table 1). Data gaps in network coverage include the Basin edges such as near Weed, Yreka, Lake Shastina, Little Shasta River, and Pluto’s Cave, additional continuous continuous monitoring wells, and groundwater temperature. Continuous monitoring in particular would support the evaluation of changes in storage and with model calibration. Additional data gaps include representation of domestic wells and vulnerable drinking water users. Expansion of the monitoring network and filling of data gaps will depend on grant funding.

Through the partnership with the SVRCD and through a Water Smart grant obtained from the Bureau of Reclamation, 14 wells have been already instrumented with continuous data and telemetry throughout the Basin Figure 5. Continuous groundwater level data will be used to refine the SWGM and to further improve SMC definition.

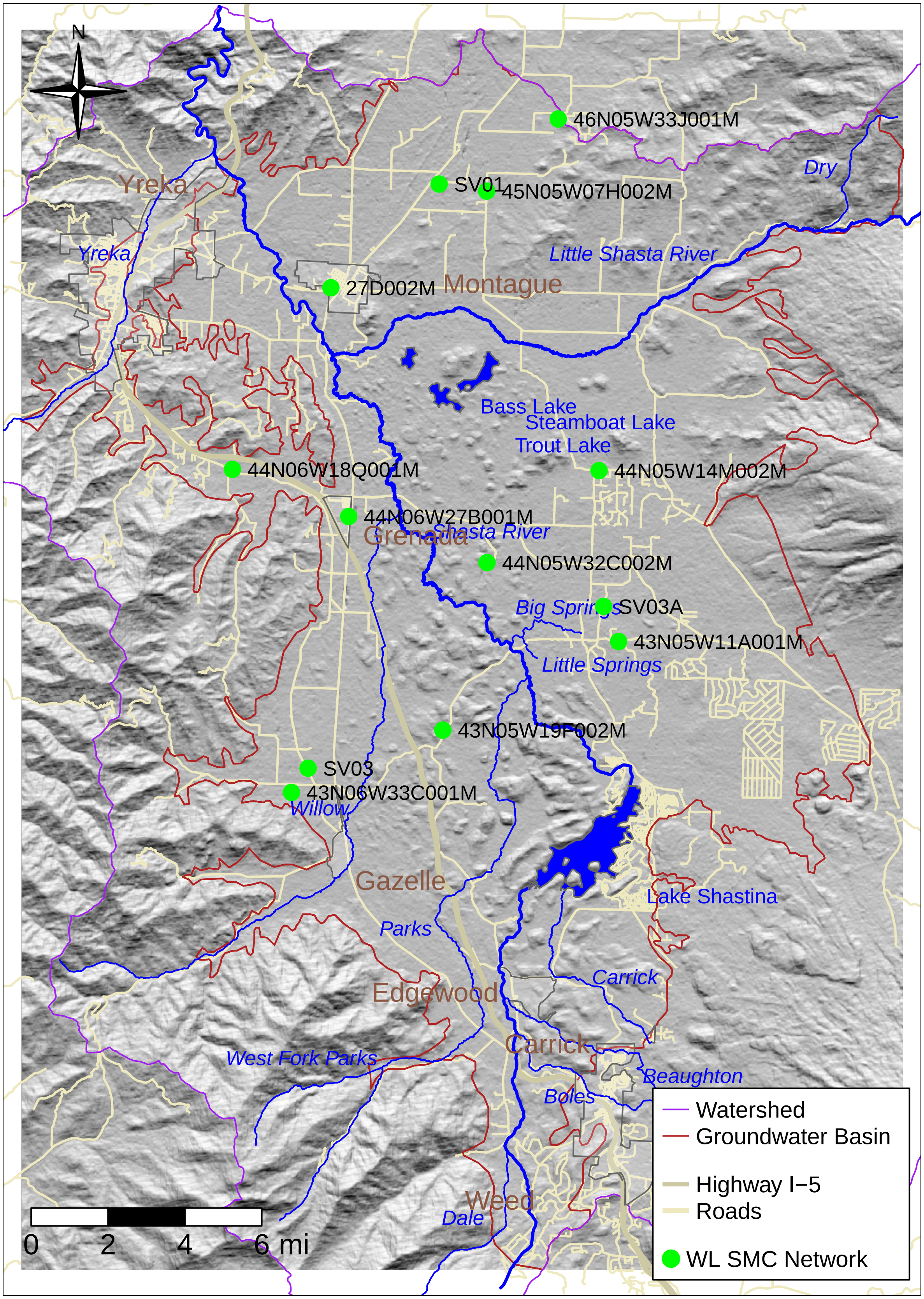

Figure 8: Water Level Monitoring Network.

Groundwater Quality Monitoring Network

Requirements

Requirements for the monitoring network for the degraded water quality sustainability indicator are outlined in 23 CCR 354.34 (c)(4):

Degraded Water Quality. Collect sufficient spatial and temporal data from each applicable principal aquifer to determine groundwater quality trends for water quality indicators, as determined by the Agency, to address known water quality issues.

Data Gaps

Data gaps in the groundwater quality monitoring network were identified due to inadequate spatial coverage, monitoring frequency, and/or lack of representativeness of Basin conditions and activities. The sites with existing and ongoing groundwater quality monitoring are public supply wells and are therefore concentrated near population, or seasonal population, centers, leaving much of the Basin without representative monitoring data. The location of these data gaps is shown on the map of the existing groundwater quality monitoring locations (see **??**, reprinted from Chapter 3). These data gaps are due to the limited number of wells that conduct current and ongoing monitoring for the identified constituents of concern, all public supply wells. The wells in the existing groundwater quality network also have a temporal data gap with a frequency of measurement annually or greater, corresponding to the public water supply system sampling frequency. A higher frequency of sampling, at minimum biannually, is necessary to enable determination of trends in groundwater quality on an intra-annual scale. No local issues or circumstances are expected to prevent monitoring. As discussed in Section 3.3.3, the groundwater quality monitoring network will be expanded with a minimum addition of five wells within the first five years of plan implementation to address this data gap. Possible candidate wells for inclusion in this expansion including wells used by dairy operators to report groundwater data to NCRWQCB, domestic wells, and wells included in the monitoring network for groundwater levels.

Depletions of Interconnected Surface Water Monitoring Network

Requirements

The requirements for the depletion of interconnected surface water monitoring network, as part of § 354.34. Monitoring Network, are detailed below:

(A) Flow conditions including surface water discharge, surface water head, and baseflow contribution.
(B) Identifying the approximate date and location where ephemeral or intermittent flowing streams and rivers cease to flow, if applicable.
(C) Temporal change in conditions due to variations in stream discharge and regional groundwater extraction.
(D) Other factors that may be necessary to identify adverse impacts on beneficial uses of the surface water.
(E) Changes in gradient between river and groundwater system.

Data Gaps

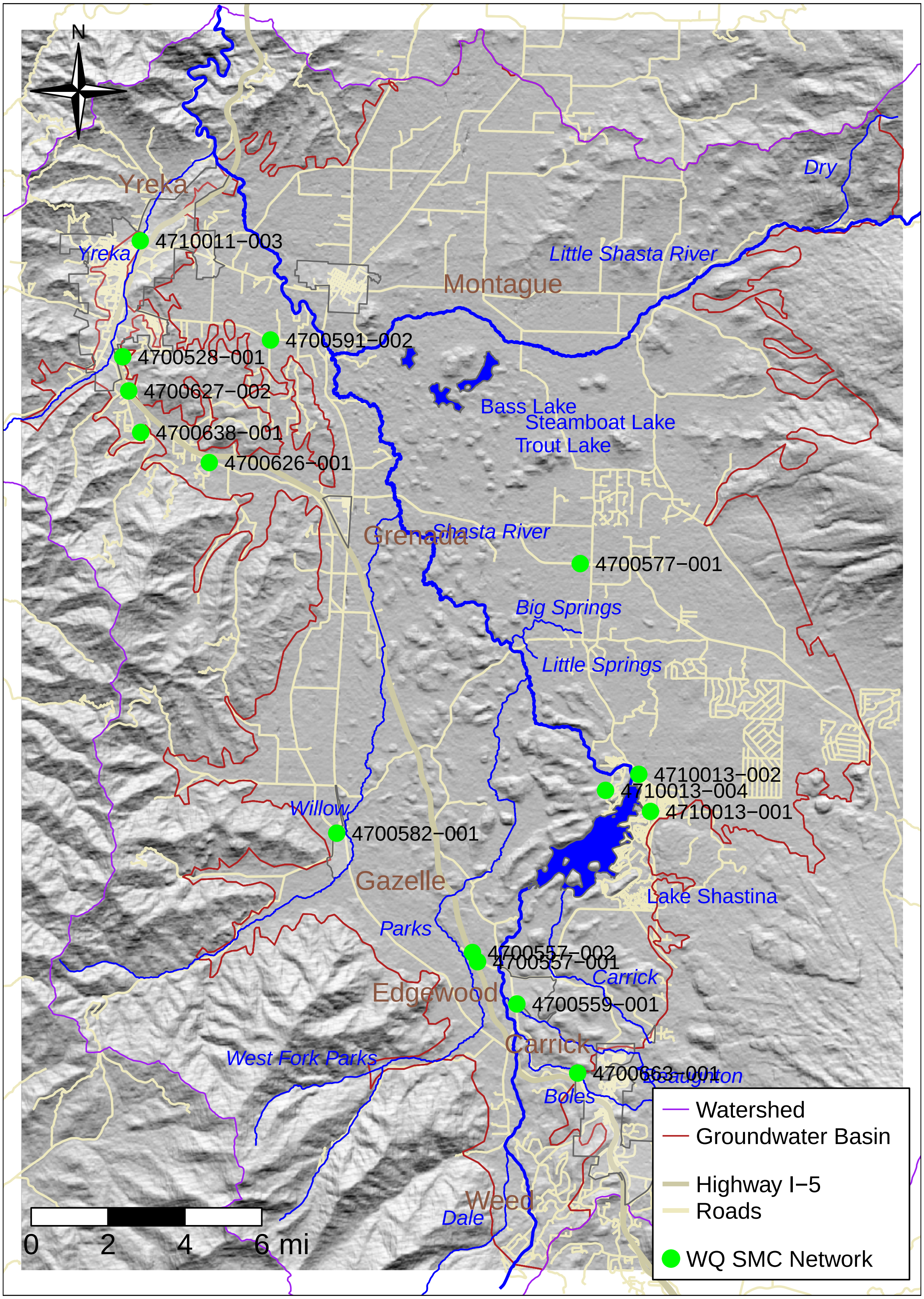

Figure 9: Water Quality Monitoring Network.

The Shasta Watershed Groundwater Model (SWGM) will be the primary tool for estimating depletions of interconnected surface water after sufficient additional data has been collected at springs, particularly the Big Springs Complex, and Shasta River tributaries. The proposed implementation schedule (see Chapter 5) aims to obtain a better calibrated model over the next 5 years. Spring and flow monitoring is necessary not only for inputs and calibration of the model, but also to create new ISW SMCs and demonstrate sustainability. Wells to be used in observation of long-term trends in the hydraulic gradient between the aquifer and stream were identified as a data gap for the monitoring network associated with the depletions of interconnected surface water sustainability indicator. Two transects of shallow piezometers instrumented with continuous pressure transducers across the Shasta River, and one on the little Shasta have already been installed and will provide critical information to fully understand the relationship between the river and the aquifer. More transects may be considered in the next 5 years pending funding availability. Additional spring and tributary monitoring sites will also depend on funding. Reprinted from Chapter 3, tentative additional ISW sites will include the sites in Table 2, with locations shown in Figure 2.

The GDE monitoring network currently has one single well, leaving no coverage for all other potential GDEs (see Chapter 3). The GDE monitoring network must expand to additional shallow wells.

Table 2: Future monitoring locations for monitoring interconnected surface water, dependent on funding.

Monitoring Location	**Monitoring Type**	**Agency**
Shasta River near Yreka (SRY)	Stream Gage	USGS
Shasta River at Grenada Pump Plant (SPU)	Stream Gage	DWR
Big Spring Creek (Water Wheel)	Stream Gage	CDFW
Parks Creek	Stream Gage	NA

III. Additional Data or Information Valuable for Measuring Progress Towards the Basin Sustainability Goal

Additional data has been identified that may be valuable to evaluations of progress towards the Basin's sustainability goal. This is primarily additional monitoring information that may be useful to identify adverse impacts on biological uses of surface water, in addition to existing biological monitoring in the Basin.

These include evaluation of streamflow depletion impacts on juvenile salmonids and use of satellite imagery for monitoring riparian and non-riparian vegetation. The GSA may consult other entities or specialists, as feasible, to determine the value of this data.

IV. Data Gap Prioritization

The identified data gaps are prioritized for actions to be taken to resolve them. Data gaps are categorized into "high," "medium," and "low" prioritization statuses based on the value to understanding basin setting or in comparison to the defined SMCs to evaluate Basin sustainability. Filling data gaps can be achieved through increasing monitoring frequency, addition of monitoring sites to increase spatial distribution and density of the monitoring network or adding or developing new monitoring programs or tools. Summaries of the data gaps discussed in this appendix, associated prioritizations, and strategies to fill the data gap are shown in Table 2.

Note: Prioritization to be refined and discussion of added monitoring for continuous groundwater and temperature, isotopes, and soil moisture after preliminary evaluation of the new data that have been collected since 2021. Expansion expected in 2022.

Table 3: Data gap prioritization

Priority	Data Gap Summary	Strategy to Fill Data Gap
High	Groundwater quality monitoring network	Planned expansion of groundwater quality monitoring network in the first five years. Additional expansion will be evaluated at the five-year update.
High	Expand the groundwater level network to cover current data gaps, particularly near surface waters (potential ISWs) and potential groundwater dependent ecosystems.	The GSA will seek local volunteers with historical groundwater level data and seek funding for installation of additional monitoring wells.
High	Depletions of interconnected surface water monitoring network	Dependent on funding, additional stream gages and spring monitoring, with particular focus on Big Springs. Also continued or additional piezometer transects with continuous groundwater level and temperature measurements near the river to determine the gradient between the aquifer and stream. All additional data will assist in the calibration of SWHM, to evaluate the baseflow SMC defined in Chapter 3 for ISW, and potentially redefine the ISW SMCs in a future GSP update.
High	Identification and evaluation of Groundwater-Dependent Ecosystems	Using satellite imagery to confirm location and extent of GDEs and evaluate twice per year to assess GDE health over time.
Medium	Groundwater extraction data	A PMA in Chapter 3 proposes voluntary measures to gather extraction data, with public outreach to encourage participation.
Low	Additional precipitation data to confirm presence of rainfall gradient.	No strategy has been defined yet to fill this data gap.

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