Database	Table	Description	Primary Key	Affiliated Tables
Sierra Valley	lst_monitoring_point_data_source	List of data sources that a well can be associated with.	monitoring_point_data_source	wells
	lst_rep_mon_site	List of Representative Monitoring Site that a well can be associated with.	rep_mon_site	wells
	PassFail_DupCheck	Not used in web application.		
	PassFail_Fail	When processing the import of analytical data, rows that fail data checks are copied to this table.	pff_ID	edd_summary
	PassFail_Pass	When processing the import of analytical data, rows that pass data checks are copied to this table.	pfp_ID	edd_summary
	PassFail_QC	When processing the import of analytical data, rows that are noted as QC, as indicated by the SAMP_ID field of the import record, are copied to this table.	pfq_ID	edd_summary
	photo_library_items	Stores metainformation about images related to wells.	photoLibraryItemID	wells
	readings	Bottom level analytical data in the sites-wells-sample-readings hierarchy that stores the actual results of a reading.	reading_id	samples, wells, analytes (shared db), methods (shared db), edd_summary
	report_order	Not used in web application.		
	samples	Mid-level analytical data in the sites-wells-sample-readings hierarchy that stores information on the group of readings handled as a collection.	sample_id	wells, edd_summary
	sites	Top-level table that stores location data, in the form of a multi-polygon, into which wells are grouped.	site_id	
	SpecialDataFeatures	Not used in web application.		
	user_layer_items	Not used in web application.		

Database	Table	Description	Primary Key	Affiliated Tables
Sierra Valley	user_layers	Not used in web application.		
	user_queries	Not used in web application.		
	userFavoriteWellLists	Users can create custom groups wells that are used in different aspects of the web application. This table contains the top-level information about those lists.	userFavoriteWellListId	users
	userFavoriteWells	Wells that are associated with a group list. Linking table between users and userFavoriteWellLists.	userFavoriteWellId	users, userFavoriteWellLists
	users	Log In credentials, settings and information for application users	user_id	
	water_levels	Groundwater level observations related to wells.	water_level_id	wells
	water_levels_hf	Not used in web application.		
	well_aquifers	Not used in web application.		
	well_types	Not used in web application.		
	WellFlows	Flow rate observations related to wells.	wellFlowId	wells
	WellLinks	URLs that are listed and associated with a well.	wellLinkId	wells
	WellProduction	Production data observations associated with wells.	wellProductionId	wells
	wells	Top level well information including location data stored as a point.	well_id	sites, wells
	WQPSs	Water Quality Protection Standard data associated with a well and used for concentration layer on map.	wqpsID	wells, analytes (shared db)

Appendix 2-2: Brief History of Ramelli Ranch Vicinity

Brief History of the Ramelli Ranch Vicinity
Sierra Valley, CA

Daniel Elliott, M.A.

February 8, 2021

TABLE OF CONTENTS

Brief History of the Ramelli Ranch Vicinity

The Northern Sierra Nevada Mountains contain the physical evidence of a rich and complex Native American history reaching back thousands of years. These landscapes are rooted deeply in tribal memory. The mountain valleys were central places from which long used trails radiated out following the ridgetops and the many water courses. The benches and terraces above the valleys were places where large encampments were established and maintained season after season. Sierra Valley presented an expansive base for settlement and held an array of valuable resources. The low elevation pass at the northeast end was a gateway for Great Basin populations to enter the mountains while the northwest arm of Sierra Valley and the outlet of the Middle Fork of the Feather River (Middle Fork) provided a natural pathway east from Northern Sierra Nevada.

Archaeological sites in this same vicinity show evidence of human occupation from as early as 5,500 years ago (Waechter and Andolina 2004). As climate and ecosystems fluctuated from warmer and wetter to colder and drier conditions, Sierra Valley was continuously used for seasonal forays and settlement. Artifacts and cooking features present at multiple ancient campsites documented in the area suggests a strong emphasis on the processing and export of bulbs, roots and seeds. Hunting of the abundant waterfowl within the marsh-like lowlands, and rabbits and deer on the drier valley bottom and surrounding hills was also very important.

The Washoe to the east and the Mountain Maidu (or Northeastern Maidu) to the north and west met within Sierra Valley for uncounted generations (D'Azevedo 1986:467, 471; Riddell 1978:370-386). These tribes had different cultural backgrounds and very different languages. The pre-contact Washoe were a Great Basin tribe. Sierra Valley was at the northeastern edge of a large traditional territory that encompassed much of today's Western Nevada. They gathered a variety of roots, bulbs and grasses from the valley but there was reportedly a particularly prized grass found here that they called *múćim* which was also the name they applied to the valley itself (ibid:474). The Washoe obtained resources through trade or access into Mountain Maidu territory (e.g., acorns and salmon).

The pre-contact Mountain Maidu were adept at life in the Northern Sierra Nevada Mountains (Riddell 1978:370-386). Central to them was the upper reaches of the Middle Fork and the North Fork of the Feather River including the fall salmon runs. A strong Mountain Maidu presence in Northwestern Sierra Valley is evident in the archaeological resources recorded in this vicinity. The Mountain Maidu also benefited in trade coming from the east obtaining resources not readily available in their traditional territory (e.g., obsidian).

All of this was massively disrupted in the middle of the nineteenth century with Euro-American contact. While there are no known accounts confirming entry into Sierra Valley, early trappers were reportedly working along the Truckee River in the early 1830s (D'Azevedo 1986:493). The pioneer ranches that began to be developed in the mid-1850s spelled the end of traditional lifeways of the Mountain Maidu and the Washoe within Sierra Valley. By the 1860s, large portions of the valley bottom were being drained and put under cultivation. Yet at least some of the mountain camps were still used by surviving families and groups. As late as November 1867 the *Mountain Messenger* noted that the tribes had once again engaged in their annual practice of fall burning in the hills surrounding Sierra Valley (2 November 1867 in Sinnott 1982:70). Burning was routinely undertaken season after season but this period certainly marked the end of the annual cycle. The remaining Native American population could no longer gain access to manage the ecosystem at a landscape level.

In 1850 James P. “Jim” Beckwourth entered Sierra Valley and recognized the advantage of the low elevation pass at the northeast end (Wilson 1972; **Figure 1 and 2**). He blazed a trail beginning at what is today Sparks, Nevada crossing the pass then continuing along the north end of Sierra Valley then through Grizzly Valley and American Valley to finally reach the settlement of Bidwell’s Bar; now below the waters of Oroville Reservoir. Between 1851 and 1854 some 1,200 emigrants used the trail leading 12,000 head of cattle, 700 sheep, and 500 horses into Northern California (Young 2003:59). While most emigrants continued on, being eager to realize the promise of gold, a hardy few remained behind to establish the first ranches and homesteads in Sierra Valley.

Figure 1. James P. Beckwourth.

Figure 2. Beckwourth Pass looking east ca. 1910. The railroad at left is the SierraValleys RR discussed below. (Both photos - Plumas County Museum)

Of African-American descent, Jim Beckwourth was a trapper, scout, trader, explorer and all around entrepreneur. He was also, by all accounts, a gifted story teller. He personally led the first emigrant wagon trains over the pass and along his new trail in August of 1851 (Wilson 1972:135). Beckwourth established a trading post at the northwestern end of Sierra Valley where his cabin would be the first constructed house emigrants would see since the Utah territory. Here, at what he named the War Horse Ranch, he would meet the weary emigrants and here they would pause before the final leg of their long westward journey (**Figure 3**). He reportedly lost his first two cabins in rapid succession due to conflicts with the local Native Americans but reconstructed a new one each time (Fariss and Smith 1971 [1882]:260).

Figure 3.

Log cabin associated with Beckwourth's Ranch labeledhere as the "Old Beckwourth Hotel at Willow Glen, Plumas County 1849-1910." There has been some professional debate regarding the historical validity ofthis log cabin as truly being associated with Jim Beckwourth (it certainly was not present in 1849). The cabin survives today and is used as the Beckwourth Museum along Rocky Point Road. (Plumas County Museum).

It is reported that something of a colony grew up at the ranch with "…fields of fine vegetables, a herd of about two hundred sheep, a hundred ponies and immense flocks of domestic fowls." (Wilson 1972:158-159). Beckwourth remained for several years journeying about the countryside on various errands while maintaining his trading post but he did not realize the profits he anticipated. His insatiable wanderlust along with conflicts with the growing number of ranchers in the area led to his departure from Sierra Valley. At what point he actually gave up his place is unclear but by the end of 1858 he had left California for good (1972:160).

By the mid-1860s, several ranches were well established along the northwestern end of Sierra Valley including the Abraham Ede Ranch by ca. 1860, the George Mapes Ranch in 1863, and Peter Parish who was present by early 1860s in the area that would later include the town of Beckwith/Beckwourth (Fariss and Smith 1971 [1882]). By 1867 Beckwourth's old ranch was owned by Alexander Kerby (sometimes recorded as the common spelling of Kirby) (Elliott and Kliejunas 2006:5). His two-story ranch house on the hill overlooking the Middle Fork was reportedly constructed in the 1860s (**Figure 4**; Plumas County Historical Society [PCHS] 1985:57). In 1870 John Ross established a ranch in a narrow arm of the valley southeast of the Kerby Ranch that still retains the name Ross Meadow (Elliott 2004). By 1872 the small valley just north of Kerby's, the Grizzly Creek arm, was under the ownership of David T. Jones (Lawson 2021). The lower end of Jones' land holdings along the creek became known locally as Willow Glen.

In the early years Sierra Valley ranchers provided hay, butter, and beef to the mining communities in Sierra County including Downieville (Sinnott 1982). Products, including large quantities of hay, were delivered over high country trails by mule trains. In the 1860s the Nevada Comstock was on the rise and demand for all types of consumer products was very high. Dairy products brought a high return if they could reach the Nevada markets. Sierra Valley ranchers and farmers responded and profited accordingly. Also beginning in the mid-1860s, the higher elevation meadows and valleys (e.g. Red Clover Valley) began to be used for dairy, hay production, and summer range.

Figure 4.

Alex Kerby's house located directly along the Quincy-Reno Wagon Road on the old Beckwourth Ranch. Thishouse survives today and can be seen from Highway 70 near the Lester T. Davis Rest Area.

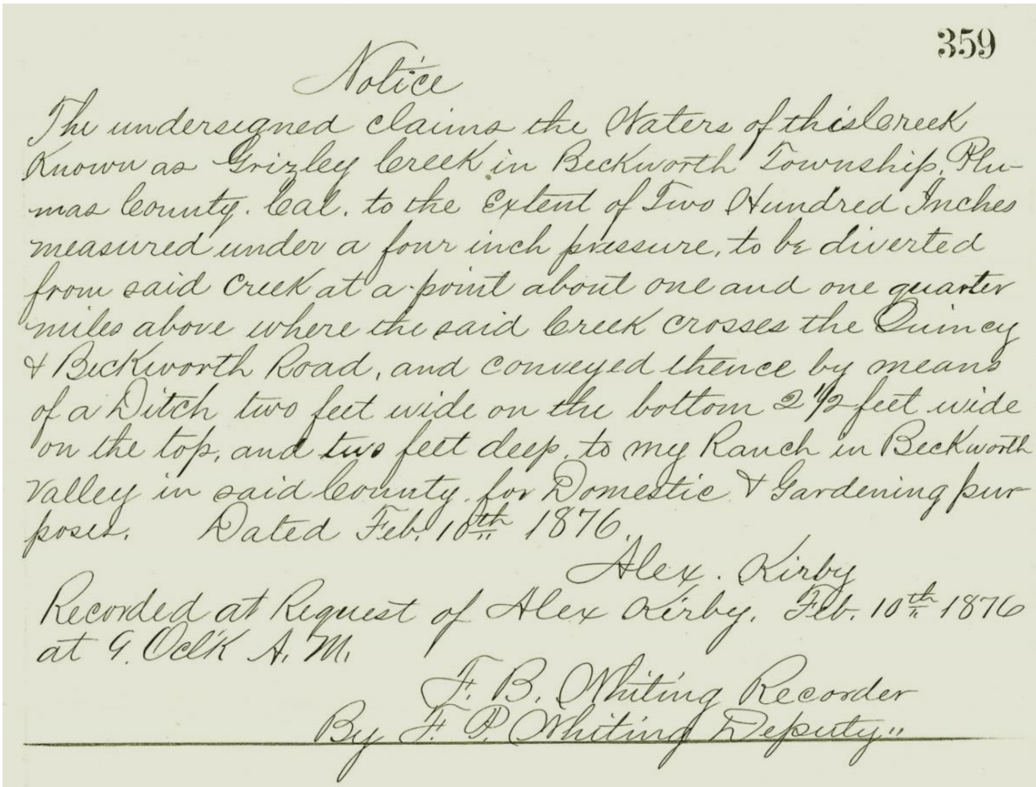
The cabin to the right is the same log cabin (Figure 3) that now serves as the BeckwourthMuseum; moved from its location on the old ranch to itspresent location along Rocky Point Road in 1985. (Plumas County Museum).

The trail along the north end of the Sierra Valley had been upgraded to a wagon road by the early 1860s; a critical outlet for Sierra Valley exports from the northern end of the valley. This road was the link between Plumas County and Reno, and to the Central Pacific Railroad once it was completed in 1869. It passed right through the Kerby Ranch.

During the first two decades of settlement in the northwestern end of the valley, the Beckwourth/Kerby Ranch continued to be a stopping point on the main road. The Beckwourth Cemetery (more recently known as Whispering Pines Cemetery) was in use just north of the ranch at least as early as March of 1862 (USGenWeb Archives 2020). In the late 1860s the town of Beckwourth began to develop a little over two miles east of the ranch where the Red Clover Road intersected with the Quincy-Reno Road.

The Red Clover Road (today's Beckwourth-Genesee Road) was completed in 1870 all the way through to Indian Valley. It became an important, albeit seasonal, freighting route allowing for even more distant agricultural exports to reach markets in Nevada (Fariss and Smith 1971 [1882]:237). It was, however, used year-round as a stage route (using sleighs when necessary) and mail delivery until 1910. In 1865, William Bringham constructed a hotel at this location (ibid:260, 262; PCHS 1968:16-17). On August 24, 1870 a post office was established here (Salley 1976). The Plumas County Map for 1874 shows the new town in its present location and names it "Beckwourth" but the name, for decades to come, was "Beckwith" due to an error in the submission of the name to the U.S. Post Office Department (**Appendix 1, Map 3**). This was not changed until 1932 (ibid). Beckwourth/Beckwith grew modestly over the next several decades reaching its zenith in the late 1800s and early 1900s (**Appendix 2**).

As early as 1868 Alex Kerby was being taxed for 160 acres along with "furnishings, wagons, a reaper, hogs, 13 head of cattle, [and] four horses" (Elliott and Kliejunas 2006:7). Most or all of the cattle listed were very likely dairy cattle. On February 10, 1876, Kerby recorded a water claim on Grizzly Creek for "Domestic and Gardening purposes" (**Figure 5**). He was named in this official documentation as Alex Kirby (not Kerby). This historic water conveyance has been in use ever since this time to irrigate the fields below the ranch. By the mid-1880s, he had expanded his land holdings to 560 acres. Alex Kerby had a large family and was very well regarded in Eastern Plumas County. His ranch remained one of the most substantial in the area throughout the remainder of the nineteenth century.


359

Notice

The undersigned claims the Waters of this Creek Known as Grizley Creek in Beckworth Township, Plumas County. Cal. to the extent of Two Hundred Inches measured under a four inch pressure, to be diverted from said Creek at a point about one and one quarter miles above where the said Creek crosses the Quincy & Beckworth Road, and conveyed thence by means of a Ditch two feet wide on the bottom 2½ feet wide on the top, and two feet deep, to my Ranch in Beckworth Valley in said County. for Domestic & Gardening purposes. Dated Feb. 10th 1876.

Alex. Kirby

Recorded at Request of Alex Kirby. Feb. 10th 1876 at 9. Oclk A. M.

F. B. Whiting Recorder
By F. P. Whiting Deputy

Figure 5. Alex Kirby's (Kerby) Grizzly Creek Water Claim as recorded by Plumas County on February10, 1876.

The Sierra Valley and Mohawk Railroad was established in 1885 (Myrick 2007:116-137). This financially troubled narrow gauge railroad was the first to enter Plumas County. It began from a junction point off the Nevada, California, and Oregon Railway a few miles southwest of today's Hallelujah Junction. It climbed over Beckwourth Pass (where the old grade can still easily be seen south and above Highway 70) and continued westward along the northern margin of Sierra Valley. Here construction stalled east of Beckwith in August of 1887. Construction did not resume until 1894 when the line was sold and became the Sierra Valleys Railroad (SVRR). Following this the rails were quickly laid as far as Beckwith in June of 1895. It was pushed further west along the Middle Fork past Portola (not yet present) to a new settlement established by the railroad itself named Clairville. It reached Clio in 1903 and finally a short extension reached the Davies Sawmill (today's Graeagle) in 1916 before it ceased operations.

The SVRR right of way passed through Kerby's landholdings just south of the ranch house and barns where it had been graded but no rails laid when Alex passed away on December 1, 1888 (Elliott and Kliejunas 2006:9-10; **Appendix 1 – Map 4**). It was not until December of 1895 before the estate was settled. The Kerby family appears to have already left Plumas County prior to 1900 as none of them were captured on the U.S. Census that year. The ranch was finally sold in 1904. Personal property recorded at this time included 2 work horses, 6 mares, 1 saddle horse, 27 dairy cows, [uncounted] chickens, 6 hogs, a mowing machine and rake, 2 wagons, 1 cart, 2 sets of harness, dairy furnishings, 1 plow, 1 harrow and 100 tons of hay, along with 560 acres including the main house, barns and numerous outbuildings (Plumas County Book of Deeds – V.30, P.423, 30 March 1903).

Before his passing in 1888, Alex Kerby appears to have had some initial involvement in the establishment of a new sawmill along the SVRR within the narrow canyon west of the ranch. It was present prior to 1892 and prior to the completion of the railroad here in 1895. The mill was called the Kerby (Kerby) Band Mill early on (Myrick 2007:117). It was one of the very first in the area to use a band saw instead of circular saws; a significant technological advancement at the time. Kerby's involvement, however, was likely limited to his landholdings and the granting of right-of-ways for the new railroad (**Figure 6**). The completion of the SVRR through Eastern Plumas County was indeed a catalyst for the expansion of the lumber industry here. New sawmills were constructed and established operations found new opportunities for expansion (**Figure 7**).

Considerable Italian-Swiss immigration into Sierra Valley had been well underway by the 1880s (Hall and Hall 1973). Many of the old pioneer ranches ultimately passed to Italian-Swiss families who made a name for themselves in the region – particularly in the dairy industry. One of many instances of this was the sale of the Kerby Ranch to Alfonso Ramelli on November 3, 1904 (Elliott and Kliejunas 2006:10). Interestingly, there was more than one Ramelli family in Sierra Valley who appear to have been somewhat disassociated with one another for reasons lost to history. Alfonso and his brother David had been active in the Beckwith area prior to the purchase of the Kerby Ranch. David Ramelli was active in the vicinity at least by 1896 (Lawson 2021). Alfonso Ramelli purchased the old Ross Ranch land holdings in 1902; a total of 480 acres (John Ross had passed away in 1899) (Elliott 2004:12-14). Thus, the Ross acreage was already under Alfonso's ownership when he purchased the Kerby Ranch two years later. From this point on, the old Kerby Ranch and acreage in Ross Meadow combined to become the Ramelli Ranch.

A second railroad found its way into northwestern Sierra Valley at the turn of the century. This was the Boca and Loyalton Railroad (B&LRR), a standard gauge system that had been completed as far as burgeoning lumber center of Loyalton by July of 1901 (Myrick 2007:139-149). From here it extended northwest through the center of Sierra Valley to reach Beckwith by November 1901. This obviously provided significant competition for the SVRR. The B&LRR, while being a common carrier short line like the SVRR, directly served the expanding timber industry in the area. The Horton Brothers in Red Clover Valley and the Reno Mill and Lumber Company (now operating the old Kerby Band Mill) relocated their milling operations to Loyalton now that logs could be economically moved by rail. The new line was extended through the narrow rocky canyon west of the Ramelli Ranch by 1905 into the area where Portola would soon be established. The rails were laid on the opposite bank (south) of the Middle Fork from the SVRR so that, from Beckwith to the future site of Portola, there were now two parallel railroads in operation.

When the Western Pacific Railroad (WPRR) was constructed through this same area soon afterward (1906-1909), they purchased the B&LRR grade on the south side of the canyon and incorporated this segment into the new transcontinental line. The WPRR was completed in late 1909. Under current ownership of the Union Pacific Railroad, it remains in constant use to this day. Yet, for a short time in the 1910s, there were actually <u>three</u> operating railroads within the northwestern arm of Sierra Valley between Beckwith and the Ramelli Ranch area – an exceedingly rare instance (**Appendix 1, Map 5**).

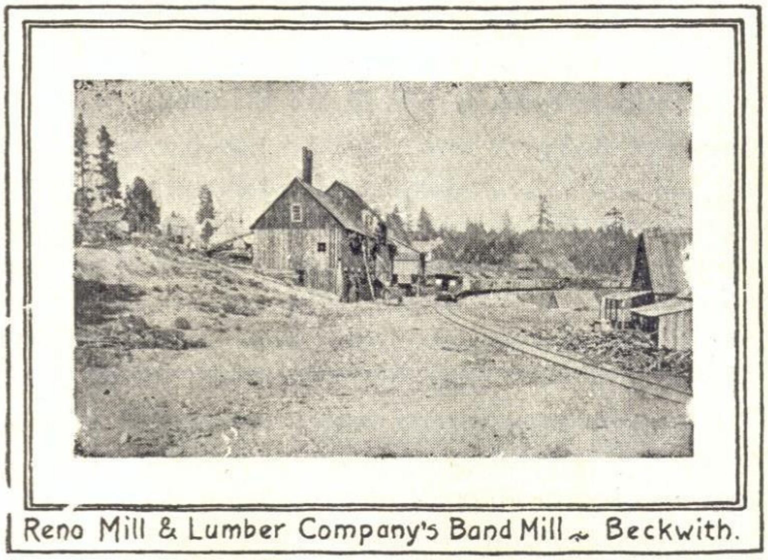
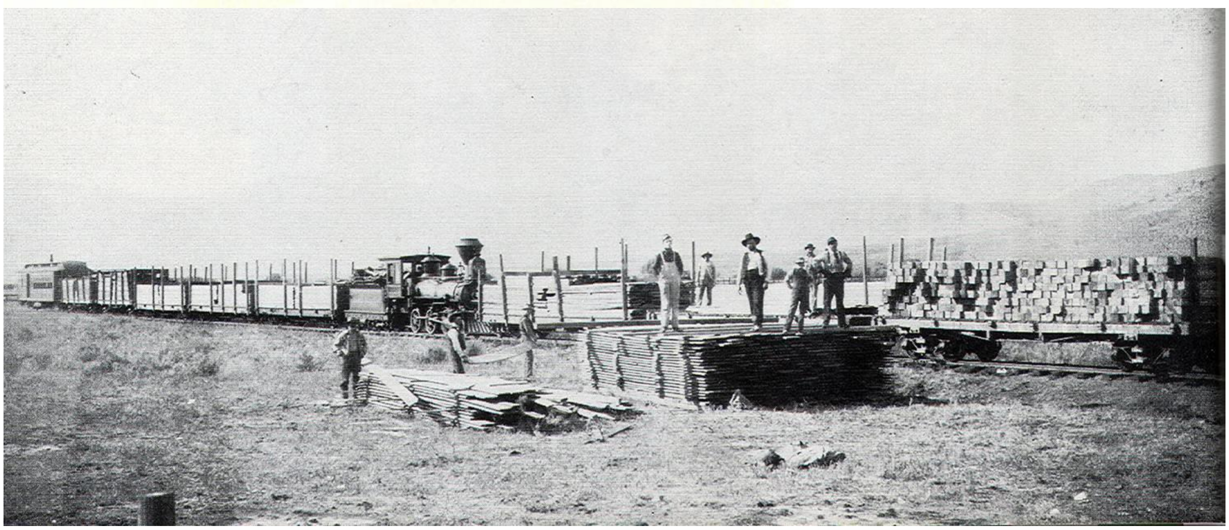


Figure 6 (left). The Reno Mill and Lumber Co. Band Mill (aka Kerby Band Mill) shown here ca. 1900. The railroadis the SVRR which was later overlain byState Highway 24 and is today's Rocky Point Road.

Figure 7 (below). Loading lumber and ties onto a SVRR train near Beckwith around 1900. This lumber likely came from the Red Clover Valley area wherethe Horton Brothers had operated a sawmill since the mid-1890s. (both photos - Plumas County



Sometime shortly following the completion of the B&LRR through the canyon in 1905, a railroad spur was constructed north over Alfonso Ramelli's property that extended up Grizzly Creek for a little under two miles. The spur appears to have initially been used to log the area along Grizzly Creek. Ramelli reportedly had a dispute with the placement of this spur and the B&LRR had to litigate which resulted in a payout of $2,500 to the landowner (Myrick 2007:142).

In 1912 the Grizzly Creek Ice Company was established by local businessman Charles Gulling (Boardman 1990). Gulling had also been the manager and an investor in the Reno Mill and Lumber Company's Band Mill before it was relocated to Loyalton in 1903 (Myrick 2007:124). A concrete dam was constructed on Grizzly Creek that created a ca. 14-acre reservoir used to cut the ice in the winters for cold storage railroad box cars. Ice was also harvested directly from the Middle Fork of the Feather River in Portola near today's Gulling Bridge. The Grizzly Creek rail spur was used for several decades to move ice down to the Western Pacific Railroad for use in their cars. When the reservoir was first developed, Ramelli's ditch needed to be re-routed and Alfonso was deeded the right of way needed by the new company (Elliott and Kliejunas 2006:11).

The SVRR was finally bought out by the WPRR in 1918 and was quickly taken up (Myrick 2007:126). Two years prior they had purchased the B&LRR (ibid:144). The track leading from the Beckwith/Beckwourth area back to Loyalton was retained and used by the Clover Valley Lumber Company as part of their logging railroad mainline through 1957. The WPRR maintained it until it ceased being used at all after 2001 (Truckee-Donner Historical Society 2021). A short section of the old B&LRR mainline that reached the Grizzly Creek spur serving the ice harvesting operation was retained until the spur was finally abandoned and taken up sometime prior to 1940 (**Appendix 3**).

The Grizzly Creek Ice Company was purchased by the Clover Valley Lumber Company in 1917 who continued to run it for many years. Ice harvests were dependent on the severity of the winter with multiple “crops” being typical but there was at least one year (1934) that was so warm that no ice was cut at all (Boardman 1990). A camp for the seasonal laborers was present at the site as well as a large ice barn. Ice harvests were discontinued in 1941 as refrigeration technology matured. The site was purchased by John and Dorothy Walton in 1943 who converted it into a recreational camp. It remains active to this day as Walton’s Grizzly Lodge.

The area directly to the west and north of the Ramelli Ranch along Grizzly Creek continued to be known locally as Willow Glen. Here picnics and meetings were often held between the residents of the Portola area and the population of Beckwith and the surrounding ranches. In 1905, when construction of the WPRR was just beginning, David Jones established a hotel on his property; presumably on or close to the old main road (Lawson 2021). He moved some of the buildings left behind by the Reno Mill and Lumber Company to his hotel site. Mr. Jones was unable to procure a license from the County to sell liquor; an application that was officially protested by the WPRR. This undoubtedly cut into potential profits from the many nearby workers building the new railroad at the time. His hotel was short-lived as he passed away in 1909 and it does not appear to have continued operation after this.

The Ramelli Ranch operations were continuous throughout the first half of the twentieth century (**Figure 8**). Alfonso relinquished the ranch to his son Guido in 1919 (Hall and Hall 1973:38). Dairy operations at the ranch finally ceased in the 1950s (Sweeney 1995:13). Guido Ramelli managed the ranch until his death in 1955. Mrs. Guido Ramelli resided here through the 1970s while the ranch continued to be operated for haying and beef cattle. Highway 70 (as newly designated in 1964) had been realigned to its present location by the early 1970s cutting between the old ranch and the cemetery. The old highway following the Middle Fork through the canyon became Rocky Point Road. As noted above, the log cabin attributed to James Beckwourth was moved off the old ranch property in 1985 and is now serves as the Beckwourth Museum. Ownership of the ranch remained with the Ramelli family up until 1978 when it was sold to the Ramelli Investment Group (Sweeney 1995:13). In September of 1980, 1,723 acres of agricultural land to the south and east of the old ranch was purchased by the USDA Forest Service. The old house and barns remain in private ownership. In December of 1980, the water rights and a 10-foot wide easement from the old Grizzly Ice Dam extending to the outlet just above the Middle Fork were also deeded to the Forest Service which has been continually maintained and used.

Figure 8. The Ramelli family stands on the front porch of their home in the early 1900s.The old wagon Quincy-Reno Road continued to pass right past the front door well into the automotive age of the early 1900s but, by the 1930s,the highway had been re- routed to the south. This photo was taken from the road looking back to the northwest. Compare with Figure 4. (Plumas County Museum).

References

Boardman, Pauline

1990 History of Ice Harvest and the Grizzly Creek ice Company. Plumas Memories, Plumas County Historical Society No. 55, June 1990. Plumas County Museum, Quincy, CA.

Cafferata, Patty

2005 Mapes Hotel and Casino: The History of Reno's Landmark Hotel. Eastern Slope Publishers: Reno, NV.

D'Azevedo, Warren L.

1986 Washoe. In *Handbook of North American Indians, Vol. 11*, *Great Basin*: 466-498. Warren L. D'Azevedo, vol. ed., Washington, D.C.: Smithsonian Institution.

Elliott, Daniel

2004 Assessment of Effects and National Register of Historic Places Determination of Eligibility for FS 05-11-51-1007 [Ross Ranch Site]. HRM Report No. 01-44-04. Plumas National Forest. Report on file at the Beckwourth Ranger District, Blairsden, CA.

Elliott, Daniel and Mary Kliejunas

2006 Heritage Resources Inventory and Determination of Effect for the Ramelli Ditch Reconstruction Project. Report No. 01-08-06, Beckwourth Ranger District, Plumas National Forest. On file at the Beckwourth Ranger District, Blairsden, CA.

Fariss and Smith

1971 *History of Plumas County, California – 1882*. Reproduction 1971, Howell-North Books: Burbank, CA.

Hall, Jacqueline, and JoEllen Hall

1973 *Italian-Swiss Settlement in Plumas County: 1860 – 1920*. Research Paper No. 1. Association for Northern California Records and Research, Chico, CA.

Lawson, Scott

2021 Unpublished notes pertaining to the History of Northwestern Sierra Valley. Used by permission from the author, February 2021.

Myrick, David

2007 *Railroads of Nevada and Eastern California, Volume. III: More on the Northern Roads*. University of Nevada Press, Reno, NV.

Plumas County Historical Society [PCHS]

1968 Bringham Family. In *Plumas Memories*. The Plumas County Historical Society, Quincy, CA, Vol. 20, pp. 16 - 18.

1985 Sierra Valley – Plumas and Sierra Counties – 1882: Beckwith. In *Plumas Memories*. The Plumas County Historical Society, Quincy, CA, Vol. 50, pp. 56-57.

Plumas County Recorder's Office

1903 Book of Deeds, Vol. 30, Pg. 423, 30 March 1903. Plumas County Courthouse, Quincy, CA.

Riddell, F.A.

1978 Maidu and Koncow. In *Handbook of North American Indians, Vol. 8: California*. R.F. Heizer, Vol. Editor. pp. 370-386. Smithsonian Institution, Washington D.C.

Sinnott, James J.

1982 History of Sierra County: *Volume IV – Sierra Valley, Jewel of the Sierras*. Mid-Cal Publishers: Fresno, CA.

Salley, Harold E.

1976 History of California Post Offices – 1849-1976. Postal History Associates, Inc., La Mesa, CA.

Sweeney, F.

1995 Archaeological reconnaissance for the Ramelli Ranch Grazing Allotment, Report No. 05-11-01 (FY95). Report on file at the Beckwourth Ranger District, Plumas National Forest, Blairsden, CA.

Truckee-Donner Historical Society

2021 Tracking the Railroad from Boca to Loyalton. Electronic document at https://www.truckeehistory.org/tracking-the-railroad-from-boca-to-loyalton.html Accessed February 2021.

USGenWeb Archive

2020 Beckwourth (Whispering Pines) Cemetery. Electronic document at http://files.usgwarchives.net/ca/plumas/cemeteries/beckwourth.txt Accessed December 2020.

Waechter, Sharon A. and Darren Andolina

2004 *Ecological and Prehistory in Sierra Valley, California: Excavations at CA-PLU-1485*. Far Western Anthropological Research Group, Inc., Davis. Submitted to Caltrans District 2, Redding.

Wilson, Elinor

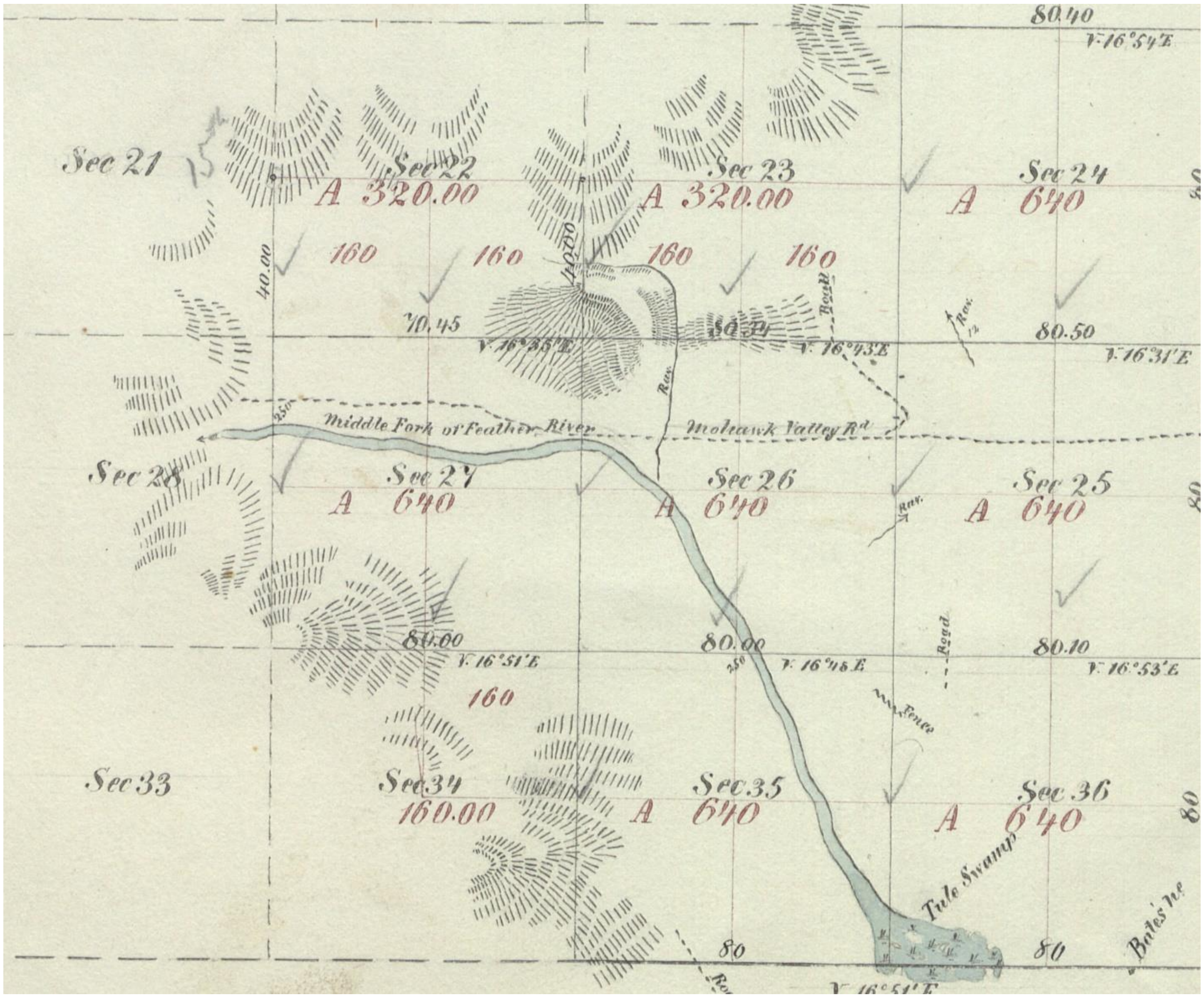
1972 *Jim Beckwourth: Black Mountain Man and War Chief of the Crows*. University of Oklahoma: Norman, OK.

Young, Jim

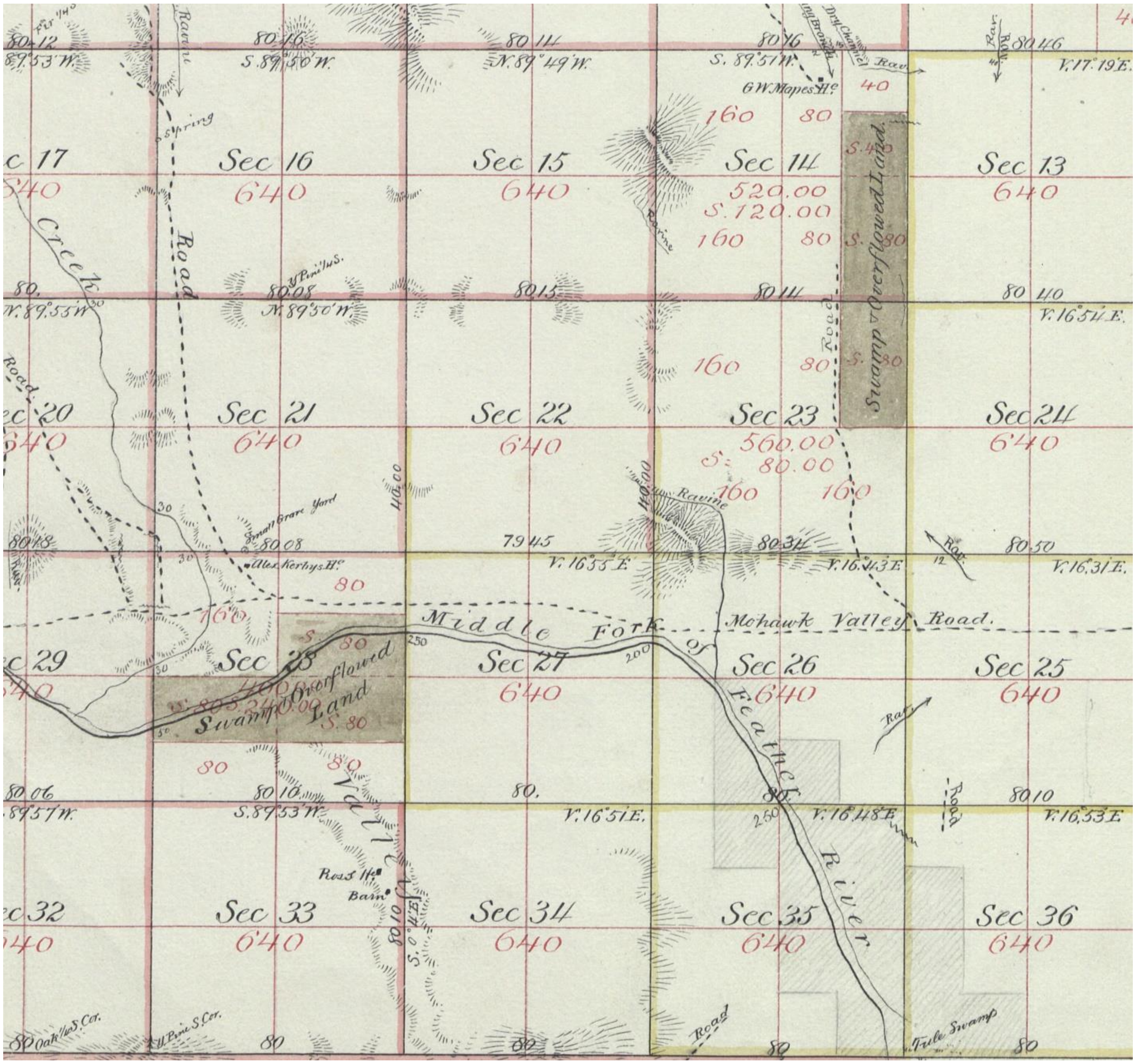
2003 Plumas County – History of the Feather River Region. Arcadia Publishing, San Francisco, CA.

Brief History of the Ramelli Ranch Vicinity – Elliott, 2021

Appendix 1 – Historic Maps showing the Ramelli Ranch Vicinity

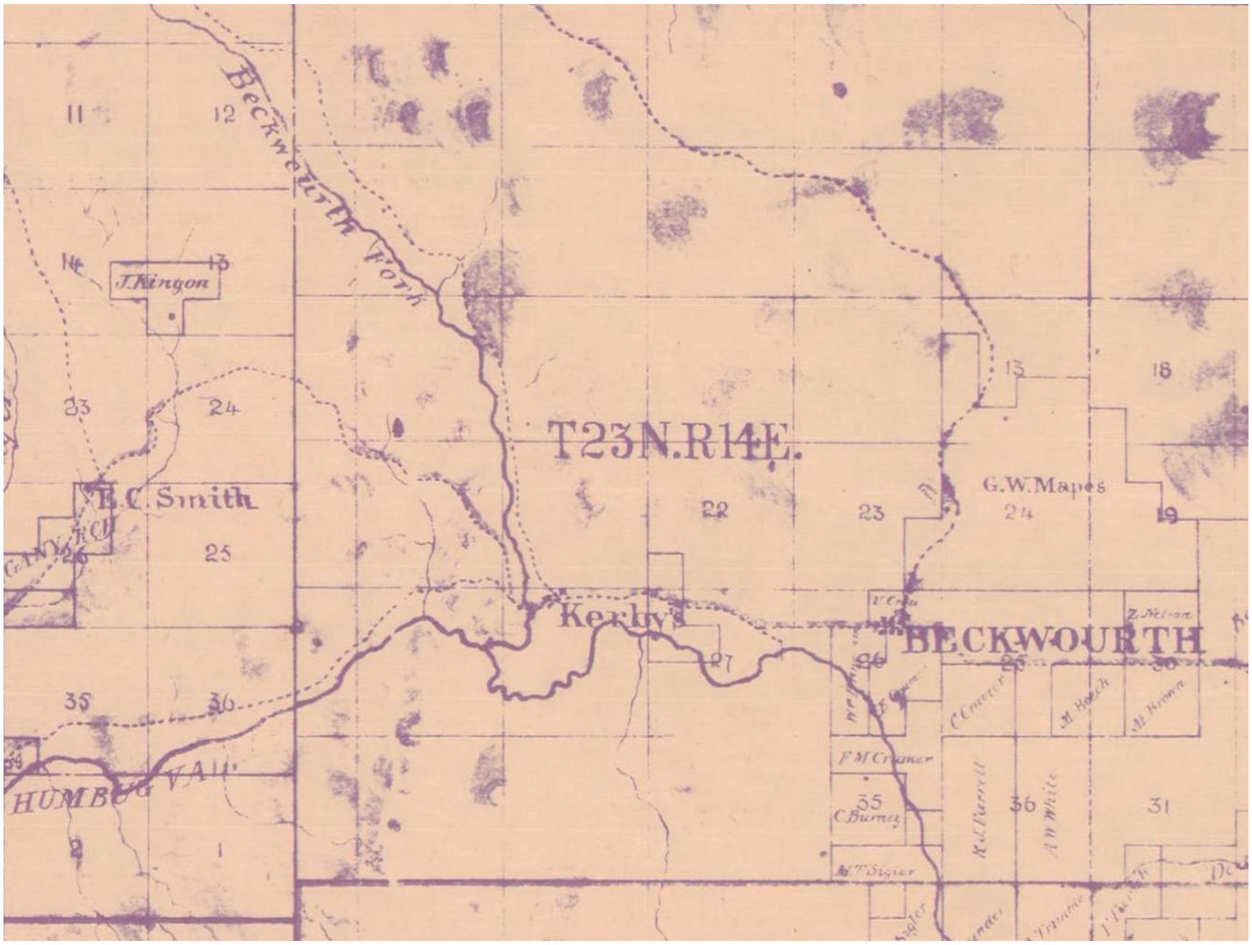


Map 1: A clip of the Government Land Office (GLO) plat 1864 for Township 23 North, Range 14 East. Only the Mohawk Valley Road, which was the route of the Quincy – Reno Wagon Road, is shown as an improvement in this early survey but the Beckwourth Ranch was present, of course, along with others in this location. The ownership of the ranch between Jim Beckwourth's departure in the mid to late 1850s, and Alex Kerby's arrival by 1866 is not clear in the historic record. The north trending Red Clover Road in the northeast ¼ of Section 26 is shown but it was not completed as a wagon road through to Indian Valley until 1870.

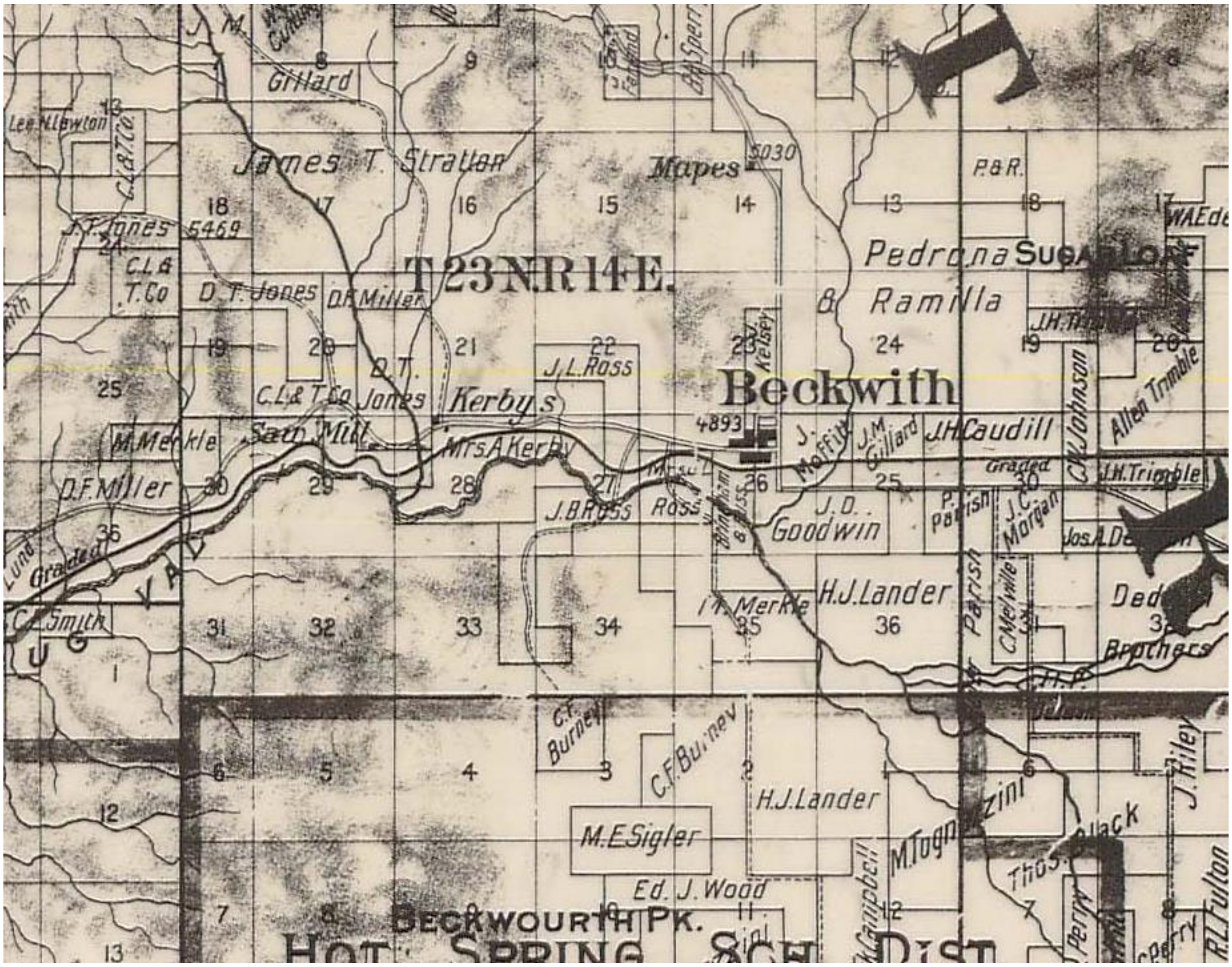


Map 2: A clip of the GLO Plat 1875 for Township 23 North, Range 14 East showing "Alex Kerbys Ho" and just to the north a "Small Grave Yard." The Mohawk Valley Road was the Quincy – Reno Road running straight east across the northern end of Sierra Valley. The town of Beckwourth is not yet shown (northeast ¼ of Section 26) although at least some settlement was present by this time. The north trending road that was the Red Clover Road through to Indian Valley is shown. The Mohawk Valley Road up to Kirby's Ranch then branching north through the west half of Section 21 is the route of the Beckwourth Emigrant Trail.

"Swamp and Overflowed Land" is defined as wetlands (e.g. marshlands) found unfit for cultivation without drainage or levees.

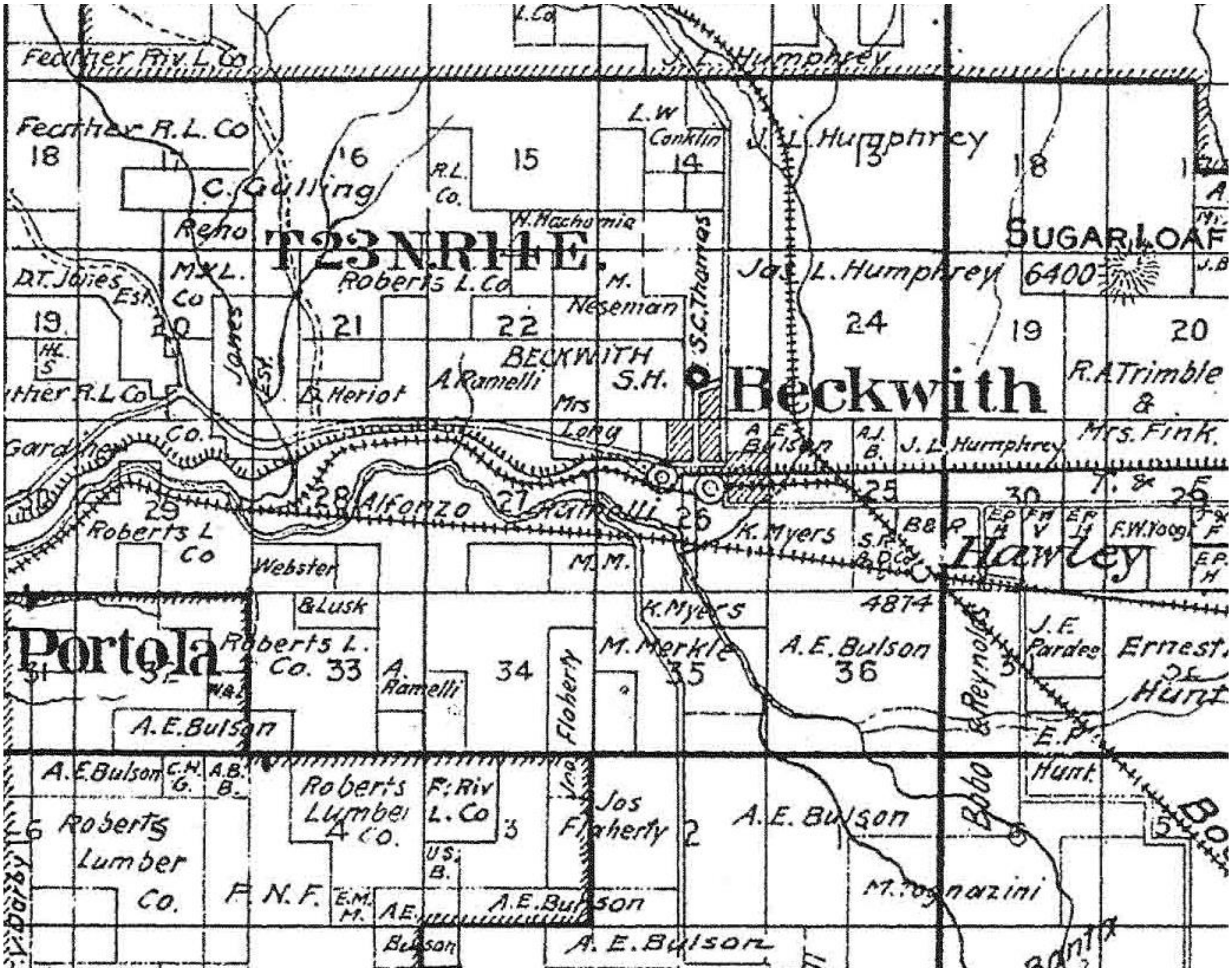


Map 3: Clip of the 1874 Map of Plumas County prominently showing “Kerby’s” and the newly established town of Beckwourth (Beckwith) and the early roads. Note all the land holdings in the area around the town where the pioneer ranches were already being subdivided into smaller parcels. Note also George Mapes land holdings to the north of Beckwourth. Mapes literally began a cattle empire from his Sierra Valley ranch but he had sold the ranch here and re-located to the Reno area in early 1880s (Cafferata 2005:59-68). Note that Grizzly Creek is named as “Beckwourth’s Fork” of the Middle Fork of the Feather River. The 1875 GLO plat of the same area, however, names it Grizzly Creek.



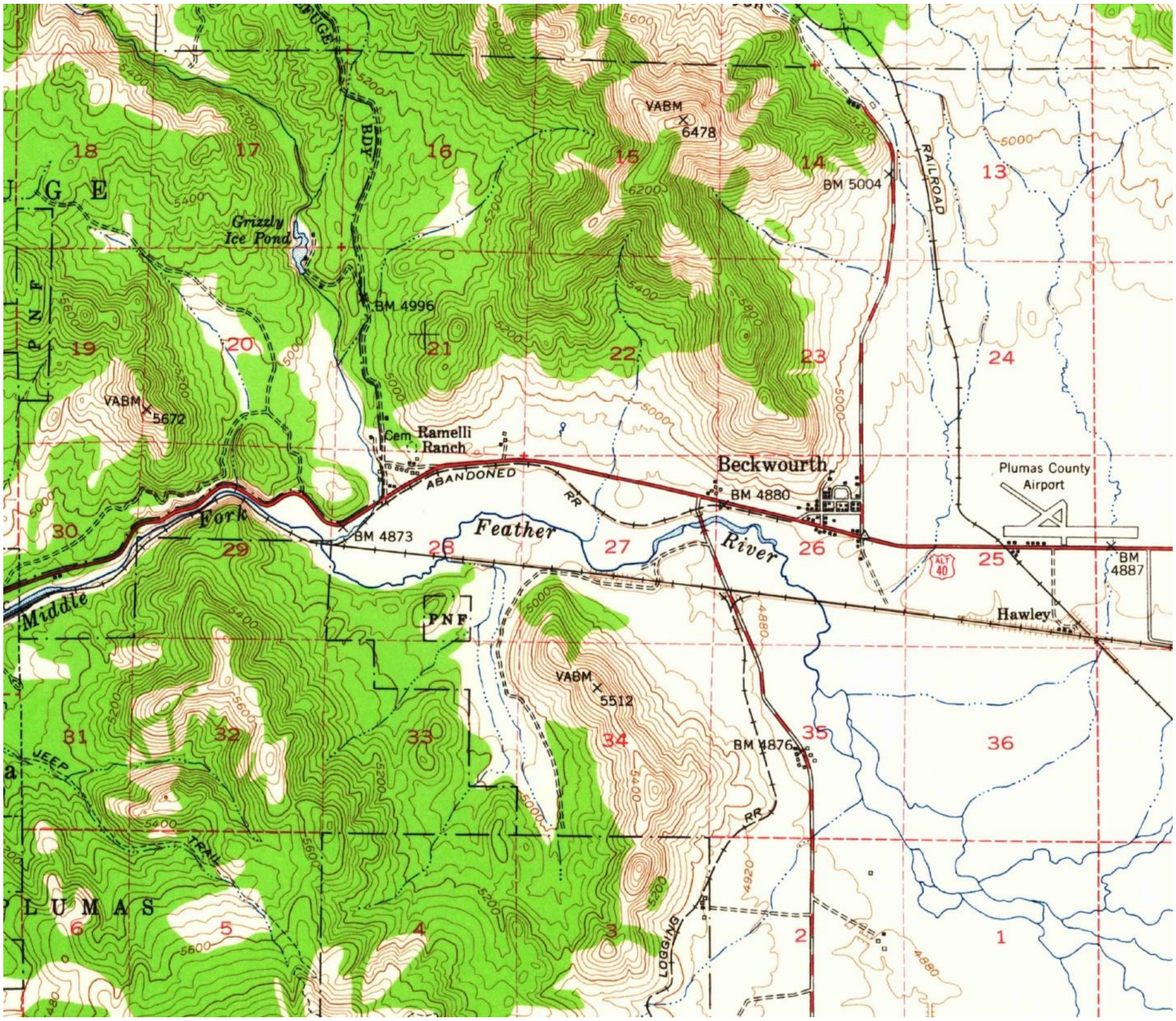
Map 4: Clip of the 1892 Map of Plumas County again shows “Kerby’s” prominently but the land is shown as under the ownership of Mrs. A. Kerby as Alex had passed away in December of 1888. Note also the landholdings of John Ross (J.B.) to the south that was purchased by Alfonso Ramelli in 1902. This purchase did include the land now owned by John’s son James Ross (J.L.) in Section 22.

The Sierra Valleys Railroad is shown extending through the Kerby landholdings but was only graded without rails which would not happen until 1895. The “Saw Mill” that was known early on as the Kerby Band Mill is present here by this time.



Map 5: Clip of the 1912 Map of Plumas County showing all three railroads in place between Beckwith/Beckwourth and Rocky Point: the Sierra Valleys Railway to the north, the Boca and Loyalton Railroad just below but also north of the river, and the brand new Western Pacific Railroad to the south bypassing Beckwourth. The Western Pacific had bought the right of way from the Boca and Loyalton through the narrow canyon leading to Portola. Note Alfonso Ramelli's extensive land holdings including the old Ross Ranch area to the south.

Three separate railroads passing through a rural valley, even for only a few short years, is almost unheard of historically. The Western Pacific rapidly bought out and did away with both of the older lines.



Map 6: Clip from the Portola 15' (1:62500) 1950 quadrangle showing the alignment of what was then State Highway 24 as it dipped south of the Ramelli Ranch and entered the canyon following today's Rocky Point Road. The current alignment of Highway 70 extends between the Ramelli Ranch and the cemetery then cuts through the hills north of the canyon.

A portion of the long abandoned Boca and Loyalton Railroad is still shown on the map but not the older Sierra Valleys grade that was mostly beneath the highway in this area. The old spur heading up to the Grizzly Ice Pond is also not shown. The railroad to the south of Beckwourth was the link to Calpine, a large lumbering concern at the southeast end of Sierra Valley. This grade had not been used for years when it was depicted here in 1950. The railroad grade north and east of Beckwourth, however, was still in use by the Clover Valley Lumber Co. It was discontinued and taken up in the 1956-1957 timeframe. The old ex-Boca and Loyalton/Clover Valley grade continuing south of Hawley was maintained as a link to Loyalton by the Western Pacific and still exists (2021) but is no longer used.

Brief History of the Ramelli Ranch Vicinity – Elliott, 2021

Appendix 2 – Panorama of the Town of Beckwith (Beckwourth) ca. 1915

A series of three photos from the hillside just north of town looking back to the east, south and southwest. The photos were taken ca. 1915 but show the town largely as it would have appeared in the 1890-1915 timeframe. The brick building in the center of the second photograph is the Mason's Hall constructed ca. 1909 that still stands today.

The third photo shows the meadow area west toward the old Ramelli Ranch.

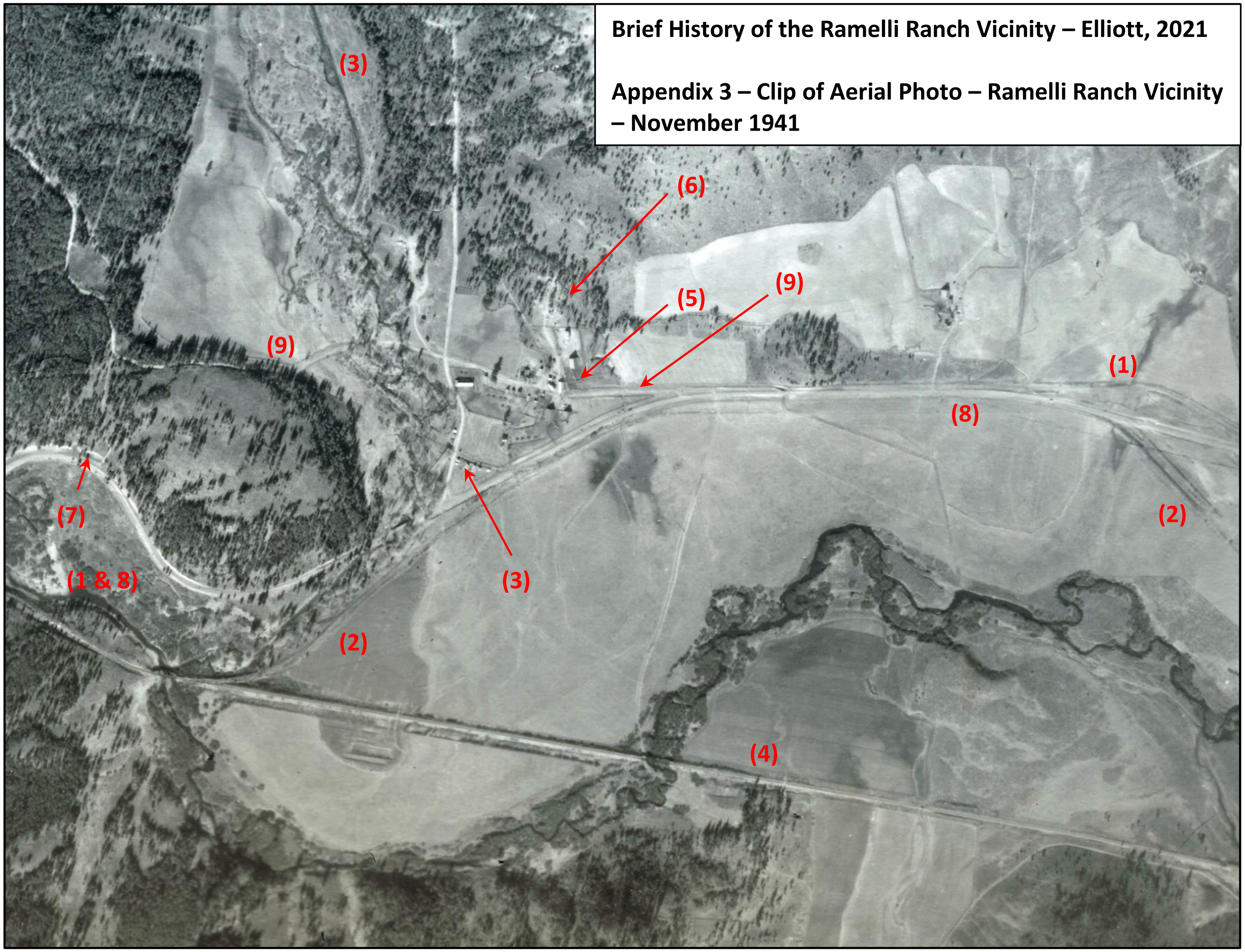
(Courtesy of the Plumas County Museum)


Beckwith - Sierra Valley - California


Thompson Studio

Brief History of the Ramelli Ranch Vicinity – Elliott, 2021

Appendix 3 – Clip of Aerial Photo – Ramelli Ranch Vicinity – November 1941



Aerial photograph CXW 21-160 taken on 5 November 1941 showing the Ramelli Ranch Vicinity. 1) Sierra Valleys RR bed, 2) Boca & Loyalton RR bed, 3) Grizzly Ice Pond Spur (already long abandoned), 4) Western Pacific RR (Union Pacific RR as of 1982), 5) Beckwourth/ Kerby/Ramelli Ranch, 6) Beckwourth Cemetery (aka Whispering Pines), 7) Kerby Band Mill/ Reno Mill & Lumber Co. Sawmill site, 8) State Route 24 (Hwy 70 as of 1964), 9) Reno-Quincy Wagon/Stage Road.

Brief History of the Ramelli Ranch Vicinity, Sierra Valley, CA
Extra Notes

Daniel Elliott, M.A.

February 8, 2021

The Beckwourth Trail extended through today's town of Beckwourth and continued west more or less along today's Hwy 70 then running though the old Kerby/Ramelli Ranch where Jim Beckwourth established his trading post-ranch in 1852. From there the trail turned north following the eastern bank of Grizzly Creek toward Grizzly Valley and beyond. Its greatest use as an emigrant trail was between 1851 through 1855. There is little or no sign of it in its historic form in the Ramelli Ranch area.

A 1975 published soil survey of Sierra Valley identifies the Beckwourth area as one of the prime sections of the valley in terms of crop yield – i.e. alfalfa-grains-hay (Sketchley 1975:64). Bounded by a comparatively close line of hills to the north and south and with a constrained outlet for the river, water retention is naturally high yet much of is still reasonably well drained. Little improvement would have been required for raising hay and providing excellent forage for cattle in the early days. Kerby's 1870s ditch diverting water from Grizzly Creek would have, of course, increased effectiveness significantly allowing, among other advantages, harvesting of multiple crops in a single season.

Sketchley, Harold R.

1975 Soil Survey of Sierra Valley Area, California, Parts of Sierra, Plumas, and Lassen Counties. USDA Soil Conservation Service and Forest Service. University of California Agricultural Experiment Station.

It is not clear when the moniker "Willow Glen" was first applied to the lower reaches of Grizzly Creek near the outlet with the Middle Fork (the area where the Beckwourth Museum cabin is now). No real community aside the Beckwourth/Kirby/Ramelli Ranch was ever present here. It appears to have been a pleasant meeting area in the spring through fall – a kind of meeting place between Portola residents and the Sierra Valley population – where picnics or other gatherings would often occur and is often mentioned in this regard by local newspapers in the early twentieth century. Jones' ca. 1905-1910 hotel here was very short lived.

There were Ramelli's in the Vinton area, there were also Ramelli's in the Loyalton area, then there were the Ramelli's of Beckwith/Beckwourth vicinity beginning with the brothers David and Alfonso. Nephew of the brothers immigrated to California late and wound up purchasing the Illinois Ranch east of Quincy in 1920. The Ramelli families in and around Sierra Valley described, as best it is known, in Hall and Hall's *Italian-Swiss Settlement in Plumas County: 1860 – 1920* (p. 41-43).

Historic Themes represented:

1) Native American settlement pattern, resource use and procurement, inter-tribal relations and trade
2) Early Euro-American westward exploration, emigration and settlement (esp. James P. Beckwourth)
3) Early ranching and dairy industry
4) Transportation – early roads
5) Transportation – railroads
6) Lumbering (in the vicinity)
7) Ice harvesting industry (nearby)

Appendix 2-3: Communications & Engagement Plan

SIERRA VALLEY SUBBASIN GROUNDWATER BASIN - APPENDIX 2-3 COMMUNICATIONS & ENGAGEMENT PLAN

Stakeholder Communications & Engagement Plan

Sustainable Groundwater Management Act (SGMA) Implementation
Initial Version: December 5, 2019
Revision One: December 30, 2020
Revision Two: December 13, 2021

TABLE OF CONTENTS

BACKGROUND

The purpose of the Sustainable Groundwater Management Act (SGMA), signed by Governor Brown in 2014, is to ensure local sustainable groundwater management in medium- and high-priority groundwater basins statewide. California's Department of Water Resources (DWR) has determined that the Sierra Valley Groundwater basin located in Plumas and Sierra counties is medium priority and subject to SGMA.

The initial version of this Communication and Engagement (C & E) Plan was released in December of 2019, with the first revision released in December 2020 to reflect the creation of the Technical Advisory Committee (TAC) – focusing on the tasks associated with developing a Groundwater Sustainability Plan (GSP) for the Sierra Valley subbasin. The TAC represented an array of stakeholder interests whose work was guided by the Roles and Responsibilities document provided as Appendix C. The roles and responsibilities were reviewed and refined by TAC members at the December 2020 and January 2021 TAC meetings.

Subsequent to the release of the first revision for the C & E plan, COVID-19 affected many of the outreach and engagement activities and opportunities identified in the plan. Jurisdictional public health guidelines and restrictions reduced the opportunities for in-person meetings. Outreach activities shifted to include greater use of hybrid meetings, an outdoor public workshop, online surveys and email.

This second revision to the C & E Plan includes a new section on outreach for implementation activities occurring after submission of the GSP to the Department of Water Resources (DWR) in January 2022.

SGMA Milestones:

OUTREACH & ENGAGEMENT FOR GSP IMPLEMENTATION

In December 2021, the work of the technical team transitioned from GSP development to implementation activities. This included an increased focus on funding and options for early Project and Management Actions (PMAs).

The following draft language, on Outreach & Engagement for GSP implementation, reflects the new phase in GSP activities and is informed by comments received on the GSP Public Review Draft. The proposed text for Revision Two of the C & E Plan, as well as the draft proposals for outreach and engagement, will be presented to the TAC for discussion and refinement during the February 2022 TAC meeting. The most recent version of the C & E Plan will be posted on the documents page of the Sierra Valley Groundwater Management District (SVGMD or District) website at https://www.sierravalleygmd.org/gsp-documents, under the heading of Sierra Valley documents.

The objectives for implementation outreach and engagement are as follows:

- Maintain and enhance stakeholder communications, discussions and input on GSP activities and discussions
- Support broader awareness and understanding of Sierra Valley groundwater conditions and trends as monitoring activities and modeling updates address data gaps
- Provide updates and developments relating to specific Sierra Valley groundwater priorities and PMAs as they are identified.

At the February 2022 TAC meeting, members will review, expand, and discuss implementation outreach activities, which may include options such as:

- Continuation of the TAC, with a review of meeting frequency and member composition
- Creation of working groups that are topic-specific (for example, domestic well conditions) or place-based (such as disadvantaged communities) to discuss and inform specific PMAs or address specific issues
- Expanded outreach to the broader community (for example: newsletters or updates distributed by related organizations or entities; presentations, workshops or information-sharing at local events and meetings; general-interest articles in local media)

DESIRED OUTCOMES & GOALS OF THE C & E PLAN

Plan Goals: SGMA requires Groundwater Sustainability Agencies (GSAs) to consider the interests of beneficial uses and users of groundwater and encourages involvement of diverse social, cultural, and economic elements of the population within the basin during Groundwater Sustainability Plan (GSP) preparation and implementation (Water Code Sections 10723.8(a) (4) and 10723.2).

The goals of the Stakeholder Communications & Engagement Plan (Plan) are to:

1. Inform stakeholders and enhance their understanding about water and groundwater resources in the Sierra Valley basin, the purpose and need for sustainable groundwater management, the benefits of sustainable groundwater management, and the need for a GSP.
2. Engage a diverse group of stakeholders throughout the GSP preparation and implementation process and promote informed feedback from stakeholders.
3. Employ a variety of outreach methods that encourage broad participation and make participation accessible.

4. Respond to stakeholder concerns and provide accurate and up-to-date information.
5. Manage communications and engagement in a manner that provides maximum value to stakeholders and constitutes an efficient use of the GSAs' resources.

Time Period: This Stakeholder Communications & Engagement Plan is intended to cover communications and engagement through January 2022, which is when the GSP is due to be submitted to DWR. Since this is a multi-year effort, this Plan may be amended, as needed.

Outcomes: The desired outcome of this Plan is to achieve adoption of the GSP with input from stakeholders in consideration of the economy, culture, and environment within the basin. In practical terms, the GSP regulations require a communications section of the GSP that must include the following:

- Explanation of the GSAs' decision-making process
- Identification of opportunities for public engagement and involvement
- Description of GSAs' encouragement of active involvement of diverse elements of the population within basin
- Method the GSAs shall follow to inform the public about GSP progress

This Plan forms the basis for the communications section of the GSP.

The timelines below illustrate the concurrent processes of stakeholder engagement and other SGMA activities in the basin:

2018	2019	2020	2021
•Developed inter-agency agreements •Began defining Basin Setting •STAKEHOLDER ENGAGEMENT	•Continue Basin Setting work •Describe existing Monitoring Protocols •STAKEHOLDER ENGAGEMENT	•Assessment of Monitoring Networks •Begin Data Management and Modeling formats •Begin Sustainable Management Criteria •STAKEHOLDER ENGAGEMENT	•Continue Sustainable Management Criteria •Define Projects and Management Actions •GSP document preparation and adoption •STAKEHOLDER ENGAGEMENT

GSP Planning Timeline and Stakeholder Communication at-a-Glance

COMMUNICATIONS AND ENGAGEMENT FOR GSP ELEMENTS

To engage the public in development of a GSP that is science-based, complex, technical, and includes achievable outcomes, the GSAs will strive to meet the following overall objectives:

- Educate the public, communicating what may often be complex concepts in a straightforward, comprehensible manner.

- Show how the input received has been incorporated into the plan or process, or explain if comments cannot be addressed in the plan or process.
- Remain focused on results and outcomes to develop a GSP that is effective and compliant with SGMA.

It is anticipated that the GSP will contain five chapters:

1. Introduction (background and administrative requirements)
2. Plan Area and Basin Setting (description of groundwater basin setting)
3. Sustainable Management Criteria (defining local sustainability)
4. Projects and Management Action (to achieve sustainability)
5. Plan Implementation (working the plan)

The process for developing the GSP will involve simultaneous efforts regarding technical and planning aspects.

Technical Considerations

The technical consulting team will lead efforts on:

A. Data collection and analysis
B. Development of hydrologic models
C. Evaluation and expansion of monitoring networks
D. Development of Sustainable Management Criteria (minimum thresholds, measurable objectives and interim milestones)
E. Identification of planning scenarios
F. Initial drafting of GSP text

Planning and Management Considerations

Working with the GSAs, planning partners and basin stakeholders, the technical consulting team will support:

A. Development of a sustainability goal and definition of significant and unreasonable undesirable results
B. Assessment and enhancement of existing monitoring networks and data management system
C. Identification and evaluation of proposed projects and management actions
D. Development of GSP implementation costs, detailed schedule, and annual reporting to DWR.

Each element of work will include outreach with the goal of educating and engaging stakeholders on the technical and policy aspects of the GSP elements. Outreach and engagement will include a mix of communication approaches and tools. Additional details on GSP planning processes and responsibilities are contained in Appendix C.

SGMA REQUIREMENTS FOR STAKEHOLDER OUTREACH & ENGAGEMENT

SGMA requires GSAs to consider the interests of all beneficial uses and users of groundwater as a part of GSP development and implementation. Further, as is stated in Water Code Section 10727.8, “The GSA shall encourage the active involvement of diverse social, cultural, and economic elements of the population within the groundwater basin prior to and during the development and implementation of the GSP.” In addition, the GSP Regulations require that GSAs document in a communications section of the GSP the opportunities for public engagement and active involvement of diverse social, cultural, and economic elements of the population within the basin.

The Plan also identifies a variety of communication methods (see page 12) that will be employed to address the distinct interests of each group and provides a schedule of activities (see Appendix A) that clearly outlines the timeline for Plan implementation.

RELEVANT PARTICIPANTS/POTENTIAL AUDIENCES IN THE SIERRA VALLEY BASIN

Participating GSAs and Interagency Coordination

There are two GSAs within the Sierra Valley Basin that are actively participating in GSP development:

- ✓ Sierra Valley Groundwater Management District (District)
- ✓ Plumas County

Most of the basin is within the jurisdiction of the District. However, there is a small section of the basin outside the jurisdiction of the District and within Plumas County. Consistent with Water Code Section 10727(b), the two GSAs intend to develop a single GSP covering the entire basin.

While the GSAs are not required by SGMA to enter into a formal coordination agreement, the Sierra Valley Basin GSAs have entered into a voluntary interagency agreement in the form of a Memorandum of Understanding (MOU) that specifies the GSAs’ intent to cooperatively implement SGMA.

The lands in the basin within Plumas County, but outside the jurisdiction of the District, are also within the management jurisdiction of the federal government, or more specifically, United States Forest Service (USFS) lands of the Plumas National Forest (PNF). This area within Plumas County and under the jurisdiction of the PNF is also significant to California Native Americans, including native people of the Washoe, Paiute, and Maidu Tribes, who have deep and enduring cultural connections to this area of the basin. Through stakeholder outreach and engagement, Plumas County may enter into agreements with California Native American Tribes and/or PNF, if warranted.

Interested Parties & Other Stakeholders

As required by SGMA, the GSAs must establish and maintain a list of interested parties and provide an explanation of how those interests will be considered when developing and implementing the GSP. Specifically, Water Code Section 10723.2 identifies the following parties that GSAs must consider, and these interests include, but are not limited to:

- Agricultural users of groundwater
- Domestic well owners
- Municipal well operators
- Public water systems
- Land use planning agencies
- Environmental uses of groundwater
- Surface water users
- The federal government
- California Native American Tribes
- Disadvantaged communities (including those served by private domestic wells or small community water systems).

Stakeholder Group Interests & Engagement Purpose

The following table identifies the categories of stakeholder interests and the corresponding groups that will be the focus of the GSAs' engagement efforts. The table also specifies the anticipated appropriate level of engagement for various stakeholder groups.

Table 1. Sierra Valley Stakeholder Group Interests & Objectives of Engagement

Category of Interest	Stakeholder Groups	Anticipated Level of Engagement
General Public • Citizens groups • Community leaders • Interested individuals • Universities/Academia	• Interested Individuals on Interested Parties List maintained by GSA (District) • Upper Feather River Watershed Group	Inform to improve public awareness of sustainable groundwater management
Land Use • Municipalities • Local land use agencies • Regional land use agencies • Community Service Districts	• City of Loyalton • Plumas County (Planning Department, Public Works, Environmental Health) • Sierra County (Planning & Building, Public Works, Environmental Health)	Consult and involve to ensure land use policies are supporting GSP, and there are no conflicting policies between the GSAs / GSP and local government agencies

 2021.12.13

Category of Interest	Stakeholder Groups	Anticipated Level of Engagement
Urban/ Commercial & Non-Commercial Agricultural Users • Water agencies • Irrigation districts • Municipal water companies • Mutual water companies • Resource conservation districts • Farmers/Farm Bureaus • Water Districts • Water-users associations • Irrigated Lands Regulatory Program Coalition	• Plumas-Sierra Farm Bureau • Plumas-Sierra Cattlemen's Association • Plumas-Sierra Cattlewomen's Association • Plumas-Sierra County Agricultural Commissioner • Plumas-Sierra University of California Cooperative Extension • Sierra Valley Grange #466 • Sierra Valley Resource Conservation District (RCD)	Inform and involve to ensure sustainable management of groundwater and consider viability of agricultural economy
Other Commercial Users • Commercial and industrial self-suppliers	• American Renewable Power	Inform and involve in assessing impacts to users
Environmental and Ecosystem Uses • Federal and State agencies • Wetland managers • Environmental groups	• Plumas Audubon Society • The Nature Conservancy • Feather River Trout Unlimited • Northern Sierra Partnership • Feather River Land Trust • California Department of Fish and Wildlife, relative to Antelope Valley, Smithneck Creek, and Crocker Meadows Wildlife Areas	Inform and involve to consider/incorporate potential ecosystem impacts to GSP process
Surface Water Users • Irrigation Districts • Water Districts • Water users' associations • Agricultural users	• Sierra Valley Mutual Water Company • Little Last Chance Creek Water District • Middle Fork Feather River Decree 3095	Inform and involve to collaborate to ensure sustainable water supplies
Economic Development • Chambers of commerce • Business groups/associations • Elected officials • State Assembly members • State Senators • Economic Development Team	• Sierra Institute for Community & Environment • Sierra County Board of Supervisors • Plumas County Board of Supervisors	Inform and involve to support a stable economy
Human Right to Water • Disadvantaged	• City of Loyalton • Sierra Brooks Water System	Inform and involve to provide safe and secure groundwater supplies to all residents and

Category of Interest	Stakeholder Groups	Anticipated Level of Engagement
communities • Small water systems • Environmental justice groups/community-based organizations • Domestic well owners	• Sierra County Water Works District #1 (Calpine) • Sierraville Public Utility District • Private well owners	communities reliant on groundwater
Tribes • Federally Recognized Tribes • Non-Federally Recognized Tribes	• Washoe, Paiute and Maidu Tribes • California Indian Water Commission	Inform, involve and consult with Tribal government
Federal Lands • U.S. Fish and Wildlife Service • U.S. Bureau of Reclamation • U.S. Army Corps of Engineers • U.S. Forest Service	• Plumas National Forest • Tahoe National Forest	Inform, involve and collaborate to ensure basin sustainability
Integrated Water Management • Regional water management groups (IRWM regions) • Flood agencies	• Upper Feather River Integrated Regional Water Management Group	Inform, involve and collaborate to improve regional sustainability

DEFINING ANTICIPATED LEVEL OF ENGAGEMENT

The International Association for Public Participation (www. iap2.org) provides the following definitions for the terms used in Table 1 relating to anticipated levels of engagement.

Inform: "To provide the public with balanced and objective information to assist them in understanding the problem, alternatives, opportunities, and/or solutions." (This will be achieved primarily through email correspondence, public workshops and other outreach activities throughout GSP development.)

Consult: "To obtain public feedback on analysis, alternatives, and/or decisions." (The GSAs will keep stakeholders informed, will listen to and acknowledge stakeholder concerns, and provide feedback on how stakeholder input has been addressed in the GSP. There will be opportunities for stakeholder comments at TAC meetings, public workshops, through surveys, and at GSA meetings.)

Involve: "To work directly with the public throughout the process to ensure that public concerns and aspirations are consistently understood and considered." (This will be achieved through TAC meetings, surveys, public workshops, GSA meetings, and targeted briefings, as warranted.

Collaborate: (Adapted definition) To partner and to seek advice and innovation in formulating solutions that can be incorporated into the GSP.

COMMUNICATION & ENGAGEMENT FORUMS

Formal Requirements

SGMA sets requirement for public hearings, public notices and documentation of how stakeholders may participate in the development and implementation of the GSP. Three requirements relating specifically to GSP development include:

- Prior to beginning to develop a GSP, GSAs must publicly release a written statement of how interested parties may participate in developing and implementing the GSP. The statement must be provided to Sierra and Plumas counties and any incorporated city in the basin. This Communication and Engagement Plan serves as the statement on opportunities for participation in the GSP process.
- Prior to adopting or amending a GSP, GSAs must conduct a public hearing.
- A notice of the hearing must be issued, at least 90 pays prior to the hearing, to any city or county within the area of the proposed plan or amendment.

Briefings to the GSAs at Public Meetings

Representatives of the GSAs will be briefed on the status of GSP development and activities at monthly Board meetings of the Sierra Valley Groundwater Management District (SVGMD). Briefings may consist of informational items, discussions and/or requests for formal motions by the Board. Pursuant to the Brown Act, SVGMD Board meetings are open to the public. Also, Board meetings will have a virtual meeting option consistent with California Executive Order N-25-20.

Technical Advisory Committee

A key venue for GSP engagement centers on convening a Technical Advisory Committee (TAC). Drawing on the list of stakeholder interests found in Table 1, membership on the TAC will provide a diverse range of perspectives, interests and expertise regarding GSP content. While the GSAs have authority and responsibility for the final content of the GSP, TAC members will collectively provide advice, input and recommendations to the GSAs on all aspects of the GSP. The TAC meetings will be open to the public. The TAC is anticipated to meet on a monthly basis for a period of eight months.

Dedicated Outreach to Tribal Interests

Plumas County is serving as the lead entity for outreach to Tribal interests, providing information on the GSP process and inviting Tribes to identify how they would prefer to be involved with, or updated on, the GSP effort. A description of Tribal outreach efforts and resources are provided in Appendix B.

Public Workshops

The GSAs will convene public workshops to share information and receive feedback on the GSP content and process. These workshops provide opportunities for people to learn about groundwater, SGMA, and GSP elements. Workshops can be organized in a variety of ways, including open houses, "stations" where people can ask questions one-on-one, and traditional presentations with facilitated question-and-answer sessions. Workshops may also include small group breakout discussions, comment cards and other techniques. Whatever format is used, workshops will be designed to maximize opportunities for public input.

Workshops will occur at key points in the planning process to ensure that stakeholders have opportunities to provide input and give feedback on the GSP. Workshops also serve as a venue to respond to stakeholder comments on the GSP. The following table outlines the approximate number of workshops, the estimated timing of the workshops, and the expected purpose/topics that will be addressed at each workshop, which is aligned with the scope and sequence in the development of required GSP elements.

Adjustments to Stakeholder Outreach Due to the Coronavirus

Throughout 2020 and 2021, cases of COVID-19 flared and subsided across California and the United States. COVID protocols and restrictions have impacted the ability to hold, or participate in, public hearings. Subsequently, the TAC meetings occur as either in-person with virtual meeting options or as a meeting with virtual participation only. To promote an active exchange of ideas and perspectives during and after TAC meetings, materials such as worksheets and online surveys will be structured to enhance TAC discussions.

Table 2. Public Workshop Schedule

Workshop Number	Timing of Workshop	Primary Topics/Purpose
1	October 2018	SGMA overview and milestones, SGMA implementation activities to date, GSP planning process timeline/work plan overview, identification of opportunities for stakeholders to participate in GSP planning (such as, siting of monitoring wells on property, registration of inactive wells, etc.)
2	Fall 2019	• Update the community on the planning grant, work plan, and schedule • Presentation summarizing basin conditions and other relevant information that form the basis for preliminary basin setting • Solicit community input on preliminary basin setting results
3	Early Spring 2021	• Input on sustainable management criteria, including sustainability goals, undesirable results, minimum thresholds, measurable objectives, and interim milestones • Begin discussion on projects and management actions
4	Summer 2021	• Continue discussion on projects and management actions • Solicit comments on draft GSP sections
5	Fall 2021	• Response to stakeholder comments on draft GSP • Provide comments/feedback on refined draft GSP

METHODS FOR STAKEHOLDER OUTREACH & ENGAGEMENT

Outreach and communication efforts will take many forms, depending on the need (e.g., provide general background information, provide notice of upcoming public meetings). Communication methods include, but are not be limited to the following:

- Traditional media: When required or appropriate, press releases will be distributed to the media list in time to meet deadlines for local newspapers to inform the general public (see Table 3).
- Website: Background information, notice of public meetings, and information on GSP process and content will be posted on the District website at: www.sierravalleygmd.org/sierra-valley-groundwater-sustainability-plan.
- Email updates to interested parties: The District will collect the names and contact information of interested parties at monthly District board meetings and public workshops, at a minimum. Through targeted outreach, GSAs will build and refine the Interested Parties List. Information will be sent via email, via post or phone, as appropriate, to those who have provided their contact information.
- Personal communication: Local GSA representatives, consultants and GSA officials will communicate directly with stakeholders (via email, telephone, U.S. mail, in-person), as appropriate and necessary.
- Meetings and workshops: Meetings and workshops will be conducted at various locations within the basin, and for various purposes (e.g., work groups, public meetings), as needed and appropriate. Meetings and workshops may be a combination of in-person and/or virtual participation.
- On-line surveys: To provide the greatest access possible to the greatest number of people, on-line surveys may be a useful stakeholder engagement tool to get a sense of stakeholder values as they relate to the development of sustainable management criteria and may be employed throughout the GSP development process.
- Printed materials: Printed materials will be used throughout the GSP development process for increasing awareness and understanding. Materials may take many forms, including flyers to be posted and otherwise made available in public places at key milestones, educational materials provided at meetings, a limited number of hard copies of GSP documents as they become available, and meeting handouts to facilitate public understanding and participation.

Table 3. Print & Online Media Sources & Contact Information

Media Source	Contact
Mountain Messenger	(Carl Butz) carl@themountainmessenger.org https://mountainmessenger.com/
Plumas/Sierra Sustainable Farmers Guild	Facebook Page https://www.facebook.com/groups/132658446885231/
Portola Reporter (Plumas News)	(Eva Small) esmall@plumasnews.com; (Debra Moore) Managing Editor, Feather Publishing dmoore@plumasnews.com https://www.plumasnews.com/
Sierra Booster Newspaper – Sierra Valley News Portal	(Jan Buck) jbuck@psln.com https://www.sierrabooster.com/
Sierraville.org	http://www.sierraville.org

REFERENCE MATERIALS

DWR has developed various reference materials about SGMA and GSP development. While not comprehensive, the below table lists some essential SGMA reference materials to aid with successful GSP development.

Table 4. Reference Documents for SGMA Implementation

Reference Document Titles	Publishing Entity	Date/ Year of Publication
Groundwater Sustainability Plan (GSP) Emergency Regulations Guide https://govt.westlaw.com/calregs/Browse/Home/California/CaliforniaCodeofRegulations?guid=I74F39D13C76F497DB40E93C75FC716AA&originationContext=documenttoc&transitionType=Default&contextData=(sc.Default)&bhcp=1	DWR	July 2016
Best Management Practices Documents: 1. Monitoring Protocols Standards and Sites 2. Monitoring Networks and Identification of Data Gaps 3. Hydrogeologic Conceptual Model 4. Water Budget 5. Modeling 6. Sustainable Management Criteria https://water.ca.gov/Programs/Groundwater-Management/SGMA-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents	DWR	2016-2018

Reference Document Titles	Publishing Entity	Date/ Year of Publication
Reference Document Titles	**Publishing Entity**	**Date/ Year of Publication**
Guidance Documents: **1.** Resource Guide for Climate Change Data and Guidance **2.** Guidance for Climate Change Data Use During Sustainability Plan Development **3.** Stakeholder Communications and Engagement **4.** Engagement with Tribal Governments **5.** GSP Annotated Outline **6.** Preparation Checklist for GSP Submittal https://water.ca.gov/Programs/Groundwater-Management/SGMA-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents	DWR	2016-2018
SGMA Portal This portal allows local agencies, groundwater sustainability agencies (GSAs), and watermasters to submit, modify, and view the information required by the Sustainable Groundwater Management Act (SGMA), and enables the public and interested stakeholders to view submitted information and provide comments, where applicable. **No login is required for public access**. https://sgma.water.ca.gov/portal/	DWR	website
Other SGMA websites • California Water Boards Website: www.waterboards.ca.gov/water_issues/programs/sgma The home page has links for SGMA Compliance, State Intervention, Reporting and Fees, and Resources for GSA (which includes a Past Events section, with videos of past workshops) • UC Davis SGMA Website: http://groundwater.ucdavis.edu/SGMA The opening page contains an extensive list of links to information on aspects of SGMA		
Other related websites • TNC website with information and resources on Groundwater-Dependent Ecosystems (GDEs): https://groundwaterresourcehub.org		

EVALUATION & ASSESSMENT

Any communication strategy should include opportunities to check in at various points during implementation to ensure that it is meeting the communication and engagement goals and complying with SGMA. This plan is a living document that can be modified to accurately reflect changing conditions or approaches related to GSP communications and engagement. First drafted in December 2019, the Plan was revised in December 2020 and again in December 2021. At the conclusion of the GSP process, the C & E Plan will be finalized to document the stakeholder process. The final version will also include an assessment to reflect on lessons learned: what worked, what didn't go as planned and – in hindsight – what might have been done differently?

APPENDIX A
SGMA IMPLEMENTATION SCHEDULE OF ACTIVITIES

Sierra Valley Groundwater Basin
Sustainable Groundwater Management Act (SGMA) Implementation
2019-2022 SCHEDULE OF ACTIVITIES

Acronyms:

- C= Consultant(s)
- DWR= California Department of Water Resources
- GSA= Groundwater Sustainability Agency(ies)—Referring to SVGMD and Plumas County
- PT/PC= GSP Project Team/Planning Committee
- Sub= SVGMD Board Subcommittee
- TAC= Technical Advisory Committee
- TSS= Technical Support Services Program (DWR)
- PW= Public Workshop

Month/Year	Meetings/Milestones	Key Topics & Actions
January 2019	• GSP Project Team (monthly)	1. PT: Clarify GSP Work Plan priorities and next steps 2. PT: Refine work plan to incorporate draft GSP development progress
February 2019	• GSP Project Team (monthly) • SVGMD Board Meeting (monthly) • Tribal-FS Meeting	1. GSA: Approve coordination agreement between SVGMD and Plumas County 2. PT: Review GSP draft sections (Chapter 1 and Land Subsidence) to help identify data, technical, and resource gaps to inform development of GSP grant application work plan.
March-April 2019	• GSP Project Team (monthly) • SVGMD Board Meeting (monthly) • SVGMD Board Planning Subcommittee • Initiating Planning Grant	1. C: Bachand & Associates recharge study report findings presentation to SVGMD Board of Directors at March board meeting. 2. PT/GSA: GSP Project team present preliminary subsidence presentation to the SVGMD Board of Directors at April Board meeting.
May-August 2019	• GSP Project Team (monthly) • SVGMD Board Meeting (monthly) • SVGMD Board Planning Subcommittee ○ Defining Programs and Priorities for funding	1. PT with Burkhard Bohm: Compile existing basin setting information (technical information associated with basin conditions) to compare to GSP requirements and identify data, technical, and resource gaps to inform development of GSP grant proposal. 2. C/PT/Sub: Establish schedule for subcommittee meetings (to begin meeting in June). 3. PT/Sub/GSA: Present PSP requirements and activities and timeline for completion of proposal to SVGMD Board of Directors at June-July Board meetings. 4. PT: Prepare draft comments to DWR on draft PSP 5. PT/GSA: Present draft PSP comments to SVGMD at June board meeting and receive input. 6. PT/GSA: Incorporate SVGMD and Plumas County comments and finalize comments on draft PSP and submit to DWR. 7. DWR: Release Phase 2 final Basin Prioritization results.

 DRAFT REVISIONS – 2020.12.30 (not for distribution)

Month/Year	Meetings/Milestones	Key Topics & Actions
		8. TSS (GSA/DWR): Complete agreement with landowners for entry permit on land for TSS multi-completion well installation. 9. TSS (GSA/DWR): Complete environmental documentation for TSS multi-completion well application.
September-October 2019	• GSP Project Team (monthly) • SVGMD Board Meeting (monthly) • SVGMD Board Planning Subcommittee	1. TSS (DWR): Prepare agreements with landowner, drilling contractor, SVGMD. 2. TSS: Begin construction on multi-completion well. 3. DWR: Release of final PSP for GSP planning grant program (release date 9/9/19). 4. C/PT/GSA/Sub: Attend DWR informational webinar (9/18/19), draft GSP grant proposal, present progress updates and receive input and comments at SVGMD monthly board meetings and subcommittee meetings, incorporate GSA input. 5. Pass SVGMD board resolution for GSP planning grant submission (October SVGMD board meeting).
November-December 2019	• GSP Project Team (monthly) • SVGMD Board Mtg. (monthly) • Finalizing Planning Grant • Public Workshop	1. Submit GSP planning grant to DWR (November 15, 2019). 2. GSA/PT: Plan for fall public workshop. 3. PW: Public workshop (early December).
January-March 2020	• GSP Project Team (monthly) • SVGMD Board Meeting (monthly)	1. C: Release of groundwater study report. 2. DWR: Announce draft & final GSP grant awards, work with DWR on pre-contracting. 3. GSA/PT: Draft and review RFP(s) for any needed GSP consulting services as per the GSP grant application and determine process for consultant selection. 4. DWR: Release Project Solicitation Package for GSP Implementation Grants.
April-June 2020	• GSP Project Team (monthly) • SVGMD Board Meeting (monthly)	1. GSA/PT: Finalize RFP(s) for consulting services and release. 2. GSA/PT: Respond to consulting team questions before proposal submission. 3. GSA: Receive consultant proposals
July-September 2020	• GSP Project Team (monthly) • SVGMD Board Meeting (monthly)	1. GSA: Conduct interviews and select consultant(s) 2. GSA: Contract with selected consultant(s) 3. C/PT/GSA: Launch GSP development process.
October-December 2020	• GSP Planning Committee (monthly) • SVGMD Board Meetings (monthly) • TAC Meetings (Nov., Dec.)	1. C/PC/GSA: Convene TAC 2. C/PC/GSA: Foundational work on data management system and modeling approach 3. C/PC/TAC/GSA: Groundwater quality 4. C/PC/TAC/GSA: Subsidence 5. C/PC/TAC/GSA: Evaluating sustainability (sustainability goal, SMCs, measurable objectives, minimum thresholds, undesirable conditions) 6. C/PC/TAC/GSA: Monitoring networks 7. C/PC/TAC/GSA: Roles & Responsibilities document 8. C/PC/TAC/GSA: Revised C & E Plan

 DRAFT REVISIONS – 2020.12.30 (not for distribution)

Month/Year	Meetings/Milestones	Key Topics & Actions
January-March 2021	• GSP Planning Committee (monthly) • SVGMD Board Meetings (monthly) • TAC Meetings (monthly)	1. C/PC/TAC/GSA: Data management, modeling approach 2. C/PC/GSA: Assessment and improvement of monitoring network 3. C/PC/TAC/GSA: Representative monitoring 4. C/PC/TAC/GSA: Basin Settings, Hydrologic Conceptual Model 5. C/PC/TAC/GSA: Groundwater Storage 6. C/PC/TAC/GSA: Draft GSP chapters on groundwater quality, subsidence
April-June 2021	• GSP Planning Committee (monthly) • SVGMD Board Meetings (monthly) • TAC Meetings (monthly) • SGMA Public Workshop	1. C/PC/TAC/GSA: Surface Water-Groundwater Interactions (GDEs) 2. C/PC/TAC/GSA: Groundwater Levels 3. C/PC/TAC/GSA: Draft GSP chapters on basin setting, HCM and groundwater storage, ***4. PW: Sustainability Indicators (5 areas) and related SMCs*** (May?)
July-September 2021	• GSP Planning Committee (monthly) • SVGMD Board Meetings (monthly) • TAC Meetings (TBD) • SGMA Public Workshop	1. C/PC/TAC/GSA: Draft GSP chapters on surface water-groundwater interactions (GDEs), groundwater levels 2. C/PC/TAC/GSA: Projects and Management Actions 3. C/PC/TAC/GSA: Draft GSP text on Projects and Management Actions 4. ***PW: Projects and Management Actions*** (early Sept.?) 5. C/PC/TAC/GSA: Final monitoring network
October-December 2021	• GSP Planning Committee (monthly) • SVGMD Board Meetings (monthly) • TAC Meetings (TBD) • GSP Public Workshop	***1. PW: Draft GSP for public Comment (mid-October?)*** 2. C: Incorporate public comments and prepare final review draft GSP 3. PC/GSA: Final review of GSP 4. C: Prepare final draft of GSP 5. GSA: GSAs adopt resolutions in support of GSP
January-March 2022	• GSP Planning Committee (monthly) • SVGMD Board Meetings (monthly) • TAC Meetings (TBD)	1. GSA: Submit GSP to DWR via SGMA Portal 2. Prepare submittal of first Annual Report 3. C/GSAs/TAC: Develop strategies for outreach and engagement during implementation

APPENDIX B
TRIBAL OUTREACH GUIDANCE

Tribal Outreach Efforts and Resources

Consistent with Water Code Section 10720.3, the federal government or any federally recognized Indian Tribe, may voluntarily agree to participate in the preparation or administration of a GSP through a joint powers authority or other agreement with local agencies in the basin. A participating Tribe shall be eligible to participate fully in planning, financing, and management. Additionally, SGMA identifies California Tribes (including those that are not federally recognized) as possible beneficial users whose interests shall be considered in GSP development and implementation.

The Plumas National Forest lands within Plumas County but outside of the District's boundary are considered important to area Tribes, including the Maidu, Paiute, and Washoe.

Plumas County will take the lead on Tribal outreach and engagement.

Outreach Steps

Plumas County contacted the Native American Heritage Commission (NAHC) and requested a Native American Contacts List of Tribes with known traditional lands or cultural areas located within the boundaries of the Sierra Valley Groundwater Management District, Basin Boundary, and Watershed Boundary in Plumas and Sierra counties. Those Tribes include:

- Estom Yumeka Maidu Tribe of the Enterprise Rancheria
- Greenville Rancheria of Maidu Indians
- Mooretown Rancheria of Maidu Indians
- Susanville Indian Rancheria
- Tsi Akim Maidu
- United Auburn Indian Community of the Auburn Rancheria
- Washoe Tribe of Nevada and California

In addition, the following Tribes were also contacted, as they may have traditional lands or cultural places or knowledge of cultural Tribal resources within the boundaries of the SVGMD, Basin Boundary, and watershed:

- Pyramid Lake Paiute Tribe
- Reno-Sparks Indian Colony
- Mechoopda Indian Tribe
- KonKow Valley Band of Maidu
- Honey Lake Maidu

Communications by email, phone, and mail were made to these twelve Tribes to notify them of the SGMA SV Subbasin GSP planning process, to invite them to participate, and to confirm that Tribal engagement is directed by individual Tribes, with interested Tribes communicating their preferred methods of contact and pathways of engagement. For example, engagement could solely be in the form of informational updates as an interested party or could be more involved with direct participation on a committee or during meetings or while attending public workshops. Follow up with individual Tribes was conducted and tailored to the specific Tribal responses received.

Per DWR's Engagement with Tribal Governments guidance document, a follow up to the Tribal primary points of contact by telephone was also conducted by Plumas County within two weeks of the initial contact.

In the event a Tribal representative was not able to be contacted within a responsible timeframe, Plumas County consulted with DWR's Office of Tribal Policy Advisor for guidance (Anecita Agustinez, DWR Tribal Policy Advisor).

On a case-by-case basis as directed by each Tribe's preferred pathway of engagement, Plumas County will facilitate the implementation of actions that may include preparation of a formal letter from the Plumas County Board of Supervisors to each of the Tribes, involvement of the District with the Tribes, development of a Joint Powers Agreement (JPA) or Memorandum of Understanding (MOU) if requesting full participation per the Water Code, and/or establishing an engagement framework.

Relevant DWR Information

SGMA Section 10720.3. …any federally recognized Indian Tribe, appreciating the shared interest in assuring the sustainability of groundwater resources, may voluntarily agree to participate in the preparation or administration of a groundwater sustainability plan or groundwater management plan under this part through a joint powers authority or other agreement with local agencies in the basin. A participating Tribe shall be eligible to participate fully in planning, financing, and management under this part, including eligibility for grants and technical assistance, if any exercise of regulatory authority, enforcement, or imposition and collection of fees is pursuant to the Tribe's independent authority and not pursuant to authority granted to a groundwater sustainability agency under this part.

Must a local agency exclude federal and Tribal lands from its service area when forming a GSA?

No, federal lands and Tribal lands need not be excluded from a local agency's GSA area if a local agency has jurisdiction in those areas; however, those areas are not subject to SGMA. But, a local agency in its GSA formation notice shall explain how it will consider the interests of the federal government and California Native American Tribes when forming a GSA and developing a GSP. DWR strongly recommends that local agencies communicate with federal and Tribal representatives prior to deciding to become a GSA. As stated in Water Code §10720.3, the federal government or any federally recognized Indian Tribe, appreciating the shared interest in assuring the sustainability of groundwater resources, may voluntarily agree to participate in the preparation or administration of a GSP or groundwater management plan through a JPA or other agreement with local agencies in the basin. Water Code References: §10720.3, §10723.2, §10723.8

Tribal Outreach Resources

The following are links to Tribal outreach resources and considerations, each of which captures important principles and resources for Tribal outreach. A short summary of key outreach principles can be found below.

- Guidance Document for Sustainable Groundwater Management: Engagement with Tribal Governments (January 2018)
- CalEPA Tribal Consultation Policy Memo (August 2015)
- DWR Tribal Engagement Policy (March 2016)
- CA Natural Resources Agency Tribal Consultation Policy (November 2012)
- SWRCB Proposed Tribal Beneficial Uses
- CA Court Tribal Outreach and Engagement Strategies
- Traditional Ecological Knowledge (TEK) resources
- Water Education Foundation Tribal Water Issues

Key Outreach Principles

- Engage early and often.
- Consider Tribal beneficial uses in decision-making; identify and seek to protect Tribal cultural resources.
- Share relevant documentation with Tribal officials.
- Conduct meetings at times convenient for Tribal participation with ample notifications.
- Request relevant process input/data/information from Tribes.
- Empower Tribes to act as Tribal cultural resources caretakers.
- Designate a Tribal liaison(s) where appropriate.
- Share resources for Tribal involvement as is feasible.
- Develop MOUs where relevant.
- Be mindful of the traditions and cultural norms of Tribes in the area.

Key Outreach Partners/Liaisons

The following are potential partners to Plumas County and the District for Tribal outreach:

- California Indian Water Commission, Inc.
- DWR Office of Tribal Advisor
- DWR Northern Region Office

Appendix C

GSP Planning Roles and Commitments

ROLES & COMMITMENTS
Sierra Valley Groundwater Sustainability Plan (SVGSP)
Technical Advisory Committee (TAC)
V6 - November 20, 2020

Section 1. Background

The Sustainable Groundwater Management Act (SGMA), enacted in 2014, created a "framework for sustainable, groundwater management" that balances use and recharge. Medium- and high-priority groundwater basins across California are required to create and implement a Groundwater Sustainability Plan (GSP) with measurable objectives and milestones in increments of five years in order to achieve sustainability over a 20-year timeframe. The Sierra Valley groundwater subbasin in Plumas and Sierra counties was ranked by the California Department of Water Resources (DWR) as medium priority and is required to prepare and submit a GSP by January 31, 2022.

Although DWR provides guidance and identifies required elements for the GSPs, local Groundwater Sustainability Agencies (GSAs) develop the GSPs for their respective groundwater basins and subbasins. This allows local entities to create GSPs that address local interests, conditions, and priorities within the required elements of the GSP. In Sierra Valley, the two GSAs for the subbasin are the Sierra Valley Groundwater Management District (District) and the County of Plumas (Plumas). These GSAs entered into a Memorandum of Understanding (MOU) on January 8, 2019 to develop a single GSP for the Sierra Valley groundwater subbasin.

SGMA requires GSAs to consider the interests relating to the uses and users of groundwater. The GSAs must state how the perspectives of interested parties will inform the operations of the GSAs, as well as the development of the GSP. These interested parties include a wide range of governmental entities, water users, water systems, California Native American tribes, and economic and environmental considerations. Also, GSAs "shall encourage the active involvement of diverse social, cultural, and economic" perspectives. In addition to holding public workshops, the Sierra Valley GSAs established a Technical Advisory Committee (TAC) to bring multiple perspectives into the development of the GSP.

Section 2. GSP Process Timeline, Purpose and Activities

For the Sierra Valley groundwater subbasin, the GSP must be developed, released for public comment, approved by the GSAs, and submitted to DWR no later than January 31, 2022. The GSP must meet SGMA requirements.

This process is established to incorporate input from different interested parties to create a GSP that will be adopted by the GSAs. The resulting GSP will provide a more complete understanding of the groundwater subbasin, and of strategies and options, to support sustainable long-term use and stewardship of groundwater supplies.

A technical consultant team, led by Larry Walker and Associates, is assisting the GSAs in developing information and the GSP itself. This may include, but is not limited to, the following elements:

- data sets, analyses and modeling efforts
- descriptions of local groundwater basin conditions (Basin Setting)
- targets or "Sustainable Management Criteria" relating to:
    i. groundwater levels and storage
    ii. land subsidence
    iii. groundwater quality
    iv. surface water-groundwater interactions (including groundwater-dependent ecosystems)
- potential projects and actions addressing the Sustainable Management Criteria (SMCs) to enhance long-term stewardship of groundwater

Section 3. Structure, Roles and Responsibilities

NOTE: The Roles and Commitments document is intended to provide guidance for the Sierra Valley GSP planning effort. It is drafted as a living document that may be revised as needed.

GSAS: THE GSAS – SIERRA VALLEY GROUNDWATER MANAGEMENT DISTRICT AND PLUMAS COUNTY – WILL:

- **RETAIN AUTHORITY AND RESPONSIBILITY FOR THE FINAL PRODUCT AND THE DECISIONS CONTAINED WITHIN**
- **CONTRACT FOR TECHNICAL SUPPORT AND FACILITATION SERVICES**
- **PARTICIPATE IN THE PLANNING COMMITTEE AND TAC TO PROVIDE INFORMATION ON POLICY, OPERATIONAL, AND REGULATORY MATTERS**

PLANNING COMMITTEE: A PLANNING COMMITTEE – CONSISTING OF REPRESENTATIVES FROM THE TWO GSAS, THE TECHNICAL CONSULTING TEAM, AND PLANNING PARTNERS – WILL MEET TO:

- Identify individuals and parties with interests or expertise related to GSP development
- Develop draft proposals for work plans and timelines
- Anticipate and help address data needs
- Prepare agendas and materials for all meetings and public workshops, ensuring that materials are understandable and provide enough information for meaningful discussion
- Share insights on issues and developments that arise
- Advise on implementing and updating the Stakeholder Communications and Engagement Plan
- Review and discuss progress to date and next steps

Generally, the Planning Committee will meet once each month for two hours.

ROLES & COMMITMENTS
Sierra Valley Groundwater Sustainability Plan (SVGSP)
Technical Advisory Committee (TAC)
V6 - November 20, 2020

Technical Advisory Committee (TAC): Collectively, members of the TAC will provide advice, input, and recommendations to the GSAs on all aspects of the GSP. TAC members also have responsibilities to:

- Carefully review, discuss and refine the GSP chapters
- Identify, assess, and review data needs and provide resources that are appropriate for each task
- Help anticipate and describe near- and long-term future conditions and planning efforts that will influence factors related to the GSP
- Respond to GSP-related questions and queries from the District
- Arrive at each meeting fully prepared to discuss agenda items; this includes reviewing materials and information distributed in advance of the meeting
- Participate in a problem-solving approach based on respectful and constructive dialogue, where the interests of all members are considered
- Keep their organizations and constituents informed about the process, discussions and recommendations; and to seek and report back on feedback received as a result of informational briefings

It is expected that eight (8) TAC meetings will be scheduled, each about 3 hours long. The dates and times will be reviewed for each meeting. For 2020, TAC meetings were held on November 4th and December 7th.

The District Board will be regularly updated on the development of the GSP and discussions of the TAC.

Work Groups: Ad hoc work groups may be created as needed to address specific tasks, technical aspects, or issues. Additional participants may be invited to join to provide necessary perspectives or expertise.

Public Workshops: Public workshops will be scheduled several times, to provide updates, share ideas, and solicit input on the GSP contents and process.

- Several public workshops will take place in 2021
- A public hearing is required prior to adoption of the final GSP

FACILITATOR: THE FACILITATOR'S PRIMARY RESPONSIBILITY IS TO MAINTAIN AN OPPORTUNITY WHERE ALL PERSPECTIVES, VIEWS AND OPINIONS ARE HEARD AND THOUGHTFULLY CONSIDERED. THE FACILITATOR WILL:

DESIGN AND CONDUCT A CONSENSUS-SEEKING PROCESS WHERE THE TAC CAN BEST ASSIST THE GSAS IN DEVELOPING A GSP WITHIN REQUIRED REGULATORY GUIDELINES AND TIMEFRAMES

- Facilitate all meetings that are part of the GSP process, generating agendas and meeting summaries
- Capture the range of views and ideas presented by TAC members and reporting on where there are areas of both agreement and differences
- Develop draft proposals and recommendations for the GSAs that reflect TAC discussions

Technical Consultant(s):

- Research technical issues
- Inform and engage the Planning Committee on GSP development
- Develop draft text for the GSP, including but not limited to:
    i. Basin Settings and Hydrologic Conceptual Model
    ii. Monitoring networks and associated evaluations and analyses
    iii. Sustainable Management Criteria
    iv. Projects and Management Actions
- Present and discuss draft text, and incorporate input from the GSAs, Planning Committee, TAC meetings, and public workshops
- Prepare memoranda and/or technical reports as needed to document work products

Section 4. TAC Composition

To bring a diverse range of perspectives into GSP development, a core group of individuals serve on the TAC who have interest or expertise regarding GSP content. Members are invited to identify alternates in case the original member is unable to attend a TAC meeting.

It is proposed that the following interests, organizations, and/or individuals serve on the TAC. Membership can be updated as needed.

- GSA: Sierra Valley GMD
- GSA: Plumas County
- Planning Partner: Feather River Land Trust
- Planning Partner: Greg Hinds
- Agricultural Uses: Sierra Valley RCD
- Agricultural Uses: UC Cooperative Extension
- Tribal Uses: TBD
- Integrated Water Management: Upper Feather River IRWM
- Small Water Systems: Sierra Brooks Water System, Sierraville Public Utility District
- Land Uses: City of Loyalton, USFS Plumas National Forest
- Economic Development: Sierra County, Plumas County
- Environmental and Ecosystem Uses: Plumas Audubon Society
- Water Quality: Departments of Environmental Health (Sierra Co., Plumas Co.)
- Soils, Subsidence: Integrated Environmental Restoration Services
- Groundwater: Sierra County Public Works
- Domestic Well Users (those who rely exclusively on domestic wells for water supply)

DWR and CDFW have been invited to participate in TAC meetings as ex-officio agency members.

Consultant Support

The TAC is supported by core members of the LWA consulting team:

- Laura Foglia, Project Manager

- Betsy Elzufon, Assistant Project Manager
- Judie Talbot, Outreach and Engagement Facilitator

Section 5. Decision Making

The Groundwater Sustainability Agencies (GSAs) have responsibility and authority for all decisions regarding the final GSP and its adoption.

In its work, the TAC will strive to find agreement on suggestions and recommendations related to the GSP. As needed, participants could be asked to show their level of support for suggestions being developed, and to submit ideas for improving those suggestions being developed.
Those areas that receive substantial agreement will receive the highest possible consideration for inclusion in the GSP. However, group consensus alone does not determine whether an item will be incorporated into the final GSP. For those areas where differences remain, the full range of perspectives will be submitted to the GSAs for their review. The GSAs, with assistance from the Planning Committee, will determine the priorities and preferred forums for resolving those differences. Ultimately, the GSP must be reviewed and adopted by the GSAs (the District and Plumas) and DWR.

Section 6. TAC Meeting Approach

Hybrid Meeting Options:
Standing TAC members and consultants are encouraged to participate at in-person meetings. TAC meetings will have a webinar option to support involvement of TAC members who cannot attend in-person, as well as encourage participation by TAC liaisons and ad-hoc TAC members. During the pandemic, there may be times when the only option for meeting participating will be online.

Attendance: Given the volume of information that needs to be considered and developed, regular attendance by TAC members or their designated alternate is essential. Alternates must be identified in advance, fully briefed and able to represent the member when making suggestions and recommendations related to the GSP.

Open Meetings: TAC meetings are open to the public. Public comments are welcome during the meetings as time allows. Ideas, comments, questions, and suggestions can also be submitted via email to sierravalleygmd@sbcglobal.net or by postal mail to SVGMD – GSP at .O. Box 88, Chilcoot, CA 96105, or through the Sierra Valley Groundwater Management District's 'Contact Us' webpage at https://www.sierravalleygmd.org/contact-us and note 'GSP Public Comment' in the 'Subject' line.

Problem-solving: All TAC participants agree to:

- Listen for understanding and openly share information with others who hold diverse views
- Not ascribe motivations or intentions to the statements or actions of others
- Work to develop creative proposals, suggestions, and recommendations that address the interests of all

- Keep commitments once made
- When appropriate, distinguish between personal versus organizational perspectives (i.e., for an organization that a TAC member represents)

Good faith: All participants agree to act in good faith in all aspects of this consensus-seeking process and to communicate their interests in TAC meetings, public workshops, Planning Committee, District Board meetings and Plumas County Board of Supervisors meetings. Comments and suggestions made in open and honest conversations about creative options, approaches, or strategies will not be used against any party in litigation or public relations campaigns. This provision will not restrict the ability of participants to pursue legal remedies.

Good faith also requires that participants or their organizations not make commitments they do not intend to follow through with. Participants must act consistently in the GSP process and in other forums where the issues under discussion in the GSP process are also being addressed. Good faith provisions continue to apply to participants who withdraw from the process.

Section 6. TAC Communications

In planning processes, ideas may become fully formed over the course of several meetings. Subsequently, when members discuss the work of the TAC, care should be taken to distinguish new concepts from those recommendations adopted by the full group. When discussing the process with others, TAC members should present their own perspectives, without characterizing the positions and views of any other party or attributing comments to other members. TAC members are encouraged, and will be facilitated, to develop common statements about their work for release into newsletters and similar publications.

GSA Briefing Summaries will be prepared and distributed, providing updates on discussions. This will allow GSA parties to anticipate what types of materials will be included in packets for monthly District Board meeting discussions.

Meeting Summaries will be provided via email to TAC members, including the GSAs, and posted on the SVGMD GSP website at https://www.sierravalleygmd.org/tac-meetings for public viewing within seven (7) working days of TAC meetings.

Related Data: TAC members are encouraged to contribute and share information (excluding privileged or confidential materials) that help inform discussions and clarify questions of fact. As appropriate, support materials that explain, interpret or analyze data or policies can also be provided.

Appendix 2-4: Comment Response Summary

1.0 Public Review of SVGSP

The Public Review Draft of the Sierra Valley Groundwater Sustainability Plan (GSP) was posted on October 13, 2021 and comments were accepted through November 15, 2021. The GSAs received 115 comments from 28 comment letters on the draft GSP during the public comment period. Private citizens, state agencies, non-governmental organizations, and other organizations representing beneficial users and uses of groundwater in the region submitted comments. In addition, the SVGMD Board provided comments on January 4, 2022.

Once the public comment period ended, the GSA reviewed each comment and recorded a response along with a recommended action if pertinent. Comments were grouped by topic so the GSA could manage and respond to multiple comments on a similar topic (i.e., Multiple Comment Responses or MCR). The GSA then developed responses to address all identified MCRs. In addition, responses to individual comments were also provided.

1.1 Comment management and organization

This section describes the methodology the GSAs used to organize the comments made on the draft GSP into MCR categories for review and response. The comment response matrix was developed in Excel and categorizes the comments made on the draft GSP by MCR topic. Each comment was given its own unique comment identification number (CIN) and was then assigned to a MCR category and entered into the Excel tool.

Twelve different MCR topics were identified and included: groundwater dependent ecosystems, interconnected surface water, the water budget, climate change, demand management, outreach, identification of disadvantaged communities and tribes, monitoring, data gaps and GSP implementation, projects and management actions, subsidence, and GSA rate structure. The responses to the MCRs are shown in Attachment A to this summary.

The comment response matrix is an Excel tool generated and utilized by GSA staff and consultants to organize comments by MCR topic to respond to the different MCR categories. Table 1 shows the types of information included and the complete comment and response matrix is included in Attachment B to this summary.

Table 1: SVGMD GSP comment and comment response matrix column labels and descriptions.

Matrix Column	Column Description
Author	Identity of person or agency comment was submitted by
CIN	Unique comment identifier
MCR	Multiple comment response topic
Group	Groups A-C (see section 3.1.2)
Description	Brief description of comment category/topic
Location in GSP	Chapters or sections of draft GSP commented upon
Comment	Original comment submitted by commentator
Response/Recommended action	Actions taken or recommended and/or written response to comment.

1.1.1 Comment Groups

After assigning sub-categories and writing brief descriptions of the comments, GSA staff and consultants conducted a detailed evaluation of the scope, relevance, and importance of each individual comment. Through this activity, staff and consultants conducted an initial grouping, or prioritization, of these comments based, in part, on their applicability to 23 CCR § 355.4(b)(10). These groupings are further described below.

"**Group A**": Comments were assigned to Group A if they raised substantial technical, policy, or legal issues most likely to be subject to 23 CCR § 355.4(b)(10). Of the 128 comments received, 33 were assigned to Group A.

"**Group B**": Comments were assigned to Group B if they required additional evaluation or significant changes to the GSP and considered valid technical or policy issues for focused review. This included comments that referred to content and themes included throughout the GSP and would require more consideration to address. Of the 128 comments received, comments 56 were assigned to Group B.

"**Group C**": Comments were assigned to Group C if they primarily raised editorial issues or could be addressed without requiring further technical evaluations or significant changes to the GSP text. For example, if a comment indicated that a certain passage or section of the GSP could be improved through a closer editorial review, it was categorized as Group C. Of the 128 comments, 33 were assigned to Group C and directly addressed by the GSA and consultant staff.

Attachment A Responses to Multiple Comments

1. **MCR Topic**: Groundwater Dependent Ecosystems (GDE)
   Response to MCR:
   "A summary of all the main comments received about GDEs is provided below. Our conclusions regarding GDE (and ISW) relies heavily on groundwater elevation data. We agree that shallow groundwater is a data gap due to the sparse distribution of wells in the shallowest western side of the basin and due to the significant uncertainty on well screening and actual well depth. The groundwater level data used for the GDE analysis is the same groundwater level data used in all other analyses in the GSP and the data is provided in Appendix 3-1. It contains the Representative Monitoring Points (RMPs) and additional data that were not selected for the RMP monitoring network. Section 3.3.1.4 now provides additional detail on the monitoring wells used, their depth (less than 300 feet), and how only the shallow groundwater levels from multi-completion wells were used in the interpolation.

   Given the lack of shallow groundwater data and uncertainty in the vegetation map, all of the GDEs are best described as potential GDEs. This has been clarified in Chapter 2 of the GSP.

   To start providing the needed information, four additional wells will be installed near the GDEs in the western half of the basin. This will help to better assess shallow groundwater and help to calibrate the groundwater model to assess the effects of groundwater management on GDEs. Regarding GDEs, the 30 ft threshold will be reexamined after GSP submittal to reflect variation in groundwater elevation and uncertainty due to the lack of shallow groundwater. The special status species list will be refined after GSP submittal to include GDE units based on location within the basin and hydrology. Finally, the Normalized Difference Vegetative Index (NDVI) analysis will be clarified to account for localized changes as well as larger-scale changes near monitoring points and within the large GDE complex in the western half of the basin. The Sustainable Management Criteria (SMC) triggers can be adjusted if GDE health declines. SMCs were set above thresholds.

   We used the best available data to compile the list of special status species and acknowledged that Sierra Valley is an important bird area. Our sources for sensitive species included: the California Natural Diversity Database (CNDDB), California Native Plant Society (CNPS) Manual of California Vegetation (2021), Harnach (2016), eBird (2021),TNC freshwater species lists generated from the California Freshwater Species Database (CAFSD) (TNC, 2021), USFWS’s Information for Planning and Consultation (IPaC) portal (USFWS, 2021), Feather River Land Trust Sierra Valley Birder’s Guidebook (Feather River Land Trust n.d.), Vestra (2005), and CDFW's BIOS database.

We will happily add information from additional reports after the GSP is submitted if they are made available to us.

As part of the GSP, the health of GDEs will be tracked using NDVI coupled with measurements of shallow groundwater elevations near GDEs. If the interconnected surface water flows and the health of GDEs (as measured by NDVI) decline around the monitoring points and the change is due to groundwater management, the minimum thresholds (MTs) and measurable objectives (MOs) will be reevaluated."

2. **MCR Topic**: Interconnected Surface Water (ISW)
   Response to MCR:
   "Quantification of ISW depletion is a difficult task considering the novelty of the model and lack of surface water data to perform calibration. Besides the streamflow gage on the Middle Fork Feather River there has been no continuous monitoring of streamflow within the groundwater basin in the last ~40 years. Consequently, this is considered a data gap and will be addressed by recommendations in the monitoring plan. As this data gap is addressed, we will be better able to assess how groundwater management is affecting interconnected surface water and groundwater elevations and the GSAs can target areas where ISW depletion is occurring. Assessing the effect on beneficial users will require more information on groundwater elevations and ISW to target areas that might require data linking flow and groundwater changes to habitat response.

   Recommendations in the monitoring plan look to fill these data gaps, but the number of new RMPs must strike a balance of filling data gaps and the cost of monitoring to the SVGMD. Additional description of the proposed monitoring network for GDEs has been included in Section 3.4.4, Monitoring Networks Summary.

   Interconnected surface waters were mapped by Balance Hydrologics using whatever well data were available and things like hydraulic gradients. To map ISW, we conservatively chose a wetter than average period by using groundwater elevation for springs of 2017-2020 which represented the highest groundwater elevations since 2006. Figure 2.2.2-12 will be modified to show depth to groundwater contours and wells used in the analysis. Additional monitoring required to better understand both groundwater dynamics and interconnected surface flow is described in section 3.4.4. This monitoring plan will be expanded in upcoming drafts of the GSP.
   The streams classified as a data gap in Figure 2.2.2-12 are retained as potential ISW. MTs of RMPs in these areas were set with this in mind by limiting decline of groundwater levels near ISW to the historical low groundwater elevation. "

3. **MCR Topic**: Water Budget
   Response to MCR:
   "The hydrologic model description has been added to Section 2.2.1 and the water budget has been added to Section 2.2.3."

4. **MCR Topic**: Climate Change
   Response to MCR:

"Projected climate change impacts using the four climate change scenarios provided by DWR are included in the updated version of Section 2.2.3. In addition, climate change has been considered in the uplands management and restoration PMA, groundwater recharge PMA and fuels reduction PMA.

The GSAs also acknowledges data gaps and existing uncertainty in its SV integrated hydrological model, as outlined in Appendix 2-5. While the model was developed based on the best available science and data and provided a sufficient understanding of Basin conditions, further improvements are needed to conduct climate change studies and simulate future scenarios. GSAs has sought to coordinate with local and regional stakeholders in generating and conducting climate change scenarios to include the largest spectrum of expected changes possible. This will help the GSAs include the changes to reservoir operation and surface water availability in the Basin. Surface water availability can have significant impacts on the Basin and need to be incorporated into future scenarios. There are several other climate factors in addition to temperature that influence recharge processes (e.g., timing of precipitation, precipitation volume, storm intensity). Changes in these could enhance, negate, or diminish any temperature change effects on recharge processes. "

5. **MCR Topic**: Demand Management
   Response to MCR:
   “Developing a groundwater allocation system is discussed in Chapter 4, Section 4.3.7 Groundwater Trading and Allocations System. The section stated "Because this water management approach [pumping allocations] would have direct economic impact through reduced irrigation water volumes, and would require additional administration actions by the SVGMD, it is not identified in the GSP as a primary management action. Due to numerous comments/requests, the text was changed to list pumping allocations as a potential management action IF other PMAs fail to address overdraft. Text was also added to say that pumping can also be redistributed vertically and spatially. For example, deep ag wells can be limited to pumping from deep aquifer layers while GDEs and domestic users can extract from the upper aquifer layer.”

6. **MCR Topic**: Outreach
   Response to MCR:
   "Outreach and engagement strategies are described in detail in the Communication and Engagement Plan and in Chapter 2 of the GSP. We will note that traditional community outreach activities were restricted by COVID as in-person events were not always possible. However, online monthly TAC and Board meetings were publicized through the SVGMD website and through emails to interested parties. In addition, all meeting materials and meeting recordings are posted on the SVGMD website. Other approaches to publicizing events are listed below.

   Moving forward, comments on the outreach and engagement process are being taken into consideration and the approach during GSP implementation is provided in a new section on outreach and engagement for Implementation that has been added to the Communication and Engagement Plan (Appendix 2-3).

As described in Chapter 2, substantial efforts to engage the public in development of the GSP have been underway since 2018 with public workshops being conducted in April 2016, February 2017, March 2017, October 2018, December 2019, May 2021, and October 2021. These workshops were publicized through:

- Print and on-line media/newspaper announcements: Mountain Messenger; Plumas News; Sierra Booster and www.sierraville.org
- Outreach partners' newsletters, websites, and social media accounts
- GSA websites, with posting of TAC meeting minutes, materials, and recordings on the SVGMD website
- Interested parties email lists
- Posting of public workshop flyers at local establishments
- Distributing surveys using multiple formats: hard copies at workshops, posted as PDFs, and links to online versions

In addition, TAC meetings have been held monthly since November 2020 and GSP updates have been provided at the monthly SVGMD Board meetings. The Board meetings are open to the public and, as noted above, all meeting materials are posted on the SVGMD website."

7. **MCR Topic**: Identification of Disadvantaged Communities and Tribes
   Response to MCR:
   "To assist in DAC identification, DAC spatial layers have been added to the Data Management System (DMS). Inclusion of a specific figure within the GSP was deemed unnecessary as the boundaries can easily be obtained through other sources and do not affect SMCs developed for the basin. No federally recognized tribal lands are present in Sierra Valley.

   We believe that our sustainable management criteria protect domestic wells from impacts. Therefore, such an analysis would not substantively change the fact that projected groundwater management is not expected to impact domestic wells in the basin. To our knowledge, all domestic and municipal users in the basin are solely reliant on groundwater.

   However, the number and locations of domestic wells have been identified as a data gap that will be addressed during GSP implementation. This was discussed extensively at the TAC meeting on December 6th. SMCs, Chapter 3, will be modified to describe undesirable results according to decisions made at the December 6th meeting. Domestic well SMC has been removed until a more complete well inventory and assessment has been completed. Well inventory will be done within ~2 years and SMC can be re-evaluated for the 5-year GSP update."

8. **MCR Topic**: Monitoring
   Response to MCR:
   New information has been discussed with the GSAs and more details on the monitoring network and on the commitment about future data collection are presented in chapter 3 and chapter 5. Section 3.4.4 provides a summary of existing monitoring networks and

planned additions to address data gaps for groundwater elevation, water quality, ISW and subsidence. Potential funding and schedule for addressing data gaps and expanding monitoring networks are discussed in Section 4.2.2 (Monitoring and Reporting PMA) and in Chapter 5.

9. **MCR Topic**: Data Gaps and GSP Implementation
   Response to MCR:
   "Concern has been expressed that the plan identifies many data gaps, and we agree that these must be filled in order to better ensure sustainable groundwater management in the SV basin. Nonetheless, the plan uses the best available information, and suggests the avoidance of significant and unreasonable impacts to beneficial users. Reducing MTs as suggested would likely lead to significant and unreasonable impacts to growers, ranchers, and municipal systems - only in the proximity of these users are groundwater levels allowed to decline beyond historical lows. As noted in the comment response to the Design and Implementation of Monitoring Networks, additional information on existing monitoring networks and planned enhancements has been provided in Section 3.4.4. There are a limited number of existing shallow groundwater wells in the Basin and of those even fewer have existing groundwater data or are suitable for collecting groundwater data. RMPs for ISW and GDEs represent those existing shallow groundwater wells suitable for monitoring and several new wells. The number of new wells is intended to strike a balance of filling data gaps and the cost of those wells to the SVGMD. If data gaps continue to exist, the Plan can be modified at the 5-year update to include additional RMPs."

10. **MCR Topic**: Projects and Management Actions
    Response to MCR:
    "Reoperation of Surface Water Supplies is a PMA included in Potential Projects and Management Actions in Chapter 4 that received multiple comments. There are other PMAs also being considered and evaluated with respect to potential effectiveness and technical and economic feasibility. Input on which PMAs are most feasible will continue to be sought during the GSP Implementation process. The GSAs will evaluate timelines for demand management once preliminary results from PMAs in Tier I will be evaluated. This will provide a better understanding on the actual needs for the basin. The process for prioritizing PMAs will begin in February 2022 and complete within the first year of GSP implementation."

11. **MCR Topic**: Subsidence
    Response to MCR:
    "Inelastic (permanent) subsidence is a physical process where the arrangement of fine-grained materials (typically clays and silts) is altered such that compaction occurs. While this compaction does result in some loss of storage in these fine sediments, the majority of useable groundwater is stored and transmitted in coarse-grained sediments which are unaffected by subsidence. Therefore, subsidence is a concern because differential deformation of the land surface can have adverse effects on engineered structures and conveyance systems (bridges, railroads, canals, etc.) on the land surface, not because of reduced subsurface storage capacity. The known extent and vertical displacement of subsidence in Sierra Valley is discussed in Section 2.2.2.5 of the GSP.

Subsidence was discussed extensively by the TAC on December 6 in response to this and other public comments. It was decided to revise the subsidence discussion to indicate it needs closer monitoring. Monuments will be installed in the area mentioned and InSAR data will initially be used to monitor subsidence. Additional surveys will be conducted if InSAR subsidence increases by 50% of the average annual subsidence from baseline period (2015-2021). The GSAs may at their discretion elect to survey monuments more frequently, pending available funds. "

12. **MCR Topic**: GSA Rate Structure
    Response to MCR:
    "The questions regarding cost allocation in funding GSP implementation are valid concerns in groundwater management in California. The Sierra Valley Basin has an established revenue structure that splits costs between property owners and well owners, through parcel fees and meter fees. Property owners of parcels that have large-capacity wells pay both fees, while property owners of parcels without large-capacity wells pay the parcel fee only. This revenue structure does spread costs out among both well owners and property owners in general, though it provides additional consideration to wells by imposing the meter fee. At this point a variety of options are being considered. One option presented in the Funding Options Technical Memorandum, a parcel tax, would allocate cost widely to all property owners. This mechanism would not charge based on groundwater extraction. While the advantage of this method is a lower rate for each property, it is true that it would not take usage into account.
    Several fee models presented in the Memorandum do take usage into account. These models project that any additional costs associated with GSP implementation will be borne by the well owners, through the implementation of either a regulatory fee or property related fee on wells. This would mean that whether GSP implementation costs end up closer to the low estimate or the high estimate, large-capacity well owners will bear any additional cost burden. The options of structuring of these fees are presented in the Funding Options Technical Memorandum as either an estimated usage fee, which would charge based on an estimated usage rate, or actual usage fee, which would require the use of meters on all non-de minimis wells. There are advantages to each of these methodologies, and both attempt to take usage into account. The question of cost allocation will continue to be evaluated and will consider these comments as the GSAs develop the final funding plan during the first year of GSP implementation. "

Attachment B Responses to Public Comments

Author	CIN	MCR	Group	Description	Location in GSP	Comment	Response / Recommended Action
Board	Board-001	MCR PMAs	A	Shallow GW Wells	ch 4	Well inventory should not be a Tier 1 PMA, put in Tier 2 for domestic wells, no funding, de-emphasize domestic wells	Split into two PMAs - Tier 1 PMA is for existing metering and inventory of large capacity agricultural wells. Inventory of domestic and other wells moved to Tier 2 and considered a potential PMA based on available funding particularly with respect to adding domestic wells. Moved to 4.3.2
Board	Board-009	MCR Demand Management	A	PMAs	ch 3, 4	modify language to remove references to pumping curtailment	edits made
CDFW	CDFW-001	MCR ISW	A	ISW	Section 2.2.2.6	Comment #1 – Interconnected Surface Water Systems (2.2.2.6 Identification of interconnected surface water systems; starting page 2-87): The GSP does not include an estimate of the quantity and timing of depletions of interconnected surface water systems as required by 23 CCR § 354.16(f). a. Issue: The GSP identifies interconnected and disconnected surface waters within the subbasin and assesses vertical hydraulic gradients to identify where reaches are likely gaining, losing, or mixed. However, the GSP does not include information related to the quantity and timing of depletions from these interconnected surface waters as required by 23 CCR § 354.16(f).	Quantification of ISW depletion is a difficult task considering the novelty of the model and lack of surface water data and of continuous shallow groundwater data to perform calibration. In lieu of a poor estimation of ISW depletion, the Plan proposes to maintain horizontal hydraulic gradients near ISW and GDEs so additional depletion of ISW does not occur. Quantification of ISW in the form of actual stream depletion attributed to groundwater pumping will occur at the 5-year update when sufficient data is available.

Author	CIN	MCR	Group	Description	Location in GSP	Comment	Response / Recommended Action
CDFW	CDFW-002	MCR GDE	A	GDE	Section 2.2.2.7	Comment #2 – Groundwater Dependent Ecosystems (2.2.2.7 Identification of groundwater-dependent ecosystems; starting page 2-93): Groundwater dependent ecosystem (GDE) identification, required by 23 CCR § 354.16(g), is based on methods that risk exclusion of ecosystems that may depend on groundwater. a. Issues: i. Depth to Groundwater Threshold: The GSP relies on a groundwater level threshold of 30-feet below the ground surface (bgs) to screen potential GDEs within the subbasin. However, there is a lack of shallow groundwater monitoring data, and few wells are located near potential GDE areas (line 2297). The GSP states that the standard deviation of 2017-2020 average groundwater elevation within one half-mile of GDEs ranges from 42 to 80 ft; 9,500 acres of potential GDEs were removed based on the 30-ft bgs threshold. These removed potential GDE areas would be reclassified as GDEs if groundwater elevations increased by one standard deviation (line 2302). Given the high level of uncertainty of shallow groundwater levels throughout the subbasin and the lack of information regarding GDE rooting depths (line 2341), relying solely on a 30-ft threshold and coarse shallow groundwater extrapolations to remove potential GDE areas is not a conservative approach to GDE identification. ii. Special Status Species: The GSP includes a list of special-status plant and wildlife species within the subbasin “that may occur within or be associated with the vegetation and aquatic communities in or immediately adjacent to potential GDEs” (page 2-95, line 2261). The GSP does not identify which GDE areas within the subbasin were found to support the special status species listed. iii. Changes in Vegetation Health Assessment: The GSP uses Normalized Difference Vegetation Index (NDVI) to assess changes in vegetation health for GDE areas within the subbasin. While assessing NDVI can be a helpful tool for determining vegetation trends, the subbasin scale used for the analysis may be too broad to capture localized NDVI trends for smaller groups of GDE areas, making it difficult to inform discrete protective management actions for localized impacts.	Agreed. The 30 ft threshold will be reexamined after GSP submittal to reflect variation in groundwater elevation and uncertainty due to the lack of shallow groundwater. The special status species list will be refined after GSP submittal to include GDE units based on location within the basin and hydrology. Finally, the NDVI analysis will be clarified to account for localized changes as well as larger-scale changes near monitoring points and within the large GDE complex in the western half of the basin.

Author	CIN	MCR	Group	Description	Location in GSP	Comment	Response / Recommended Action
CDFW	CDFW-003	MCR GDE and MCR ISW	A	SMC	Section 3.3.1	Comment #3 – Sustainable Management Criteria (3.3.1 Groundwater Elevation, 3.3.3 Depletion of Interconnected Surface Waters; starting pages 3-6 and 3-17): Groundwater level and interconnected surface water sustainable management criteria (SMC) may not protect against undesirable results for fish and wildlife beneficial uses and users. a. Issues: i. Groundwater Level Minimum Thresholds (MTs): The GSP sets MTs for groundwater levels by linearly projecting groundwater decline through 2032, taking the lower of that value or the lowest post-2015 groundwater level, and then further reducing the MT by 10% of the range of historically observed groundwater levels. The Department appreciates that the GSP includes a specific analysis of the impact of the established MTs on environmental beneficial users of groundwater, and that the MTs at some representative monitoring points were adjusted as needed to be more protective of GDEs. However, additional discussion of the methods used to ensure avoidance of impacts to GDEs is needed. ii. Interconnected Surface Water MTs: MTs for ISW, using groundwater levels as a proxy, are set at the lowest groundwater level that occurred after January 2000. The GSP acknowledges that groundwater depletion is occurring within the subbasin but contends that the depletion is not significant or unreasonable. However, the GSP does not include evidence needed to support this claim. The GSP focuses on avoiding exceedance of the maximum rates of depletion that have previously occurred within the subbasin. Though a condition may have occurred within the subbasin previously, that does not necessarily mean that undesirable results were not occurring. For instance, in 2015, historically low groundwater levels led to adverse impacts to vegetated and aquatic GDEs and ISW including stressed or dying riparian vegetation, poor instream habitat availability, and increased water temperatures (DFW 2019). A GSP must first evaluate potential adverse impacts to beneficial uses and users of ISW, determine what depletions would lead to those unreasonable impacts, and then set mts accordingly. As the GSP does not quantify baseline ISW depletion conditions (See Comment #1) or present modeled depletion rates that would occur at the established MTs, there is insufficient information to assess potential impacts to environmental beneficial uses	The SMCs triggers can be adjusted if GDE health declines. SMCs were set above thresholds. MCR ISW and MCR GDE provide more details.

Sierra Valley Groundwater Management District

Author	CIN	MCR	Group	Description	Location in GSP	Comment	Response / Recommended Action
						and users. iii. Undesirable Results and SMC Triggers: The GSP requires 25% of groundwater level and ISW representative monitoring wells in the subbasin to fall below their minimum thresholds for two consecutive years before identifying an undesirable result to GDEs or ISW. While environmental users are usually adapted to sustain short-term lowering of groundwater levels during dry periods, environmental users may not be able to sustain extended periods of reduced groundwater access that would result from allowing groundwater levels to fall to historic lows or deeper for two consecutive years. Under these MTs, by the time an undesirable result is declared, and management actions are initiated in response to the undesirable result, environmental groundwater users will have already experienced significant stress and potentially irreversible mortality. The Department appreciates that the GSP identifies triggers for groundwater level MTs, and presumably will identify ISW triggers when Section 3.3.3.4.2 is completed, that would initiate GSA review when reached. However, the groundwater level triggers require groundwater levels to fall below their historic low for two consecutive years; as it is likely that environmental users were experiencing negative impacts at the historic groundwater low, this trigger definition will not initiate GSA review and potential management actions early enough to avoid adverse impacts to beneficial uses and users.	

Author	CIN	MCR	Group	Description	Location in GSP	Comment	Response / Recommended Action
CDFW	CDFW-004	MCR Monitoring	A	Monitoring Networks	Section 3.4.1.1	Comment #4 – Monitoring Networks (3.4.1.1 Groundwater Elevation Monitoring Network, 3.4.1.4 Depletions of Interconnected Surface Water Monitoring Network, 4.2.2 Monitoring and Reporting; starting pages 3-39, 3-49, and 4-13): The GSP should include a more detailed discussion of the adequacy of the monitoring network for assessing impacts to GDEs. The GSP should include additional information related to the schedule for implementation of the planned project to improve the monitoring network.	New information has been discussed with the GSAs and more details on the monitoring network and on the commitment about future data collection are presented in chapter 3 and chapter 5.
CDFW	CDFW-005	MCR PMAs	A	PMAs	Page 4-19	Comment #5 – Projects and Management Actions (PMAs) (Tier II: Potential Projects and Management Actions; starting page 4-19): The GSP should include timelines for implementation of potential PMAs related to demand management within the subbasin.	The GSAs will evaluate timeline for demand management once preliminary results from PMAs in Tier I (Existing and Ongoing PMAs) are evaluated. This will provide a better understanding on the actual needs for the basin.

Author	CIN	MCR	Group	Description	Location in GSP	Comment	Response / Recommended Action
Donna Lindquist	Lindquist-002		A	Equal representation		The TAC is composed of major stakeholders but has no official representation from domestic well users who represent the largest part of the community in Sierra Valley. There are domestic well users on the TAC but they have competing interests that conflict with small or non-ag producers. Broadening the TAC to include smaller domestic well users is needed as well as more continuous outreach to educate water users on overdraft issues and consequences.	See Appendix C in the Communication and Engagement Plan.
Feather River Land Trust	FRLT-005		A	SMC		We believe that the SMC for groundwater elevation is problematic because it does not target areas where change is most likely to occur. The SMC for groundwater level defines an undesirable result if 25% or more of the Representative Monitoring Points (RMP) detect groundwater below their Minimum Thresholds for two consecutive years. While we agree the overall approach to this SMC is sound, we think it is flawed in practice because it does not focus on changes in the areas of the basin where reductions in groundwater levels are most likely. It appears there are perhaps twelve to fourteen wells in the areas where groundwater level reduction (and subsidence) are most likely to occur. The current standard of 25% of wells with declines may overlook substantial changes to groundwater because the 37 RMP are spread throughout the basin.	Based on comments received and further discussion with the TAC, the numbers have all been revised and the undesirable result has been identified as more than 10% of the RMPs to fall below their Minimum Thresholds. More details are now provided in Chapter 3.

Author	CIN	MCR	Group	Description	Location in GSP	Comment	Response / Recommended Action
Feather River Land Trust	FRLT-008	MCR Demand Management	A	PMAs		The draft plan includes numerous proposed potential actions to address the supply side of the recharge-groundwater use equation. While the plan does speak to increasing irrigation efficiencies, the major factor on the use side of the equation, pumping, is not addressed. The plan explains this element is not included because it would result in reduced pumping and economic costs. This reasoning lacks context in that allocations would be instituted only if other supply side elements of the plan are ineffective in providing for groundwater sustainability. We note that not including this element may serve as a disincentive to groundwater users to devise ways to reduce or avoid economic loss through conservation, trading, and other measures.	MCR Demand Management
Feather River Land Trust	FRLT-010	MCR ISW	A	SMC		It is possible that the 2015 levels caused adverse effects to domestic wells, flows and water quality in the Middle Fork Feather River, springs and artesian wells and other values. There is no data presented to support the contention that values were or were not impacted. It is possible that instituting the SMC would bring about situations where groundwater is at or near the threshold elevations for longer periods of time than those which produced the 2015 elevation. The impact to beneficial uses and users from ground water at the target levels present over longer periods of time needs to be discussed.	MCR ISW
Feather River Land Trust	FRLT-011	MCR GDE	A	GDE		FRLT believes the plan’s delineation of GDE is flawed because it does not include either springs or artesian wells. These features are perhaps the most likely habitats to be affected by changes in groundwater availability. Springs often provide habitat for rare species, especially invertebrates, and are also often an important source of stock water. As such, these habitats would appear to be excellent indicators of both ecological and hydrologic conditions. Our concern is heightened due to possible loss of these features over time. We are concerned that they are not included as GDE and their long-term density and distribution will not be monitored.	Agreed. Springs have been added to the GDE map.

Author	CIN	MCR	Group	Description	Location in GSP	Comment	Response / Recommended Action
K Tanner	Tanner-003	MCR Demand Management	A	PMAs	4.3.7-4.3.7.1	What is written is clear & makes sense but there seems to be a disjunction between this & statements made by at least one SVGWMD board member at the 11/03/21 meeting. The board member repeatedly stated “curtail and cut pumping is the only way” to reduce the lowering of ground water levels. Given that sentiment, perhaps this should be addressed as a primary management action. Also, if drought conditions persist, it may not be reasonable to wait 5 years to reassess this as a primary management action.	Developing a groundwater allocation system is discussed in Chapter 4, Section 4.3.7 Groundwater Trading and Allocations System. The section stated "Because this water management approach [pumping allocations] would have direct economic impact through reduced irrigation water volumes, and would require additional administration actions by the SVGMD, it is not identified in the GSP as a primary management action. Due to numerous comments/request, changed text to list pumping allocations as a potential management action IF other PMAs fail to address overdraft. Added text describing pumping can also be redistributed vertically and spatially. For example, deep ag wells can be limited to pumping from deep aquifer layers while GDEs and domestic users can extract from the upper aquifer layer.
Kevin Starr	Starr-005	MCR GSA Rate Structure	A	GSA Rate Structure		• The proposed payment structure to fund and implement the plan to fall on every property owner is not fair and should reflect a structure based on use.	MCR GSA Rate Structure
Kim McKinney	KM-001	MCR Demand Management	A	PMAs		My first concern is that there is little in the Plan to address constraints on groundwater overdrafting. The very title of the proposed Plan contains the word sustainability and yet the Plan provides minimal, if any triggers to prevent or reduce chronic overdrafting.	MCR Demand Management
Kristi Jamason	Jamason-004		A	SMC	Section 3.3.1.1 (line 124)	25% is too high. There is too much variability between the RPMs - locations, depths. Serious issues could arise in discreet areas without reaching a 25% threshold.	As discussed during the December 6th meeting with the TAC, this SMC has been modified so that GSAs should be notified/warned if 1.) two wells fall below MT for two consecutive years OR 2.) four wells fall below the MT in a given year. If a ‘warning’ occurs the GSAs will review what conditions may have changed, including increased pumping, precipitation patterns, etc.

Author	CIN	MCR	Group	Description	Location in GSP	Comment	Response / Recommended Action
Kristi Jamason	Jamason-006		A	GSA Rate Structure	Table 5.3.2	Funding column needs to tease out installation funding vs ongoing tasks - monitoring/reading and data analysis	Tables have been revised
Lucy Blake (Lemon Canyon Ranch)	Blake-002	MCR Demand Management	A	PMAs		For instance, could there be a market-based program for limiting the number of agricultural wells in Sierra Valley and gradually reducing the number of wells over a 20-30-year period) Similar strategies have been used to reduce air pollutants and carbon. For roe, the specific strategy selected is less important than the discussion and adoption of a meaningful, legally enforceable, and equitable way to reduce pumping in Sierra Valley.	MCR Demand Management

Author	CIN	MCR	Group	Description	Location in GSP	Comment	Response / Recommended Action
Lucy Blake (Lemon Canyon Ranch)	Blake-007	MCR GSA Rate Structure	A	GSA Rate Structure		The last concern I want to raise today is the question of who should pay to lix the problem. In the Funding Options Technical Memorandum, there is a suggestion that the cost of addressing the groundwater overdraft problem be split between people with high-capacity wells and property owners throughout the valley, whether they pump groundwater, or not. Where is the equity in that? Why should people who had no role in causing the problem to be asked to fund its resolution? The cost of addressing the groundwater overdraft problem should largely be borne by those who created the problem, with whatever financial assistance is available from the State of California. Unfortunately, according to the memorandum (see p.9), property owners all over Sierra Valley are already paying more to cover the operating costs of the Sierra Valley Groundwater Management District than high capacity well owners.	Thank you for your comments. The question of cost allocation in funding GSP implementation is a valid concern in groundwater management in California. The Sierra Valley Basin has an established revenue structure that splits costs between property owners and well owners, through parcel fees and meter fees. Property owners of parcels that have large-capacity wells pay both fees, while property owners of parcels without large-capacity wells pay the parcel fee only. This revenue structure does spread costs out among both well owners and property owners in general, though it provides additional consideration to wells by imposing the meter fee. At this point a variety of options are being considered. One option presented in the Funding Options Technical Memorandum, a parcel tax, would allocate cost widely to all property owners. This mechanism would not charge based on groundwater extraction. While the advantage of this method is a lower rate for each property, it is true that it would not take usage into account. Several fee models presented in the Memorandum do take usage into account. These models project that any additional costs associated with GSP implementation will be borne by the well owners, through the implementation of either a regulatory fee or property related fee on wells. This would mean that whether GSP implementation costs end up closer to the low estimate or the high estimate, large-capacity well owners will bear any additional cost burden. The options of structuring of these fees are presented in the Funding Options Technical Memorandum as either an estimated usage fee, which would charge based on an estimated usage rate, or actual usage fee, which would require the use of meters on all non-de minimis wells. There are advantages to each of these methodologies, and both attempt to take usage into account. The question of cost allocation will continue to be evaluated and will consider these comments as the GSAs develop the final funding plan during the first year of GSP implementation.

Author	CIN	MCR	Group	Description	Location in GSP	Comment	Response / Recommended Action
Mike and Jennifer Blide	JMB-005	MCR GSA Rate Structure	A	GSA Rate Structure		Finally, the costs of operating the Groundwater Management District, as well as the future costs of mitigating the overdraft problems, should be borne using some sort of pro-rata system whereby those property owners who are utilizing the most water should be paying the most money.	MCR GSA Rate Structure
NGO Consortium	NGO-011		A	Native Vegetation/Managed Wetlands	WB Sections	Quantify and present all water use sector demands in the historical, current, and projected water budgets with individual line items for each water use sector, including native vegetation.	Details are included in Section 2.2.3 (Water Budget) which has been added.
NGO Consortium	NGO-012		A	Native Vegetation/Managed Wetlands	WB Sections	State whether or not there are managed wetlands in the subbasin. If there are, ensure that their groundwater demands are included as separate line items in the historical, current, and projected water budgets.	We are not aware of managed wetlands in the Sierra Valley Basin
NGO Consortium	NGO-022	MCR Climate Change	A	Climate Change		Present calculations and descriptions (i.e., in tables, figures, and text) for the projected water budget. Ensure that the GSP incorporates climate change into all inputs of the projected water budget.	Included in the updated version of Section 2.2.3
NGO Consortium	NGO-023	MCR Climate Change	A	Climate Change		Integrate climate change, including extreme climate scenarios, into all elements of the projected water budget to form the basis for development of sustainable management criteria and projects and management actions.	MCR Climate Change: Projected climate change impacts are Included in the updated version of Section 2.2.3. Increased warming with decreased precipitation is one of several possible future climate conditions, which was evaluated under the "2070 DEW" scenario.
NGO Consortium	NGO-024	MCR Climate Change	A	Climate Change		Calculate sustainable yield based on the projected water budget with climate change incorporated.	Included in the updated version of Section 2.2.3

Author	CIN	MCR	Group	Description	Location in GSP	Comment	Response / Recommended Action
NGO Consortium	NGO-025	MCR Climate Change	A	Climate Change		Incorporate climate change scenarios into projects and management actions.	Climate change has been considered in the uplands management and restoration PMA, groundwater recharge PMA and fuels reduction PMA. The GSAs also acknowledges data gaps and existing uncertainty in its SV integrated hydrological model, as outlined in Appendix 2-5. While the model was developed based on the best available science and data and provided a sufficient understanding of Basin conditions, further improvements are needed to conduct climate change studies and simulate future scenarios. GSAs has sought to coordinate with local and regional stakeholders in generating and conducting climate change scenarios to include the largest spectrum of expected changes possible. This will help the GSA include the changes to reservoir operation and surface water availability in the Basin. Surface water availability can have significant impacts on the Basin and need to be incorporated into future scenarios.
NGO Consortium	NGO-027	MCR Data Gaps	A	Data Gaps		Increase the number of RMPs in the shallow aquifer across the subbasin as needed to map ISWs and adequately monitor all groundwater condition indicators across the subbasin and at appropriate depths for all beneficial users. Prioritize proximity to DACs, domestic wells, GDEs, and ISWs when identifying new RMPs.	There are a limited number of existing shallow groundwater wells in the Basin and of those even fewer have existing groundwater data or are suitable for collecting groundwater data. RMPs for ISW and GDEs represent those existing shallow groundwater wells suitable for monitoring and several new wells. The number of new wells is intended to strike a balance of filling data gaps and the cost of those wells to the SVGMD. If data gaps continue to exist, the Plan can be modified at the 5-year update to include additional RMPs.

Author	CIN	MCR	Group	Description	Location in GSP	Comment	Response / Recommended Action
Plumas Audubon Society	PAS-003	MCR GDE	A	GDEs, ISW		More rigorous work needs to be done on this. The proposed management actions are a good start, but it is necessary to specify which Integrated Surface Waters as well as Groundwater Dependent Ecosystems will be monitored, when and how this will begin, what the ongoing commitment will be, and how data for each selected site will be reported. This is critical and the monitoring should start at the beginning of the implementation phase, i.e., February, 2021.	Monitoring sites for ISW will occur at the list of RMPs in table and figure 3.3.3-1. Additional monitoring sites are proposed in table and figure 3.4.1-3. The number of new RMPs strike a balance of filling data gaps and the cost of monitoring to the SVGMD.

Author	CIN	MCR	Group	Description	Location in GSP	Comment	Response / Recommended Action
Rachel Hutchinson, Forest Service	Hutchinson-001		A	PMAs	Ch. 4, p 4-36	The GSP draft states: "National Resource Conservation Service has implemented meadow restoration projects in Clover Valley and Perazzo Meadows that divert water from going downstream." If your team understands that this is an accurate statement, I suggest a reference needs to be provided for this information. There are several inaccuracies associated with this statement: There is no evidence from the groundwater and surface water monitoring that has occurred in these locations that water is being "diverted from going downstream." The groundwater levels were recharged post-restoration. Reports published by Balance Hydrologics on Perazzo meadow and by The Sierra Fund for Red Clover Valley can be referenced showing that water is not diverted from going downstream. I am happy to provide these if needed. Red Clover Valley is outside of the watershed and the basin and should probably not even be included in this document. Suggest mention of this project. If you want to include another meadow within the basin where groundwater recharge occurred as a result of meadow restoration, I suggest you utilize Knutson Meadow within Carman Valley. There are several peer reviewed publications (by Jerry Davis et al. from San Francisco State University) on the benefits associated with this project, I provided those to Stillwater several months ago. NRCS did not implement the project at Perazzo Meadows, the US Forest Service did. Suggested Re-write: "the US Forest Service implemented meadow restoration projects at Perazzo Meadow and Knutson Meadow that successfully recharged groundwater levels."	Thank you for this information. The suggested edit was made in Chapter 4.

Author	CIN	MCR	Group	Description	Location in GSP	Comment	Response / Recommended Action
Steven Roberts	Roberts-001	MCR Demand Management	A	PMAs		I believe that the habitats the ranchers use for agriculture is important; the history of our valley IS all about ranching. However, at the expense of Sierra Valley property owners, the "well is running dry" and I believe that the State, the Sierra Valley Groundwater Management District Board, and the public must address and implement a sustainable groundwater plan before there is no water to split between the domestic users and the high capacity well owners. Unlike the 'olden days' when our water was free, I foresee a cost to water usage for all parties. The Sierraville Utility Water District recently (September 2021) implemented a substantial rate/fee increase and reduced the maximum gallon usage per household and I am monitored for usage; over-usage fees are significant. The high capacity, high volume water users should also be adequately monitored, and overdraft usage charged particularly in drought years.	MCR Demand Management
TAC	TAC-001		A	GSA/TAC Roles and Responsibilities	Section 2.1.5.3	While we were provided with information regarding various aspects of the plan, the TAC essentially reviewed plan elements as they were prepared. With very few exceptions, the TAC was not engaged in collaborative planning. Our feedback was primarily provided in writing. Comments of individual TAC members were not shared with other TAC members, issues and concerns raised in written comments were not discussed by the group. Disposition of the comments were not shared with either the commenters or the group. In short, we feel the TAC essentially served as a group of individual plan reviewers, not a Technical Advisory Committee.	More details on the TAC roles and responsibilities have been included in the attachment C of the Communication and Engagement Plan (Appendix 2-3).
TAC	TAC-003		A	GSA/TAC Roles and Responsibilities		The role of the TAC needs to be clarified. The GSAS are responsible for development and implementation of the GSP. In effect, the TAC serves at their request. We think a logical first step would be for the GSAs to articulate what they desire and expect from a TAC. This would hold for both revisions to the draft Plan and potentially, assistance in monitoring, implementing, and revising the final plan. It could be that the GSAs do not wish to use a TAC and would instead rely on their own experience and expertise.	More details on the TAC roles and responsibilities have been included in the attachment C of the Communication and Engagement plan (Appendix 2-3).

Author	CIN	MCR	Group	Description	Location in GSP	Comment	Response / Recommended Action
Tom Dotta	Dotta-002	MCR Demand Management	A	PMAs	Ch 4	Sierra Valley has a serious problem. Let's make it simple, more water is taken out than put in. To solve the problem 1. more dams are needed and irrigate with stored rainwater 2. The ground is recharged by ponds or forced wells 3. Quit taking the water out for irrigation.	MCR Demand Management
Board	Board-002	MCR Demand Management	B	PMAs	4.3.9	Conservation easements are not a feasible example of land repurposing and is too specific	references to conservation easements were deleted from the voluntary Land Repurposing PMA (4.3.9) and referred to more generally as areas where there are opportunities for irrigation reductions
Board	Board-003	MCR Data Gaps	B	Data Gaps	ch 4	Aquifer Characterization is more addressing a data gap than a PMA	This PMA was deleted and the information on needing better characterization of the basin (i.e., east vs west, shallow vs deep aquifers) was moved to the data gap appendix
Board	Board-004	MCR Demand Management	B	PMAs	4.3.1	ag irrigation efficiencies PMA -use of variance frequency drive (VFD) should be added to this PMA	this was added to this PMA
Board	Board-005	MCR Monitoring	B	Monitoring Networks	4.3.2	monitoring network modifications should be characterized as optimizing the networks rather than expanding them	edit made to Inventory a Metering PMA, to say optimize instead of expand
Board	Board-006	MCR Monitoring	B	Monitoring Networks	through-out	clarify that proposed potential monitoring is not required/does not commit SVGMD to conducting potential monitoring	made changes throughout the text to clarify what is required and what is "POTENTIAL"
Board	Board-007		B		ch 1	Add description of SVGMD's efforts to manage groundwater prior to SGMA	text added to say that SVGMD was established in 1980 and has been controlling new well construction and monitoring agricultural pumping
Board	Board-010	MCR PMAs	B	PMAs	ch 4	references to grazing/alfalfa are more specific than needed	changed references to 'crop irrigation' and other more generic terms

Author	CIN	MCR	Group	Description	Location in GSP	Comment	Response / Recommended Action
Board	Board-011	MCR PMAs	B	PMAs	4.3.3	add reference to groundwater recharge in the Reoperation of surface water supplies PMA	added text about Badenaugh Creek option
Board	Board-012	MCR PMAs	B	Outreach	4.2.4	Number/frequency of meetings will depend on need and available funding	removed number (2-4) and frequency (quarterly) from PMA - exact schedule will be determined
Board	Board-013	MCR PMAs	B	PMAs	4.3	Commitment to prioritizing PMAs in February 2022 may be unrealistic	Changed language in introduction to 4.3 to provide longer time frame for this process - will begin process in February 2022 and complete within first year of GSP implementation
Carl Butz	Butz_001	MCR GDE	B	GDE		Adaptative management of the watershed, the very laudable goal of the SGMA, therefore, requires the Groundwater Sustainability Plan to include measures insuring all the data hydrologists need to evaluate the situation is to be gathered. As it stands, I am particularly concerned about the fragile Groundwater Dependent Ecosystem (GDE) of the Sierra Valley. With droughts likely to increase in frequency and duration due to climate change, I want to know if the freshwater marsh and meadow system is going to be sacrificed because of the deep wells used to produce alfalfa. Currently there simply isn't enough data to make an intelligent guess.	Agreed, shallow groundwater is a data gap. Four additional wells will be installed near the GDEs in the western half of the basin. This will help to better assess shallow groundwater and help to calibrate the groundwater model to assess the effects of groundwater management on GDEs.

Author	CIN	MCR	Group	Description	Location in GSP	Comment	Response / Recommended Action
Ceci Dale-Cresmat	Cresmat-001	MCR Demand Management	B	PMAs		The document clearly shows that there is a ground water over-drafting problem in Sierra Valley. The plan shows that approximately 6,000 ac ft would be sustainable, yet over twice that amount is being drafted in an average year. This is not sustainable and a target of 6,000 ac ft should be placed in the plan as a limit, with no further drafting. An assessment should be made of all the landowners' water uses and those that are using more than is sustainable should be required to reduce water use. There is technology available to use less water in crop production and those include irrigation water management, (there is a host of practices included in this such as soil moisture monitoring in fields and only applying what a crop needs, updating and improving irrigation systems so the lowest use systems are used, etc.) Other measures could include using alfalfa crop varieties that use less water or switching to dryland crops or just using the land currently under production for high water use crops to rangelands where little to no water is used.	MCR Demand Management
Ceci Dale-Cresmat	Cresmat-002	MCR PMAs	B	Shallow GW Wells		Ø Effects of high production ag wells on domestic wells and livestock wells (6-8" casing size) is not addressed in the document. When surface water dries up, livestock are dependent on livestock wells and springs for water sources. Over-drafting the ground water will have a direct effect on both livestock wells and domestic wells throughout Sierra Valley by dropping the water table. There was a reference in the document that if 6 of 10 domestic wells dry up, this would be a trigger to change ground water use by large agricultural wells (10-12" casing). What happens to landowners of those 6 wells? Does that include livestock wells? Who is going to monitor that? Bottom line is, if one dries up then that should be a trigger to change things or better yet, set a limit to ag well pumping to 6000 ac ft per year.	MCR PMAs

Author	CIN	MCR	Group	Description	Location in GSP	Comment	Response / Recommended Action
Ceci Dale-Cresmat	Cresmat-003	MCR GDE and MCR ISW	B	ISW, GDEs		Ø There was little if any sections of the document that address what the effects will be on streams, springs, artesian wells, and wetlands from over-drafting ground water. As we all know Sierra Valley is a critical part of the Pacific Flyway and negative effects to the wetlands and other surface waters could be devastating to this resource. This resource should be addressed in the plan and assurances made that no negative effects to this resource occur in the future.	The Plan addresses this issue by limiting future decline of groundwater levels near GDEs and ISW to the historical low groundwater elevation. Details provided in MCR ISW and MCR GDE
Ceci Dale-Cresmat	Cresmat-004	MCR Outreach	B	Outreach		Ø There has been a lack of public input in this process. The effects of this plan are broad and input from residents of Sierra Valley and surrounding areas should be sought. The effects of long term over-drafting will be felt in Sierra Valley and beyond. There are many recreational users that come to Sierra Valley and generate income to local businesses. This could be lost if desertification occurs in the area due to ground water over-drafting and the effects on streams, wetlands, domestic and livestock wells.	MCR Outreach
Cindy Noble	Noble-001	MCR Subsidence	B	Subsidence		I am not sure residents of Sierra Valley are aware of the large-scale subsidence in the northeast corner near the town of Vinton. This information was presented to the SGMA process by the CA Department of Transportation and should be of great concern to both Agricultural water users and domestic well owners in the area.	MCR Subsidence
Cindy Noble	Noble-002	MCR Outreach	B	Outreach		I believe that the process that produced the current draft plan did not meet the standard of “Community Based” inclusion. I attended a single community meeting where there were maps and as I remember a group of consultants who worked on this process provided a great deal of very interesting information. Sadly, there was zero follow up and I never heard of any other Community engagement in the Sierra Valley Sustainable Groundwater planning process.	MCR Outreach

Author	CIN	MCR	Group	Description	Location in GSP	Comment	Response / Recommended Action
Donna Lindquist	Lindquist-001		B	Draft Plan Content		I found the report to be cumbersome, longer than needed, full of confusing acronyms and difficult to follow. There are many important gaps in the analysis that I will mention below. The technical information and long-winded discussions should be moved to appendices to avoid overwhelming the non-technical reader. An executive summary that is less than 3 pages is needed to CLEARLY summarize background, objectives, studies to date, and the recommended long-term solutions. The existing summaries are too long and complicated for the lay-reader to understand or to keep their attention.	A short summary will be added to the plan.
Donna Lindquist	Lindquist-003	MCR Data Gaps	B	Data Gaps		The SVGPS, along with other technical data, indicate significant aquifer overdraft in certain parts of the valley but this report concludes any chronic long term impacts are manageable. I find that hard to believe since both technical and physical evidence does not support this conclusion which indicates that additional analysis is needed to better understand the sustainability of current extraction practices.	Estimation of the overdraft and sustainable yield of the basin based on two different analyses has been included in Sections 2.2.3.6 and 2.2.3.7, respectively. SGMA mandates that significant and unreasonable impacts to beneficial users of groundwater (e.g., industrial, domestic, and environmental uses) are avoided. The Plan details groundwater management that avoids such impacts, and also lays out where data gaps hinder the assessment of such impacts and how to "fill" those gaps.
Donna Lindquist	Lindquist-004	MCR Subsidence	B	Subsidence		Many technical reports (including the recent Cal Trans report on damages to Highway 70) document serious levels of subsidence especially in the NE end of the valley. The SVGSP largely ignores these data and concludes that the situation is manageable over the long term, even with the current rate of subsidence. The Plan has missed the mark on this point and a more in depth study and analysis needs to be done. Groundwater pumping needs to be reduced to protect natural resources in the valley and the livelihood of residents.	Subsidence was discussed extensively by the TAC on December 6 in response to this and other public comments. It was decided to revise the subsidence discussion to indicate it needs closer monitoring. Monuments will be installed in the area mentioned and InSAR data will initially be used to monitor subsidence. Additional surveys will be conducted if InSAR subsidence increases by 50% of the average annual subsidence from baseline period (2015-2021). The GSAs may at their discretion elect to survey monuments more frequently, pending available funds.

Author	CIN	MCR	Group	Description	Location in GSP	Comment	Response / Recommended Action
Donna Lindquist	Lindquist-005	MCR GDE and MCR ISW	B	GDEs, ISW		Groundwater and surface waters are hydrologically connected yet the Plan includes little data on surface waters and how they interact with aquifers. This is a large data gap that needs to be addressed. There is already evidence of surface water and springs declining or even disappearing in the northern part of the valley. Surface waters also support ecological values that are unique and critical to Sierra valley, including wetland plants, fish, wildlife, and an amazing and diverse bird population. The beneficial uses of these resources need to be protected and factored into any decisions on groundwater extraction.	See MCR GDE and MCR ISW; In addition, this is a data gap to be filled by recommendations in the monitoring plan The planned additional shallow wells near the GDEs coupled with the groundwater model should help to clarify. In the absence of this data, the Plan limits the decline of groundwater levels near GDEs and ISW to the historical low groundwater elevation.
Donna Lindquist	Lindquist-006	MCR PMAs	B	PMAs		There is minimal mention of the impact of subsidence, aquifer depletion and surface water reduction on stock water and ranching operations. Ranching is important to the Sierra Valley economy and lifestyle. This needs to be addressed since it will significantly impact this industry over time. As surface water dries up, those beneficial users will be adversely affected.	MCR PMAs
Donna Lindquist	Lindquist-007	MCR Outreach	B	Outreach		Not enough effort has been put into engaging the public on the overextraction and subsidence issues that could seriously affect their financial standing and quality of life. I talked with several Sierra Valley residents who still are not aware of the issues and how they might be impacted. It seems a few large ag producers are spearheading this Plan, while other users are unaware of the potential consequences. More educational work is needed.	MCR Outreach
Feather River Land Trust	FRLT-001		B	Draft Plan Content		Nonetheless, we find that several key elements of the plan are incomplete or not included in the Public Review Draft. We further understand this version of the plan has not been reviewed by the GSAs. This makes it very difficult to understand or review the plan and to provide substantive comments. We wonder if the draft we reviewed meets standards for public review.	A short summary will be added to the plan to help with future review and missing elements have been added including the water budget, estimate of sustainable yield and climate change impacts. There will be another 75-day comment period after board adoption and after submission of the plan to DWR.

Author	CIN	MCR	Group	Description	Location in GSP	Comment	Response / Recommended Action
Feather River Land Trust	FRLT-003	MCR Subsidence	B	Subsidence		The draft plan identifies several sources of information indicating subsidence has occurred in the basin. The plan provides no discussion of a cause-and-effect relationship between pumping, groundwater levels and subsidence, but the depictions of groundwater levels (Figure 2.2.2-4) and estimates of subsidence from InSAR data (Figure 2.2.2-7) show remarkable alignment. In addition, CalTrans has documented damage to Highway 70 from subsidence. We understand the lack of long-term onsite ground elevation data makes a direct numerical Sustainable Management Criteria (SMC) for subsidence impractical. It appears however that the current plan (Table 3.4.4) does not commit to monitoring elevations in the future (monuments to achieve this purpose are classed as “other, based on future funding availability”). Given the evidence that subsidence has negatively impacted public infrastructure, there is potential for future impacts to agricultural practices and hydrology of wetland and aquatic habitats. We believe the plan needs to commit to more direct actions to monitor and manage for subsidence.	MCR Subsidence
Feather River Land Trust	FRLT-004		B	SMC		It is not clear if this estimate is based on the work of Bachand, et al (2020) or on subsequent analysis that supports this work. We realize that in talking about overdraft, average values can be misleading given the variation in wet and dry years and location within the basin. Nonetheless, it appears that available information suggests over drafting has occurred in the eastern portion of the basin. Our concern is that this basic problem does not receive more focus in the plan. We believe the plan should more clearly direct analysis, discussion, and attention to known problem areas.	Updated water budgets and a more thorough analysis of spatial and temporal conditions in the basin are included in Section 2.2.3. Quantification of overdraft and sustainable yield in the basin using the Sierra Valley Hydrogeologic System Model (SVHSM) is included in Sections 2.2.3.6 and 2.2.3.7. The estimate of sustainable yield from SVHSM agrees with previously published estimates for the basin.

Author	CIN	MCR	Group	Description	Location in GSP	Comment	Response / Recommended Action
Feather River Land Trust	FRLT-006	MCR ISW	B	ISW		Like subsidence, data to precisely delineate ISW is lacking. As a result, some potential ISW is classified as a "data gap". The most conservative approach to addressing this gap would be to treat the "data gap" ISW as ISW until data were collected to determine they were not ISW. This would include reviewing groundwater levels in the areas near these "gap ISW" and adjusting SMC as needed to protect them. A less conservative approach would be to collect data in the short to mid-term to better determine the status of the potential ISW. Because the plan does not commit to this data collection, these potential surface water habitats are at risk.	Surface water designated as a data gap maintains the same level of protection as those classified as ISW. MTs for RMPs near surface water is set at the historical low groundwater elevation.
Feather River Land Trust	FRLT-007	MCR Climate Change	B	Climate Change		The basin hydrologic model was not available at the time the draft plan was presented; we understand it will consider changes to water supply from Climate Change. Unfortunately, the draft plan seems to assume that climatic and hydrologic conditions are static. Because higher air temperatures will increase evaporation and transpiration, it is likely that less water will be available for recharge, further complicating basin overdraft. A conservative approach would be to apply assumptions about these changes to the plan. At present, we see no evidence that potential fundamental changes to the hydrology of the basin are considered.	There are several other climate factors in addition to temperature that influence recharge processes (e.g., timing of precipitation, precipitation volume, storm intensity). Changes in these could enhance, negate, or diminish any temperature change effects on recharge processes. Projected climate change impacts using the four climate change scenarios provided by DWR are included in the updated version of Section 2.2.3.
Feather River Land Trust	FRLT-009	MCR Monitoring	B	Monitoring Networks		The plan has numerous locations where additional monitoring or studies are proposed as the means to reduce uncertainties. As mentioned earlier, this includes collecting better information on potential subsidence and Interconnected Surface Waters, but these are just two examples. Nearly every aspect of the plan calls for additional information. Our concern is that these statements are not included in a monitoring plan. Our reading of the plan (Table 3.4.4) is that the only firm commitment is for up to six additional wells, used to better assess water quality. We believe that the uncertainties in the plan, including reliance on proxies, necessitate a much more robust monitoring effort. The logical alternative is to scale back the groundwater SMC to provide for greater likelihood of sustaining groundwater values in the face of the acknowledged uncertainties.	The reviewer notes that the plan identifies many data gaps, and we agree that these must be filled in order to better ensure sustainable groundwater management in the SV basin. Nonetheless, the plan uses the best available information, and suggests the avoidance of significant and unreasonable impacts to beneficial users. Reducing MTs as suggested would likely lead to significant and unreasonable impacts to growers, ranchers, and municipal systems - only in the proximity of these users are groundwater levels allowed to decline beyond historical lows. Out of an abundance of caution, groundwater levels near GDEs and ISW are not allowed to decline beyond historical lows.

Author	CIN	MCR	Group	Description	Location in GSP	Comment	Response / Recommended Action
Feather River Trout Unlimited	FRTU-001	MCR GDE and MCR ISW	B	GDEs, ISW		Historically, Sierra Valley provided high quality habitat for native fishes, with abundant wetlands providing excellent rearing habitat. Much of Sierra Valley's surface water is currently diverted for agricultural use during low flow periods, this has led to a reduction in the amount and quality of habitat. The plan is silent on the potential impacts of proposed groundwater levels on fish or fish habitat. Analysis of the proposed groundwater Sustainable Management Criteria (SMC) essentially says that impacts to beneficial users (including fish habitat) will be no worse than those which may have occurred when these levels previously occurred. This analysis is lacking in at least two important ways. First, no data is presented that documents these conditions. How for instance, did these groundwater levels influence surface water conditions in and downstream of the Valley? Second, there is no consideration of how groundwater levels at or near the SMC over long time periods might affect beneficial users.	Quantification of ISW depletion is a difficult task considering the novelty of the model and lack of surface water data to perform calibration. Besides the streamflow gage on the Middle Fork Feather River there has been no continuous monitoring of streamflow within the groundwater basin in the last ~40 years. Consequently, this is considered a data gap and will be addressed by recommendations in the monitoring plan. As this data gap is addressed, we will be better able to assess how groundwater management is affecting interconnected surface water and groundwater elevations, the GSA can target areas where ISW depletion is occurring. Assessing the effect on beneficial users will require more information on groundwater elevations and ISW to target areas that might require data linking flow and groundwater changes to habitat response.

Author	CIN	MCR	Group	Description	Location in GSP	Comment	Response / Recommended Action
Feather River Trout Unlimited	FRTU-002	MCR Climate Change	B	Climate Change		There is very little, if any consideration of likely future changes to Sierra Valley hydrology. FRTU's basin assessment, referenced above, incorporated projections of future hydrologic conditions as one factor in identifying priority subwatersheds. Using two climate change prediction models (ccsm4_rep85 and GFDL_A2), projections showed reductions in April 1 snowpack for both the Badenaugh (18 to 42 percent) Bonta (14 to 25 percent) subwatersheds. Both models projected slight increases in runoff (~5%) for both subwatersheds, though timing of flows would be earlier than at present. August 1 air temperatures were projected to increase by about 2 degrees F by 2040 for both areas. We are not proposing that these figures be used in the plan. They are provided only to illustrate that changes to the amount and timing of runoff to the Valley are likely to change in the future. Changes to evaporation and transpiration are nearly certain to occur. Such changes are likely to impact fish habitat in negative ways, especially if groundwater contributions to surface flows are reduced. In particular, we are concerned how cumulative changes to flow and water temperature will impact habitat in the Middle Fork Feather River. Not including consideration of such changes appears short-sighted.	Section 2.2.3 (Water Budget Information) of the GSP was incomplete at the time of the public release because more time was needed for model calibration and adjustment in order to improve representation of the hydrologic system. This has resulted in a model that better represents observed hydrologic conditions in the valley. Estimation of future water budgets has been performed for four different climate change scenarios provided by DWR. Since SVHSM is highly discretized in space and time, more detailed metrics, and delineation of areas of concern are required to perform a more thorough evaluation of potential habitat effects. SVHSM is not currently capable of simulating heat transport as representation of transport processes was not included in the original scope of work. However, this could be added as part of a future task order.
Feather River Trout Unlimited	FRTU-003	MCR ISW	B	ISW		Due to lack of data, numerous uncertainties in the plan (including delineation of Interconnected Surface Water, ISW) are addressed by calling for increased or targeted monitoring to fill data gaps. In the face of uncertainty, we feel this is a reasonable approach. We are concerned that commitment to following through on these needs is not evident in the plan. The monitoring tasks outlined in Table 3.4.4, do not include monitoring of GDE or additional hydrologic data needed to validate the initial delineation of ISW and GDE. If monitoring proposed to validate plan assumption will not be conducted, then those elements of the plan should be revised.	As stated, uncertainty exists in the classification of ISW, which has been identified in the Plan as a data gap. Recommendations in the monitoring plan look to fill these data gaps, but the number of new RMPs must strike a balance of filling data gaps and the cost of monitoring to the SVGMD. Additional description of the proposed monitoring network for GDEs has been included in Section 3.4.4, Monitoring Networks Summary.

Author	CIN	MCR	Group	Description	Location in GSP	Comment	Response / Recommended Action
Feather River Trout Unlimited	FRTU-004		B	Draft Plan Content		Several key components of the plan, such as the hydrologic model for the basin, were not complete when the plan was released. Additionally, numerous tables are not included, and several Appendices were incomplete or not available. The lack of a complete, coherent document made the draft plan very difficult to review.	Hydrologic model description has been added to Section 2.2.1 and the water budget has been added to Section 2.2.3
John Preschutti (Plumas Forest Project)	PFP-001	MCR Outreach	B	Outreach		As a 48-year resident of Mohawk Valley, who has been active in promoting the environmental and social health of all of eastern Plumas County, I feel that I should be considered a "stakeholder" (as anyone with these interests living in this area would be — primarily due to declining groundwater storage capabilities of the Sierra Valley Groundwater Basin and its subsequent effect on the surface water of the Upper Middle Fork of the Feather River Watershed — including Mohawk Valley.) As such, I was surprised that I was not made aware of this planning process and potential opportunity for public involvement from any official source. The lack of a physical local newspaper for almost two years due to Covid has probably contributed to this deficiency. I used to subscribe to the Feather River Reporter and would look through every issue with an eye toward articles or notices about these kinds of things. For some reason, like many others, I imagine, I didn't make the switch to reading the newspaper online in the same manner. The "outreach" part of the documentation doesn't address this huge hole in public outreach capabilities. Therefore, I ask that you extend the comment period due to the insufficient time I have had to review the plan, bring myself up to speed on the issues, and adequately comment. It should also be extended to such a time that a sufficient outreach program has been instituted. Additionally, the area of potential stakeholder status should be expanded to include areas of Eastern Plumas County outside the immediate groundwater basin (particularly downstream), such as Mohawk Valley.	We are very glad to have you engaged in this process. We will ensure that you receive the materials and information that is sent out to all interested parties. Please note that basin boundaries are established by the California Department of Water Resources. Also, a new public comment period will be after the approved GSPs are submitted to DWR; this will be noticed to all interested parties.

Author	CIN	MCR	Group	Description	Location in GSP	Comment	Response / Recommended Action
John Preschutti (Plumas Forest Project)	PFP-002	MCR Subsidence	B	Subsidence		In conclusion, what I do know about existent Sierra Valley subsidence, and the associated permanent loss of the aquifer's storage capacity, the plan should have adequate provisions for timely measuring and preventing of any groundwater overdraw.	Inelastic (permanent) subsidence is a physical process where the arrangement of fine-grained materials (typically clays and silts) is altered such that compaction occurs. While this compaction does result in some loss of storage in these fine sediments, the majority of useable groundwater is stored and transmitted in coarse-grained sediments which are unaffected by subsidence. Therefore, subsidence is a concern because differential deformation of the land surface can have adverse effects on engineered structures and conveyance systems (bridges, railroads, canals, etc.) on the land surface, not because of reduced subsurface storage capacity. The known extent and vertical displacement of subsidence in Sierra Valley is discussed in Section 2.2.2.5 of the GSP.
Kevin Starr	Starr-001	MCR Outreach	B	Outreach		• A plan of this scope and size should be a multi-year process with numerous opportunities for public engagement- not just something I hear about in passing with neighbors.	MCR Outreach
Kevin Starr	Starr-002	MCR Subsidence	B	Subsidence		• Overdrafting by large scale agriculture operations in the Sierra Valley are contributing to subsidence, which should be heavily weighted in the management plan and continued abuse should come with commensurate punitive actions.	MCR Subsidence
Kevin Starr	Starr-003		B	ISW, GDEs		• Has impact to surface water been thoroughly studied and the water dependent ecosystems that rely on it?	This is a data gap to be filled by recommendations in the monitoring plan described in Section 3.4.4.3

Author	CIN	MCR	Group	Description	Location in GSP	Comment	Response / Recommended Action
Kim McKinney	KM-002	MCR Outreach	B	Outreach		My second concern is ancillary to my first in that chronic overdrafting could result in domestic wells running dry. Because of this concern I feel that all members of the Sierra Valley Groundwater Management District need to be briefed regularly on the status of water usage in the basin in an easily digestible format. Many members work and are unable to attend meetings, but I would think a quarterly newsletter could disseminate information. This would give members, who pay a District Management fee in their property taxes an informed voice at the table.	This suggestion will be incorporated into the Communication and Engagement Plan, in the new section on Outreach and Engagement for Implementation.
Lucy Blake (Lemon Canyon Ranch)	Blake-003	MCR PMAs	B	PMAs		In short, while I am hopeful that Sierra Valley groundwater pumpers can achieve some efficiencies through improvements in irrigation technology, plant propagation or crop selection, I do not think it is either realistic or responsible to count on “new” water supplies to solve our severe groundwater overdraft problem.	MCR PMAs
Lucy Blake (Lemon Canyon Ranch)	Blake-005	MCR Climate Change	B	Climate Change		I was also disappointed not to see any real discussion about the likely impacts of climate change on water supply in Sierra Valley. The northern Sierra is projected to get both warmer and drier over the coming decades. This will reduce the amount of water stored in snowpack and accelerate the Spring run-off, reducing the total flow of water into the basin, as well as its availability for irrigation in summer. These climate change impacts, which we are already experiencing, are not something we can wish away. They are real and they must be incorporated into any assumptions used in the GSP about future water supplies in Sierra Valley. For instance, clearly the level of pumping I(en Schmidt considered “safe yield” in 2003 must be adjusted downward to reflect the amount, timing, and kind of precipitation Sierra Valley will be getting 10-20 years from now.	MCR Climate Change: Projected climate change impacts are Included in the updated version of Section 2.2.3. Increased warming with decreased precipitation is one of several possible future climate conditions, which was evaluated under the "2070 DEW" scenario.

Author	CIN	MCR	Group	Description	Location in GSP	Comment	Response / Recommended Action
Lucy Blake (Lemon Canyon Ranch)	Blake-006	MCR Outreach	B	Outreach		I am also concerned about the level of stakeholder involvement in the process. Most people in Sierra Valley depend on groundwater for their drinking water and yet most of the stakeholder opinions referenced in the draft report are heavily skewed toward individuals with large agricultural wells. Where are the other voices? Declining groundwater levels are everyone's concern. If groundwater levels drop significantly, domestic wells could run dry. That is not just a theoretically problem but one that has occurred all over California in places where agricultural pumping had been allowed to proceed unchecked. It would be unethical for us to let that happen in in Sierra Valley, where we are blessed with an abundance of water.	Outreach and engagement strategies are described in detail in the Communication and Engagement Plan and in Chapter 2 of the GSP. We will note that traditional community outreach activities were restricted by COVID as in-person events were not always possible. However, online monthly TAC and Board meetings were publicized through the SVGMD website and through emails to interested parties. In addition, all meeting materials and meeting recordings are posted on the SVGMD website. Other approaches to publicizing events are listed below. Moving forward, comments on the outreach and engagement process are being taken into consideration and the approach during GSP implementation is provided in a new section on outreach and engagement for Implementation that has been added to the Communication and Engagement Plan. As described in Chapter 2, substantial efforts to engage the public in development of the GSP have been underway since 2018 with public workshops being conducted in October 2018, December 2019, May 2021 and October 2021. These workshops were publicized through: • Print and on-line media/newspaper announcements: Mountain Messenger; Plumas News; Sierra Booster and www.sierraville.org • Outreach partners' newsletters, websites, and social media accounts • GSA websites, with posting of TAC meeting minutes, materials and recordings on the SVGMD website • Interested parties email lists • Posting of public workshop flyers at local establishments • Distributing surveys using multiple formats: hard copies at workshops, posted as PDFs, and links to online versions In addition TAC meetings have been held monthly since November 2020 and GSP updates have been provided at the monthly SVGMD Board meetings. The Board meetings are open to the public and, as noted above, all meeting materials are posted on the SVGMD website.

Author	CIN	MCR	Group	Description	Location in GSP	Comment	Response / Recommended Action
Michael Hogan	Hogan-001		B	Draft Plan Content		§ The Plan did not contain critical information on which to base assumptions or interpretations of the potential problems or solutions since the functional water balance model was not complete at the time of the posting of the Plan. Without that information, it is impossible to analyze the validity of statements and claims in the Plan, let alone the proposed Actions.	Included in the updated version of Section 2.2.3
Michael Hogan	Hogan-002		B	Draft Plan Content		§ A critical chapter of the plan, Chapter 3, was re-posted 2 weeks before comments were due. I am not a legal expert, but I believe that from the standpoint of both the State and County requirements, at least 30 days are required as an adequate posting period.	Thank you for your comment. There will be another 75-day comment period after board adoption and after submission of the plan to DWR.

Author	CIN	MCR	Group	Description	Location in GSP	Comment	Response / Recommended Action
Michael Hogan	Hogan-003	MCR Outreach	B	Outreach, Equal representation		According to the SGMA legislation, Plans should be based on broad stakeholder input in order to reflect actual stakeholder interests and values. During preparation of the Sierra Valley Groundwater Sustainability Plan, there was NO stakeholder group convened. The main stakeholder groups by actual numbers of members in the Sierra Valley are as follows: 1) Domestic well users, 2) Cattle ranchers (their use of surface waters make them a significant stakeholder group) and 3) agricultural pumpers. By volume of water used, as well as by greatest impact to overdrafting, agricultural pumpers are the most significant group. However, NONE of these stakeholder groups were present in developing this plan. A Technical Advisory Committee (TAC) was formed that had some members who were members of one or more of the stakeholder groups. However, this was not a stakeholder group nor were stakeholder interests discussed in depth. For instance, in terms of domestic well users, who depend on groundwater for their very existence in the Sierra Valley, the only question put before the TAC was how many domestic wells drying up would be 'too many'. That question itself is improper and was not asked of domestic well users but of the TAC in general, which, as I said, is not a stakeholder group, and was only partially made up of residents of the Sierra Valley. The TAC was not used as a stakeholder group. Lack of communication between TAC and GSA Board	The Technical Advisory Committee (TAC) is a stakeholder group comprised of representatives associated with an array of interests. Supplemental outreach activities included phone calls and follow-up, as well as occasionally convened working sessions to supplement TAC discussions. This approach is being expanded and is included in the Communications and Engagement Plan, in the new section on outreach for implementation.
Mike and Jennifer Blide	JMB-001	MCR Outreach	B	Outreach, Equal representation		From what I understand, this process has been flawed in that there has been little representation from domestic well users in the Valley. As far as I know, there have been few public meetings; one exception was a ZOOM offering a few weeks ago that I joined and was dismayed that there were only six persons in attendance.	MCR Outreach

Author	CIN	MCR	Group	Description	Location in GSP	Comment	Response / Recommended Action
Mike and Jennifer Blide	JMB-002	MCR PMAs	B	Shallow GW Wells		Clearly, if the numbers regarding annual overdrafts of our groundwater are correct, it is only a matter of time before some domestic wells start to fail. If the only solution is to dig a deeper well at a huge cost, it occurs to me that this does nothing to solve the problem. Also, if the trigger for any kind of mitigation measures happens only after 8-10 wells fail, then we would be seriously behind in attempting to resolve the problem. It is my opinion that a crisis management plan be implemented NOW, so that we can begin to address the annual overdrafts of water.	This was discussed extensively at the TAC meeting on December 6th. SMCs, Chapter 3, will be modified to describe undesirable results according to decisions made at the December 6th meeting. Domestic well SMC has been removed until a more complete well inventory and assessment has been completed. Well inventory will be done within ~2 years and SMC can be re-evaluated for the 5-year GSP update.
Mike and Jennifer Blide	JMB-003	MCR PMAs	B	PMAs		I am also aware that SPUD is trying to get a well drilled to serve as a secondary water source for the Town, as the current source is a surface water spring and some level of redundancy is needed for the future, especially in light of the current escalating drought cycles. This well would fill and maintain two large tanks that serve as the domestic water supply for over one hundred commercial and residential customers representing many times that number of individuals. They had better dig deep, it seems.	We thank the reviewer for noting this. SPUD sent an application for Small Community Drought funding, and they asked for support to drill a well as a backup well or with the idea of using spring water or the well based on the type of year, etc. The model can help providing guidance on that.
Mike and Jennifer Blide	JMB-004	MCR GDE and MCR ISW	B	GDEs, ISW		I am also concerned that the focus on deep water wells for irrigation of crops does not give proper import to the protection of habitat for the myriad of wildlife that call Sierra Valley home. As a major stopover for the Pacific Flyway migratory path for so many different species of birds, I am concerned that not enough attention is being paid to the maintenance of surface water habitats.	Interconnected surface waters were mapped by Balance hydrologics using whatever well data were available and things like hydraulic gradients. Four additional shallow wells will be located near the GDEs to better understand the interconnected of surface water and groundwater, which are not well constrained using available data. Based on current data little is known about the hydrology of the large wetlands used by birds. Additional monitoring will be required to better understand both groundwater dynamics and interconnected surface flow. This monitoring plan will be expanded in upcoming drafts of the GSP.

Author	CIN	MCR	Group	Description	Location in GSP	Comment	Response / Recommended Action
NGO Consortium	NGO-004	DACs	B	DACs		The GSP fails to identify the population dependent on groundwater as their source of drinking water in the basin. Specifics are not provided on how much each DAC community relies on a particular water supply (e.g., what percentage is supplied by groundwater). Identify the sources of drinking water for DAC members, including an estimate of how many people rely on groundwater (e.g., domestic wells, state small water systems, and public water systems).	We thank the reviewer for noting this and maintain that our sustainable management criteria protect domestic wells from impacts. Therefore, such an analysis would not substantively change the fact that projected groundwater management is not expected to impact domestic wells in the basin. To our knowledge, all domestic and municipal users in the basin are solely reliant on groundwater.
NGO Consortium	NGO-008	MCR GDE	B	GDE		If insufficient data are available to describe groundwater conditions within or near GDE polygons, include those polygons as "Potential GDEs" in the GSP until data gaps are reconciled in the monitoring network. Label the potential GDEs on the GDE map.	Given the lack of shallow groundwater data and uncertainty in the vegetation map, all of the GDEs are best described as potential GDEs. This has been clarified in Chapter 2 of the GSP.
NGO Consortium	NGO-013	MCR Outreach	B	Outreach		Lack of outreach to some groups. In the Stakeholder Communications & Engagement Plan, describe active and targeted outreach to engage DACs, drinking water users, tribes, and environmental stakeholders throughout the GSP development and implementation phases. Refer to Attachment B for specific recommendations on how to actively engage stakeholders during all phases of the GSP process. Utilize DWR's tribal engagement guidance to comprehensively address all tribes and tribal interests in the subbasin within the GSP.	MCR Outreach
NGO Consortium	NGO-014	MCR PMAs	B	Shallow GW Wells		In the well impact assessment, include well data from older wells (>31 years old) to better represent minimum threshold impacts to wells across the subbasin.	Older wells in the basin are those most likely to have limited construction information. Furthermore, 30 years is the standard operational lifetime assumed for most wells.

Author	CIN	MCR	Group	Description	Location in GSP	Comment	Response / Recommended Action
NGO Consortium	NGO-015	MCR DACs/Tribes	B	DACs		Describe direct and indirect impacts on DACs, drinking water users, and tribes when describing undesirable results and defining minimum thresholds for chronic lowering of groundwater levels.	We thank the reviewer for noting this and maintain that our sustainable management criteria protect domestic wells from impacts. Therefore, such an analysis would not substantively change the fact that projected groundwater management is not expected to impact domestic wells in the basin. To our knowledge, all domestic and municipal users in the basin are solely reliant on groundwater.
Plumas Audubon Society	PAS-001		B	Draft Plan Content		It is hard to understand why we are being asked to review a draft of an extremely complex and detailed GSP at this point. As you must be well aware, the draft is challenging to adequately comment on because there are so many data gaps and critical pieces of information that are missing. It is also our understanding that the District Board has neither decided nor released for public comment what will be put forward as the actual GSP that will be submitted to the state. We feel that the public will be better served when there is an opportunity to review the complete GSP, without data gaps, that will be approved by the District Board.	Thank you for your comment. There will be another 75-days comment period after board adoption and after submission of the plan to DWR and we hope that the final version of the plan will provide all the missing details and information.
Plumas Audubon Society	PAS-002	MCR GDE and MCR ISW	B	GDEs, ISW		The areas of critical concern to our organization are how all of the Beneficial Users will be impacted by the GSP. Specific concerns include adequate identification of and plans to monitor all Interconnected Surface Waters (ISW) and related Groundwater Dependent Ecosystems (GDE) as well as an accurate accounting of all Sensitive Species in Sierra Valley. A you are aware, one of our board members, Jill Slocum, was asked to serve on the Technical Advisory Committee and she has kept our chapter informed of the process. She has repeatedly expressed concern about the methodology used to determine Sensitive Species, particularly bird species, in Sierra Valley as well as their dependence on ISW and accurately identifying GDE's. To date the information in the GSP remains inaccurate and incomplete. The National Audubon Society has designated Sierra Valley as an Important Bird Area; it includes critical habitats for migrating and breeding bird populations. There are excellent sources available for an accurate assessment of Special Status Species in Sierra Valley. It seems that all of the resources listed in the document were not fully reviewed and included in the findings. This is unacceptable.	We used the best available data to compile the list of special status species and acknowledged that Sierra Valley is an important bird area. Our sources for sensitive species included: the California Natural Diversity Database (CNDDB), California Native Plant Society (CNPS) Manual of California Vegetation (2021), Harnach (2016), eBird (2021),TNC freshwater species lists generated from the California Freshwater Species Database (CAFSD) (TNC, 2021), USFWS's Information for Planning and Consultation (IPaC) portal (USFWS, 2021), Feather River Land Trust Sierra Valley Birder's Guidebook (Feather River Land Trust n.d.), Vestra (2005), and CDFW's BIOS database. We will happily add information from additional reports after the GSP is submitted if they are made available to us.

Author	CIN	MCR	Group	Description	Location in GSP	Comment	Response / Recommended Action
Board	Board-008		C		ch 3	refer to wetlands as wildlife habitats	edits made
Cindy Noble	Noble-003		C	Groundwater Overdraft		As early as 2006 the Sierra Valley Groundwater District was told that Overdraft of the aquifer was a problem. This information was published in Ken Schmidt's study that was produced on behalf of the district. Sadly, it appears nothing has been done to address this problem.	Comment noted.
K Tanner	Tanner-001		C	Grammar/typos	Ch 2	Portola Reporter no longer extant. Incorporated into Plumas News (www.plumasnews.com)	Portola Reported removed/replaced with Plumas News
K Tanner	Tanner-002		C	Grammar/typos	Ch 2 (line 2359)	quadriperforata rather than Quadriperforata	Change made
Kevin Starr	Starr-004	MCR PMAs	C	Shallow GW Wells		• The benchmark to trigger an amendment to the plan by having a certain number of domestic wells run dry would have severe, negative economic impacts to property owners.	MCR PMAs
Kristi Jamason	Jamason-001		C	Grammar/typos	Section 1.3.1 (lines 219-220)	Add "agricultural" before "wells" (SVGMD only meters big ag wells.	edit made
Kristi Jamason	Jamason-002		C	Draft Plan Content	Section 1.3.3 (line 228)	this should say "associated with large-capacity wells metered by the District…" The municipal wells may well be large-capacity, active and metered, but they are not charged this fee.	edit made
Kristi Jamason	Jamason-003		C	Draft Plan Content	Section 3.3.1.1 (lines 120-121)	Where did this sentence come from? Please remove. Totally subjective to say "minor and manageable"	Sentence revised
Kristi Jamason	Jamason-005		C	Draft Plan Content	Ch 3 Figure 3.3.1-2	Clarify Figure title/heading. Suggest: Groundwater elevation minimum thresholds are not substantially below lowest recorded values (Fall 2015) and maintain…	Clarification has been included

Author	CIN	MCR	Group	Description	Location in GSP	Comment	Response / Recommended Action
Lucy Blake (Lemon Canyon Ranch)	Blake-001	MCR PMAs	C	PMAs		While surface water helps to recharge groundwater naturally as it seeps into the ground, any attempt to artificially transfer surface water underground to augment groundwater is likely to run into strong opposition from downstream users, existing surface water users, wildlife agencies and many others.	We are now exploring opportunities in tributaries that are not adjudicated over the winter season and this seems to be a promising approach.
NGO Consortium	NGO-001	MCR DACs/Tribes	C	DACs		The GSP states that there are three Disadvantaged Communities (SDACs) in the basin, but these areas are not mapped nor is the population of each provided. Provide a map of the DACs in the basin. The DWR DAC mapping tool can be used for this purpose.	DAC spatial layers have been added to the Data Management System (DMS). Inclusion of a specific figure within the GSP was deemed unnecessary as the boundaries can easily be obtained through other sources and do not affect SMCs developed for the basin.
NGO Consortium	NGO-002	MCR DACs/Tribes	C	DACs		While the plan describes the historical and cultural affiliations of several tribes in the subbasin, the plan fails to map the locations of tribal lands or tribal interests in the subbasin.	No federally recognized tribal lands are present in Sierra Valley.
NGO Consortium	NGO-003	MCR PMAs	C	Shallow GW Wells		The GSP provides a map of domestic well density in Figure 2.1.1-7 but fails to provide depth of these wells (such as minimum well depth, average well depth, or depth range) within the basin. Include a map showing domestic well locations and average well depth across the basin.	Available well information in the basin, including location and screened intervals, can be accessed via the Data Management System (DMS). Two additional figures are provided in the Appendix (Vulnerable well impact analysis in the Sierra Valley Subbasin) that show the distribution of well depths per well type, and the depth of wells over time per well type.

Author	CIN	MCR	Group	Description	Location in GSP	Comment	Response / Recommended Action
NGO Consortium	NGO-005	MCR ISW	C	ISW		Figure 2.2.2-12 presents the map of interconnected surface water in the subbasin. The map labels areas with groundwater elevation data gaps, but it is unclear whether these reaches in these areas are retained as potential ISWs in the GSP. Use seasonal data over multiple water year types to capture the variability in environmental conditions inherent in California's climate, when mapping ISWs. We recommend the 10-year pre-SGMA baseline period of 2005 to 2015. Overlay the subbasin's stream reaches on depth-to-groundwater contour maps to illustrate groundwater depths and the groundwater gradient near the stream reaches. Show the location of groundwater wells used in the analysis. Consider any stream segments with data gaps as potential ISWs and clearly mark them as such on maps provided in the GSP.	The streams classified as a data gap in Figure 2.2.2-12 are retained as potential ISW. MTs of RMPs in these areas were set with this in mind by limiting decline of groundwater levels near ISW to the historical low groundwater elevation. To map ISW, we conservatively chose a wetter than average period by using groundwater elevation for springs of 2017-2020 which represented the highest groundwater elevations since 2006. Figure 2.2.2-12 will be modified to show depth to groundwater contours and wells used in the analysis.
NGO Consortium	NGO-006	MCR GDE	C	GDE		Clarify the legend labels used on the GDE map (Figure 2.2.2-13). Clarify the data source for GDE polygons. For example, label polygons retained, removed, or added to/from the NC dataset (include the removal reason if polygons are not considered potential GDEs, or include the data source if polygons are added).	Agreed and will include in subsequent draft (by August 2022)
NGO Consortium	NGO-007	MCR GDE	C	GDE		Provide further description of the groundwater data used in the GDE analysis, including the location of monitoring wells and their screening depth. Ensure the wells are monitoring the shallow principal aquifer.	The groundwater level data used for the GDE analysis is the same groundwater level data used in all other analyses in the GSP and the data is provided in Appendix 3-1. It contains the RMPs and additional data that were not selected for the RMP monitoring network. Section 3.3.1.4 now provides additional detail on the monitoring wells used, their depth (less than 300 feet), and how only the shallow groundwater levels from multi-completion wells were used in the interpolation.

Author	CIN	MCR	Group	Description	Location in GSP	Comment	Response / Recommended Action
NGO Consortium	NGO-009	MCR GDE	C	GDE		Use depth-to-groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) to determine the range of depth to groundwater around GDE polygons. We recommend that a baseline period (10 years from 2005 to 2015) be established to characterize groundwater conditions over multiple water year types.	We agree with the reviewer and confirm that the groundwater level elevation data used encompasses all water year types. Please see Figure 3.3.1-1 to view a subset of these data and note that they span 20 years beginning in 2000.
NGO Consortium	NGO-010	MCR GDE	C	GDE		Provide the depth-to-groundwater contour maps discussed in the GSP text. Show the location of groundwater wells used to create the map, and further discuss the screening depths of the groundwater wells to ensure they are monitoring the shallow principal aquifer. Refer to Attachment D of this letter for best practices for using local groundwater data to verify whether GDE polygons are supported by groundwater in an aquifer.	Depth to groundwater data have been used to map both GDEs and ISW locations: due to the significant uncertainty on well screening and actual well depth, a lot of uncertainty has been included in the final maps that have been produced. Because of this uncertainty, a large part of ISW and GDE have been named as potential, with the goal of collecting more data (see monitoring network and data gaps) over the very preliminary phases of plan implementation.
NGO Consortium	NGO-016		C	Degraded Water Quality		Describe direct and indirect impacts on DACs, drinking water users, and tribes when defining undesirable results for degraded water quality.14 For specific guidance on how to consider these users, refer to "Guide to Protecting Water Quality Under the Sustainable Groundwater Management Act.	We thank the reviewer for noting this and maintain that our sustainable management criteria are protective of groundwater quality. Therefore, such an analysis would not substantively change the fact that projected groundwater management is not expected to impact domestic wells in the basin. To our knowledge, all domestic and municipal users in the basin are solely reliant on groundwater. It is noted that the current MTs for the network are based on existing exceedances in the monitoring network, therefore providing protection against an increased number of exceedances. This methodology is protective of groundwater quality and avoids undesirable results by preventing further degradation.

Author	CIN	MCR	Group	Description	Location in GSP	Comment	Response / Recommended Action
NGO Consortium	NGO-017		C	Degraded Water Quality		Evaluate the cumulative or indirect impacts of proposed minimum thresholds (expressed in the GSP as maximum thresholds) for degraded water quality on DACs, drinking water users, and tribes.	We thank the reviewer for noting this and maintain that our sustainable management criteria are protective of groundwater quality. Therefore, such an analysis would not substantively change the fact that projected groundwater management is not expected to impact domestic wells in the basin. To our knowledge, all domestic and municipal users in the basin are solely reliant on groundwater. It is noted that the current MTs for the network are based on existing exceedances in the monitoring network, therefore providing protection against an increased number of exceedances. This methodology is protective of groundwater quality and avoids undesirable results by preventing further degradation.
NGO Consortium	NGO-018		C	Degraded Water Quality		Set maximum thresholds and measurable objectives for all water quality constituents within the subbasin that are impacted or exacerbated by groundwater use and/or management.	As stated in the GSP, based on a comprehensive water quality evaluation of historic and current data and reports, SMCs were developed for two constituents of concern in the Subbasin: nitrate and TDS. Arsenic, boron, iron, manganese, and pH are considered constituents of concern in the Subbasin but were not assigned SMCs because they are naturally occurring; these constituents will be monitored as part of the GSP and Basin Plan to track any potential mobilization of elevated concentrations. MTBE is identified as a potential constituent of concern; however, no SMC is defined as it is associated with contaminated sites with dedicated monitoring and cleanup (additionally, no exceedances have occurred in the last 6 years).
NGO Consortium	NGO-019		C	Degraded Water Quality		Set maximum thresholds that do not allow water quality to degrade to levels at or above the MCL trigger level.	Maximum thresholds are set for nitrate and TDS at their MCL (10 mg/L for nitrate, and 500 mg/L for TDS). Wells in the groundwater quality monitoring network already exceed this threshold for TDS, and these wells are expected to continue to exceed in the future. Therefore, the MT has been defined to not allow an increased number of wells with exceedances.

Author	CIN	MCR	Group	Description	Location in GSP	Comment	Response / Recommended Action
NGO Consortium	NGO-020	MCR GDE and MCR ISW	C	GDEs, ISW	Ch 2, 3	Provide discussion that adaptive changes in SMC for GDEs will be made, if GDE groundwater or biological monitoring reveals that existing SMC are not protective of these ecosystems.	As part of the GSP the health of GDEs will be tracked using NDVI coupled with measurements of shallow groundwater elevations near GDEs. If the interconnected surface water flows and the health of GDEs (as measured by NDVI) decline around the monitoring points and the change in due to groundwater management, the MTs and MOs will be reevaluated.
NGO Consortium	NGO-021	MCR GDE and MCR ISW	C	GDEs, ISW	Ch 2, 3	When defining undesirable results for depletion of interconnected surface water, include a description of potential impacts on instream habitats within ISWs when minimum thresholds in the subbasin are reached. The GSP 16 should confirm that minimum thresholds for ISWs avoid adverse impacts on environmental beneficial users of interconnected surface waters as these environmental users could be left unprotected by the GSP. These recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law.	We are not aware of available data that could be used to assess impacts of changes to ISW on environmental users of the basin. This has been clarified in the GSP.
NGO Consortium	NGO-026	MCR Data Gaps	C	Data Gaps	Section 3.4	Provide maps that overlay current and proposed monitoring well locations with the locations of DACs, domestic wells, and GDEs to clearly identify monitored areas.	Chapter 3 provides now more refined maps to highlight the ongoing plan for monitoring.
NGO Consortium	NGO-028	MCR Data Gaps	C	Data Gaps		Ensure groundwater elevation and water quality RMPs are monitoring groundwater conditions spatially and at the correct depth for all beneficial users - especially DACs, domestic wells, and GDEs.	Groundwater level RMPs are based on shallow groundwater conditions and the analyses presented in Section 3 protect shallow domestic wells, ISW, and GDEs.
NGO Consortium	NGO-029	MCR Data Gaps	C	Data Gaps		Describe biological monitoring that can be used to assess the potential for significant and unreasonable impacts to GDEs or ISWs due to groundwater conditions in the subbasin.	The monitoring program currently includes NDVI assessment additional shallow groundwater wells and monitoring of ISW. NDVI monitoring has been clarified in the text of the GSP.

Author	CIN	MCR	Group	Description	Location in GSP	Comment	Response / Recommended Action
NGO Consortium	NGO-030	MCR DACs/Tribes	C	DACs	Section 4.3.10	For DACs and domestic well owners, include a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation. Refer to Attachment B for specific recommendations on how to implement a drinking water well mitigation program.	See NGO-004
NGO Consortium	NGO-031	MCR DACs/Tribes	C	DACs	Section 4.3.10	For DACs and domestic well owners, include a discussion of whether potential impacts to water quality from projects and management actions could occur and how the GSAs plan to mitigate such impacts.	See NGO-004
NGO Consortium	NGO-032	MCR PMAs	C	PMAs	Section 4.3.10	Recharge ponds, reservoirs, and facilities for managed aquifer recharge can be designed as multiple-benefit projects to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. For guidance on how to integrate multi-benefit recharge projects into your GSP, refer to the “Multi-Benefit Recharge Project Methodology Guidance Document.”	The "Multi-Benefit Recharge Project Methodology Guidance Document" will be referenced and used to update Section 4.3.10, as necessary.
NGO Consortium	NGO-033	MCR PMAs	C	PMAs	Section 4.3.10	Develop management actions that incorporate climate and water delivery uncertainties to address future water demand and prevent future undesirable results.	Chapter 4 introduction describes the concept of "adaptive management" which is at the core of deciding which projects and management actions to implement. This will help address the uncertainties associated with climate change and future surface water supply availability. Also, see NGO-025
TAC	TAC-002		C	Draft Plan Content		Perhaps due to deadlines, we find that the draft plan we have been asked to review is incomplete and difficult, if not impossible to review. Many sections are incomplete. Some sections are completely absent. Additionally, the Groundwater Basin Model, which is required by SGMA, was not completed by the time of the Public Review Draft was released and did not inform many critical pieces of the plan.	We understand the challenges of reviewing a plan which was still under production. There will be another 75-day period for public comments after submission to DWR.

Author	CIN	MCR	Group	Description	Location in GSP	Comment	Response / Recommended Action
Tom Dotta	Dotta-001	MCR Outreach	C	Outreach		I agree that more people should have input. I gave up on meetings after years of going and finding that the minds were already made up prior to the meeting and my input was a joke. There are very good devices to measure the ground sinking, if something is not done to stop this not only will the valley go dry, someone will be hurt in a sinkhole. This needs action, not lip service.	MCR Outreach
Jill Slocum	JS-001			GDE		Special Status Species animals have not been adequately researched, reviewed, and identified. The lack of accuracy in the bird lists make me wonder about the veracity of other species. More work needs to be done on these as well as accurately identifying the Interconnected Surface Water (ISW) and Groundwater Dependent Ecosystems (GDE) they depend upon. I still feel that the full methodology outlined in the Plan has not been followed.	We used the best available data to compile the list of special status species and acknowledged that Sierra Valley is an important bird area. Our sources for sensitive species included: the California Natural Diversity Database (CNDDB), California Native Plant Society (CNPS) Manual of California Vegetation (2021), Harnach (2016), eBird (2021),TNC freshwater species lists generated from the California Freshwater Species Database (CAFSD) (TNC, 2021), USFWS's Information for Planning and Consultation (IPaC) portal (USFWS, 2021), Feather River Land Trust Sierra Valley Birder's Guidebook (Feather River Land Trust n.d.), Vestra (2005), and CDFW's BIOS database. We will happily add information from additional reports after the GSP is submitted if they are made available to us.
Jill Slocum	JS-002			GDEs, ISW		The identification of GDE's and ISW's needs work. These are of course critical for animal and plant species dependent on these habitats. There is much more work needed to know how these systems relate to and are dependent on deep and shallow water aquifers. Work on these areas, including monitoring and reporting, must be addressed in the first year of implementation of the Plan.	The monitoring plan suggested in Chapter 3 and chapter 5 will provide a unique set of continuous data that will be used to calibrate the groundwater model. With better data and a more refined model, it will be possible to answer questions about how different systems react to and are dependent on either shallow or deep groundwater or both. The impact of pumping on these systems will then also be evaluated.

Author	CIN	MCR	Group	Description	Location in GSP	Comment	Response / Recommended Action
Jill Slocum	JS-003			Shallow GW Wells		Other Beneficial Users, including those with domestic and municipal wells, as well as ranches dependent on surface water and shallow groundwater systems need more consideration. There needs to be immediate further studies, including ongoing accurate monitoring and reporting of the flow and levels of these systems. I doubt anyone currently knows the number households and people directly dependent on these waters at this time, but the percentage of people and livelihoods dependent on them are clearly greater than those of the large ranches with high capacity wells tapping into the deep groundwater aquifers. Sierra Valley needs all of these communities to thrive in order to maintain the health of the local economy and quality of life.	More details about including inventory of domestic and shallow wells are now included among the PMAs. Some more in depth understanding of the current situation and of the number of wells eventually at risk of going dry is critical to design a better management plan.
Jill Slocum	JS-004			Equal representation		I have a tremendous amount of respect for the large ranchers with high capacity wells who are largely dependent on the deep groundwater aquifers. They are a significant part of what makes the Sierra Valley the special place that it is. However, the concept of “Taxation Without Representation” keeps going through my mind. At present there is inadequate representation of the varied interests on the District Groundwater Board. I believe that it is critical for the membership of the Board be changed so there is diversity on the Board, reflecting the interests of all of the Beneficial Users in the District	Decision on this topic is up to the SVGMD Board and not directly associated with GSP development
Jill Slocum	JS-005			Groundwater Overdraft		Meaningful action needs to be taken now to solve the overdraft problem. Seemingly everyone recognizes that the current annual practice of over drafting more deep groundwater than is recharged has been occurring for years. Now is the time for action to resolve this critical problem. To state the obvious, while the economic health of the large agricultural ranches that rely on high capacity wells is crucial for the economic health of the Basin, this issue will not disappear and the sooner steps are taken to reverse this practice, the better for all	Thanks for your comments. The SMC defined in chapter 3 are looking into stabilizing groundwater levels as quickly as possible to minimize further impacts to other beneficial uses and users of groundwater. PMAs in chapter 4 are also expected to help reversing some of the current conditions: success of different PMAs will be evaluated and as needed, more stringent actions will be eventually considered in future updates of the plan.

Author	CIN	MCR	Group	Description	Location in GSP	Comment	Response / Recommended Action
Jill Slocum	JS-006			Draft Plan Content		And finally, as many others have expressed, it is really unacceptable we are now reviewing a document that has yet to be approved by the Board. It is critically important that there is adequate public review of the actual Plan the Board puts forward	Thank you for your comment. There will be another 75-day comment period after board adoption and after submission of the plan to DWR.

Appendix 2-5: Data Gaps and Monitoring Plan

1.0 Introduction

The purpose of this appendix is to provide an overview of potential data gaps that may prevent the monitoring networks from collecting sufficient data to measure progress towards Plan management goals. The monitoring networks are designed to collect data to monitor the SV Subbasin's sustainability indicators which include the lowering of groundwater levels, reduction of groundwater storage, depletion of interconnected surface water (ISW), degradation of water quality, and land subsidence. Each of the five sustainability indicators is monitored by a dedicated monitoring network that should have sufficient spatial density and temporal resolution to evaluate the effects and effectiveness of Plan implementation and represent seasonal, short-term, and long-term trends in groundwater conditions and related surface conditions. The monitoring networks may have deficiencies that prevent them from collecting sufficient data to evaluate the SV Subbasin's conditions. Table 1 presents the monitoring network for each sustainability indicator and provides potential data gaps, as well as the plan to improve the network and overcome the data gap. In addition to the monitoring networks, the SV Subbasin's hydrogeologic model and water budget will be used to better understand the conditions of the aquifer, and track progress towards achieving sustainability. Potential data gaps associated with the hydrogeologic model and water budget, as well as plans to overcome the gaps, are presented in Table 2.

Table 1. Monitoring Networks, Potential Data Gaps, and Plans to Enhance Monitoring Network

Sustainability Indicator (1)	Overview of Planned Monitoring Network	Potential Data Gap	Plan to Overcome Data Gap
Groundwater Level	19 District Wells (measured at least 2x/year; additional measurements during the irrigation season) 17 CASGEM wells (measured at least 2x/year, continuous measurements in the latest multi-completion wells)	Seasonal fluctuations in groundwater level are not well characterized, and the impact of pumping and irrigation on groundwater levels is not well understood.	Subject to funding availability, sensors to measure groundwater level, and telemetry to remotely download the data, may be employed in groundwater level monitoring wells to increase data collection frequency and better understand seasonal patterns in groundwater level. Increased coordination between various groundwater level monitoring and reporting programs in the Subbasin aims to expand data gathering, sharing, and analysis
		Vertical coverage of shallow and deep aquifer units may potentially be inadequate.	As the hydrogeologic conceptual model is refined, shallow versus deep zones of the aquifer will be better characterized, and targeted monitoring of these zones will be possible. Obtaining construction information (depth and screened interval) for wells in the Subbasin will allow for targeted placement of monitoring wells that provide increased vertical coverage of the aquifer.
		The potential impact of lowering groundwater levels on shallow domestic wells in the Subbasin is currently limited. Domestic well information (location, well depth, screened interval) is currently lacking.	An inventory and assessment of domestic wells, which will attempt to identify well construction information (well depth and screened interval) is expected to occur within two years of GSP adoption subject to funding availability. Utilizing this inventory, undesirable results based on well outage reports may be refined during the 5-year GSP update.
		General uncertainty in groundwater storage estimates.	Storage estimates to be refined by the updated regional groundwater flow model.

Sustainability Indicator [1]	Overview of Planned Monitoring Network	Potential Data Gap	Plan to Overcome Data Gap
Reduction of Groundwater Storage	Monitored using the same wells as the groundwater level monitoring network.	Seasonal changes in groundwater storage, and the impact of pumping and irrigation on groundwater storage are potential data gaps.	Level sensors and telemetry may be employed in groundwater level monitoring wells to increase data collection frequency and better understand seasonal patterns in groundwater level. Inventory of large-capacity wells is maintained by Sierra Valley Groundwater Management District (SVGMD), which includes active metered wells and inactive wells. Active large-capacity agricultural wells are fitted with flow meters owned and read by SVGMD. Enhancement to this program includes potential expansion to all types of wells subject to funding availability, including domestic and municipal, especially in critical locations where minimum thresholds are in jeopardy of being reached.
Interconnected surface water (ISW) and Groundwater Dependent Ecosystems (GDEs)	Groundwater levels from 13 wells (used as a proxy for ISW depletion).	Monitoring of shallow groundwater is lacking near locations critical to characterize ISW (current wells are a subset of shallow groundwater wells in the levels monitoring network). The relationship between pumping and ISW depletion is also lacking.	Instrument at least 4 existing shallow wells near ISW and GDE with continuous pressure transducers. During the GSP’s 5-year implementation period, data from shallow wells will be correlated with flow and/or stream gauge data to better characterize ISW. This information, in conjunction with updates to the Subbasin groundwater model, will allow for refined estimates of spatial and temporal ISW depletion.

Sustainability Indicator [1]	Overview of Planned Monitoring Network	Potential Data Gap	Plan to Overcome Data Gap
	Stream flow and stream stage sites. Integrated hydrologic model estimates (based on available data and tools).	The absence of continuous streamflow or stage gauges in the Subbasin is a data gap that prevents understanding of vertical hydraulic gradients that determine flux between surface water and groundwater (particularly in the central and eastern portions of the Subbasin). This inhibits estimates of ISW depletion as a rate or volume. Lack of continuous gauge data prevents estimates of seasonal changes in hydraulic gradients; additionally, the potential effects of pumping on surface water critical to beneficial users needs to be enhanced. Limited data on the extent of perched aquifers prevents ISW classification.	Evaluate possible locations and design of up to 10 stream flow gauges and up to 8 stream stage gauges to be paired with the continuous groundwater level measurements. Continuous streamflow monitoring stations are proposed as upgrades to the existing DWR stations, and other locations where measurement of streamflow is feasible. Telemetry may be employed at gauges to increase data collection frequency. Future updates to the regional groundwater flow model will enable more accurate estimates of ISW depletion rates. Water Master data will continue to be obtained from the area Water Master and will continue to be incorporated in water budget refinement and groundwater management decision making.
		Ecosystem reliance and connection to groundwater is uncertain throughout the Subbasin. This is due to uncertainties in the source of water used by vegetation and aquatic organisms, limited shallow groundwater data, and relatively old vegetation maps (vegetation maps lack sufficient detail to determine the rooting depth of vegetation to compare with groundwater depth).	In response to relatively old vegetation maps, an updated and more detailed vegetation map was started by CDFW (awaiting additional funding to complete). If this map is completed by the 5-year update, it can be used to better assess the species assemblages, the source of water, and their maximum rooting depth. Instrument at least 4 existing shallow wells near ISW and GDE with continuous pressure transducers (see above).

Sustainability Indicator (1)	Overview of Planned Monitoring Network	Potential Data Gap	Plan to Overcome Data Gap
		Lack of Normalized Difference Vegetation Index (NDVI, or vegetation indices derived from satellite imagery) values near representative monitoring points (RMPs) and insufficient spatial characterization of NDVI. This data gap prevents the use of NDVI for accurate characterization of ISW and GDE.	Changes to average NDVI values near RMPs and spatial pattern changes of NDVI will be evaluated during the GSP's 5-year implementation period. Historical NDVI data collected in the Subbasin will be examined in relation to groundwater elevation data
		Lack of established correlation between groundwater levels, NDVI, and the health of GDEs.	Changes to summer NDVI will be used in coordination with groundwater levels and interconnected surface discharge to monitor the health of GDEs in the SV Subbasin (assuming that declines in vegetation greenness will correspond to changes in water availability for special status species). Historical NDVI data collected in the Subbasin will be examined in relation to groundwater elevation data. Changes to average NDVI values around RMPs and the spatial pattern changes of NDVI throughout the Subbasin will be evaluated in updates to the GSP.
Groundwater Quality	17 GAMA wells Community Volunteer Wells (up to five; to be finalized at a future time) 1 DWR well (to be installed at a future time)	GAMA wells are monitored at irregular frequency and over extended time intervals incapable of determining temporal trends. Additionally, constituents listed in the GSP are not analyzed at every GAMA well. Lack of coverage to identify areas where septic tanks may impact groundwater quality, or to identify areas impacted by boron or arsenic. Existing wells used to monitor groundwater quality in the Subbasin are primarily located within and near the semi-urban areas of the Subbasin.	6 new wells are being selected and added to the network (5 domestic, 1 DWR). During the GSP's 5-year implementation period, the new wells will be monitored once every 2 years for TDS, nitrate, boron, and arsenic. If no problems are observed, the monitoring frequency will decrease to once every 3 years. Monitoring will be augmented as needed if constituents exceed criteria or if specific increasing trends in the constituent's concentration are observed. Additionally, during the 5-year implementation period, communication with existing monitoring programs in the Subbasin will aim to coordinate data collection and reporting.

Sustainability Indicator [1]	Overview of Planned Monitoring Network	Potential Data Gap	Plan to Overcome Data Gap
		Potentially inadequate vertical coverage of the shallow and deep zones of the aquifer.	As the hydrogeologic conceptual model is refined, shallow versus deep zones of the aquifer will be better characterized, and targeted monitoring of these zones will be possible. Obtaining construction information (depth and screened interval) for wells in the Subbasin will allow for targeted placement of monitoring wells that provide increased vertical coverage of the aquifer.
		The majority of existing wells in the Subbasin have not regularly been monitored for water quality, and it is uncommon for a well to be tested consistently between 1990 - 2020 for multiple constituents. Based on the water quality assessment, and public input, constituents of concern in the SV Subbasin were deemed to include nitrate, TDS, arsenic, boron pH, iron, manganese, and MTBE.	Evaluation of MTBE established that reported concentrations have diminished substantially over the last 10 years, and therefore monitoring will not be conducted as part of GSP efforts. SMCs are defined for nitrate and TDS. In addition to these constituents, the GSA will monitor arsenic, boron, and pH to track any potential mobilization of elevated concentrations or exceedances of the Maximum Contaminant Levels.
Land Subsidence	Groundwater levels from the groundwater level network will be used as proxy for the first two years (currently, groundwater levels and the correlations established by Poland and Davis (1969) offer the	Groundwater levels are the only long-term measure of land subsidence for the Subbasin at the time of GSP writing. No known Continuous Global Positioning System (CGPS) stations or extensometers are installed in Sierra Valley. Although satellite-based Interferometric Synthetic Aperture Radar (InSAR) measures of land subsidence are available for the SV Subbasin, these data are relatively recent, do not show long-term trends, and indicate total subsidence which represents a combination of	Groundwater level data will be augmented with annual estimates of land elevation change provided by DWR InSAR data, and ground-based surveys conducted every 5 years (ground-based monument installation and monitoring is detailed below). The ground-based surveys will be used to gauge the accuracy of future InSAR data processing. Additionally, throughout the 5-year implementation period, the correlation between the change in groundwater levels and the change in the amount of land subsidence (factoring in that total land subsidence is a composite of elastic and inelastic land subsidence) will be refined.

Sustainability Indicator [1]	Overview of Planned Monitoring Network	Potential Data Gap	Plan to Overcome Data Gap
	best-available information to estimate potential land subsidence for the Subbasin).	elastic (reversable) subsidence and inelastic (irreversible) subsidence. As such, adequate Subbasin-specific information correlating the detailed long-term connection between land subsidence and groundwater levels is lacking.	Installation of 4 monument-based land surface elevation stations will occur within the primary geographic area where subsidence is documented by DWR from InSAR data processing for 2015-2019. Geologic uncertainties, such as the Grizzly Valley Fault Zone, will also be considered when placing the monuments. Monuments will be surveyed every 5 years. Additional surveys will be conducted if InSAR subsidence increases by 50% of the average annual subsidence from baseline period (2015-2019).
		InSAR data processing may be inaccurate as it has not been compared to vertical displacement point time series data from CGPS stations.	Comparison of InSAR data processing to 4 monument-based land surface elevation stations will be conducted (detailed above).

1. This table only includes monitoring networks used to measure sustainability indicators. It does not include additional monitoring necessary to monitor the various water budget components of the Subbasin, described in Chapter 2, or to monitoring the implementation of projects and management actions, which are described in Chapter 4.

Table 2. Hydrogeologic Model and Water Budget: Potential Data Gaps and Plans to Overcome Data Gaps

Potential Data Gap	Plan to Overcome the Data Gap
Estimates of streamflow entering the Subbasin are incomplete due to lack of continuous data. Because of the discontinuous nature and infrequency of streamflow measurements (weekly at best, and mostly only during the irrigation season), the data collected by the DWR Watermaster cannot be used for more in-depth analysis such as volume calculations or flood-frequency analysis. Surface water flows entering the groundwater basin are estimated with the PRMS model (Appendix 2-7) due to the lack of observed flows (i.e., gauging stations) for the majority of streams.	Installation of near-continuous streamflow gaging stations, or upgrades to the existing DWR stations, can measure flow entering the Subbasin and calibrate model estimates of total surface inflows. These data can be used to refine the basin-wide water budget. Water Master data will continue to be obtained from the area Water Master and will continue to be incorporated in water budget refinement and groundwater management decision making.
Potential data gaps exist for aquifer characterization, structure, and hydrogeologic and transport properties. SV Subbasin numeric model requires updating to better represent and evaluate the Subbasin's existing hydrogeologic conditions. Delineation of shallow and deep aquifer units has not been completed for the Subbasin. Additionally, parts of a deep aquifer zone may be pressurized by confining low-permeability layers, although extent and isolation between shallow and deep aquifer zones likely vary throughout the Sierra Valley subbasin. Few pumping test data are available for the basin fill unit.	Robust aquifer characterization analysis. This effort would include efforts to coordinate with parties that have large-capacity wells to conduct aquifer characterization studies throughout the SV Subbasin. Typically, these studies would include collection of one week of baseline data including static water level of the pumping well and static water level and water level trends of nearby wells, spring discharge measurements of any nearby springs, and upstream and downstream flow measurements of any nearby streams. These data will be critical to better understand the geology and hydrogeology of the SV Subbasin. Siting of future monitoring wells will prioritize areas with limited subsurface characterization to the fullest extent possible. Well logs provided to SVGMD from new wells drilled within the groundwater basin will have the lithology added to the DMS so their data can be incorporated into future model updates.
Pumping data is not available at the same time interval as the model stress periods.	Per SVGMD Ordinance 82-03, continued monitoring of agricultural extraction wells is required in the SV Subbasin. Implementation of a voluntary pumping data collection program where growers record groundwater extraction volumes at the beginning or end of each month. SVGMD will still be responsible for meter reads at the beginning and end of the irrigation season.

Potential Data Gap	Plan to Overcome the Data Gap
The relative contribution of mountain-front recharge is largely unknown.	Reduction of uncertainty in other areas of the model (e.g., ET, pumping, GW-SW exchange) will improve estimates of mountain-front recharge entering the basin. Further exploration of mountain-front recharge parameterization in the integrated hydrologic model is recommended.

Appendix 2-6: Water Quality Assessment

1 Sierra Valley Groundwater Quality Assessment

Available data are used to determine which constituents may pose water quality concerns in the Sierra Valley basin. Through a December 2020 survey, the Technical Advisory Committee (TAC) identified outcomes that would be considered undesirable results, including:

- Violation of State drinking water standard or other groundwater quality standards
- Transfer of constituents between older wells without sanitary seals
- Spreading of degraded water quality into new areas
- Degradation to levels unsuitable for agricultural use

The assessment of data to assess undesirable results of groundwater quality is described in the following.

1.1 Available Water Quality Data

The information currently available on Sierra Valley groundwater quality comes from DWR's Groundwater Ambient Monitoring and Assessment (GAMA) program. While 206 wells have associated water quality data, going back as far as 1955, there are significant data gaps, including: inconsistent temporal distribution, limited spatial distribution, and missing basic well information. Additionally, the purpose of monitoring generally limits the constituents evaluated. As the available data for the basin is sporadic in time, and variable over space all data for a constituent was aggregated and evaluated against applicable water quality objectives or notification levels, as applicable. The data summary for available constituents from 2011 to 2020 is presented in Table A-1. The table contains the constituent and applicable objective (maximum contaminant level (MCL), secondary MCL, or California Notification Level). To evaluate if the constituents are potentially changing over time, the data are split into two groups ranging from 2011 to 2015, and 2016 to 2020. In each group the number of samples in that time period and number of exceedances are listed along with the maximum concentration measured. The water quality is generally good, where there are exceedances they are under 10% of measurement for most constituents.

Combining the results from Table A-1 and the desire to maintain agricultural use, nitrate, total dissolved solids (TDS), arsenic, boron, pH, iron, manganese, and MTBE were selected for further evaluation in the GSP. Specific conductivity is related to TDS. Consideration of MTBE will likely address benzene, ethylbenzene, and napthalene as they are generally related to underground tank leakage. To evaluate if the constituents are changing over time available data are binned into 7 time periods from 1986 to 2020 and plotted as box and whisker plot in Figure A-1 to Figure A-8. These plots are valuable in displaying the variability in measurements over the 7 time periods. Generally, the conditions appear to be improving or remaining the same with the exception of nitrate which may be worsening. However, the limited data makes a conclusive assessment difficult.

To evaluate the spatial distribution of data, wells with data are plotted in Figure A-9. Nitrate as N, Maximum Groundwater Quality Observations (1990 – 2020)

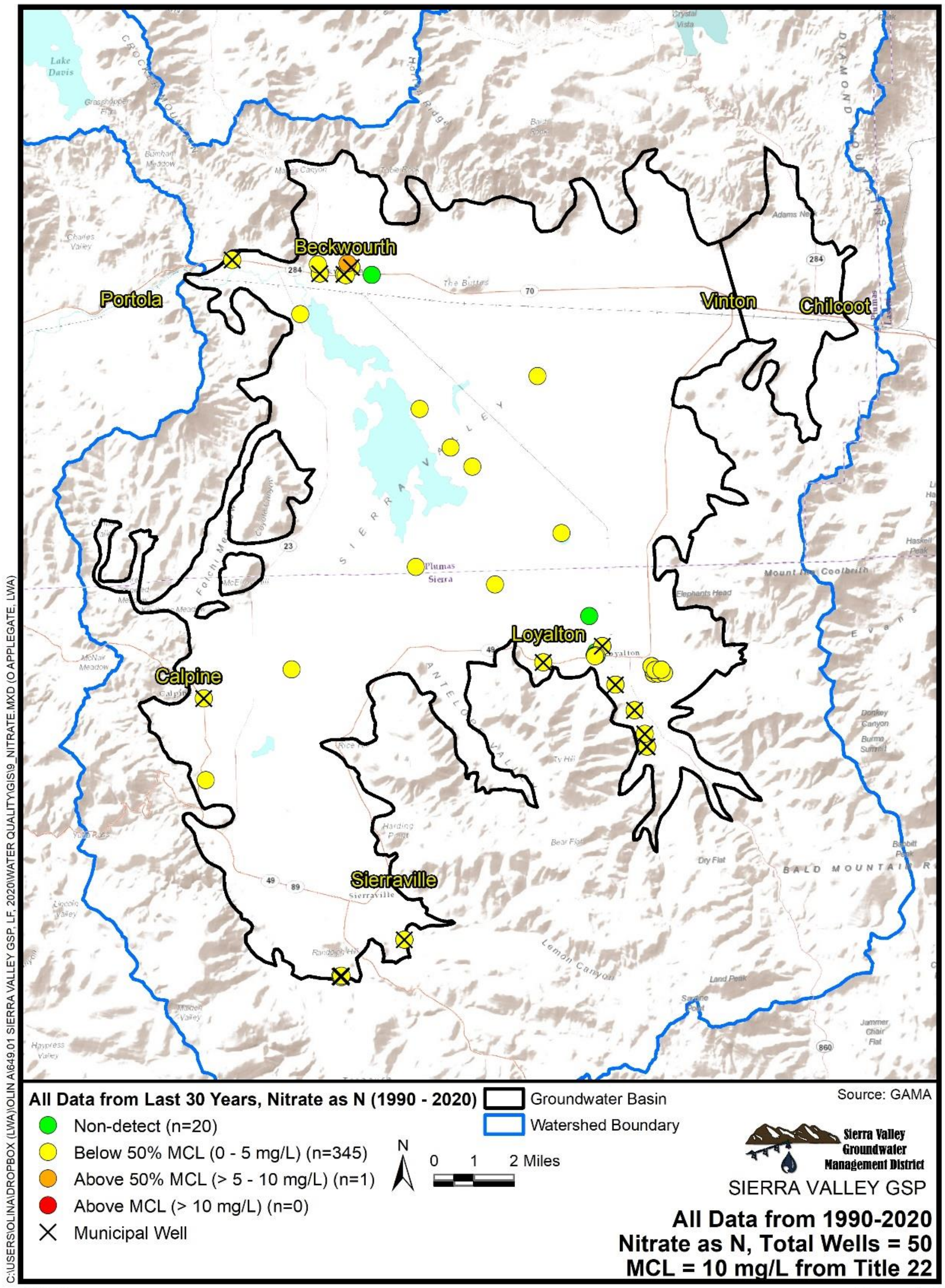


Figure A-9

to Figure A-24. In each figure the wells are color coded to identify where exceedances are occurring. Additionally, each constituent is displayed in two figures, the first with all data displayed and the second figure displaying only wells where more than one sample was collected over time.

Table A-1. Sierra Valley Groundwater Basin, Groundwater Quality Exceedance Analysis

Constituent	MCL	Units	2016 - 2020			2011 – 2015		
			Number of Wells Sampled	Number of Exceedance Wells	Highest Concentration Measured	Number of Wells Sampled	Number of Exceedance Wells	Highest Concentration Measured
Aluminum	200[a]	µg/L	12	1	210	10	1	750
Arsenic	10	µg/L	13	0	8.5	10	0	2.7
Benzene	1	µg/L	21	2	32	31	0	0.0
Boron	1[b]	mg/L	10	1	1.7	10	1	1.6
Chloride	250[a]	mg/L	14	0	210	12	0	130
Di(2-ethylehexyl)phthalate (DEHP)	4	µg/L	0	0	NA	6	1	5.3
Ethylbenzene	300	µg/L	21	2	1,000	31	0	0
Fluoride	2[a]	mg/L	4	0	0.4	1	0	0
Iron	300[a]	µg/L	13	2	1,500	12	1	2,400
Manganese	50[a]	µg/L	13	3	1,200	10	1	120
Mercury	2	µg/L	13	1	6.2	10	0	0
MTBE	5[a]	µg/L	21	0	0.7	26	6	230
Napthalene	17[b]	µg/L	20	2	450	12	0	0
Nitrate as N	10	mg/L	23	0	4.5	28	0	4.8
Specific Conductivity	900[a]	µS/cm	12	9	400,000	5	1	260,000
Sodium	--	mg/L	14	--	150	13	--	150
Sulfate	250[a]	mg/L	13	0	6.7	22	1	360
TDS	500[a]	mg/L	15	1	630	12	1	530
Tert-Butyl Alcohol (TBA)	12	µg/L	17	0	0	24	2	140

a – secondary MCL
b – California Notification Level

Figure A-1. Nitrate as N, Groundwater Quality Observations (1986 – 2020)

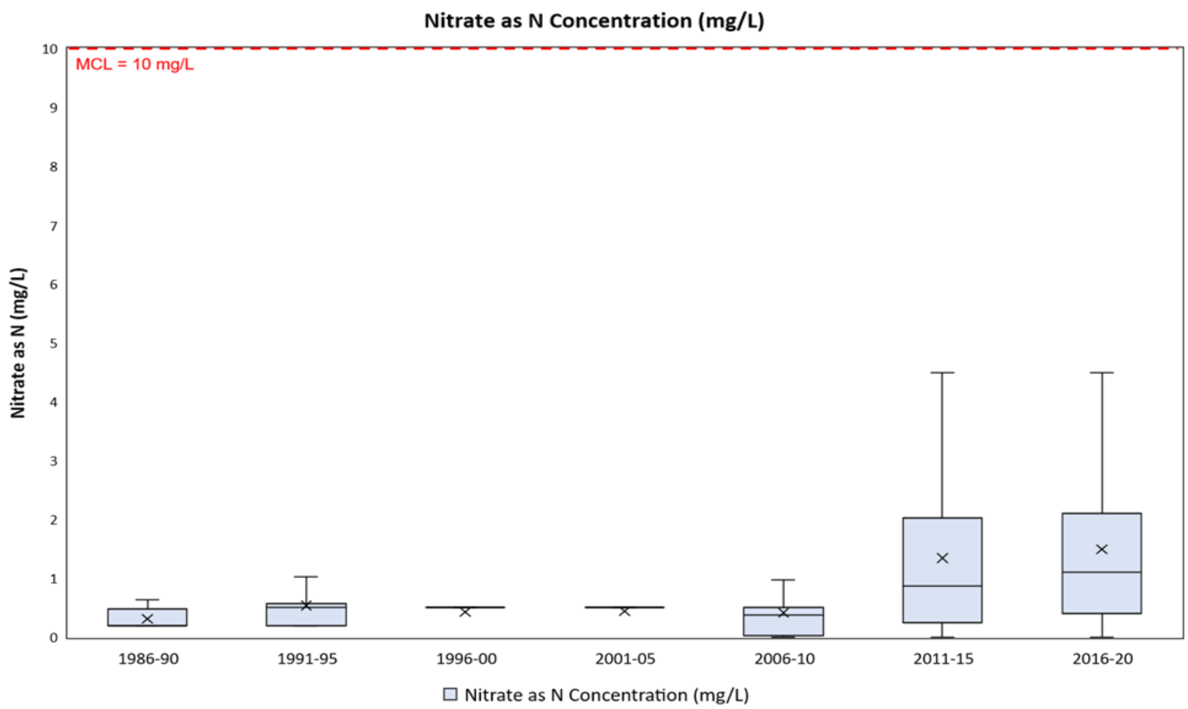


Figure A-2. TDS, Groundwater Quality Observations (1986 – 2020)

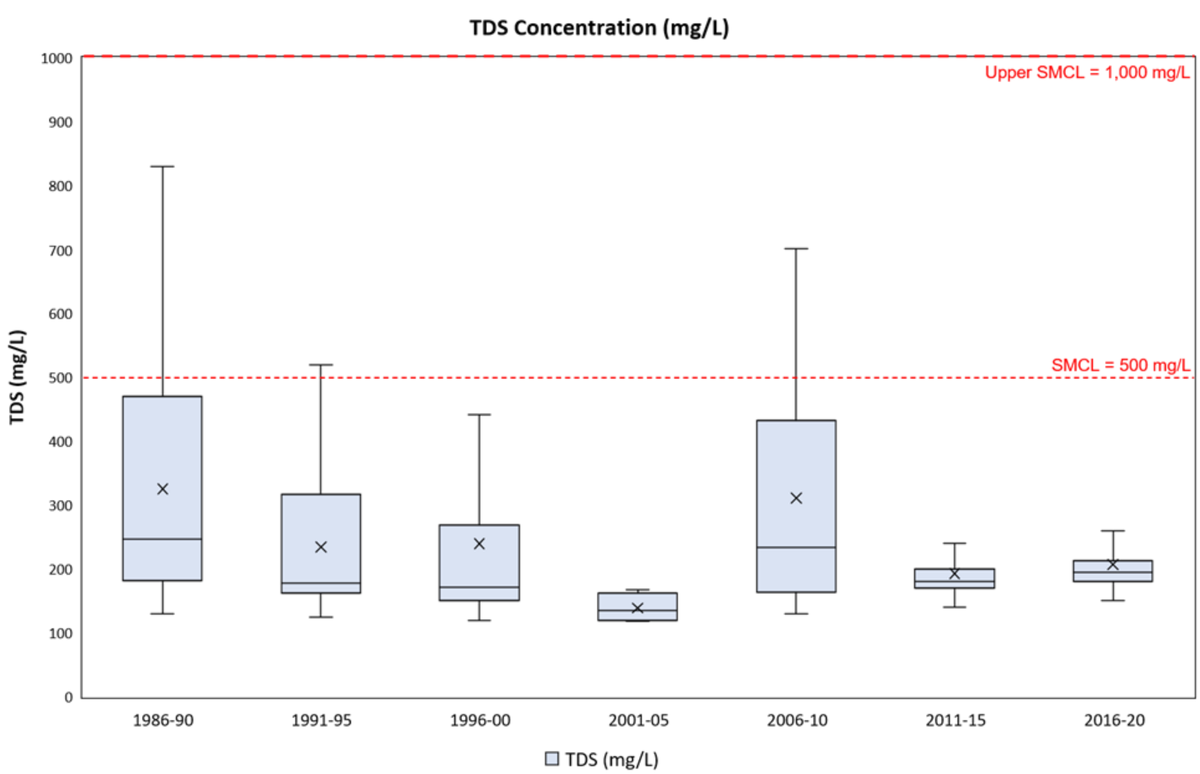


Figure A-3. Arsenic, Groundwater Quality Observations (1986 – 2020)

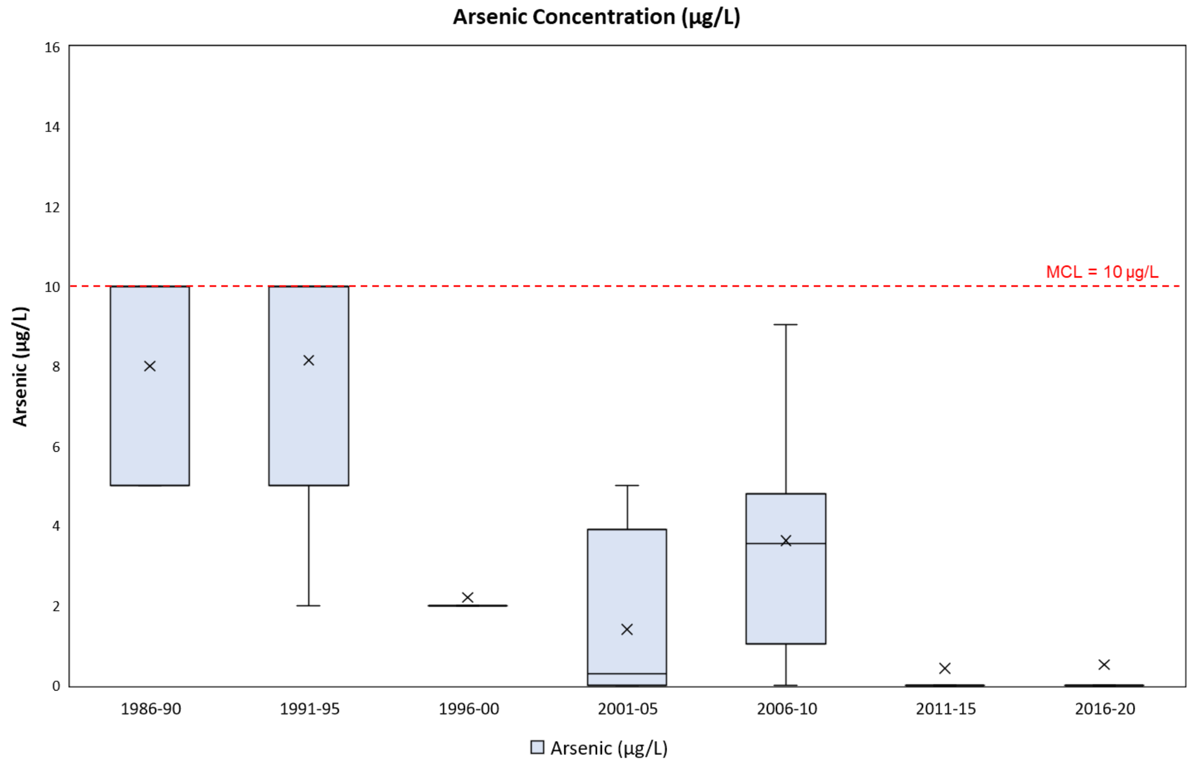


Figure A-4. Boron, Groundwater Quality Observations (1986 – 2020)

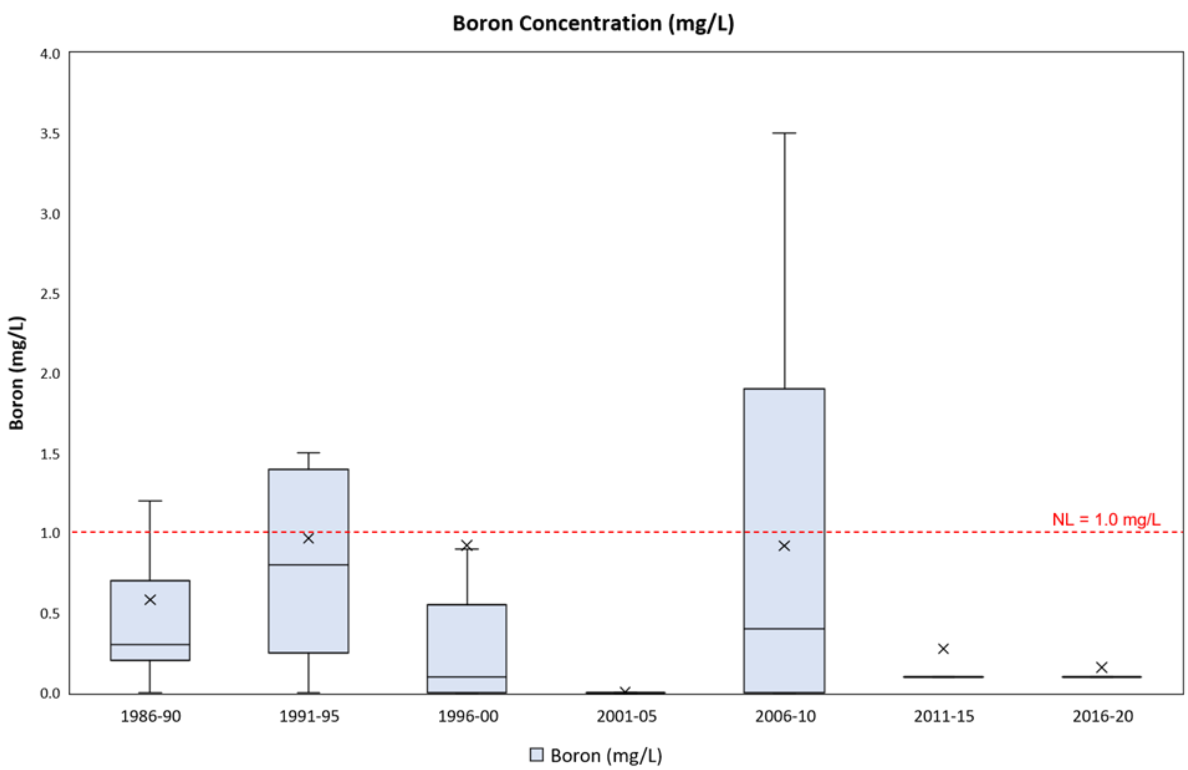


Figure A-5. pH, Groundwater Quality Observations (1986 – 2020)

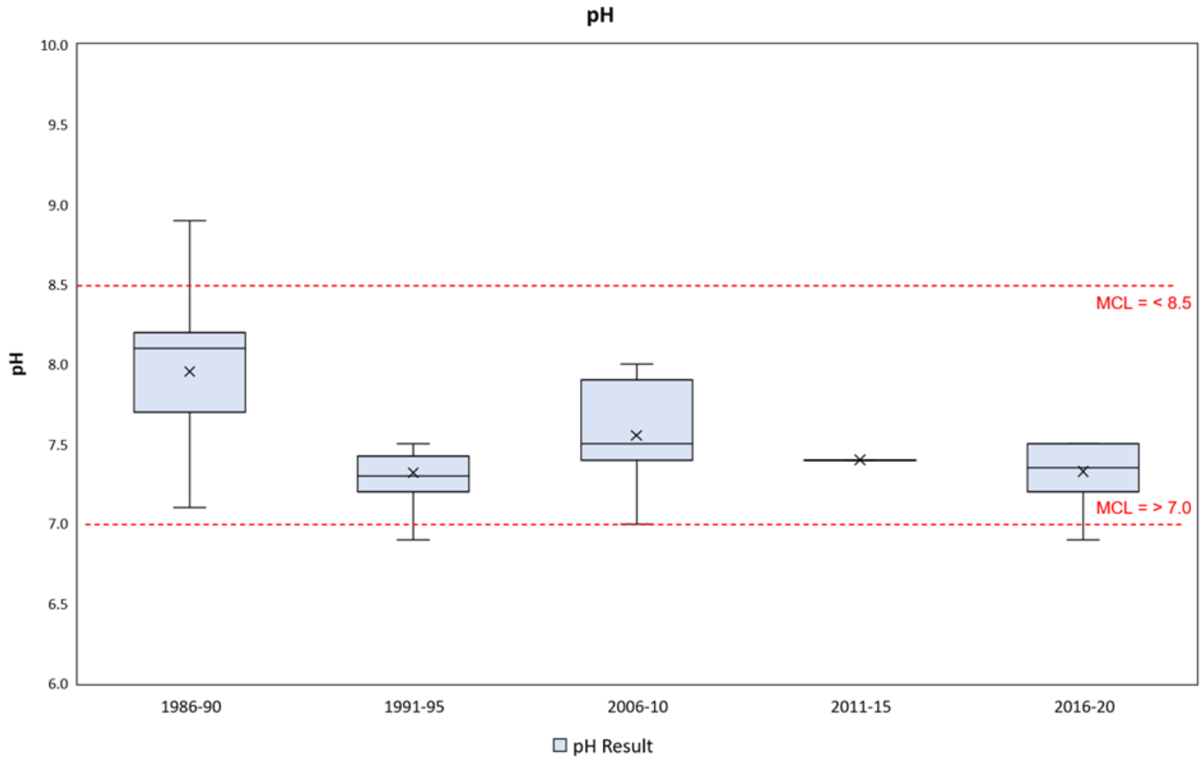


Figure A-6. Iron, Groundwater Quality Observations (1986 – 2020)

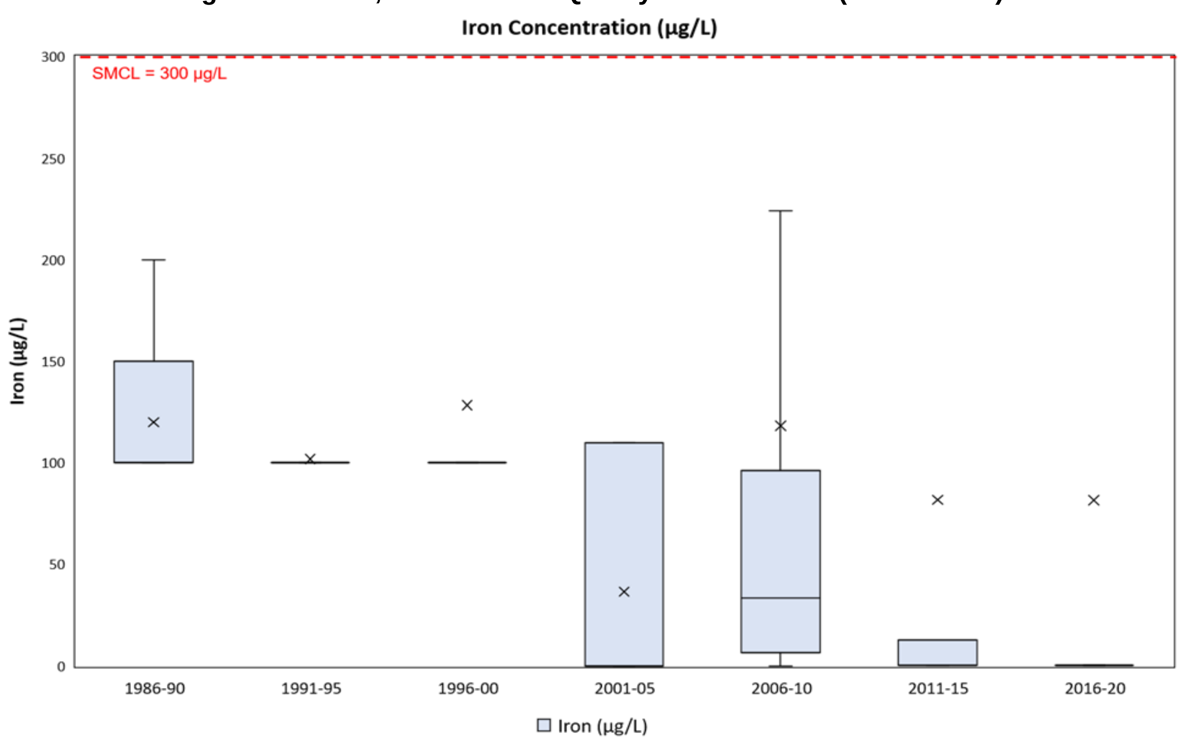


Figure A-7. Manganese, Groundwater Quality Observations (1986 – 2020)

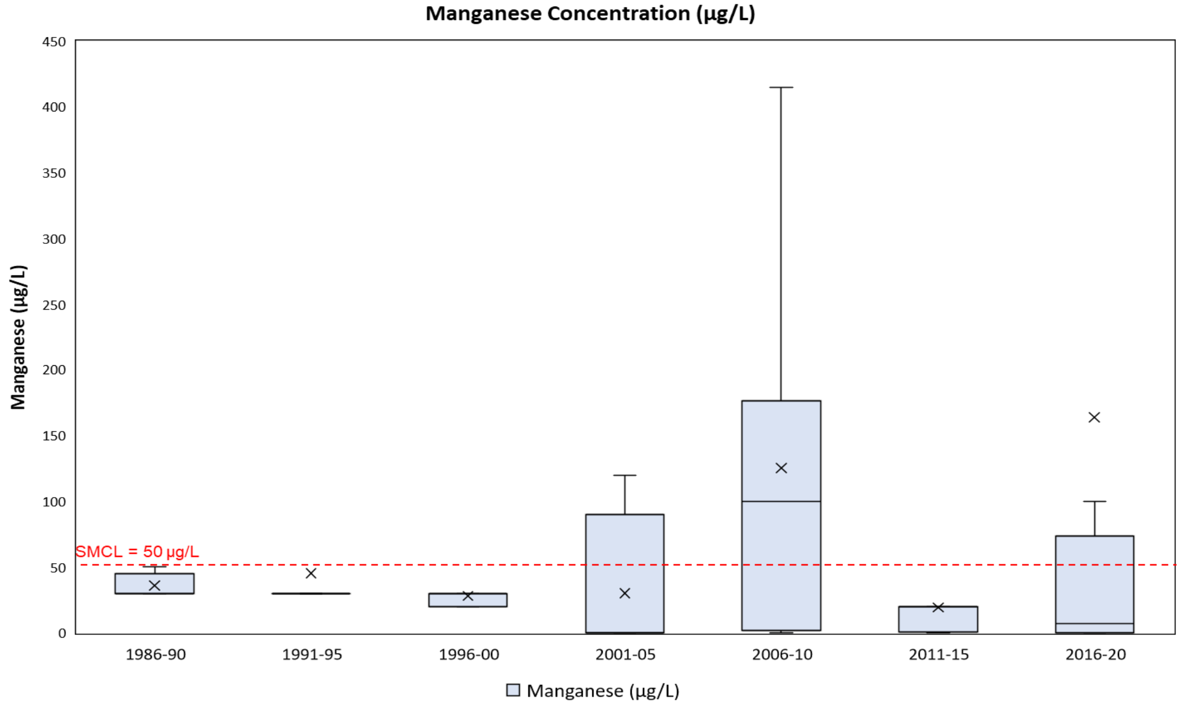


Figure A-8. MTBE, Groundwater Quality Observations (1996 – 2020)

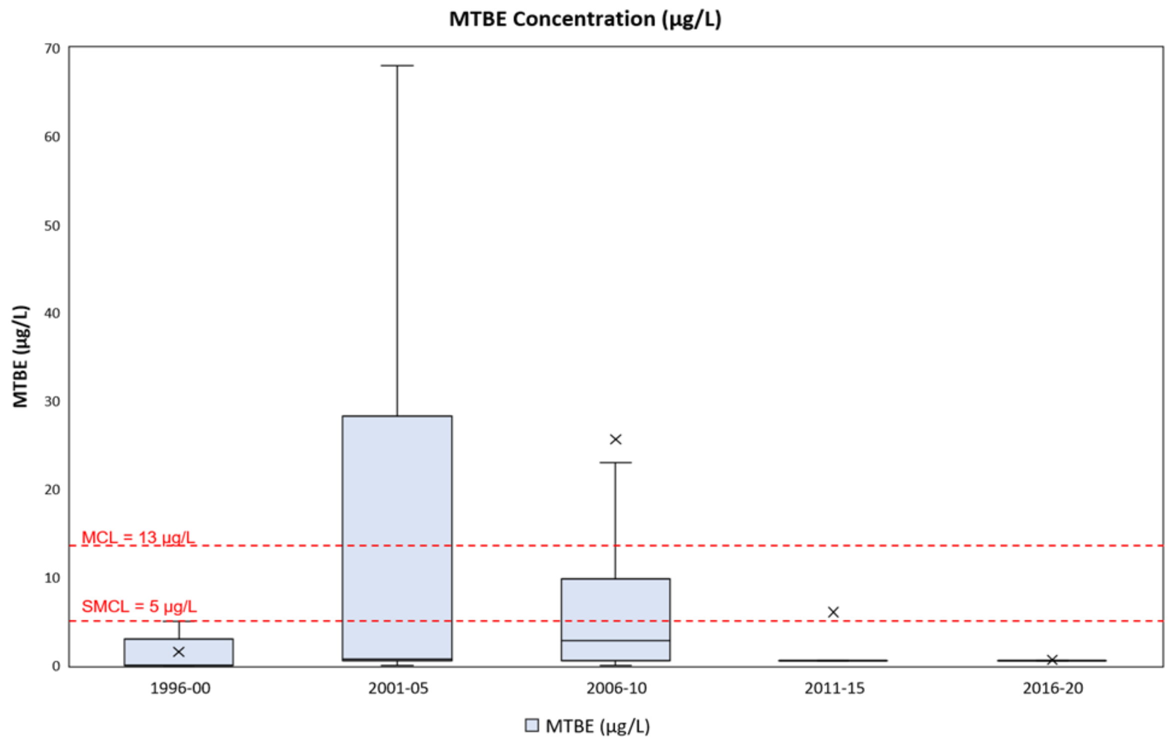


Figure A-9. Nitrate as N, Maximum Groundwater Quality Observations (1990 – 2020)

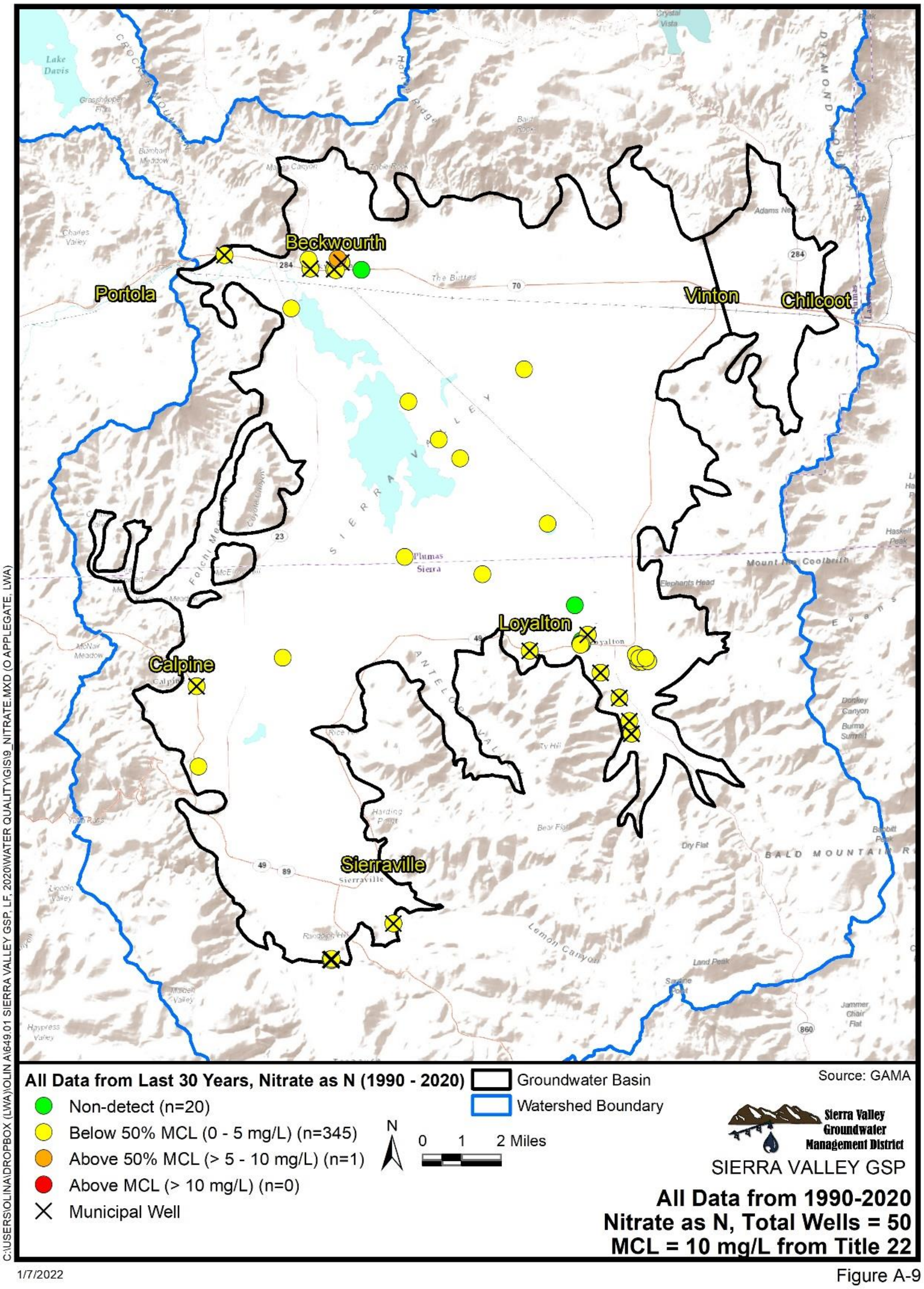
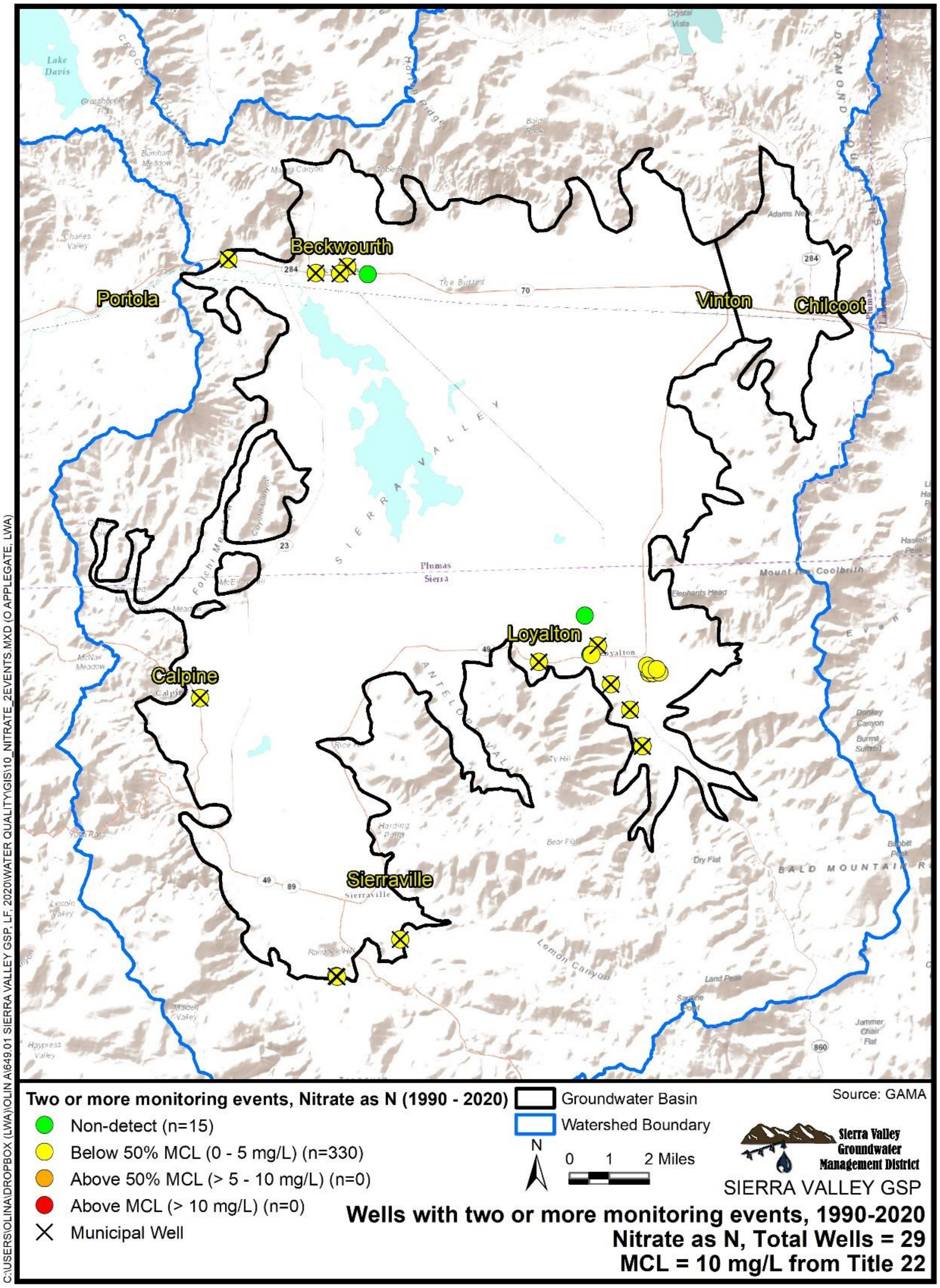


Figure A-9

Figure A-10. Nitrate as N, Maximum Groundwater Quality Observations from Wells with Two or More Measurements (1990 – 2020)



1/7/2022

Figure A-10

Figure A-11. TDS, Maximum Groundwater Quality Observations (1990 – 2020)

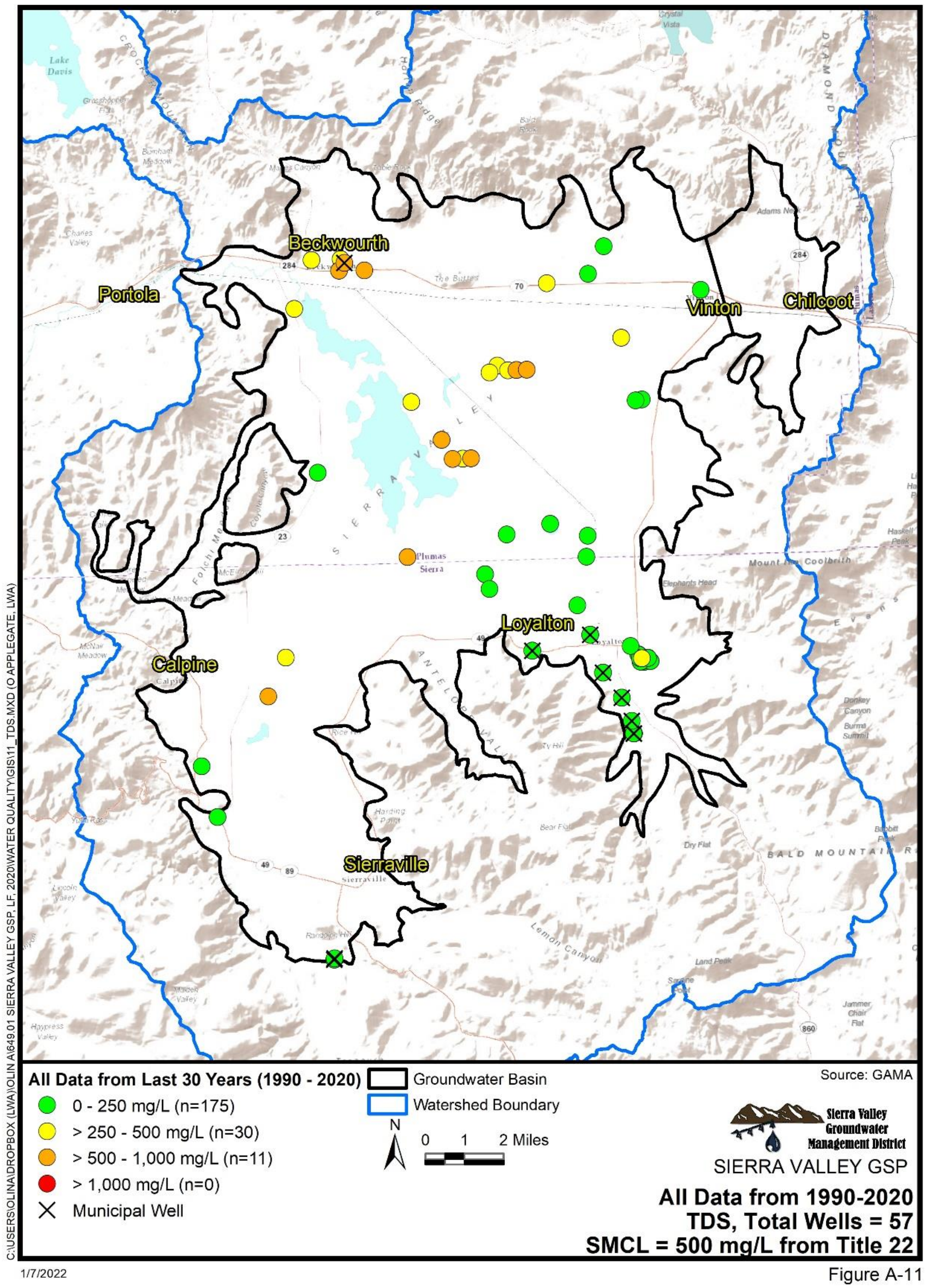


Figure A-11

Figure A-12. TDS, Maximum Groundwater Quality Observations from Wells with Two or More Measurements (1990 – 2020)

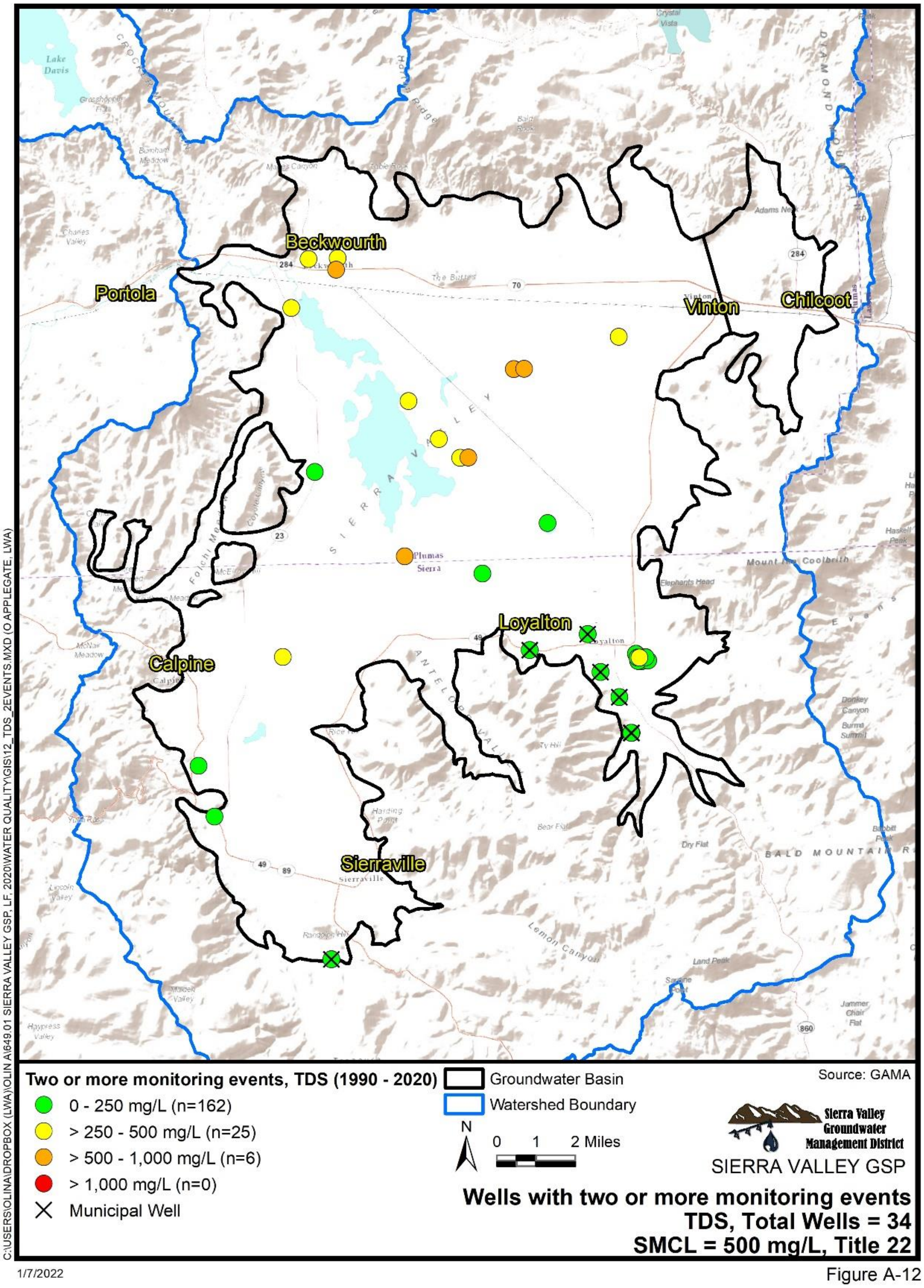
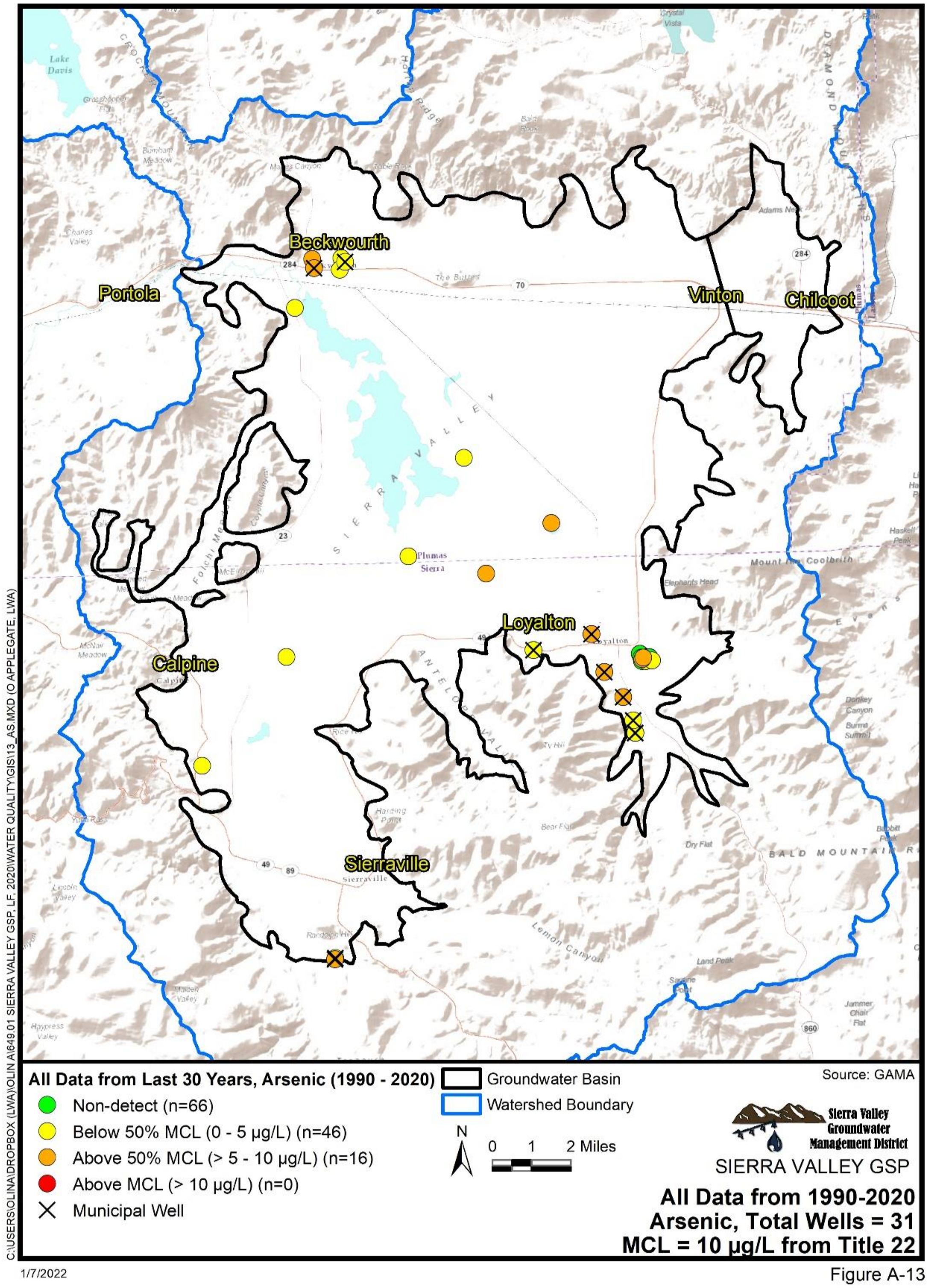


Figure A-12

Figure A-13. Arsenic, Maximum Groundwater Quality Observations (1990 – 2020)



1/7/2022

Figure A-13

Figure A-14. Arsenic, Maximum Groundwater Quality Observations from Wells with Two or More Measurements (1990 – 2020)

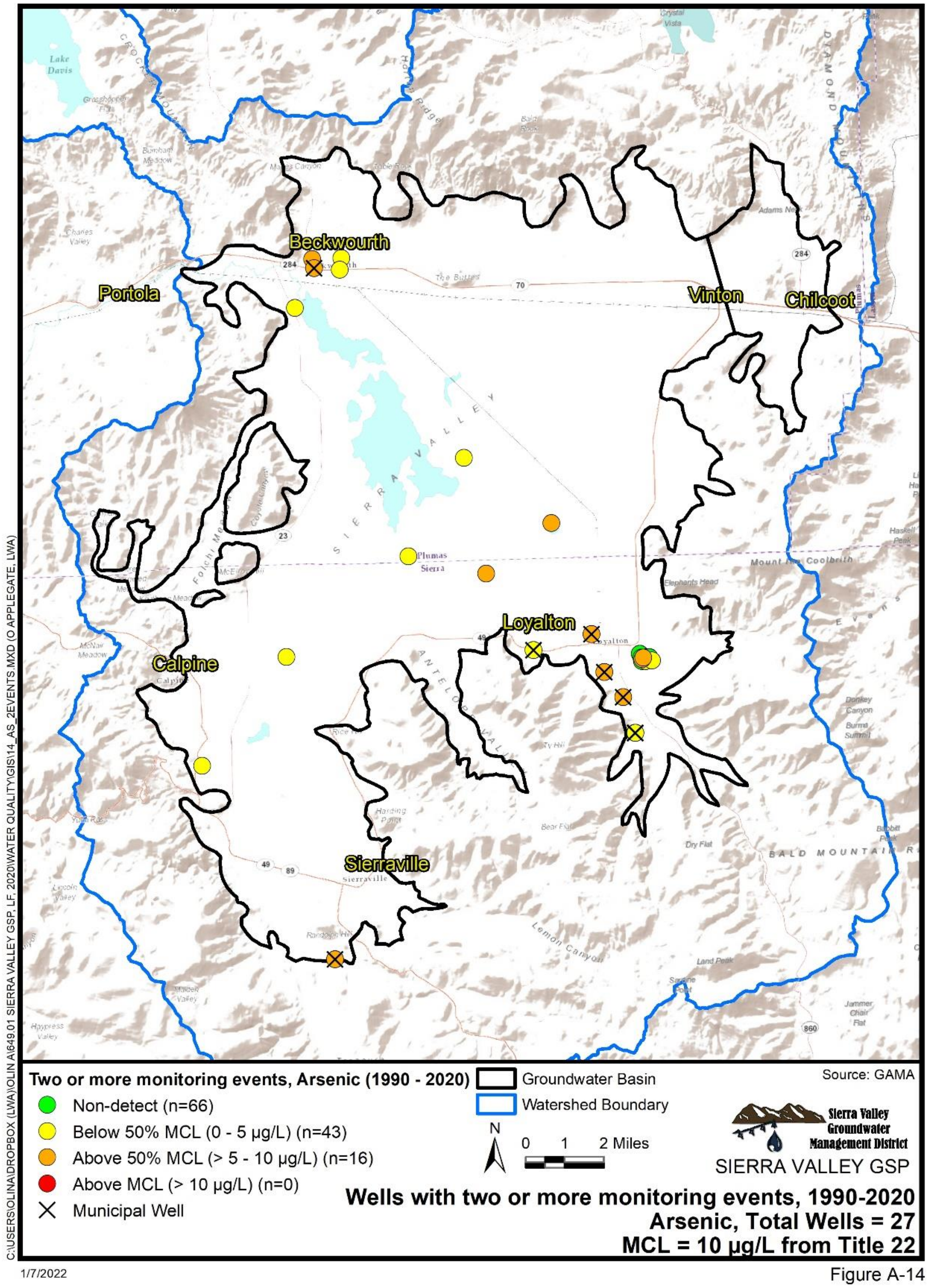
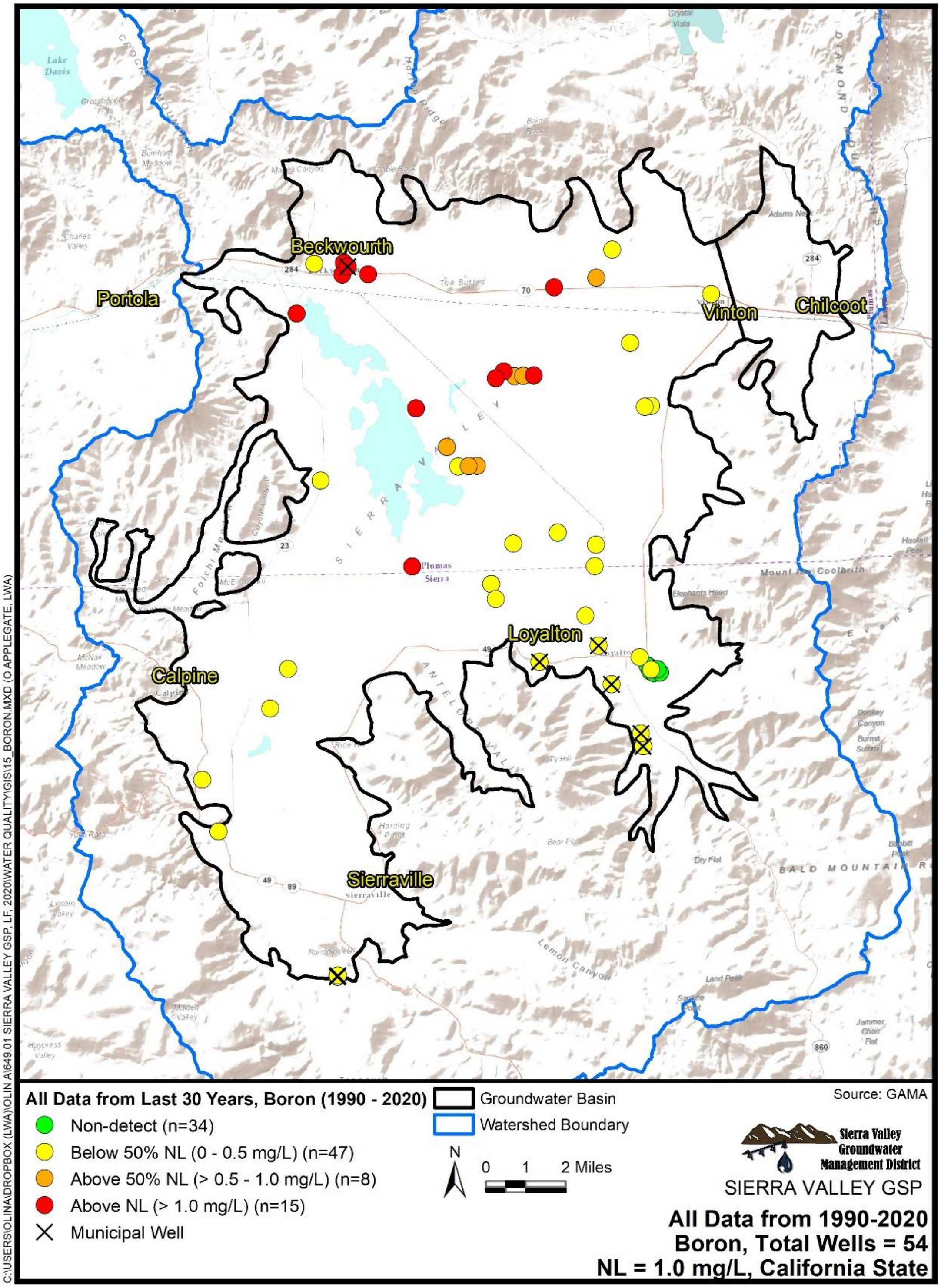


Figure A-15. Boron, Maximum Groundwater Quality Observations (1990 – 2020)



1/7/2022 Figure A-15

Figure A-16. Boron, Maximum Groundwater Quality Observations from Wells with Two or More Measurements (1990 – 2020)

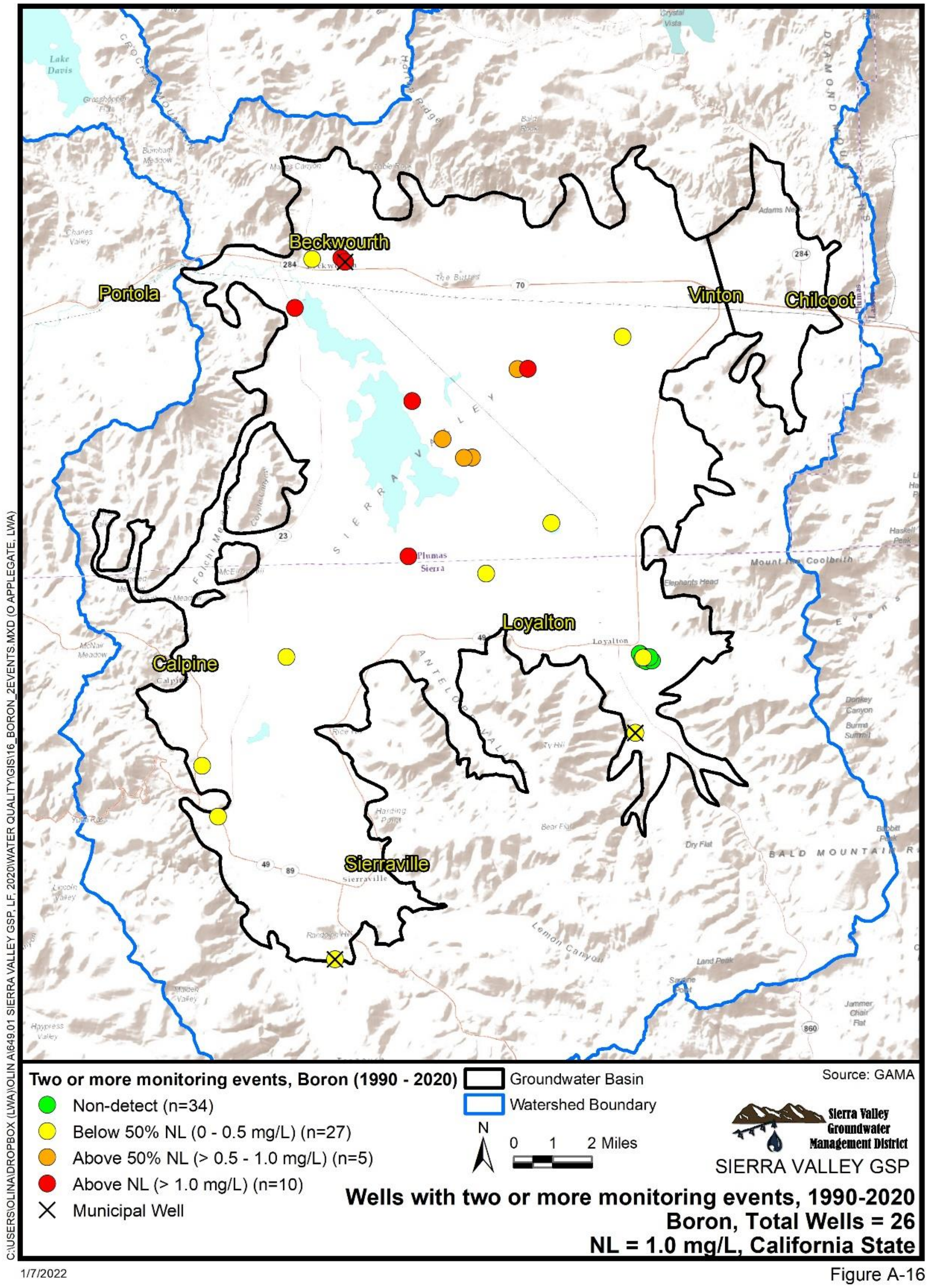


Figure A-17. pH, Groundwater Quality Observations (1990 – 2020)

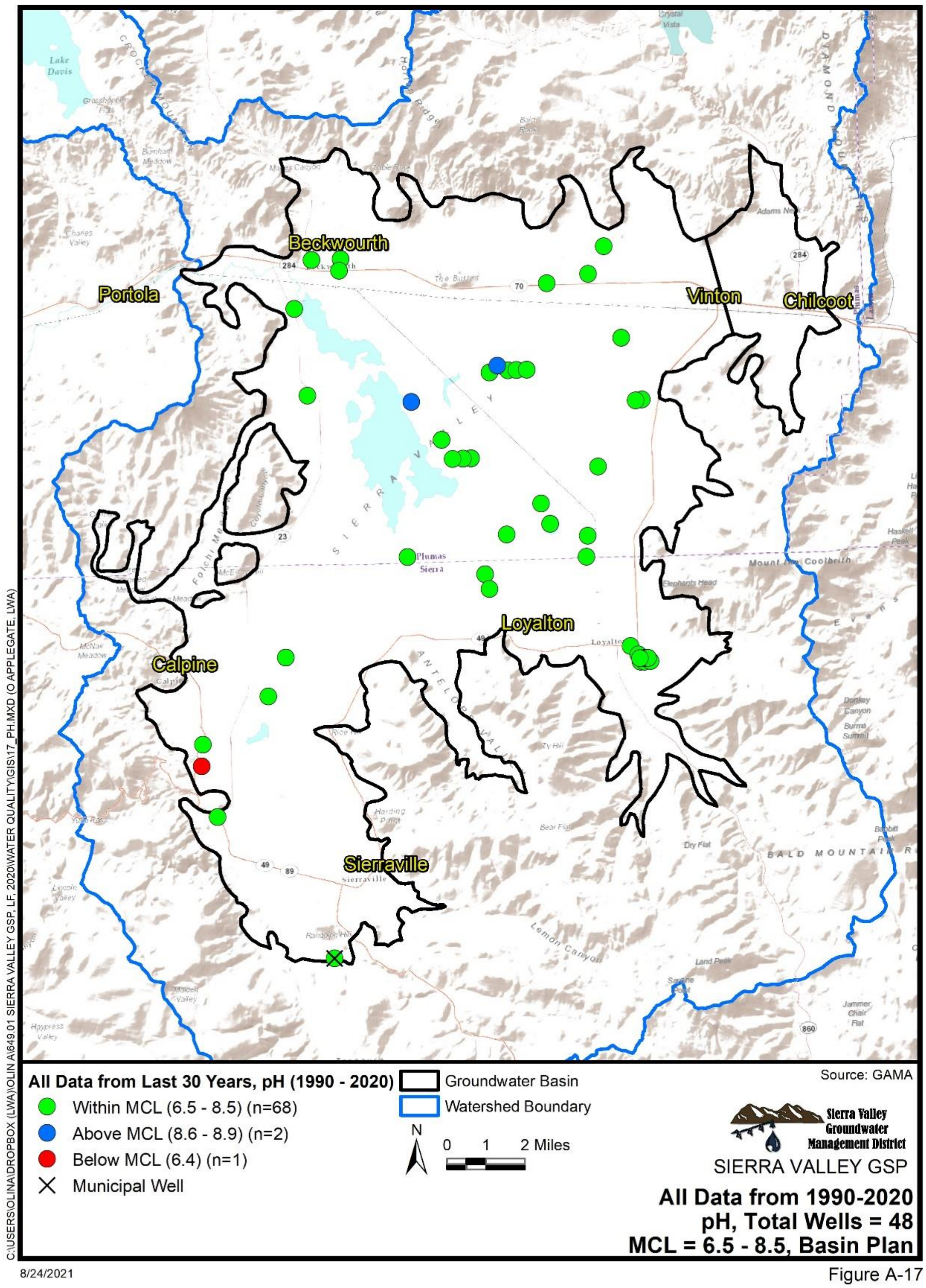


Figure A-18. pH, Groundwater Quality Observations from Wells with Two or More Measurements (1990 – 2020)

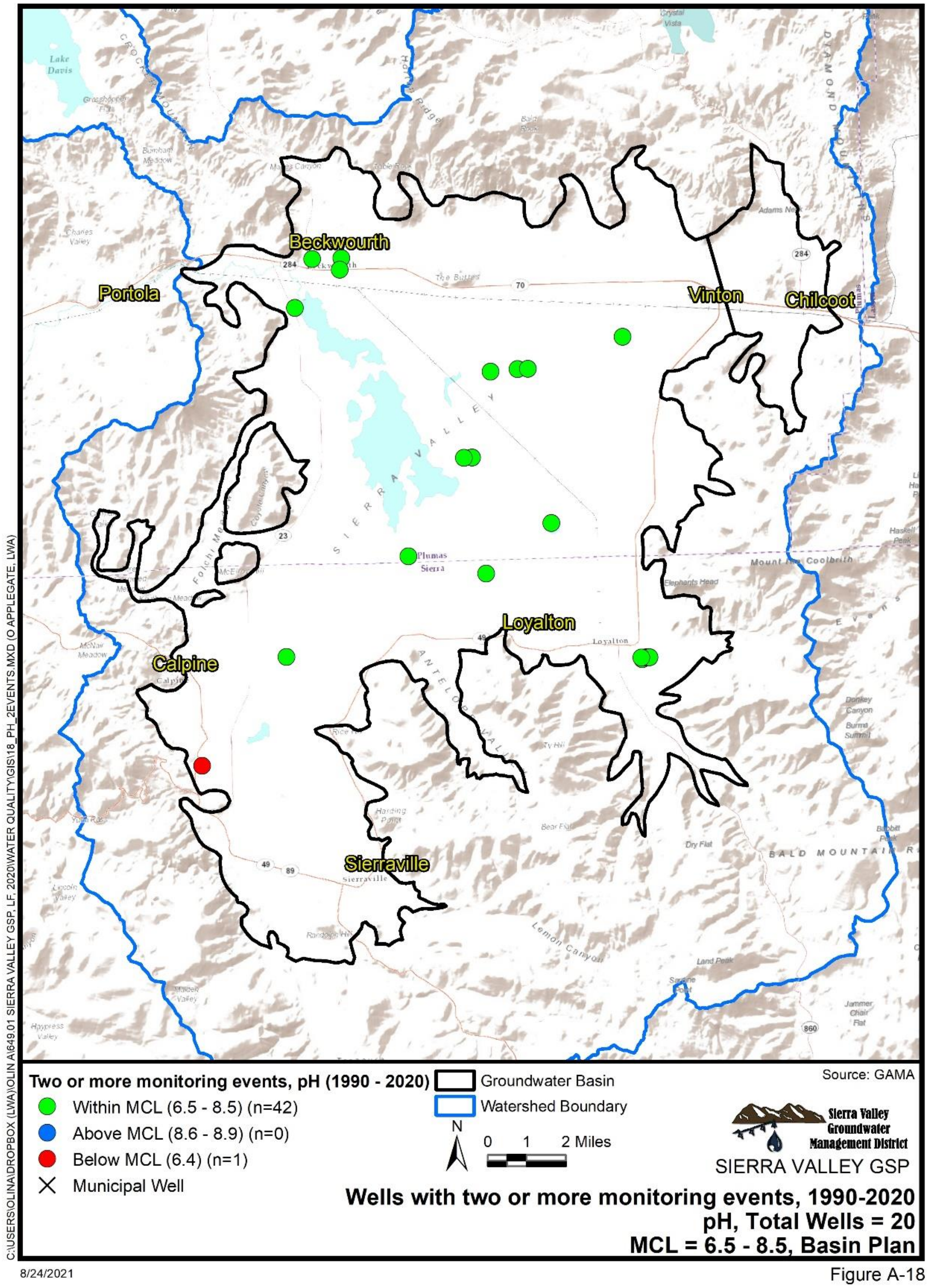
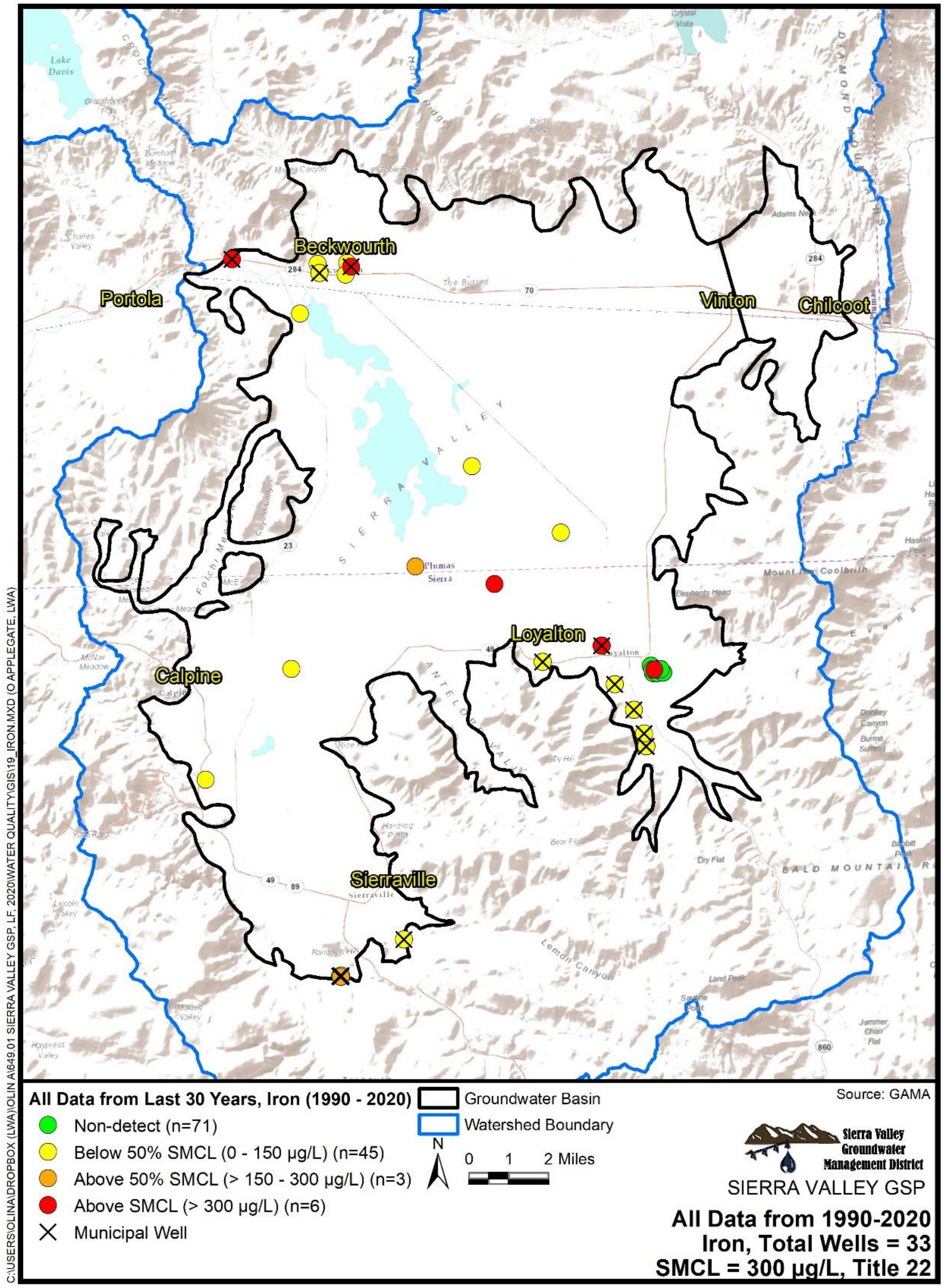


Figure A-19. Iron, Maximum Groundwater Quality Observations (1990 – 2020)



8/24/2021

Figure A-19

Figure A-20. Iron, Maximum Groundwater Quality Observations from Wells with Two or More Measurements (1990 – 2020)

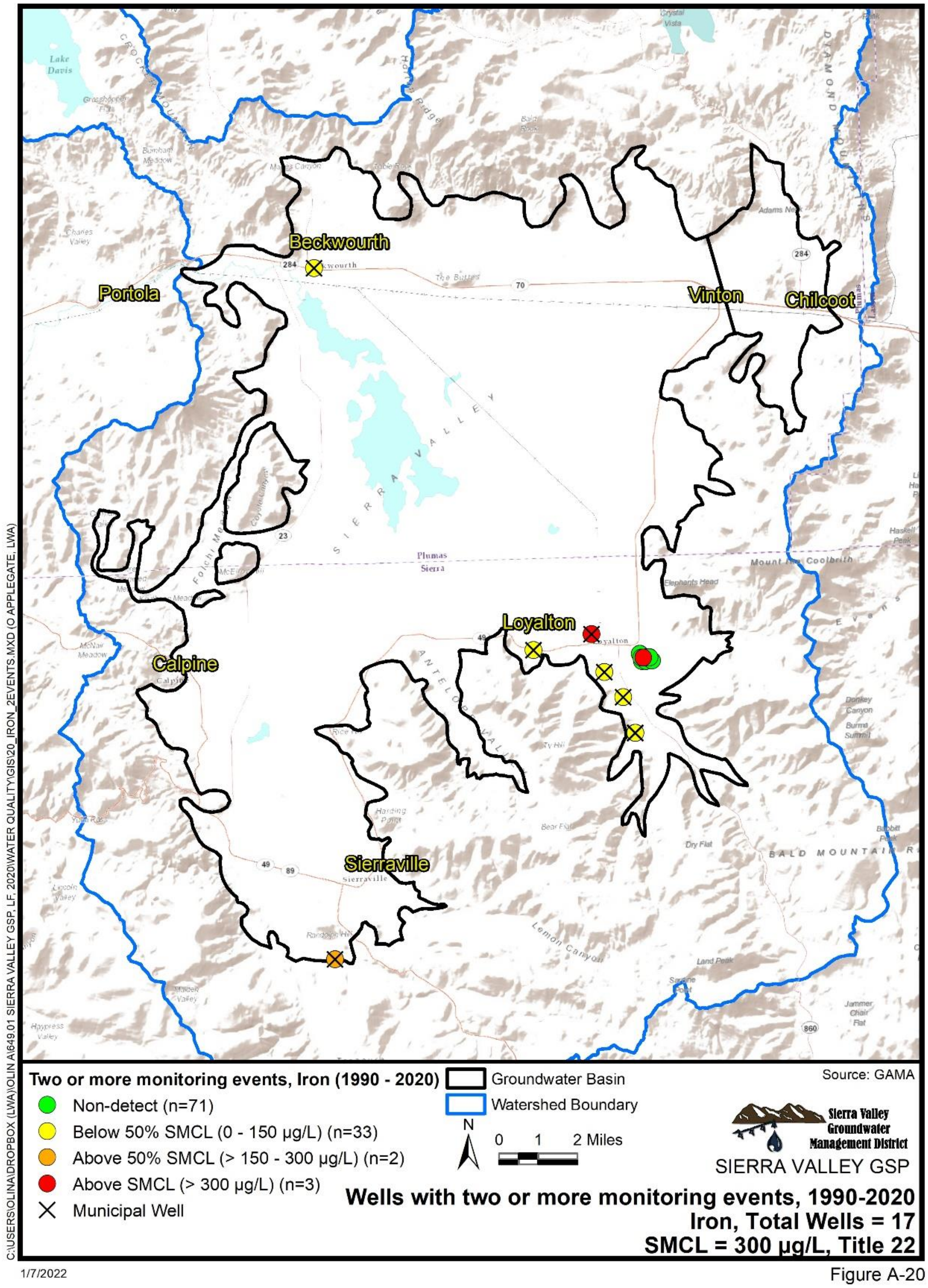


Figure A-21. Manganese, Maximum Groundwater Quality Observations (1990 – 2020)

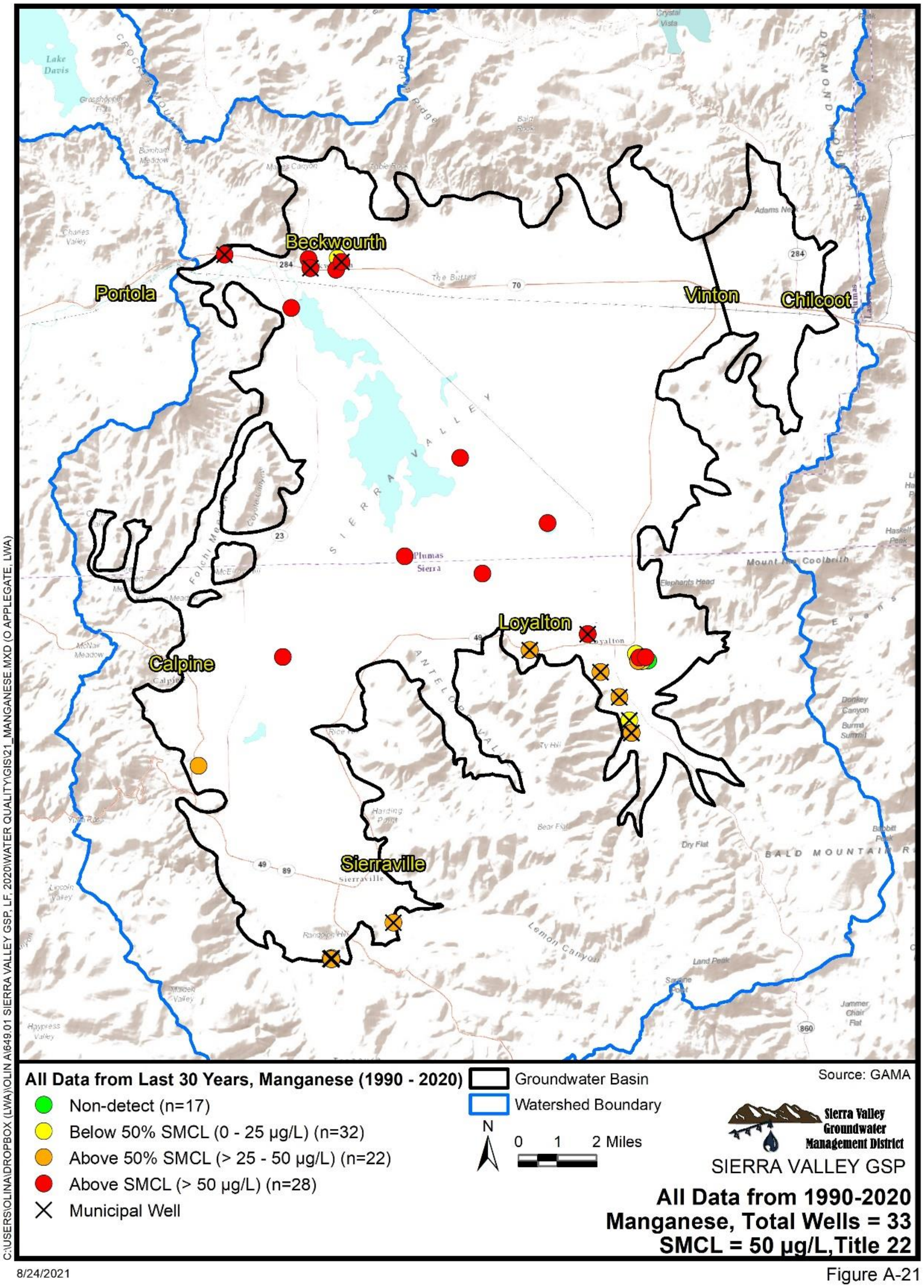


Figure A-22. Manganese, Maximum Groundwater Quality Observations from Wells with Two or More Measurements (1990 – 2020)

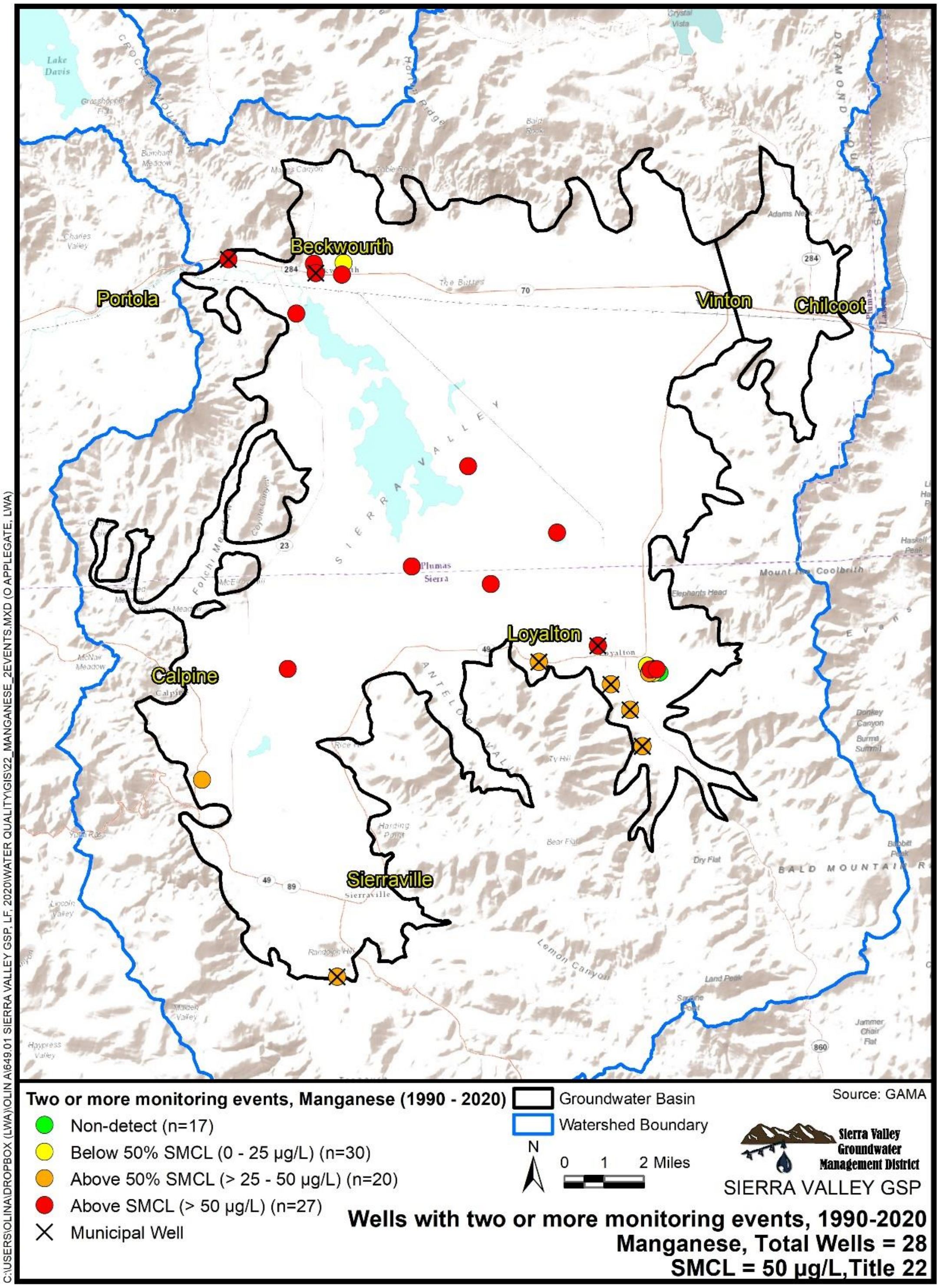
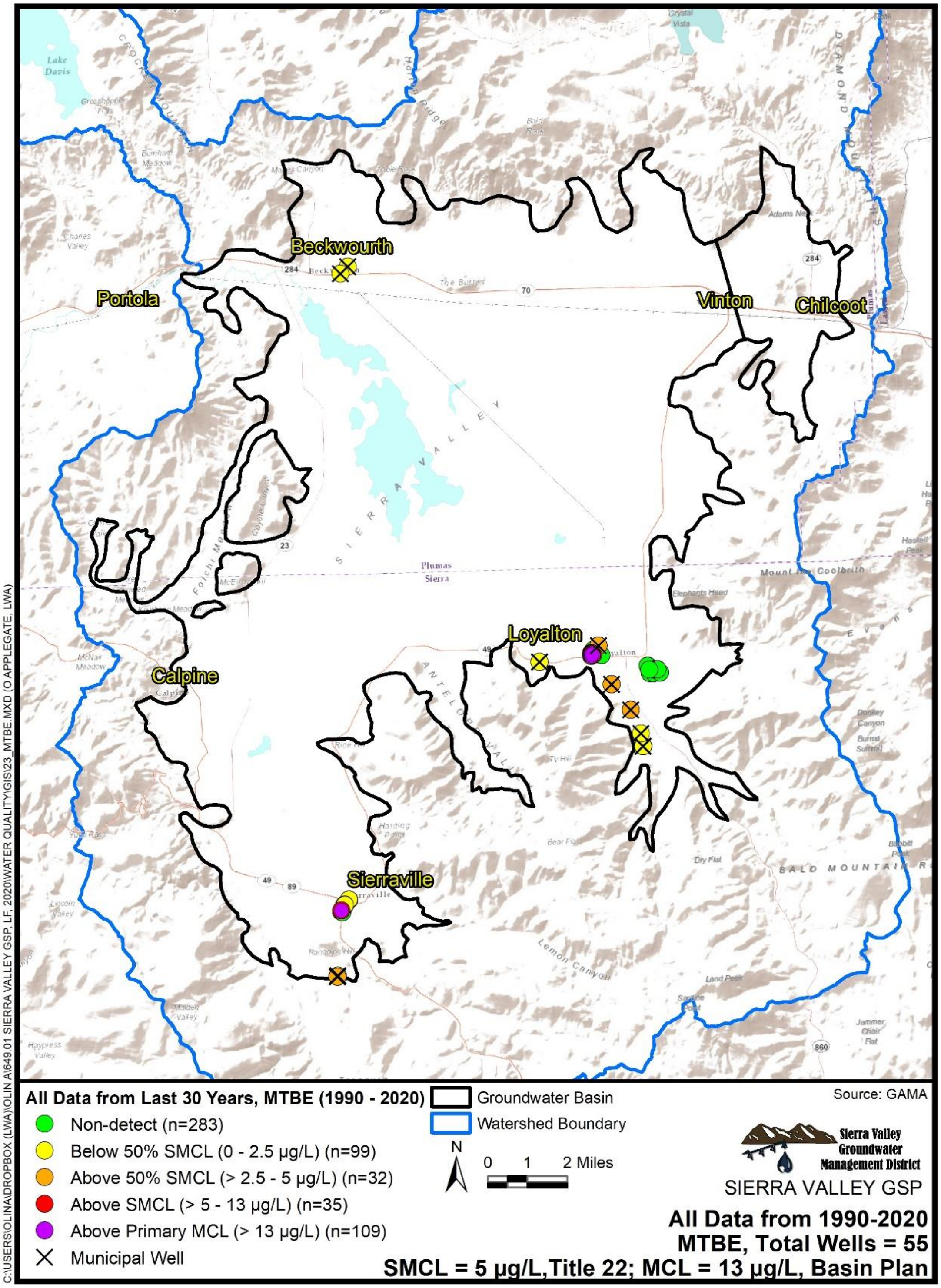


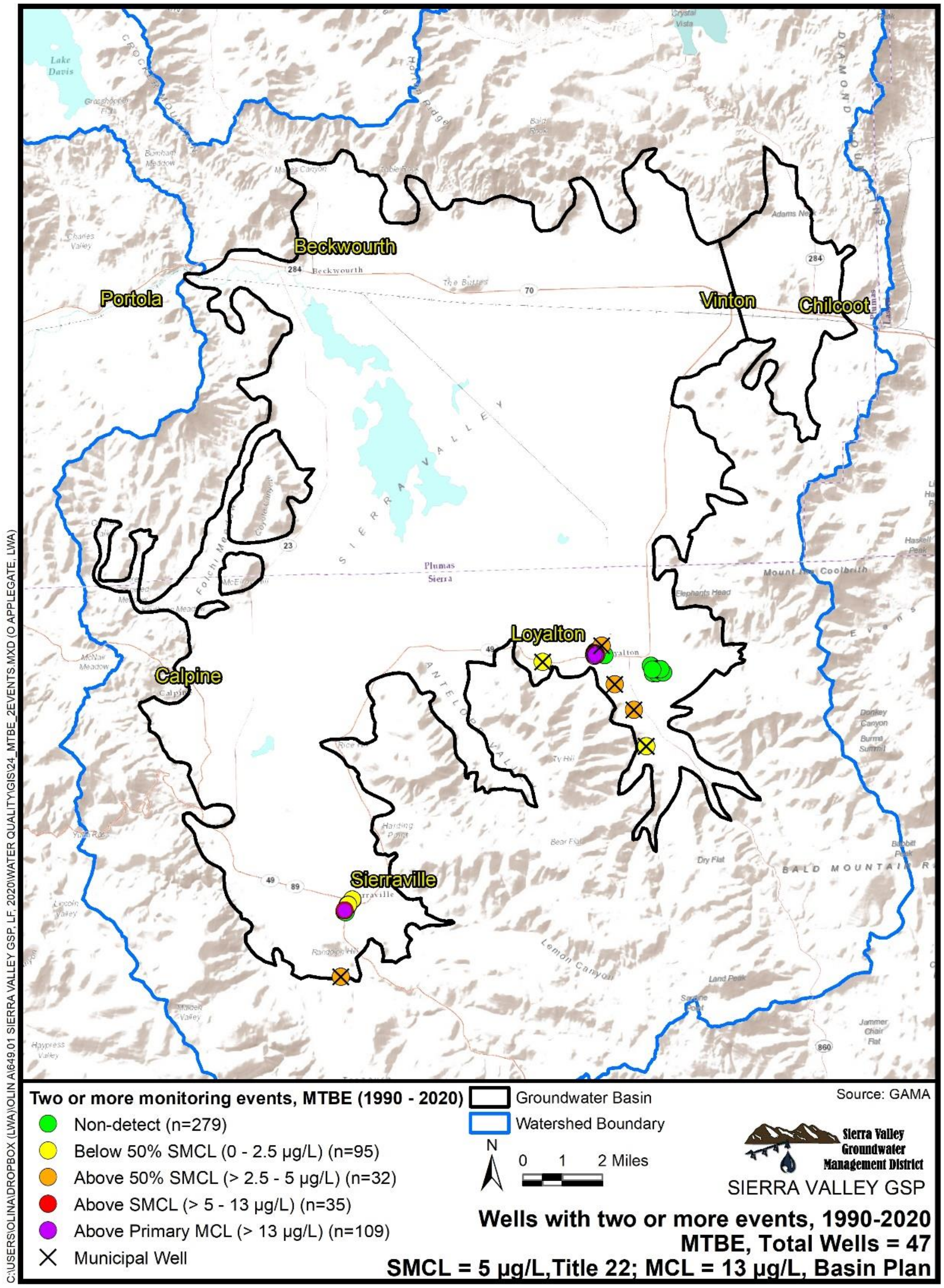
Figure A-23. MTBE, Maximum Groundwater Quality Observations (1990 – 2020)



1/7/2022

Figure A-23

Figure A-24. MTBE, Maximum Groundwater Quality Observations from Wells with Two or More Measurements (1990 – 2020)



1/7/2022

Figure A-24

Appendix 2-7: Sierra Valley Hydrogeologic System Model and Water Budget Report

Certification

This document was prepared in accordance with generally accepted professional hydrogeologic principles and practices. This document makes no other warranties, either expressed or implied as to the professional advice or data included in it. This document has not been prepared for use by parties or projects other than those named or described herein. It may not contain sufficient information for other parties or purposes.

DANIEL B. STEPHENS & ASSOCIATES, INC.

REGISTERED GEOLOGIST
TONY MORGAN
No. 159
CERTIFIED HYDROGEOLOGIST
STATE of CALIFORNIA

Douglas Tolley, PhD
Staff Hydrogeologist
gtolley@geo-logic.com
143E Spring Hill Drive
Grass Valley, CA 95945

Tony Morgan, PG, CHG
VP / Principal Hydrogeologist
tmorgan@geo-logic.com
3916 State Street, Garden Suite
Santa Barbara, CA 93105

Date signed: 1/17/2022

Table of Contents

List of Tables

List of Figures

List of Appendices

List of Acronyms

AF - Acre Feet

AFY - Acre Feet Per Year

CASGEM - California Statewide Groundwater Elevation Monitoring

CFS - Cubic Feet Per Second

CGS - California Geological Survey

CIMIS - California Irrigation Management Information System

DBS&A - Daniel B. Stephens & Associates, Inc.

DMS - Database Management System

DWR - Department Of Water Resources

ET - Evapotranspiration

GIS - Geographic Information System

GPM - Gallons Per Minute

GSA - Groundwater Sustainability Agency

GSP - Groundwater Sustainability Plan

HCM - Hydrogeologic Conceptual Model

HRU - Hydrologic Response Unit

LWA - Larry Walker Associates

MAF - Million Acre Feet

MFFR - Middle Fork Feather River

PRMS - Precipitation-Runoff Modeling System

SFR - Streamflow Routing Package

SGMA - Sustainable Groundwater Management Act

SSURGO - Soil Survey Geographic Database

SVGMD - Sierra Valley Groundwater Management District

SVHSM - Sierra Valley Hydrogeologic System Model

SWBM - Soil-Water Budget Model

SWP - State Water Project

TAF - Thousand Acre feet

USGS - United States Geological Survey

1.0 Introduction and Purpose

Daniel B. Stephens & Associates, Inc. (DBS&A) was contracted by Larry Walker Associates (LWA) under LWA Project No. 649.01 to develop an integrated hydrologic model of the Sierra Valley and database management system (DMS) to assist with Groundwater Sustainability Plan (GSP) development and implementation. This report provides a description and evaluation of the Sierra Valley Hydrogeologic System Model (SVHSM). Documentation of the DMS is included in a separate document that will be included as an appendix of the GSP; however, a link to the DMS web-interface is provided in this report.

The primary goal of SVHSM is to provide a scientifically based, objective tool that the Groundwater Sustainability Agency can use to better inform their management decisions. This is accomplished by linking three different hydrologic models that, combined, simulate the entire hydrologic flow system in the watershed (Figure 1-1). The integrated model provides detailed recent historical or projected future water budgets for the three main hydrologic subsystems: (1) land surface and soil zone, (2) surface water, and (3) groundwater. Water budgets are an accounting of all water that flows into or out of a defined project area, and provide information about changes in storage.

Sections 2 and 3 of this document summarize the basin setting and modeling approach. Hydrologic flows in the Sierra Valley watershed are simulated using three coupled models along with a 3D geologic model that was used to define aquifer geometry and sediment distribution. These models are discussed in Sections 4-7. Sensitivity analysis and model calibration results are presented in Section 8. Historical and projected future water budgets for each hydrologic subsystem of the groundwater basin are provided in Section 9. Suggestions for future data collection and areas that additional calibration efforts should focus on are included in Section 10.

The model presented and discussed in this report is separate from that developed for the Sierra Valley by researchers at UC Davis (Dib and others, 2016). Efforts were made to acquire the input files for this model to assess if they could be updated to meet

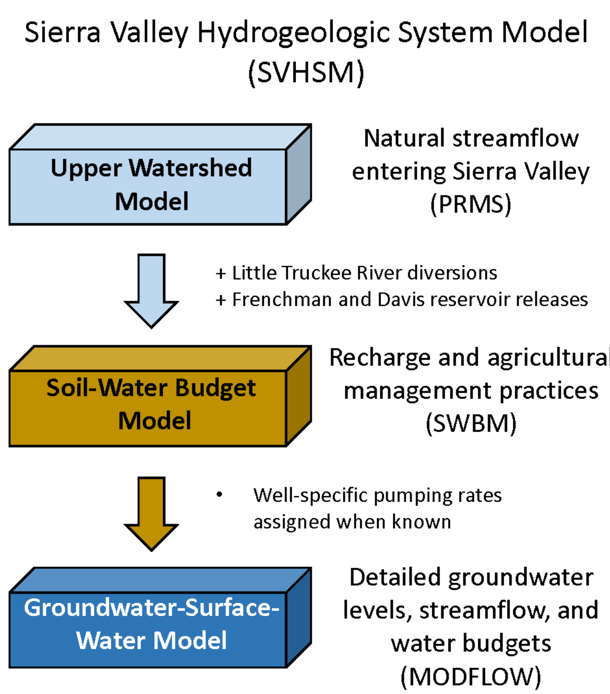


Figure 1-1. Schematic overview of the Sierra Valley Hydrogeologic System Model

GSP needs or be used to reduce effort in development of a new model. Unfortunately, the model files could not be obtained. If they become available in the future, they can be evaluated and incorporated into SVHSM as applicable.

2.0 Study Area

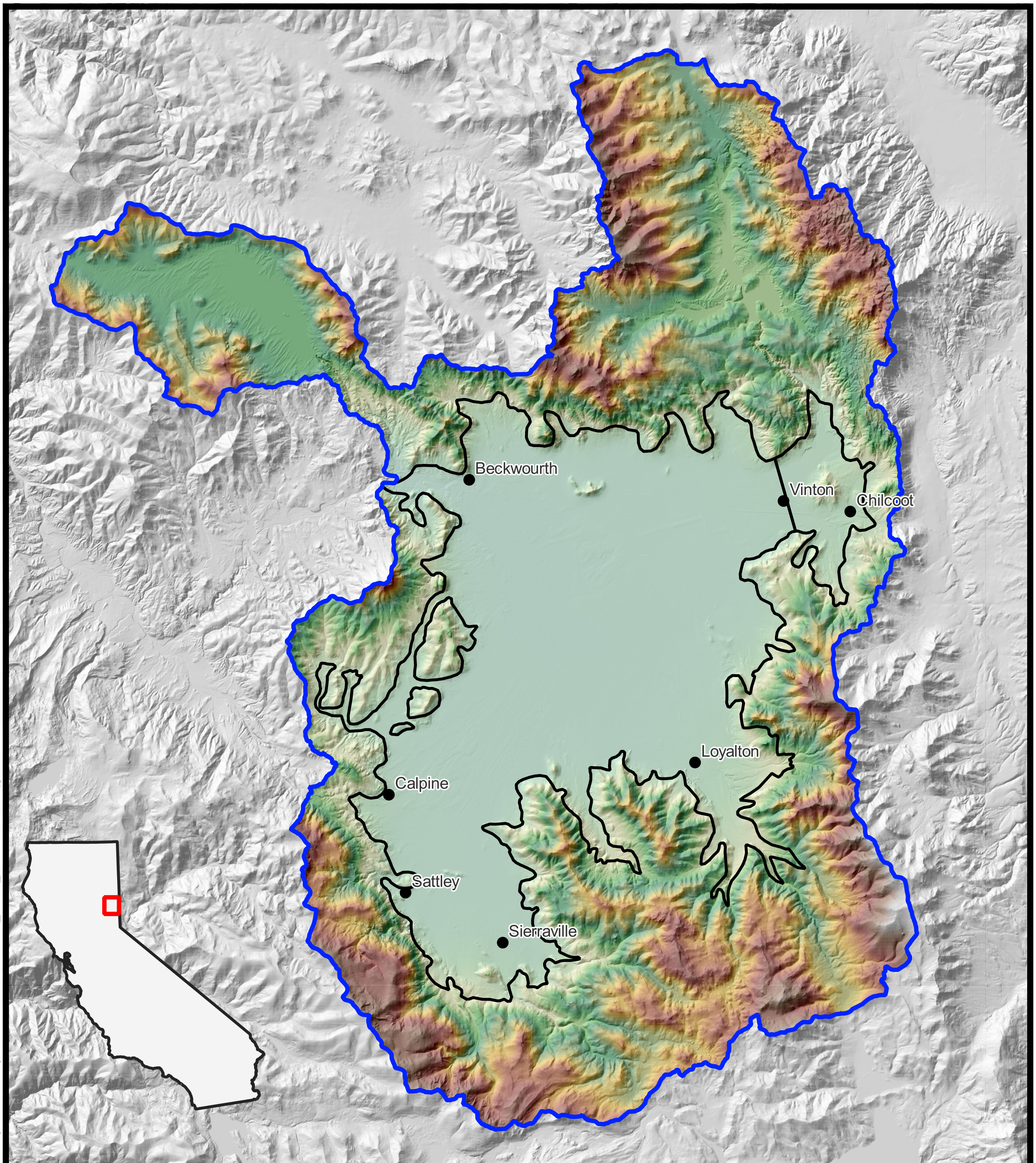
Sierra Valley is a large sub-alpine valley located in the eastern Sierra Nevada Mountains in the northern portion of the Sierra Nevada geomorphic province of California, and drains nearly 374,000 acres (Figure 2-1). The groundwater basin is about 125,900 acres and consists of the Sierra Valley (5-012.01) and Chilcoot (5-012.02) subbasins. The valley is surrounded by steep mountains and alluvial fans with various slope gradients.

Climate in the Sierra Valley watershed is strongly correlated with elevation, with higher elevations being cooler and generally receiving the greatest amount of precipitation. The watershed experiences more precipitation in the west due to the “rain shadow effect” caused by the Sierra Nevada Mountains. The combination of topography and the “rain shadow effect” results in highly variable precipitation in the watershed.

The majority of the Sierra Valley basin is private land, while the surrounding watershed is primarily national forest. On the valley floor, alfalfa grown for hay is the dominant irrigated crop. Braided streams and agricultural irrigation support wetland and riparian communities. The western valley supports approximately a 20,000-acre wetlands complex and 30,000-acre meadow complex, both the largest in the Sierra Nevada (NRCS, 2016).

Soils within the Sierra Valley Watershed vary considerably in productivity, depth, and use based on parent material, topography, and precipitation. Surface soil types within the groundwater basin are dominated by sands, clays, and silts. Silty sands make up the largest fraction of surficial soils in the groundwater basin, accounting for about 41% of the surface area. Finer-grained soil textures, such as silts and clays, make up approximately 37% of the surface area and are generally located adjacent to stream channels and wetland regions. The rest of the basin has either not been classified or is composed of relatively small fractions of mixed soils.

The groundwater basin is part of a series of downdropped fault blocks, or grabens, surrounded by uplifted mountains, or horsts. The valley floor consists of an irregular surface of basement rock, formed by steeply dipping northwest and northeast-trending vertical, normal, and strike-slip faults. Throughout its geologic history, the fault trough floor gradually subsided, while being occupied by one or several lakes (Durrell, 1986). Lacustrine (lake), fluvial, and alluvial deposits were formed as sediments eroded from the surrounding uplands and volcanic tuffs (ash deposits) and filled the space created by the fault trough floor as it continued to subside. Sierra Valley geologic units can be divided into three groups: (1) basement complex metamorphic and granitic rocks, (2) Tertiary volcanics, and (3) Quaternary sedimentary deposits of clay, silt, sand, and gravel.



Explanation

Elevation (m)

2,637

1,480

- City or Town
- Watershed Boundary
- Groundwater Basin

Notes:
1. 2x vertical exaggeration on hillshade

Source: DWR (2020) and USGS (2020)

0 2.5 5 mi

N

Sierra Valley Groundwater Management District

SVHSM Documentation
Study Area and Topograpgy

C:\Users\500\Sierra Valley GSP Dropbox\Gus Tolley\Sierra Valley GSP\GIS\QGZs\SVHSM_Model_Documentation.qgz

12/02/2021

Figure 2-1

Sierra Valley and the surrounding uplands support the MFFR headwaters and provide water to Lake Oroville as part of the California State Water Project (SWP). Many named and unnamed streams enter the Sierra Valley basin creating a large braided stream network on the valley floor. These stream flows are fed seasonally by rainfall, snowmelt, and groundwater discharge. The western portion of the valley receives greater precipitation and has more surface water than the eastern valley. Appropriative and riparian water rights holders divert most of eastern stream flow during summer, such that the downstream stretches usually dry out completely before confluence with the western channels (Vestra, 2005; Bohm, 2016). Releases from Frenchman Lake and imported water from the Little Truckee River Diversion support valley irrigation during the growing season (DWR, 1983). Many of these tributaries drain the valley as they connect to the headwaters of MFFR through a water gap in the northwestern corner of the Sierra Valley watershed.

Inflows to the Sierra Valley groundwater system are primarily sourced from infiltration of surface water in the alluvial fans at the periphery of the valley from adjacent uplands and flow from the fractured bedrock in contact with the shallow and deep aquifers (Bohm, 2016). A small amount of recharge is likely derived from direct precipitation on fan surfaces, deep percolation from irrigated agricultural fields, seepage from losing reaches of tributaries, and irrigation ditches in the valley. Recharge areas tend to be high elevation areas with underlying soils and geologic formations containing sufficient hydraulic conductivity and the right combination of climate.

Most natural groundwater discharge occurs on the valley floor in the form of evapotranspiration (ET), direct surface evaporation, outflowing reaches of streams, natural springs, seeps, and wetlands. Approximately 70 to 80% of the watershed's total water budget is lost to evapotranspiration (Vestra, 2005). Springs and wetlands are found around the edges of the valley floor and are generally more abundant in the southwestern portions of the valley, where the uplands receive significantly more precipitation. Some exist along the northern valley perimeter, likely fed by the relatively large upland recharge areas that exist north of the valley (Bohm, 2016). Flowing artesian wells are present in many parts of the valley and discharge confined ground water at varying rates; flow during the winter and spring is usually greater than the summer and fall flows.

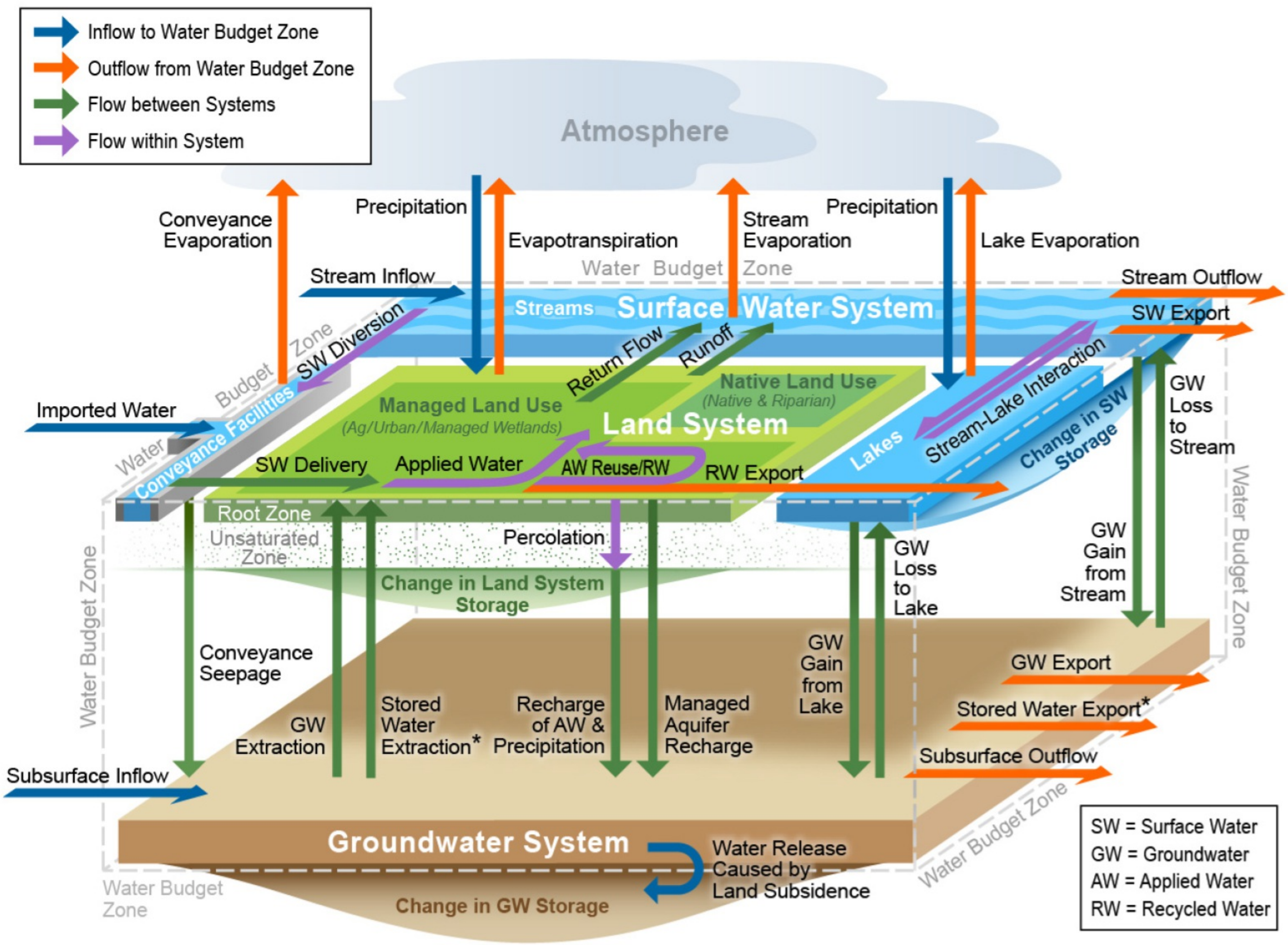
From 1999 to 2017 annual average groundwater pumping was about 8,500 acre-feet (Bachand, 2020). Approximately 90% of this pumping was from agricultural wells, with annual volumes substantially influenced by precipitation and snow pack. Average annual municipal pumping for residential water supply in Sierra Brooks, Calpine, and Loyalton was about 665 acre-feet (SVGMD, 2019). Domestic pumping in the Sierra Valley is unmetered and mostly occurs along the margin of the valley, with many domestic wells completed in bedrock outside of the groundwater basin boundary.

3.0 Modeling Approach and Framework

The Sierra Valley hydrogeologic system has been conceptualized into two primary geographic areas consisting of the Bulletin 118 groundwater basin boundary (DWR, 2018) and the upper watershed, defined as the contributing area to the Sierra Valley that is outside of the groundwater basin boundary. The hydrogeologic system in each of these two areas was subdivided into three broad categories: (1) land surface and unsaturated soil zone, (2) surface water, and (3) groundwater (Figure 3-1). This was done because flow processes that operate within each hydrologic subsystem have varying characteristic response times and spatial scales. For example, surface water flow is typically limited spatially to channels, but has short response times on the order of hours to days. In contrast, groundwater flow occurs within the entire aquifer volume and has much longer responses times on the order of days to months. Therefore, different specially tailored computer programs are required to simulate the multiple hydrogeologic processes operating within the watershed. Presentation of water budgets by hydrologic subsystem is also the method preferred by the California Department of Water Resources (DWR) (see Figure 1-1 in *Handbook for Water Budget Development: With or Without Models*).

Three computer programs are used to represent the flow of water in the Sierra Valley watershed (Figure 3-2). The upper watershed is simulated using the Precipitation Runoff Modeling System (PRMS) (Markstrom and others, 2015) developed by the U.S. Geological Survey (USGS), and is used to represent all three hydrologic subsystems outside of the groundwater basin boundary. The primary outputs of PRMS are estimates of streamflow entering the groundwater basin from the upper watershed since observed flow data are either sparse or nonexistent. The PRMS model also provides an upper limit of potential inflows to the groundwater basin from mountain front recharge processes (see Section 7.1.4). For more details on PRMS, see Section 4.The groundwater basin is simulated using two numerical models and one geologic model. Land surface processes within the groundwater basin boundary, including agricultural management practices, are simulated using the Soil Water Budget Model (SWBM) (Foglia and others, 2013; Tolley and others, 2019). Precipitation, reference ET (ET_0), and streamflow are used as inputs, with actual ET (ET_a), runoff (RO), surface water irrigation (IRR_{sw}), groundwater irrigation (IRR_{gw}), and recharge (RCH) calculated on a daily time step based on properties assigned to each field. Water demand in SWBM is estimated using the crop coefficient method (Allen and others, 1998). Pumping rates can be specified for any well such that simulated pumping rates match observed pumping rates. For more details on the SWBM, see Section 5.

Well logs, seismic study data, geologic maps, and geologic interpretations were used to develop a 3D geologic model of the Sierra Valley aquifer system using the software Leapfrog Works. The results from this model were then mapped onto the MODFLOW grid in order to distribute physical aquifer properties (hydraulic conductivity, storage coefficients, etc.) within the model domain. As more subsurface data are collected in the future, they can be incorporated into the geologic model, which can then be used to update the distribution of aquifer properties. This could improve representation of groundwater and surface water flows by the model, as there are some portions of the basin where subsurface knowledge is limited or completely lacking. For more details on the 3D geologic model, see Section 6.



Notes:
1. Figure 1-1 in DWR Handbook for Water Budget Development

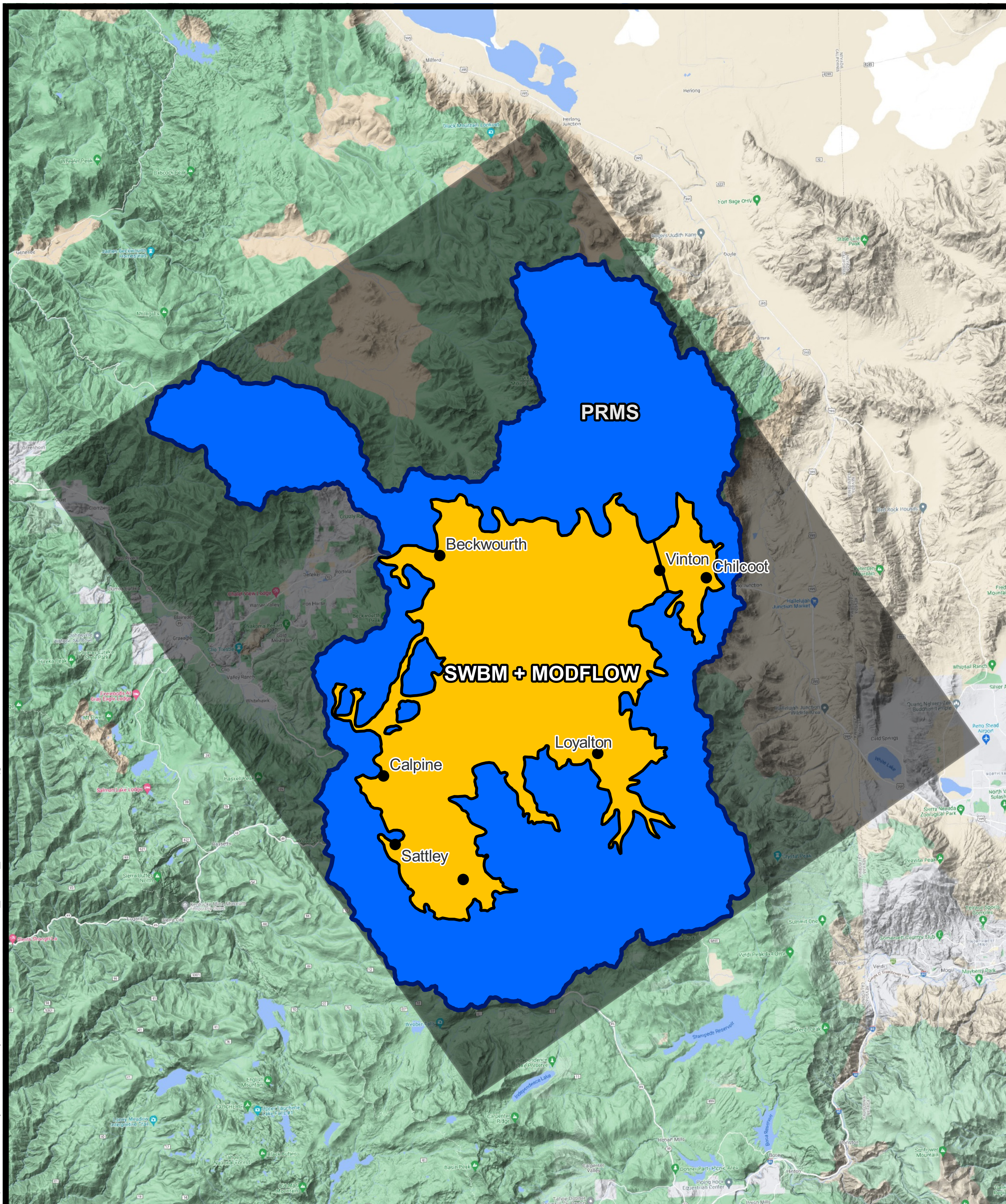
Sierra Valley Groundwater Management District

SVHSM Documentation
Hydrologic Subsystems

C:\Users\500\Sierra Valley GSP Dropbox\Gus Tolley\Sierra Valley GSP\GIS\QGZs\SVHSM_Model_Documentation.qgz

01/14/2022

Figure 3-1



Explanation

- PRMS
- SWBM + MODFLOW
- Inactive

City or Town

0 2.5 5 mi

N

Notes:
1. SWBM = Soil-Water Budget Model

Sierra Valley Groundwater Management District

SVHSM Documentation
Model Domains

C:\Users\500\Sierra Valley GSP Dropbox\Gus Tolley\Sierra Valley GSP\GIS\QGZs\SVHSM_Model_Documentation.qgz

11/30/2021

Figure 3-2

Recharge and groundwater pumping estimated by the SWBM, along with surface water inflows from PRMS (adjusted for irrigation diversions), estimated mountain front recharge (MFR), and subsurface parameter distribution obtained from the 3D geologic model, are used to drive the groundwater-surface water submodel (MODFLOW). Results include detailed water level elevations and flows within the groundwater basin, which are simulated using monthly stress periods with a daily time step. Boundary conditions (recharge, pumping, etc.) within a stress period are constant, but heads (water level elevations) and fluxes (water flows) can change within a stress period. Daily time steps are used in order to better represent surface water flow in the model. For more details on the groundwater-surface water model, see Section 7.

The combination of these numerical models ultimately produces monthly and annual water budgets for each hydrologic subsystem within the Sierra Valley watershed. Depending on the boundary conditions imposed on the model, these water budgets can represent historical and current conditions or projected future water budgets that incorporate anticipated climate change (see Section 9).

4.0 Upper Watershed Rainfall Runoff Model (PRMS)

PRMS was used to evaluate surface water runoff and general hydrologic processes for the upper Sierra Valley watershed (Figure 3-2). PRMS is a deterministic, physically based modeling system. Components of the hydrologic cycle (ET, infiltration, etc.) are simulated using physical laws or established empirical relationships based on measurable watershed characteristics. SVHSM uses a distributed parameterization of PRMS, where physical properties are assigned to specified hydrologic response units (HRUs). In SVHSM, each model cell is designated as an individual HRU so the terms are equivalent.

The PRMS model domain is 599 rows and 484 columns rotated by 35 degrees counter-clockwise around 727096.781207E, 4368418.236840N (NAD 83 UTM Zone 10 N). The grid rotation was to align the principal axes in the groundwater model with the Loyalton and Grizzly Valley faults. The ability to convert the PRMS and MODFLOW models into a single GSFLOW (Markstrom and others, 2008) model in the future was desired, so the PRMS grid was also rotated for consistency. Horizontal discretization is 100 m in both the x and y direction, with a total of 152,841 active model cells. The simulation period is from October 1, 1989 through September 30, 2020 using a daily time step.

Due to the quantity of required inputs and possible outputs, a complete description of inputs to and outputs from the PRMS model used in SVHSM is beyond the scope of this documentation. The most relevant model inputs and outputs are described below. Model inputs files were generated using a series of Python/ArcPy (ArcGIS) scripts developed by the USGS and Desert Research Institute known as GSFlow ArcPy (Gardner and others, 2018). All model files are publically available at the SVGMD website (https://www.sierravalleygmd.org/).

4.1 PRMS Inputs

Inputs to PRMS can be either temporal, semi-temporal, or spatial. Temporal inputs are specified on a daily basis, and include precipitation and temperature data. Semi-temporal inputs are specified for each calendar month, but the value for a given month is constant for the entire simulation period. For example, the temperature lapse rate for January is the same value every year, but can differ from the February temperature lapse rate. Spatial inputs are constant throughout the model run but can vary by location. These typically represent physical properties of the watershed (slope, roughness, etc.). Spatial inputs can be specified for each model cell, or a single value that applies to all model cells can be used.

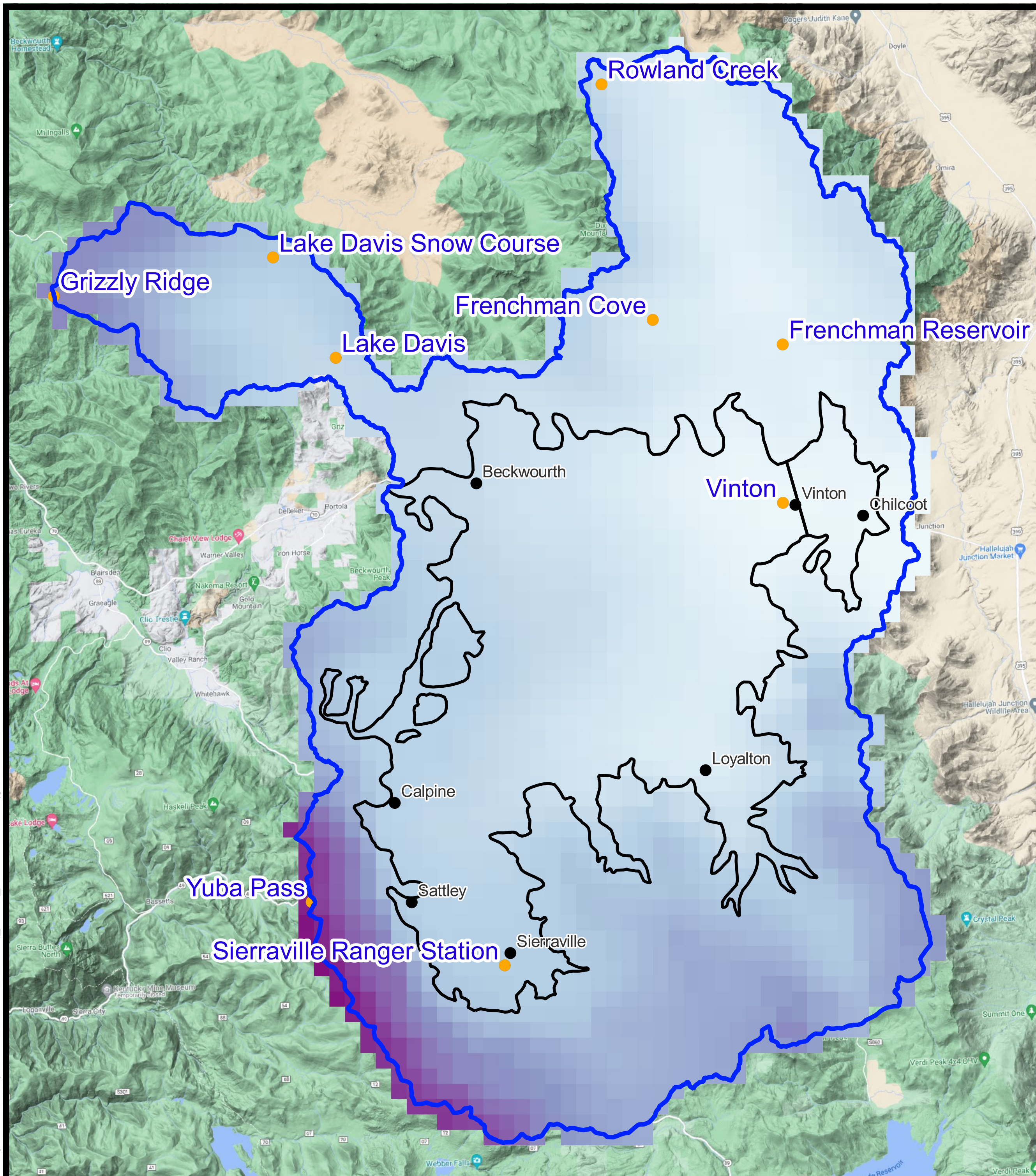
Formatted PRMS input files were largely generated using GSFlow ArcPy, a collection of Python/ArcPy (ArcGIS) scripts (https://github.com/gsflow/gsflow-arcpy). Selected inputs were then modified manually based on parameter values from the nearby Sagehen Creek model (available as an example in the PRMS software download) or via manual calibration.

4.1.1 Climate

Daily precipitation and temperature inputs from water year (WY) 1990-2020 were developed using data from the Sierraville ranger station (Figure 4-1). Days with missing data were filled in using nearby meteorological stations. Annual precipitation ranged from 10.4 to 52.8 inches per year (in/yr) (265.2 to 1,342.1 millimeters per year [mm/yr]) with an average of 23.4 in/yr (594.7 mm/yr). The PRMS module *precip_1sta* was used to distribute measured precipitation observed at the Sierraville ranger station (or inferred from other stations) across the model domain using parameters that account for elevation, spatial variation, and topography, among others. Precipitation in the model is partitioned between rain and snow, and is primarily a function of temperature. All precipitation is assumed to fall as snow below 38.3°F (3.5°C), and as rain above 59 to 68°F (15 to 20°C) depending on the calendar month. Between these temperatures, precipitation occurs as a mixture of rain and snow.

Maximum temperatures used for the model range from 90.3 to 100.3°F (32.4 to 38.0°F) and average about 95.1°F (35.1°C). Minimum temperatures at the station are about 1.1°F (–17.2°C) on average, and range from 8.6 to –17°F (–13.0 to –27.2°C). Temperatures were adjusted for elevation using a lapse rate that varied from about 15.4 to 23.2°F per mile (5.3 to 8.0°C per kilometer [km]) depending on the calendar month.

Potential ET in the PRMS submodel is calculated using the modified Jensen Haise formulation as a function of the air temperature, solar radiation, and two coefficients. Regional air temperature is represented by *jh_coef* and varies from 0.016 to 0.027 per °F depending on the calendar month. Local temperature effects on potential ET are represented by the parameter *jh_coef_hru* (Figure 4-2), with greater values indicating lower potential ET. Solar radiation data was distributed using the *ddsolrad* module, which estimates solar radiation using a modified degree-day method (Leavesley and others, 1983). This method was developed for the Rocky Mountain regions of the U.S., and is most applicable to areas where clear skies prevail on days without precipitation.



Explanation

Sources: CDEC; PRISM Climate Group

PRISM 30-yr Normal (mm)
1,585.5
345.7

Meteorological Station
City or Town
Groundwater Basin
Watershed Boundary

N

0 2.5 5 mi

Sierra Valley Groundwater Management District

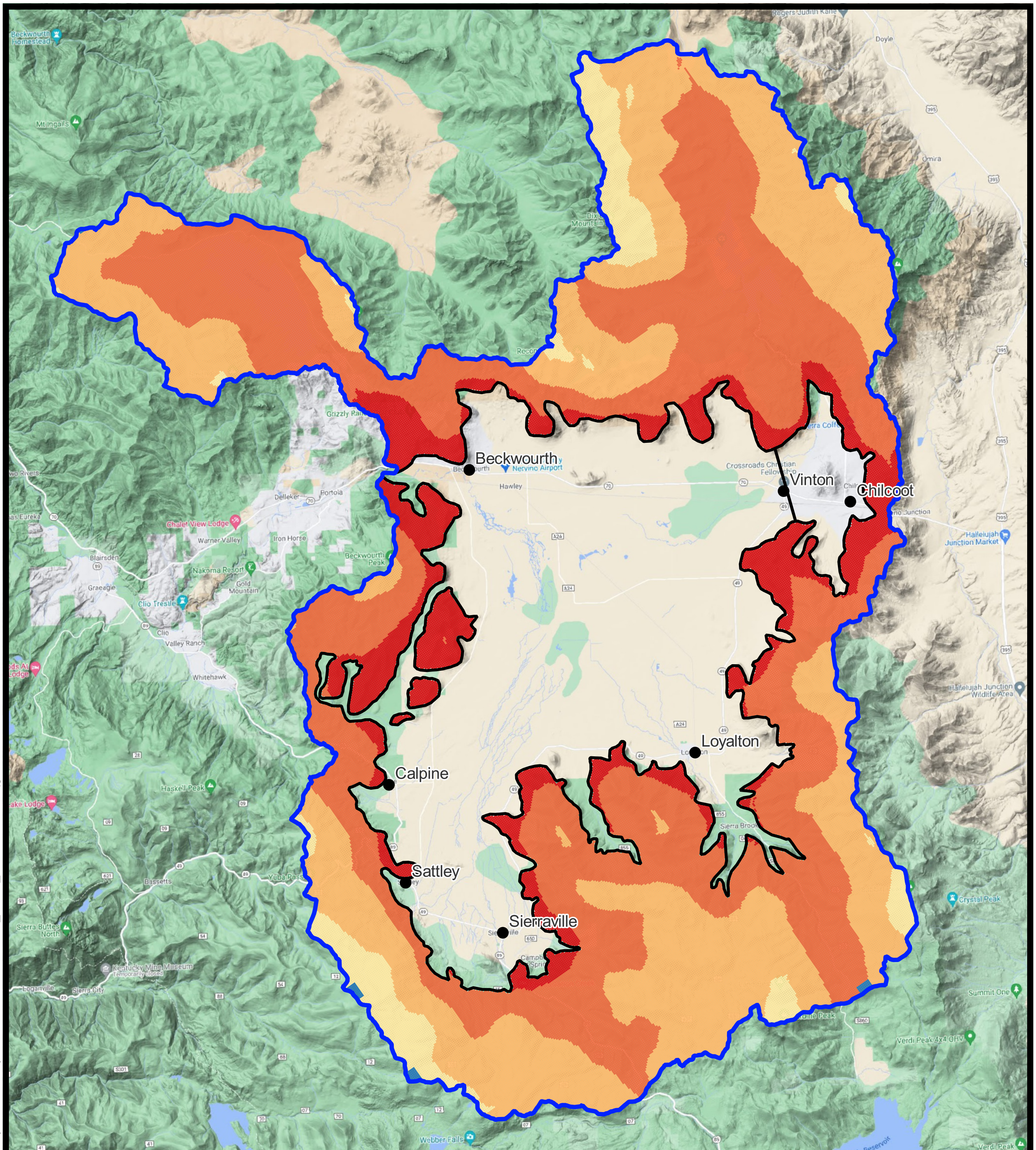
Notes:
1. PRISM normals from 1981-2010

SVHSM Documentation
Precipitation Stations and PRISM Normals

C:\Users\500\Sierra Valley GSP Dropbox\Gus Tolley\Sierra Valley GSP\GIS\QGZs\SVHSM_Model_Documentation.qgz

12/01/2021

Figure 4-1



Explanation

jh_coef_hru (per degrees F)

- < 20
- 20 - 21
- 21 - 22
- 22 - 23
- 23 - 24
- 24 - 25
- 25 - 26
- > 26

- City or Town
- Groundwater Basin
- Watershed Boundary

N

0 2.5 5 mi

Notes:
1. Greater values indicate lower ET potential.

Sierra Valley Groundwater Management District

SVHSM Documentation
PRMS Potential ET Coeffiecients

C:\Users\500\Sierra Valley GSP Dropbox\Gus Tolley\Sierra Valley GSP\GIS\QGZs\SVHSM_Model_Documentation.qgz

12/01/2021

Figure 4-2

4.1.2 Landcover

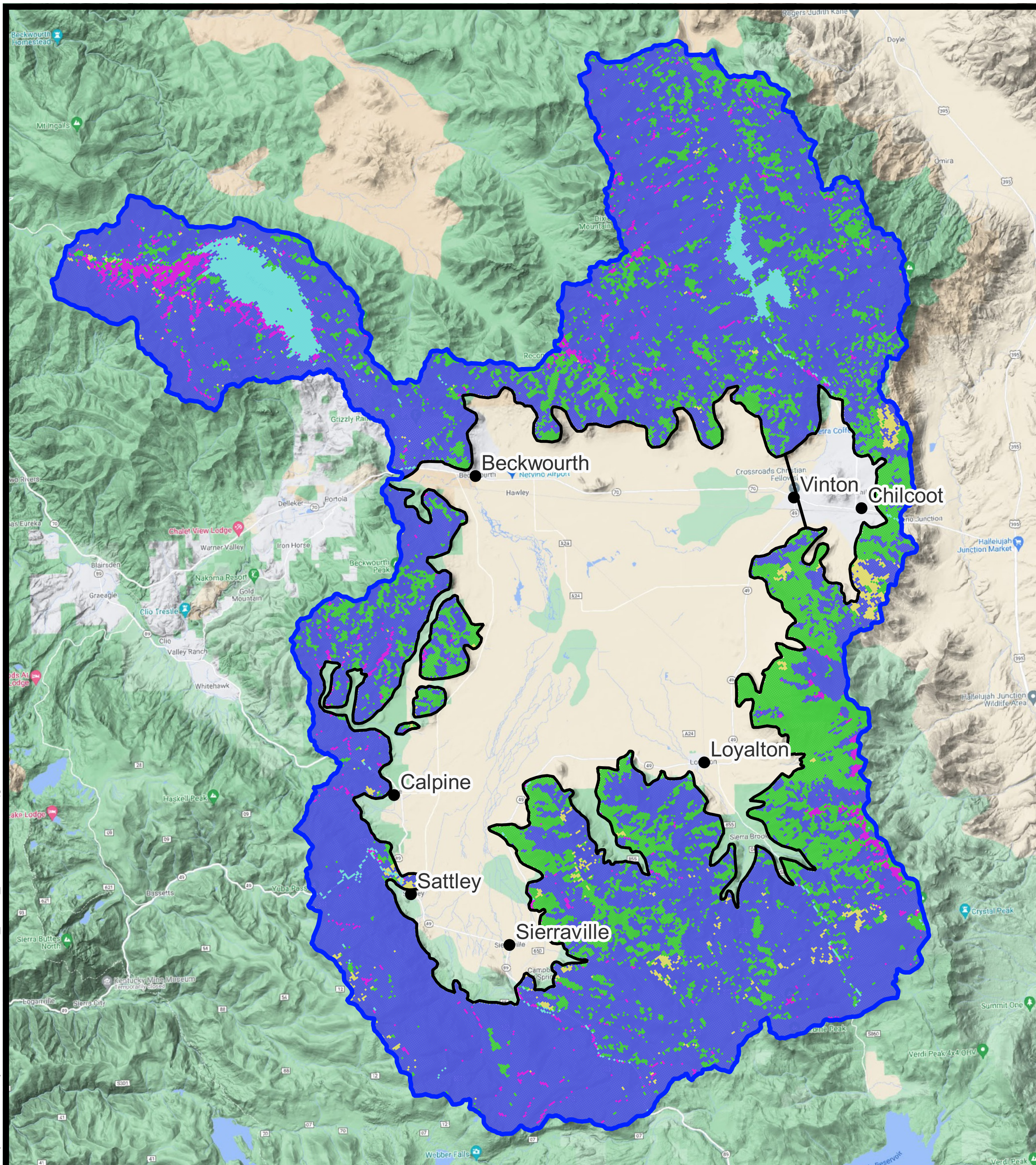
Landcover primarily affects if and to what degree canopy interception occurs, and can vary by season (winter and summer) and also by precipitation type (rain and snow). Five different classifications are available in PRMS and shown in Figure 4-3. These classifications are based on landcover data from the GAP/LANDFIRE database (USGS, 2016).

4.1.3 Soils

PRMS partitions the soil zone into three different zones (reservoirs) that represent different physical flow processes: 1) preferential-flow reservoir, 2) capillary reservoir, and 3) gravity reservoir (Figure 4-4). The preferential-flow reservoir accounts for rapid lateral interflow through large openings in the soil profile and is largely active only during rainfall events. The capillary reservoir represents soil-water content between the wilting point and field capacity thresholds. This water is immobile as it is held in place by capillary forces and can be considered to be the available water content for vegetation within the soil profile. The gravity reservoir accounts for slow, lateral interflow within the soil zone and drainage to the groundwater reservoir (not shown) represented in PRMS.

The type and distribution of soils are a significant control on most of the processes represented in PRMS, as they are used to define physical properties related to storage, infiltration, etc. Data from soil survey areas CA614, CA713, and CA719 in SSURGO (NRCS, 2020) were used to parameterize required soil inputs. Figure 4-5 shows the distribution of soil water holding capacity (field capacity) for the upper watershed. Some areas on the southern and western portions of the model domain tend to have greater soil storage capacity, but in general soil storage distribution in the upper watershed is heterogeneous. Saturated hydraulic conductivity of the soil (Figure 4-6) shows a stronger spatial correlation, with more conductive soils found in the northeast, southeast, and southwest portions of the upper watershed. Median values of hydraulic conductivity are found in the southern portion of the model domain, with the lowest hydraulic conductivities generally the north and east of the groundwater basin.

Two parameters that have a significant control over flow within the soil zone in PRMS are the parameters *slowcoef_lin* and *slow_coef_sq*, which are the linear and non-linear coefficients used to route gravity reservoir storage down slope for each HRU. Values of *slowcoef_lin* used in SVHSM ranged from about 0 to 0.005 fraction/day (Figure 4-7), and values of *slowcoef_sq* ranged from 0 to 0.63 (Figure 4-8). These are generally within the expected range provided in the PRMS user manual.



Source: National Terrestrial Ecosystems Database (GAP/LANDFIRE)

Explanation

Land Cover
- Bare Soil or Surface Water
- Grasses
- Shrubs
- Trees
- Coniferous

- City or Town
- Groundwater Basin
- Watershed Boundary

N

0 2.5 5 mi

Sierra Valley Groundwater Management District

SVHSM Documentation
PRMS Land Cover

C:\Users\500\Sierra Valley GSP Dropbox\Gus Tolley\Sierra Valley GSP\GIS\QGZs\SVHSM_Model_Documentation.qgz

12/01/2021

Figure 4-3

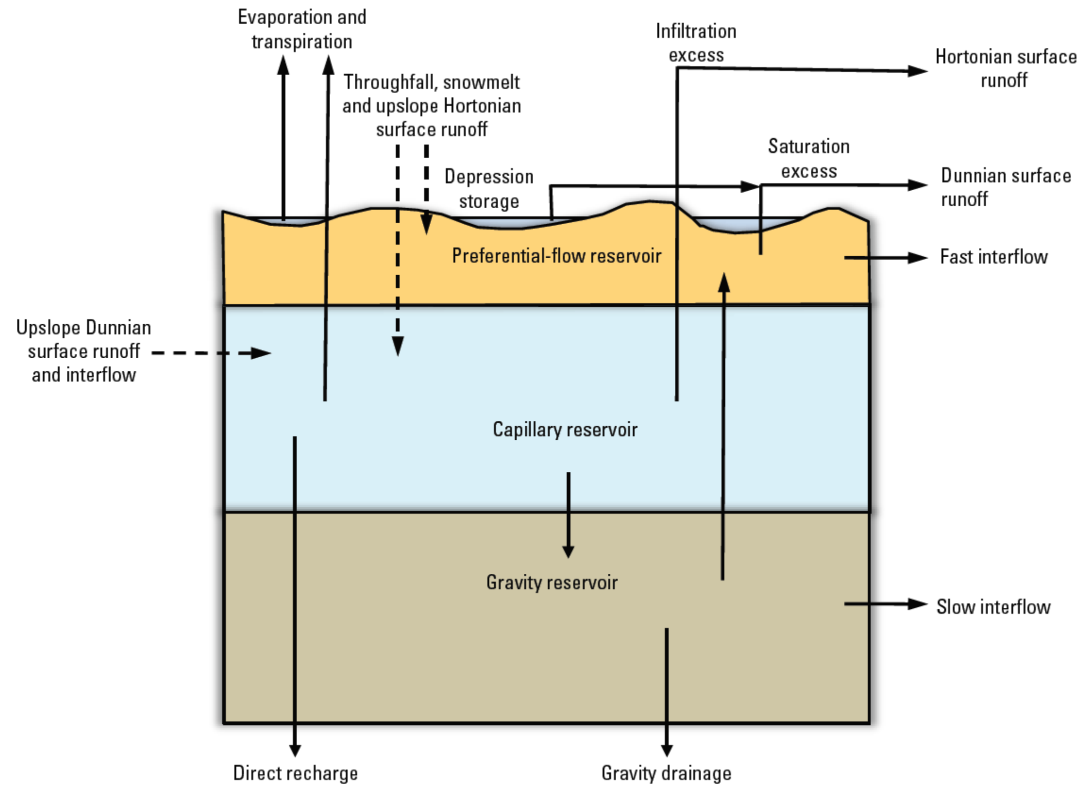
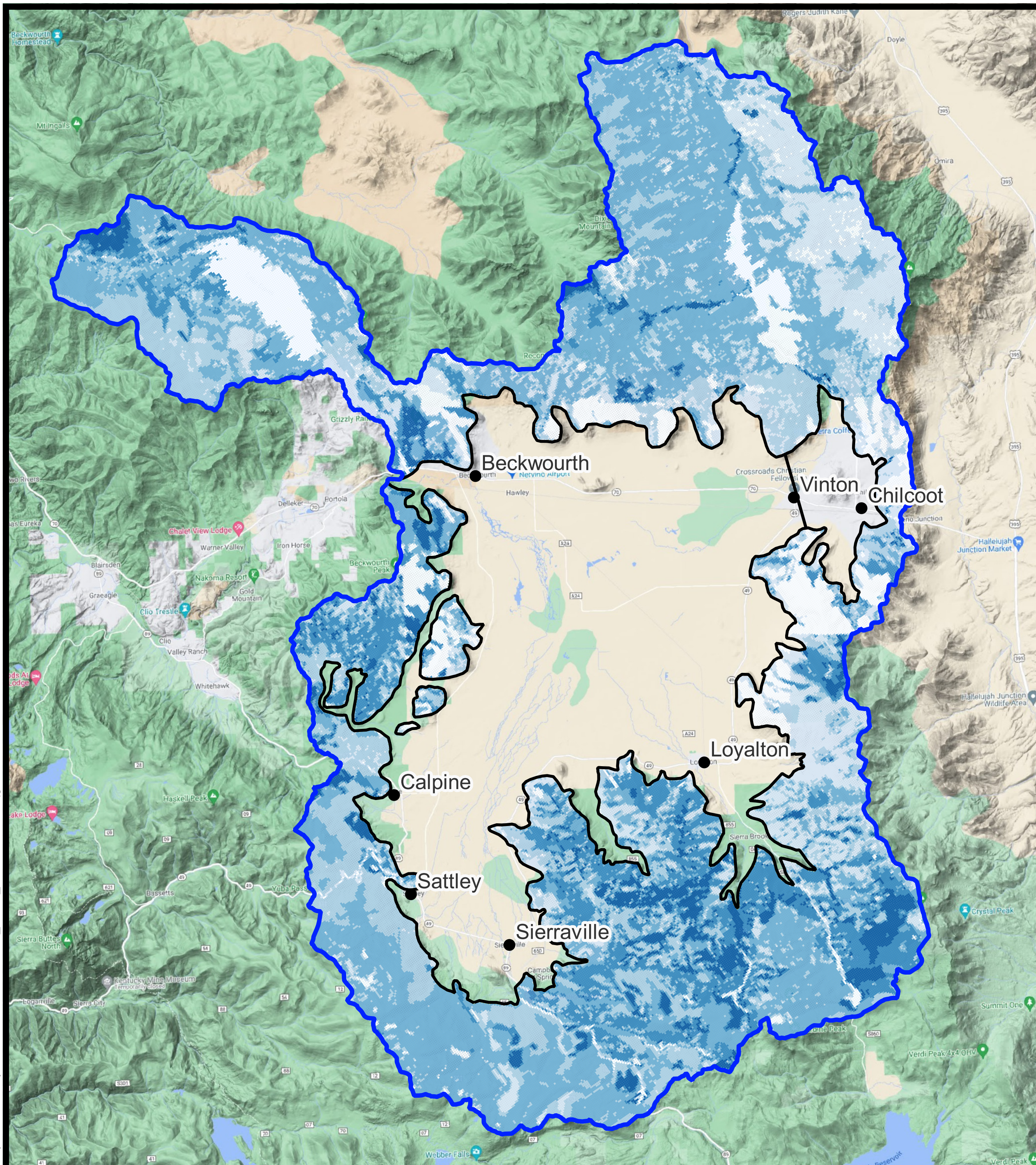


Figure 4-4. PRMS soil reservoirs



Source: SSURGO Database (NRCS, 2020)

Explanation

Water Holding Capacity (inches)
- < 1
- 1 - 2
- 2 - 3
- 3 - 4
- 4 - 5
- 5 - 6
- > 6

- City or Town
- Groundwater Basin
- Watershed Boundary

0 2.5 5 mi

N

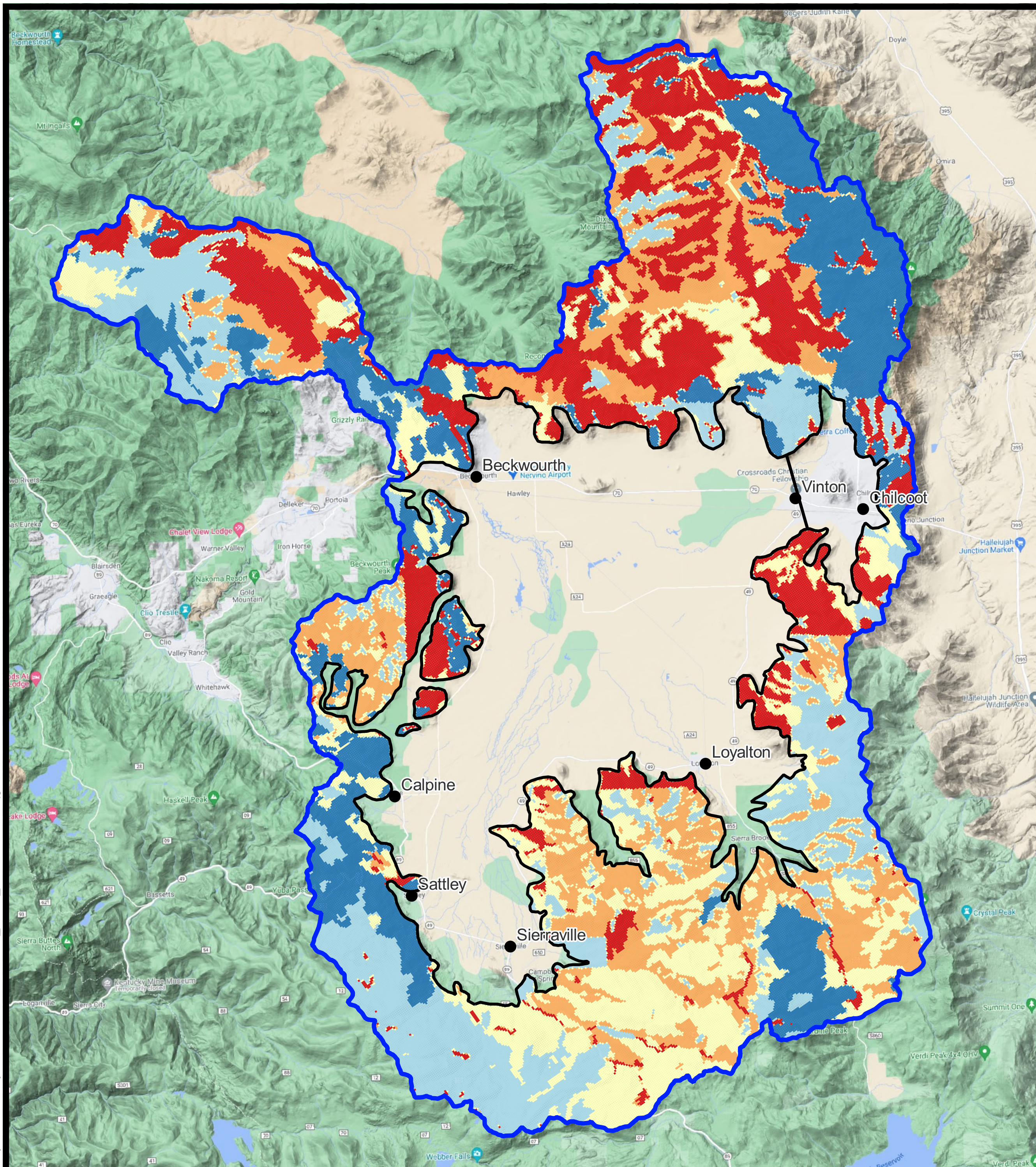
Sierra Valley Groundwater Management District

SVHSM Documentation
PRMS Soil Water Holding Capacity

C:\Users\500\Sierra Valley GSP Dropbox\Gus Tolley\Sierra Valley GSP\GIS\QGZs\SVHSM_Model_Documentation.qgz

12/01/2021

Figure 4-5



Explanation

Source: SSURGO Database (NRCS, 2020)

Ksat (ft/day)
- 0 - 1.41
- 1.41 - 1.85
- 1.85 - 4.04
- 4.04 - 7.94
- 7.94 - 39.97

- City or Town
- Groundwater Basin
- Watershed Boundary

0 2.5 5 mi

N

Notes:
1. Ksat is weighted average of all soil layers in SSURGO database

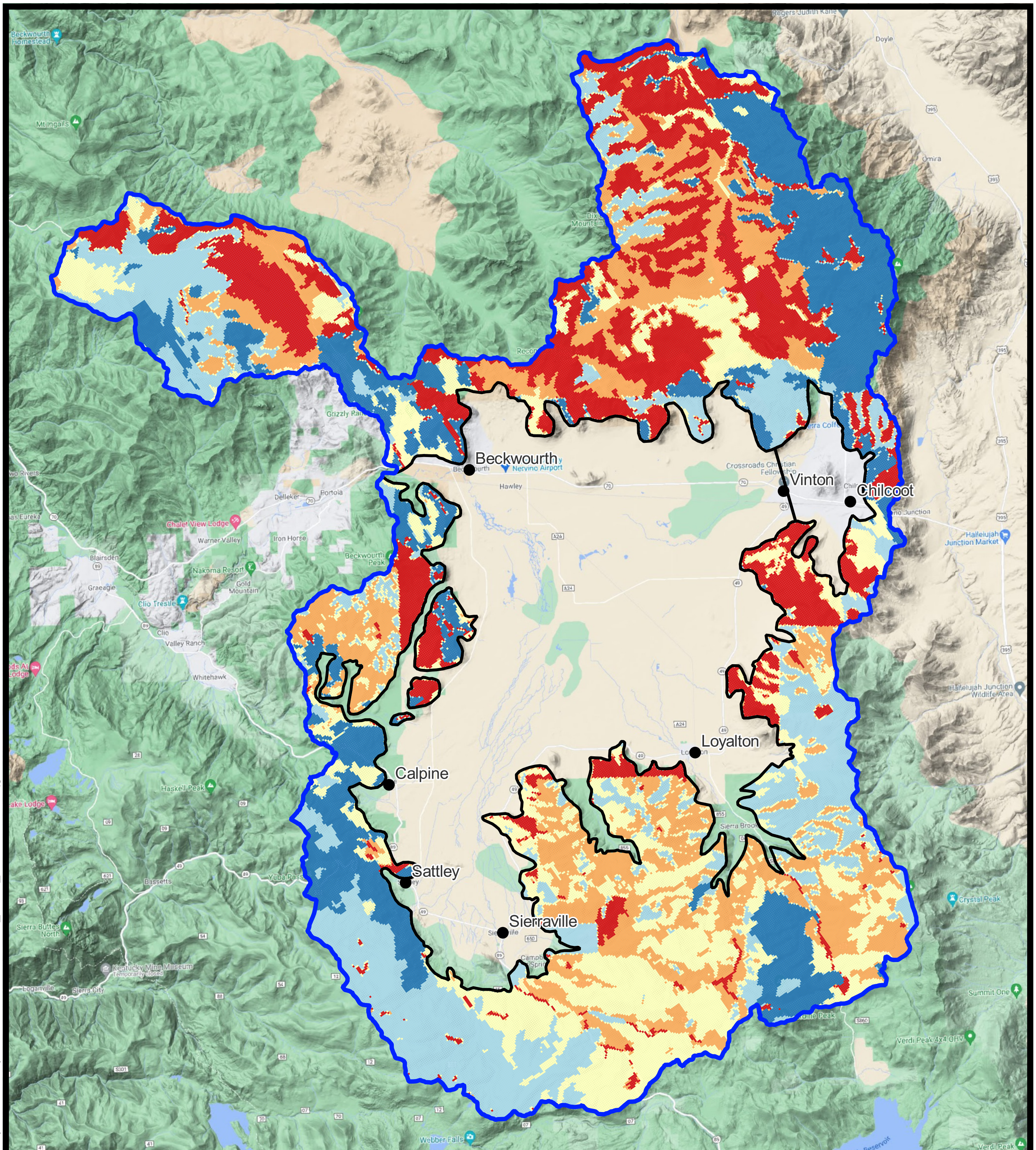
Sierra Valley Groundwater Management District

SVHSM Documentation
PRMS Soil Hydraulic Conductivity

C:\Users\500\Sierra Valley GSP Dropbox\Gus Tolley\Sierra Valley GSP\GIS\QGZs\SVHSM_Model_Documentation.qgz

12/01/2021

Figure 4-6



Explanation

slowcoef_lin (fraction/day)

- 0 - 0.000067
- 0.000067 - 0.000124
- 0.000124 - 0.000234
- 0.000234 - 0.000625
- 0.000625 - 0.004927

- ● City or Town
- Groundwater Basin
- Watershed Boundary

0 2.5 5 mi

N

Notes:
1. Greater values of *slowcoef_lin* indicate faster subsurface routing

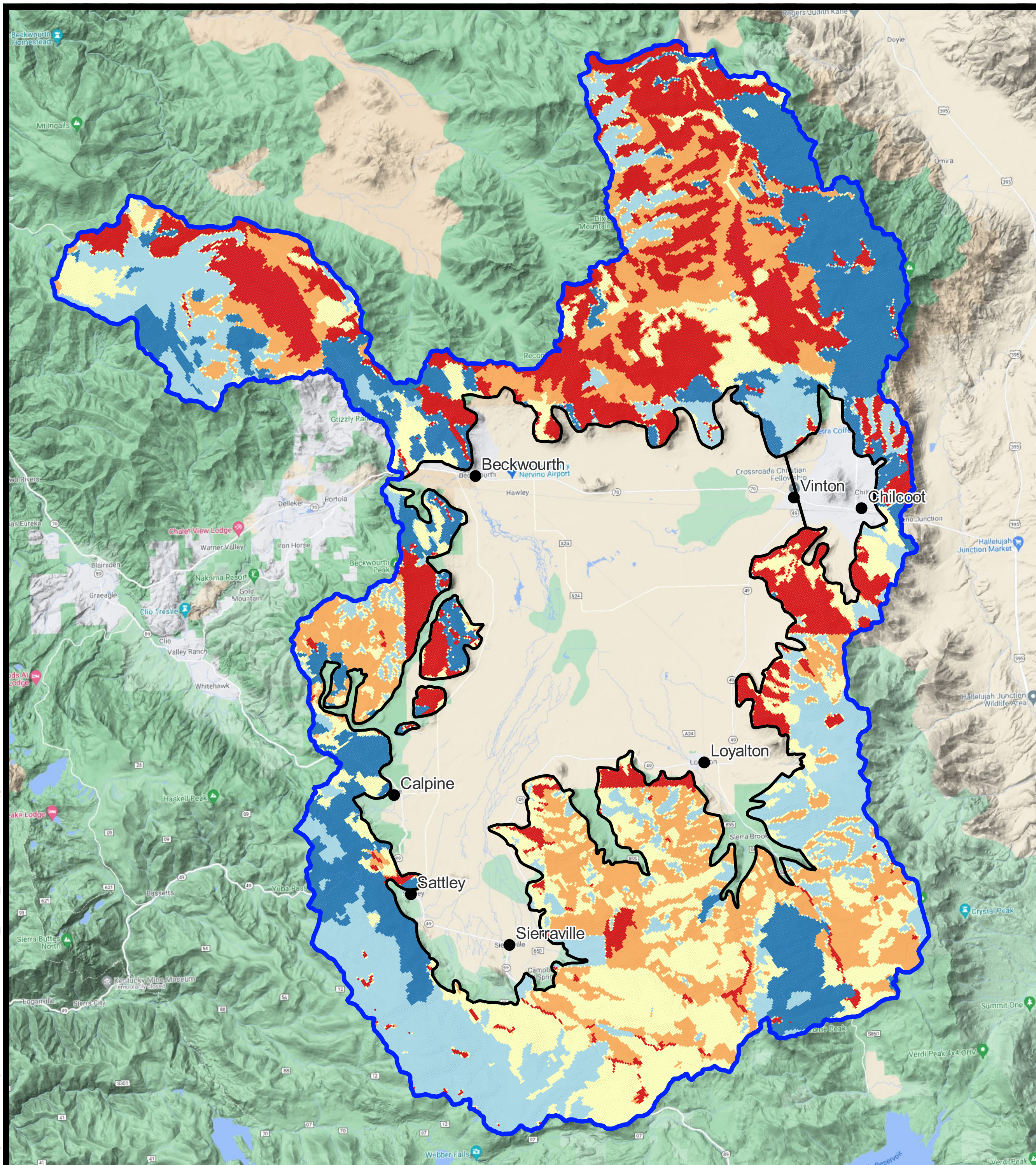
Sierra Valley Groundwater Management District

SVHSM Documentation
PRMS *slowcoef_lin*

C:\Users\500\Sierra Valley GSP Dropbox\Gus Tolley\Sierra Valley GSP\GIS\QGZs\SVHSM_Model_Documentation.qgz

12/01/2021

Figure 4-7



Explanation

slowcoef_sq

- 0 - 0.001
- 0.001 - 0.001
- 0.001 - 0.00142
- 0.00142 - 0.00368
- 0.00368 - 0.62626

● City or Town

Groundwater Basin

Watershed Boundary

0 2.5 5 mi

N

Notes:
1. Greater values of *slowcoef_sq* indicate faster subsurface routing

Sierra Valley Groundwater Management District

SVHSM Documentation
PRMS *slowcoef_sq*

C:\Users\500\Sierra Valley GSP Dropbox\Gus Tolley\Sierra Valley GSP\GIS\QGZs\SVHSM_Model_Documentation.qgz

12/01/2021

Figure 4-8

4.1.4 Groundwater

Parameterization of the groundwater reservoir in the PRMS submodel of SVHSM was generally accomplished by specifying a single value that applied to all HRUs. This method was chosen due to limited knowledge and data of the bedrock aquifer system in the upper portion of the watershed, as well as the inability to effectively explore spatial distributions of groundwater-related parameters during model calibration due to limited streamflow data. Key groundwater reservoir parameters used in SVHSM are provided in Table 4-1.

Table 4-1. Groundwater reservoir coefficients used in SVHSM.

Parameter	Description	SVHSM Value	Units	Typical Range
gwflow_coef	Coefficient for determining baseflow to streams.	0.08	fraction/day	0.001 - 0.5
gwsink_coef	Coefficient for determining losses from groundwater reservoir.	0.05	fraction/day	0.0 - 1.0
gwstor_init	Initial groundwater reservoir stoage.	1.8	inches	0.0 - 10.0
gwstor_min	Minimum groundwater reservoir storage.	0.0	inches	0.0 - 1.0
soil2gw_max	Maximum amount of the capillary reservoir excess that is routed directly to the groundwater reservoir.	0.0	inches	0.0 - 5.0

4.2 PRMS Outputs

The two primary outputs desired from the PRMS submodel of SVHSM are (1) streamflow entering the groundwater basin and (2) spatially and temporally distributed groundwater recharge in the upper portion of the watershed. Additional outputs from PRMS are available, and can be evaluated in the future if a need arises. Tabulated water budgets from the PRMS submodel of SVHSM can be found in Appendix A.

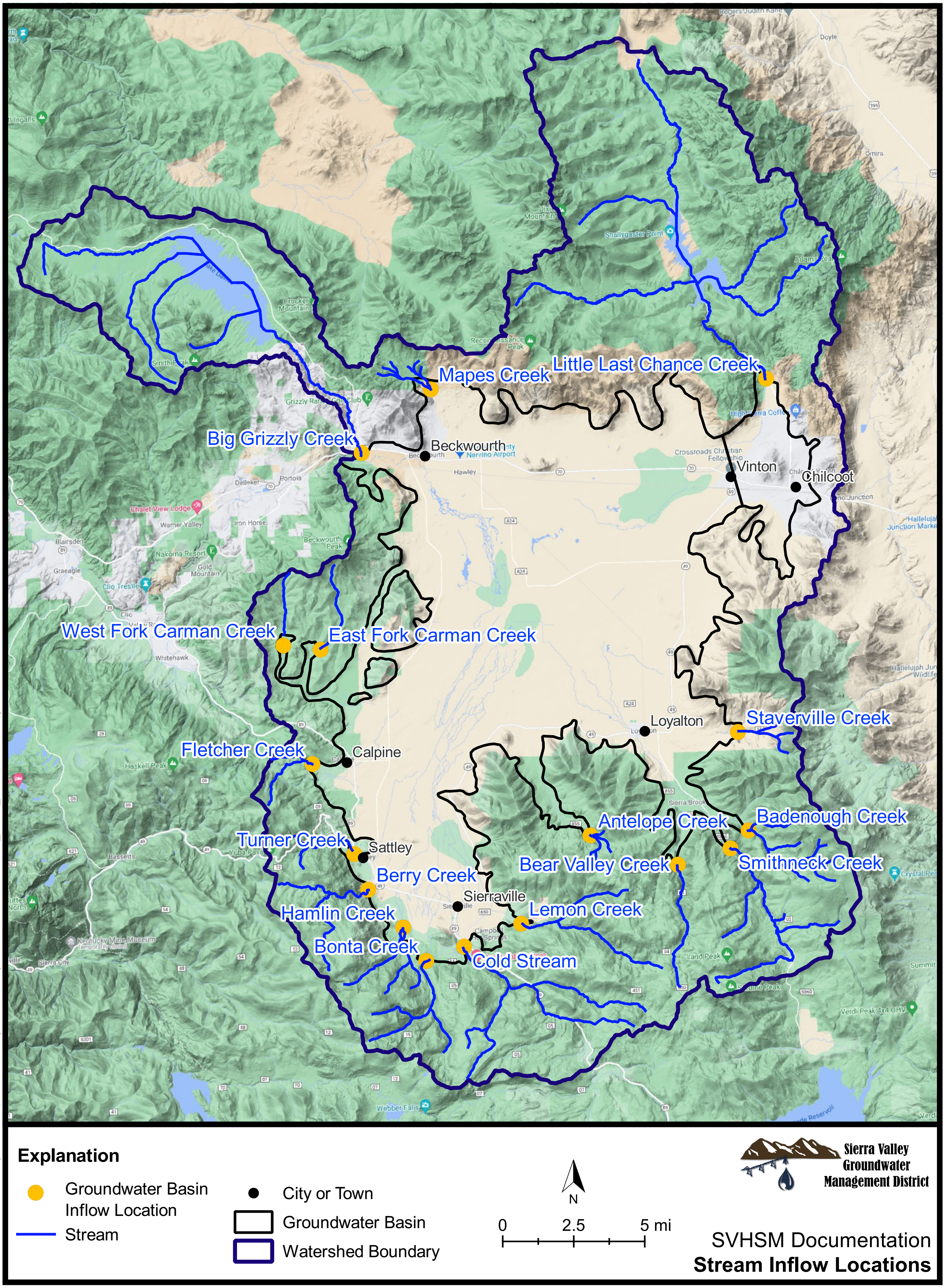
4.2.1 Streamflow

Surface water flow entering the groundwater basin from the upper portion of the watershed was simulated at 17 locations that represent the major streams in the basin (Figure 4-9). PRMS produces daily flow rates for the entire simulation period (WY 2000-2020) at each of these locations. Selected hydrographs are presented in Section 8.

4.2.2 Mountain Front Recharge (MFR)

MFR is the diffuse portion of recharge to a groundwater basin sourced from flow within adjacent mountain blocks with fractured bedrock (Wilson and Guan, 2004). Quantifying MFR is extremely difficult, as no current method for direct observation exists. Therefore, estimation is largely based on closure of basin water budgets and/or groundwater model calibration.

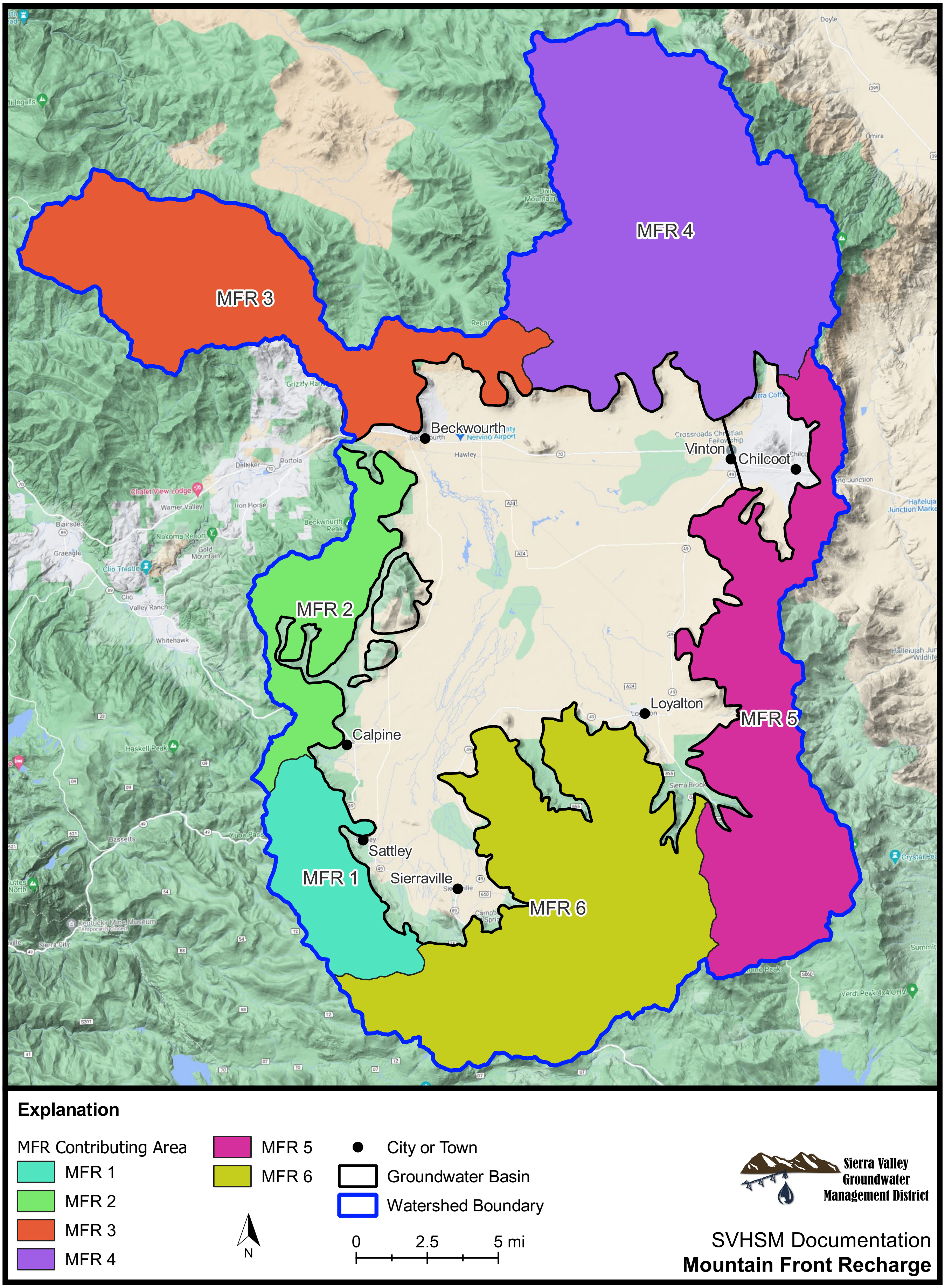
Spatially distributed groundwater recharge output from PRMS for the upper portion of the watershed was used to provide an estimate of MFR that enters the Sierra Valley groundwater basin. The upper watershed was split into six zones based on hydrogeologic understanding of the area and HUC-12 watershed boundaries (Figure 4-10). Estimated groundwater recharge in these areas is distributed across the interface between the basin sediments and surrounding bedrock (see Section 7.1.4 for more details).



C:\Users\500\Sierra Valley GSP Dropbox\Gus Tolley\Sierra Valley GSP\GIS\QGZs\SVHSM_Model_Documentation.qgz

12/02/2021

Figure 4-9



C:\Users\500\Sierra Valley GSP Dropbox\Gus Tolley\Sierra Valley GSP\GIS\QGZs\SVHSM_Model_Documentation.qgz

SVHSM Documentation
Mountain Front Recharge

12/02/2021

Figure 4-10

5.0 Soil-Water Budget Model (SWBM)

A land use/crop-soil water budget model ("soil water budget model" or SWBM) developed by researchers at UC Davis was used to simulate agricultural practices in the valley to estimate hydrologic fluxes at the field scale (Foglia and others, 2013a; Foglia and others, 2013b). The model uses the crop coefficient method (Allen and others, 1998) combined with a tipping bucket approach to estimate the water budget for the valley floor. The primary goal of the SWBM is to estimate spatially distributed groundwater pumping and recharge, which are the two most significantly altered water budget components in an agricultural groundwater basin.

The SWBM was chosen to represent land surface hydrologic processes within the Sierra Valley groundwater basin because (1) it has been successfully applied to the Scott Valley (Tolley and others, 2019), which has a similar climate and crop distribution and (2) the project team was familiar with the source code and could provide customized features if needed. The SWBM is available at https://github.com/gustolley/SWBM.

5.1 SWBM Inputs

Inputs to the SWBM submodel include climate data (precipitation and reference ET), spatial data (physical properties for each field and landuse type), hydrologic data (surface water inflows to the groundwater basin), and operational data such as irrigation season dates and groundwater pumping volumes (when available). Specific types of spatial data, such as landuse and irrigation type, can change during the simulation to reflect crop rotations and changes in irrigation type.

Formatted input files for the SWBM were generated using a pre-processing script developed in R. This documents a large portion of the workflow for converting the conceptual model of the land surface system into a numerical simulation, and decreases the time required to update the model in the future.

5.1.1 Precipitation

Precipitation in the SWBM submodel of SVHSM is specified on a daily basis using the same dataset as the PRMS submodel and distributed across the valley using the PRISM 30-year normals (Figure 4-1). For days when precipitation was less than 20% of the reference ET (ET_0), precipitation was set to zero. This was done to exclude small, low intensity precipitation events that do not significantly contribute to the land surface water budget.

5.1.2 Reference ET (ET_0)

ET_0 data were sourced from the Buntingville (#57), Macdoel II (#236), and Sierra Valley Center (#264) stations of the California Irrigation Management Irrigation System (CIMIS) network (https://cimis.water.ca.gov). Data from the Sierra Valley Center station could not be used directly as it did not come online until late October 2020, but the approximately six months of data available during SVHSM development was used to evaluate the representativeness of the other two stations.

Comparison of available data for overlapping time periods at each station revealed that the Buntingville station generally overestimated ET_0 in Sierra Valley, and that the Macdoel II station data were generally more representative. Unfortunately, the Macdoel II station data are only available from April 2015 forward, while Buntingville station data are available for the entire model simulation period. Data from both stations were used to create an ET_0 dataset that spanned the entire model simulation period. Buntingville station data were used from October 1, 1999 through March 31, 2015, and Macdoel II station data were used from April 1, 2015 through September 30, 2015. Correction factors were developed for each calendar month using the ratio of the average ET_0 at the Macdoel II station to the ratio of the average ET_0 at the Buntingville station. These correction factors were applied to the Buntingville station data for each respective month to prevent overestimation of ET_0 used in the model. Daily values of reference ET are contained within the **ref_et.txt** input file

Annual reference ET for the simulation period ranged from 41.2 to 49.39 in/yr (104.7 to 125.4 mm/yr) with an average rate of 45.74 in/yr (116.2 mm/yr). December and July had the lowest and highest ET_0 rates on average, respectively (Figure 5-1).

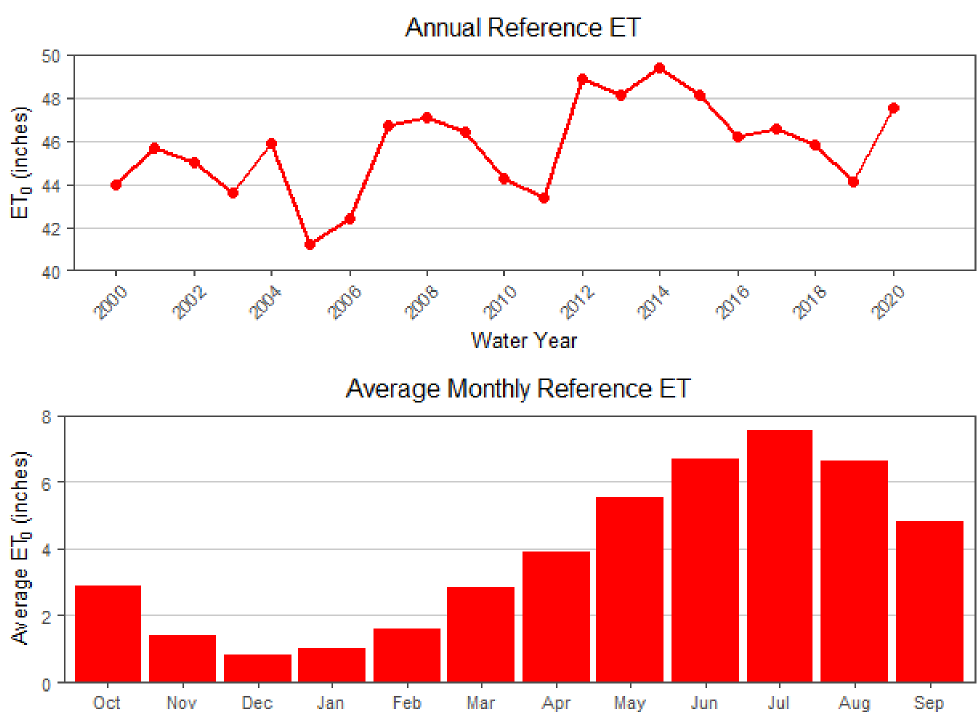


Figure 5-1. Annual total (top) and monthly average (bottom) reference ET rates used in SVHSM.

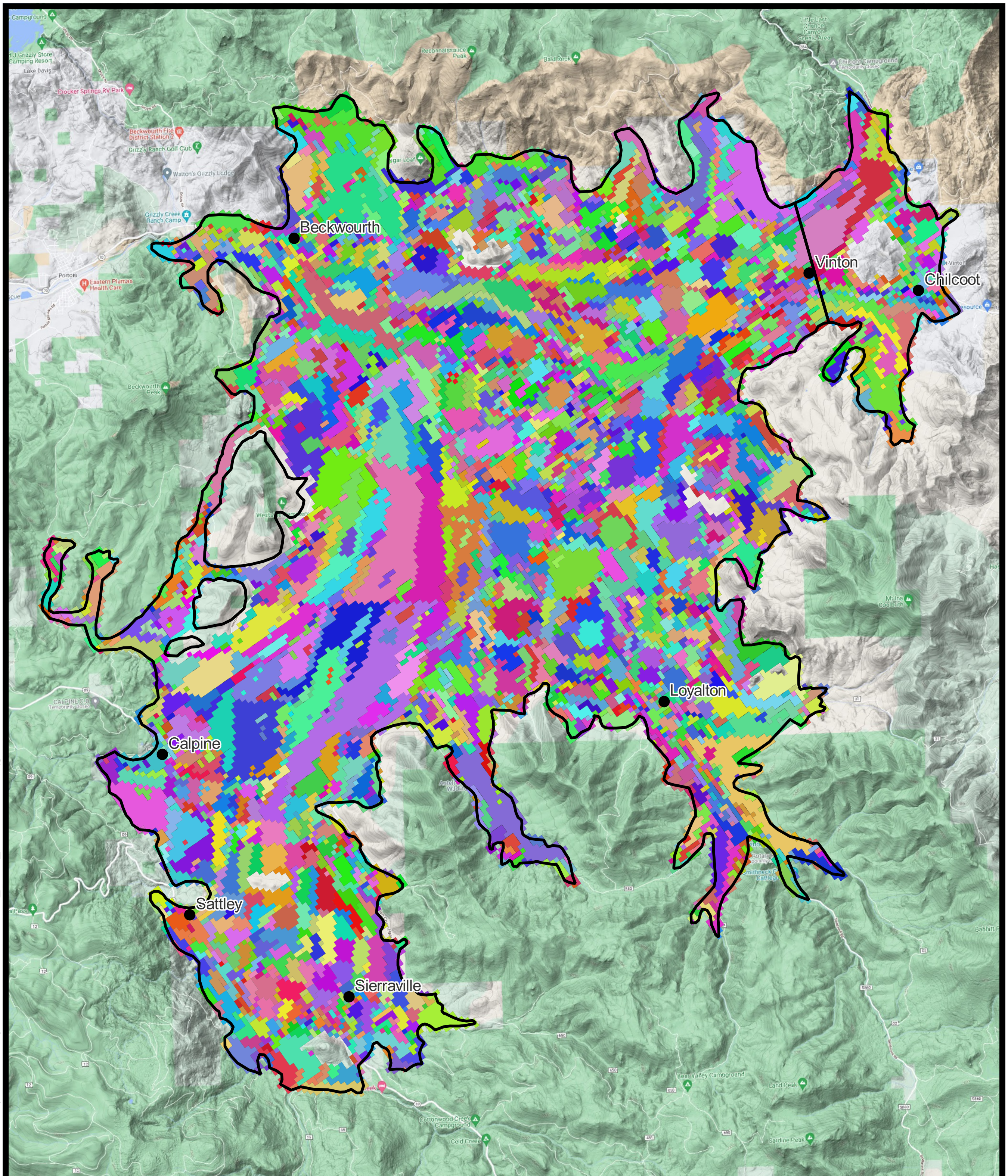
5.1.3 Field Properties

Fields are the fundamental spatial accounting unit in the SWBM, and are generally delineated using a combination of landuse surveys conducted by DWR and soil maps. The 2013 DWR landuse survey for Plumas and Sierra Counties was used as a base dataset for defining fields, and was supplemented with additional crop mapping efforts and local knowledge provided by growers and residents. This effort resulted in a total of 2953 fields being defined in SVHSM (Figure 5-2). Landuse is assigned to each field on a monthly basis and controls if, when, and how much irrigation water is applied. Nine landcover types are simulated in SVHSM (Table 5-1), and are specified on a monthly basis to account for agricultural management practices such as crop rotation and fallowing. The landcover types were chosen based on the DWR land use datasets and input from local growers and stakeholders. Landcover distribution at the beginning of the model simulation is shown in Figure 5-3 and summarized in Table 5-2. Alfalfa is assumed to rotate with grain on an eight year cycle (seven years of alfalfa, one year of grain).

Irrigation methods used in the valley include flood, wheel line sprinklers, and center pivot sprinklers (Figure 5-4). Irrigation efficiency, also known as the water application efficiency, is the ratio of the water used by a crop to the water applied. Irrigation efficiency values less than one indicate that more water is applied than is utilized by the crop. This may occur for a variety of reasons including (but not limited to) non-uniform water application, minor topographical variations across a field, and heterogeneous soils. Effective irrigation efficiency values greater than one indicate some portion of water demand is being met by depletion of soil moisture storage over the growing season. Effective irrigation efficiency values greater than 1 have been observed in the Scott Valley (Tolley and others, 2019) which has a similar crop types and management as the Sierra Valley. The combination of high water demand crops (i.e., alfalfa and pasture) and management practices that limit when water can be applied (i.e., surface-water availability, irrigation type, and cutting schedules) create conditions where crop water demand is greater than applied water deficit irrigation). Effective irrigation efficiencies in SVHSM were applied to fields according to irrigation type (Table 5-1).

Applied irrigation water in Sierra Valley can be sourced from surface water, groundwater, or a combination of the two (Figure 5-5). Fields are assigned to a surface water accounting unit based on geographic location (Figure 5-6). Surface water inflows to the groundwater basin are assigned to one of these accounting units, which determines surface-water availability for a field. Irrigation with surface water only occurs during the specified irrigation season (Table 5-1) when maximum allowable depletion has been exceeded and surface water is available. If no surface water is available then the only source of water is that remaining in the soil profile. Fields with a mixed water source preferentially use surface water when it is available, otherwise irrigation water is sourced from groundwater.

Groundwater pumping occurs on irrigated fields with a mixed or groundwater source. Figure 5-7 shows the location of fields where groundwater irrigation is applied along with the location of irrigation wells used in the model. Applied groundwater irrigation for each field is assigned to a well. No publically available dataset exists that identifies which fields are irrigated with known wells, so wells were initially assigned to fields based on proximity, and then refined with the help growers. Groundwater pumping occurs when maximum allowable depletion for a field is exceeded during the specified irrigation season.



Source: modified from 2013 DWR land use survey

Explanation

SWBM Field
Groundwater Basin
City or Town

Notes:
1. SWBM fields shown are mapped to MODFLOW grid.

0 2 4 mi

N

Sierra Valley Groundwater Management District

SVHSM Documentation
SWBM Fields

C:\Users\500\Sierra Valley GSP Dropbox\Gus Tolley\Sierra Valley GSP\GIS\QGZs\SVHSM_Model_Documentation.qgz

12/03/2021

Figure 5-2

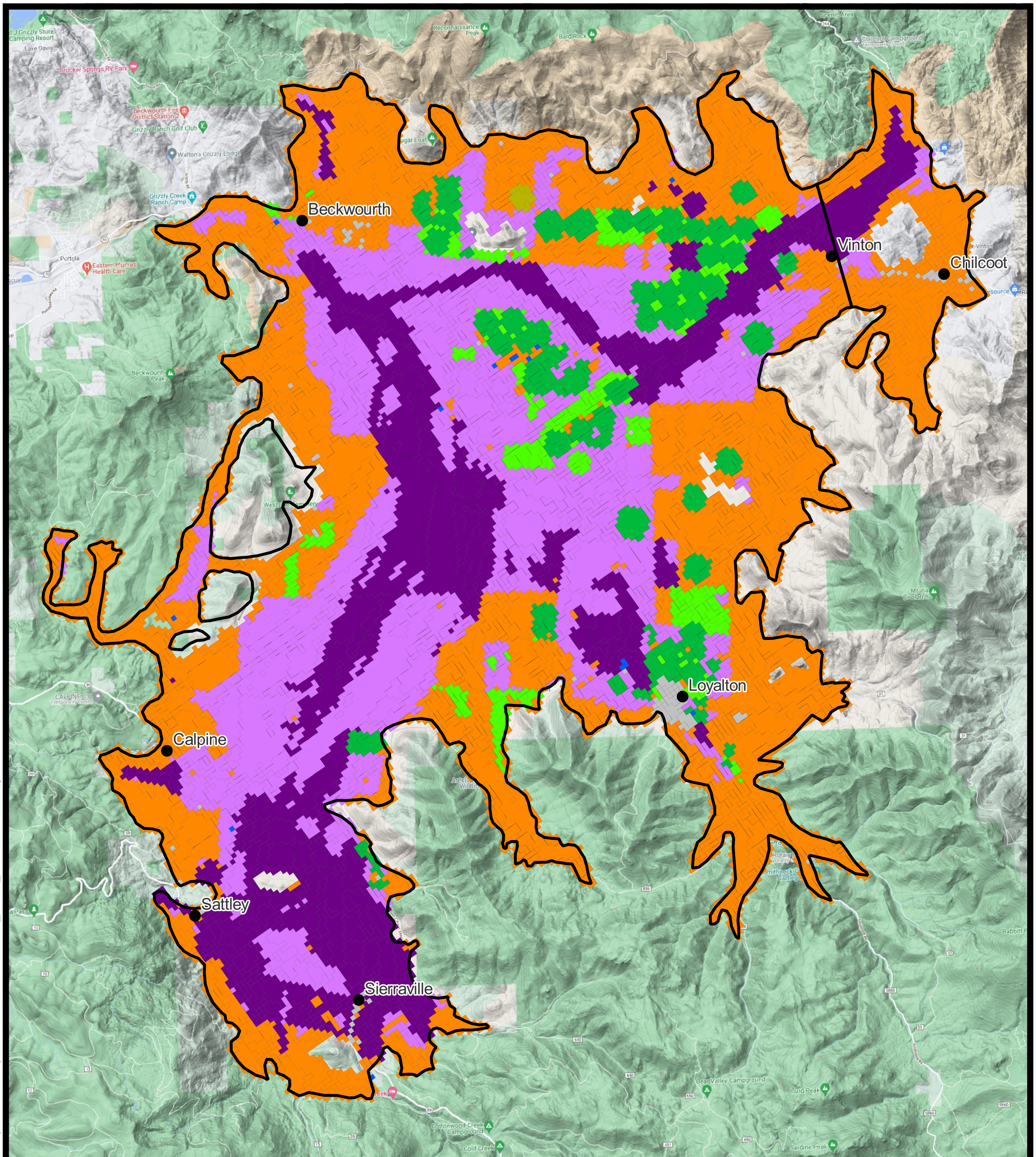
Table 5-3. Landcover categories and associated properties.

Landcover	Maximum Allowable Depletion[1]	Irrigation Season Dates	Effective Root Depth (ft)[2]	Effective Irrigation Efficiency[3]			Kc Factor
				Flood	Wheel Line	Center Pivot	
Alfalfa (Irrigated)	45%	3/25 - 9/31	19.68	0.7	1.25	1.35	0.96
Grain (Irrigated)	45%	3/16 - 7/ 10	6.56	0.7	1.25	1.35	0.96
Pasture (Irrigated)	55%	4/15 - 10/15	6.56	0.7	1	1.15	0.96
Native Vegetation	-	-	9.84	-	-	-	-
Urban/Barren	-	-	0	-	-	-	-
Water/Ponds	-	-	6.56	-	-	-	-
Alfalfa (Non-Irrigated)	-	-	19.68	-	-	-	-
Grain (Non-Irrigated)	-	-	6.56	-	-	-	-
Pasture (Non-Irrigated)	-	-	6.56	-	-	-	-

1. Maximum percentage of soil moisture depletion before irrigation is triggered.
2. Total depth that plants are able to source water from. Can be greater than plant rooting depth due to capillary wicking.
3. Values greater than 1 indicate deficit irrigation with crop water demand satisfied in part by gradual soil moisture depletion over the growing season.
4. Scaling factor for crop coefficient. Allows for uniform adjustment Kc timeseries.

Table 5-4. Landcover summary.

Landcover	Irrigation Type	Area (acres)	Area (%)
Native Vegetation	Non-Irrigated	49,826	41.6%
Pasture	Non-Irrigated	33,464	27.9%
Pasture	Flood	24,550	20.5%
Alfalfa/Grain	Center Pivot	6,122	5.1%
Alfalfa/Grain	Non-Irrigated	3,818	3.2%
Alfalfa/Grain	Wheel Line	1,123	0.9%
Barren	Non-Irrigated	685	0.6%
Pasture	Center Pivot	124	0.1%
Water	Non-Irrigated	79	0.1%
Pasture	Wheel Line	64	0.1%
Alfalfa/Grain	Flood	39	0.0%
Native Vegetation	Wheel Line	8	0.0%
TOTAL		**119,902**	**100.0%**



Explanation

SWBM Landcover
- Alfalfa (Irrigated)
- Grain (Irrigated)
- Pasture (Irrigated)
- Native Vegetation
- Urban/Barren
- Water/Ponds
- Alfalfa (Non-Irrigated)
- Grain (Non-Irrigated)
- Pasture (Non-Irrigated)
- Groundwater Basin
- City or Town

N

0 2 4 mi

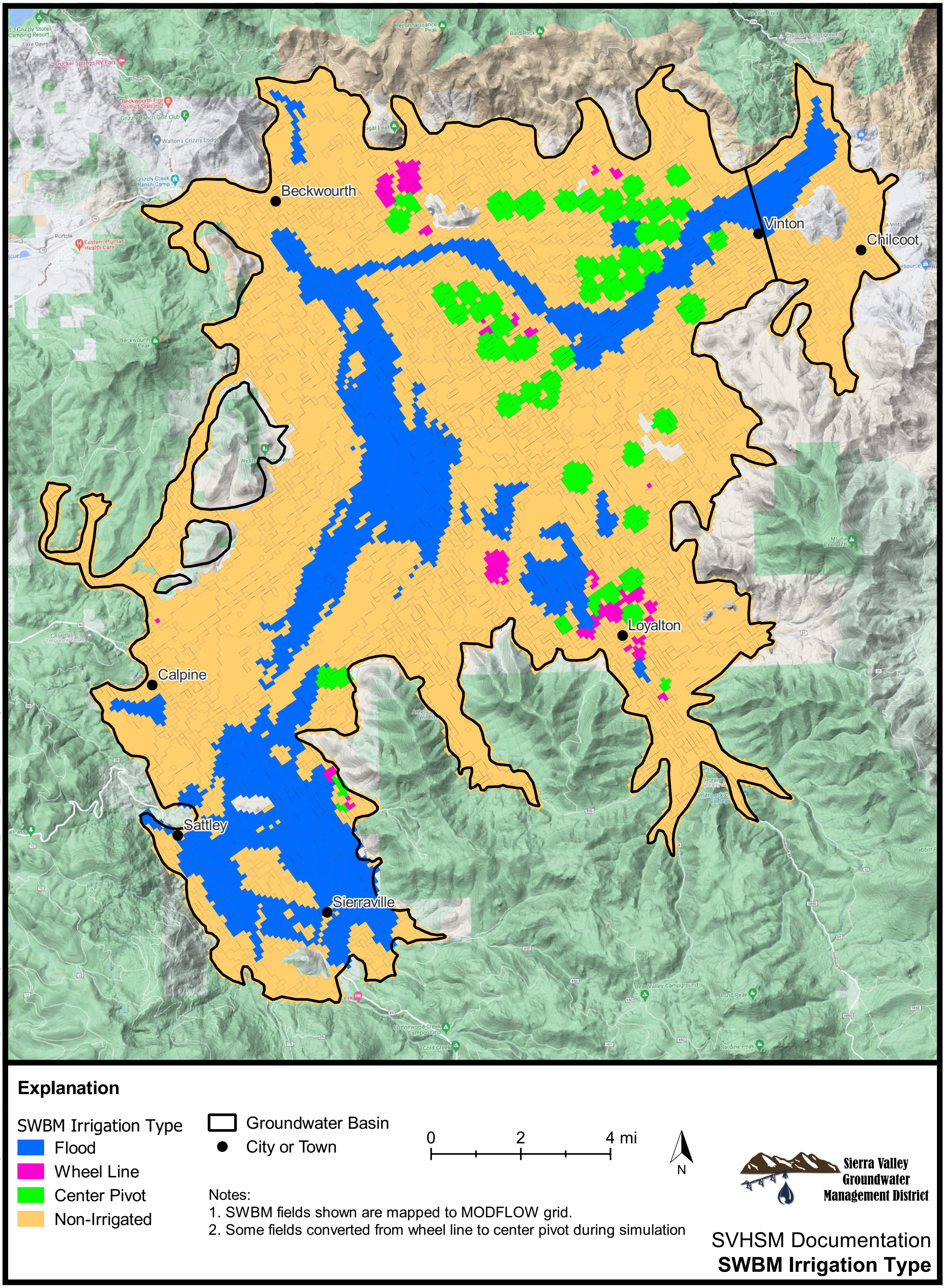
Sierra Valley Groundwater Management District

Notes:
1. SWBM fields shown are mapped to MODFLOW grid.
2. Landuse changes slightly during simulation

SVHSM Documentation
SWBM Landcover

C:\Users\500\Sierra Valley GSP Dropbox\Gus Tolley\Sierra Valley GSP\GIS\QGZs\SVHSM_Model_Documentation.qgz

12/06/2021



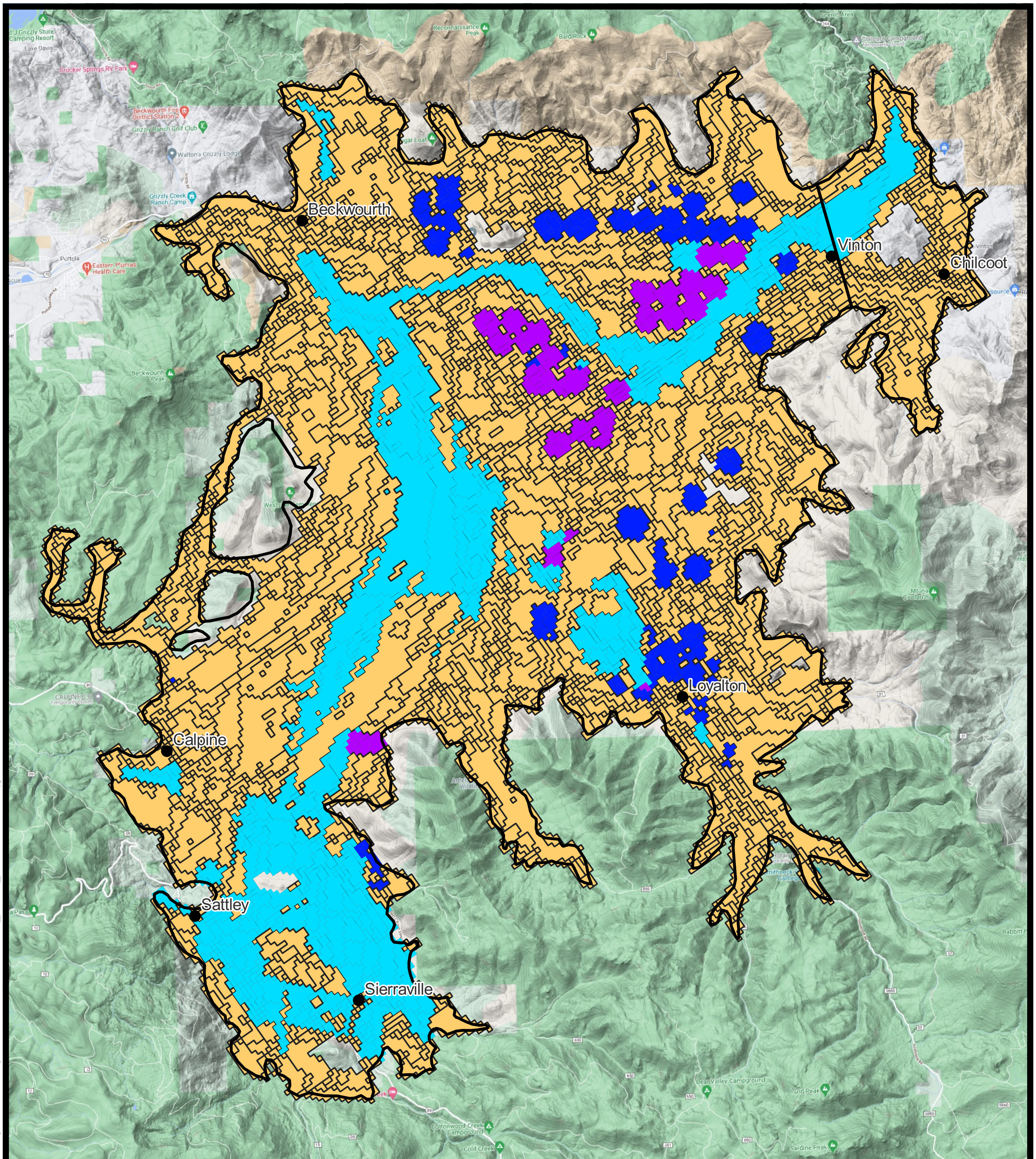
SVHSM Documentation

SWBM Irrigation Type

C:\Users\500\Sierra Valley GSP Dropbox\Gus Tolley\Sierra Valley GSP\GIS\QGZs\SVHSM_Model_Documentation.qgz

12/06/2021

Figure 5-4



Explanation

SWBM Irrigation Water Source
- Surface-Water
- Groundwater
- Mixed
- 'Non-Irrigated'

- Groundwater Basin
- City or Town

0 2 4 mi

N

Sierra Valley Groundwater Management District

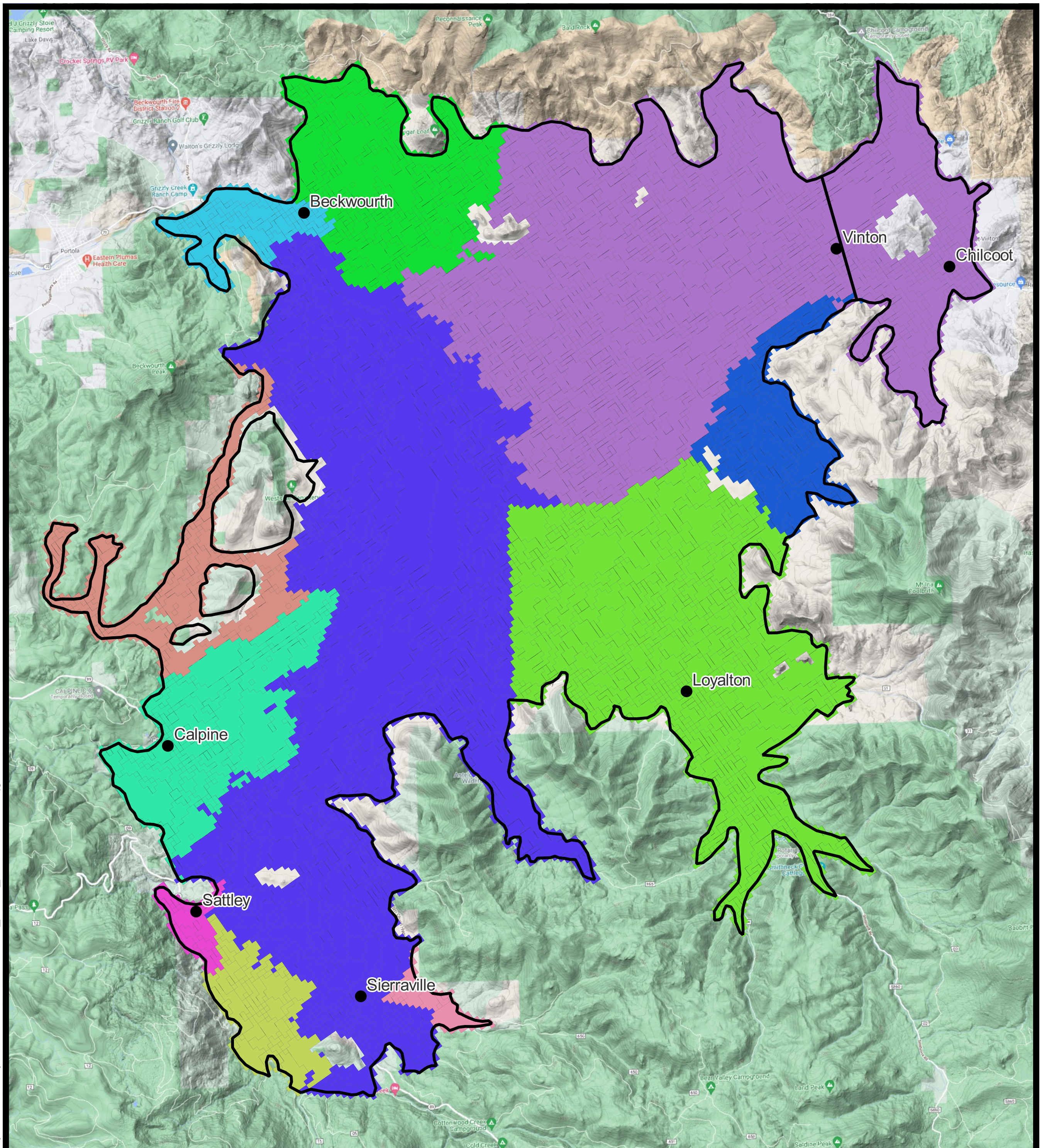
Notes:
1. SWBM fields shown are mapped to MODFLOW grid.
2. Mixed fields use surface water when available, then switch to groundwater

SVHSM Documentation
SWBM Irrigation Water Source

C:\Users\500\Sierra Valley GSP Dropbox\Gus Tolley\Sierra Valley GSP\GIS\QGZs\SVHSM_Model_Documentation.qgz

12/06/2021

Figure 5-5



Explanation

SWBM Surface Water Accounting Units
- Cold Stream
- Hamlin Creek
- Turner Creek
- Fletcher Creek
- Carman Creek
- Big Grizzly Creek
- Mapes Creek
- Little Last Chance Creek
- Correco Canyon
- Bear Valley-Smithneck Creek
- Lemon Creek

- Groundwater Basin
- City or Town

0 1 2 mi

N

Notes:
1. SWBM fields shown are mapped to MODFLOW grid.

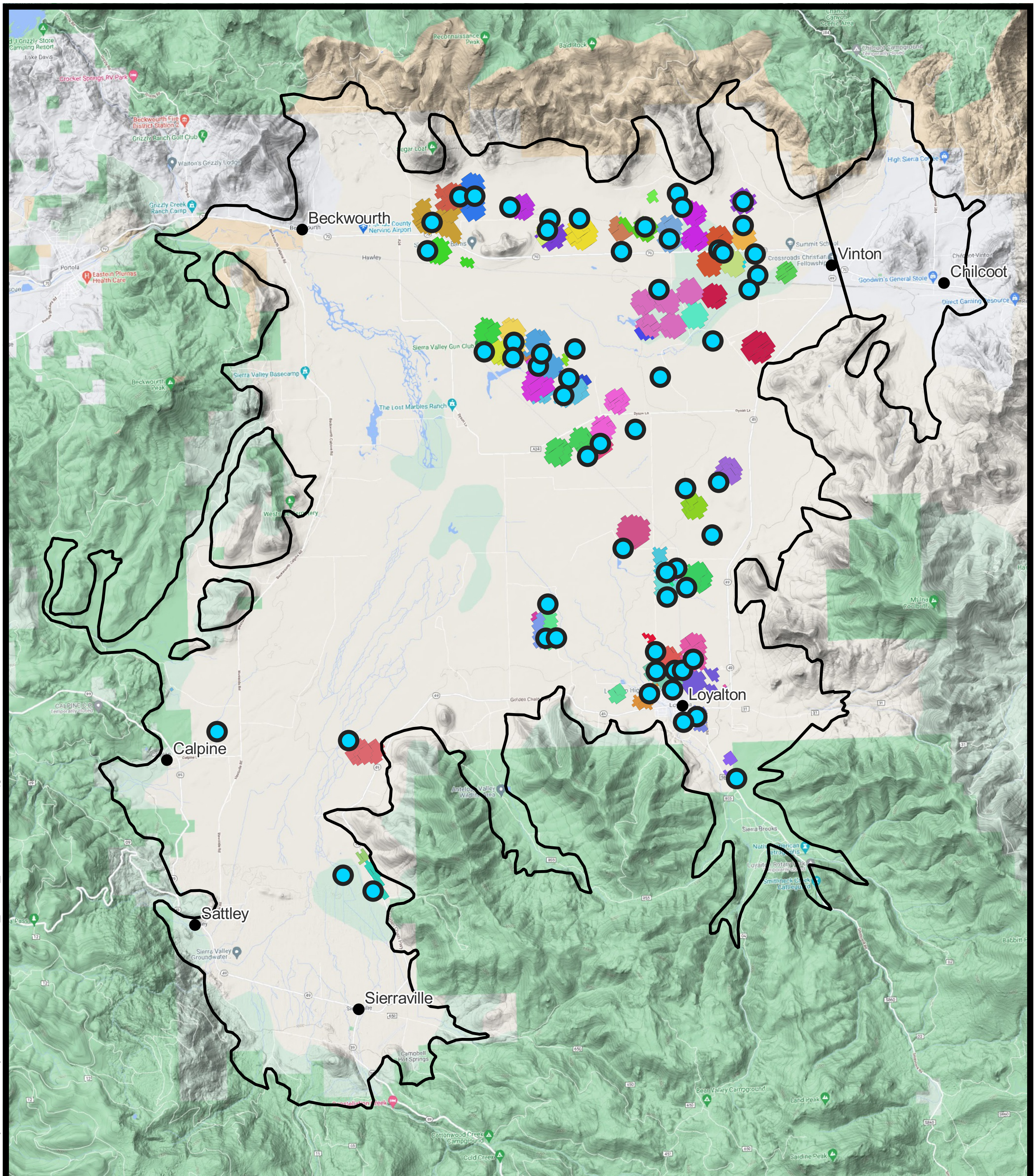
Sierra Valley Groundwater Management District

SVHSM Documentation
SWBM Surface Water Accounting Units

C:\Users\500\Sierra Valley GSP Dropbox\Gus Tolley\Sierra Valley GSP\GIS\QGZs\SVHSM_Model_Documentation.qgz

12/06/2021

Figure 5-6



Explanation

- Groundwater Irrigated Field
- Groundwater Basin
- Agricultural Irrigation Well
- City or Town

Notes:
1. SWBM fields shown are mapped to MODFLOW grid.
2. Fields colored according to assigned well.

0 1 2 mi

N

Sierra Valley Groundwater Management District

SVHSM Documentation

SWBM Groundwater Irrigation Wells and Fields

C:\Users\500\Sierra Valley GSP Dropbox\Gus Tolley\Sierra Valley GSP\GIS\QGZs\SVHSM_Model_Documentation.qgz

12/06/2021

The current version of the SWBM assumes that a field is irrigated with a single well, which, based on conversations with growers, is not always accurate. However, this would primarily affect the distribution of pumping, and not the total volumes simulated by the SWBM. This effect is small, as pumping volumes for wells are known and therefore specified for the majority of the simulation period (see Section XX - MODFLOW GW PUMPING).

The water holding capacity for each field was determined using the weighted average value found in the SSURGO database (Figure 5-8) multiplied by the rooting depth of the landcover (Table 5-1) and area of the field. Recharge only occurs when the moisture content of a field exceeds its holding capacity. Therefore, fields with greater water holding capacity can contribute more water to vegetation demands in the absence of irrigation, but also require storms of greater precipitation magnitude or intensity to generate groundwater recharge.

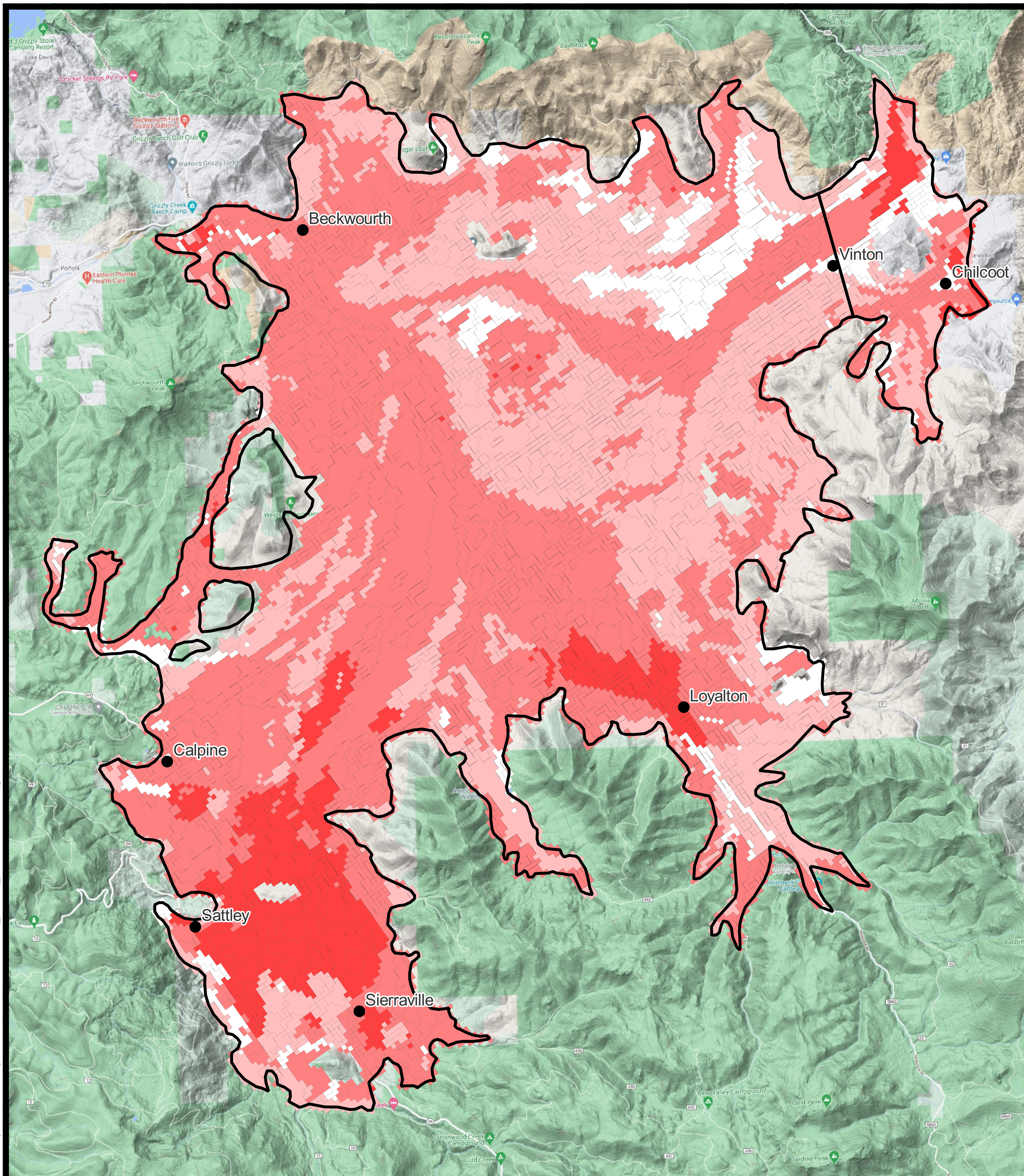
Infiltration excess (Hortonian) runoff that occurs during intense precipitation events can be estimated in the SWBM. This prevents overestimation of recharge in the model and improves surface-water representation. The maximum infiltration rate can be specified for each field using the parameter *max_infil_rate* in the **polygons_table.txt** input file. This runoff can be routed to a specific SFR segment in MODFLOW by specifying the segment number for the *runoff_ISEG* parameter in the same file. As this feature was added relatively late during model development, a constant value of 0.157 inches per day (in/d) (0.004 meters per day [m/d]) was used for all fields.

5.1.4 Crop Coefficients

The SWBM uses the crop coefficient (K_c) method to estimate water demand of crops and vegetation. The crop coefficient is a scaling factor applied to the ET_0. Values were chosen based on published literature or from previous experience gained in the Scott Valley, which has similar crop types and management practices as the Sierra Valley. The variable *kc_mult* is available in the SWBM for uniformly scaling variable K_c values.

A seasonal average K_c value of 0.9 was used for alfalfa and pasture, as opposed to a variable K_c that reflects different ET rates depending on the crop development stage. This was done because K_c values for pasture do not vary much over the growing season, and detailed information about management practices that affect alfalfa K_c values (e.g., cutting schedules) vary significantly depending on the year and grower. The growing season for alfalfa occurred from April 1 through October 15 each year, and from March 15 through October 31 for pasture. A constant K_c value of 1.2 was used for the water landcover type.

Variable K_c values were used for the grain and native vegetation landcover types. This was done instead of using seasonal average crop coefficients because the K_c values are much less dependent on grower-specific management practices. Grain K_c values range from 0 to 1.15 during April 1 though July 20, and native vegetation values range from 0 to 0.8 during March 1 through December 31 (Figure 5-9).



Explanation

SWBM Water Holding Capacity (%)
- 0 - 5
- 5 - 10
- 10 - 15
- 15 - 20

Groundwater Basin
● City or Town

0 1 2 mi

N

Notes:
1. SWBM fields shown are mapped to MODFLOW grid.
2. Volumetric capacity defined by multiplying water holding capacity by effective root depth and field area.

Sierra Valley Groundwater Management District

SVHSM Documentation
SWBM Soil Water Holding Capacity

C:\Users\500\Sierra Valley GSP Dropbox\Gus Tolley\Sierra Valley GSP\GIS\QGZs\SVHSM_Model_Documentation.qgz

12/06/2021

Figure 5-8

Figure 5-9. Crop coefficient (K_c) values by landcover type.

5.1.5 Surface Water Inflows

Surface water inflows entering the groundwater basin were estimated using the PRMS submodel (see Section 4.2.1) with the exception of Cold Stream, Big Grizzly Creek, and Little Last Chance Creek. Cold Stream flows are augmented by imported water from the Little Truckee River. These imports are measured by the Watermaster on a daily basis and were added to the natural inflows estimated by PRMS. Flows in Big Grizzly Creek and Little Last Chance Creek are regulated by reservoir releases operated by DWR. Flow data for these two streams were provided on a daily or monthly basis by the Watermaster, with releases subdivided into various categories (e.g., streamflow maintenance, water supply contract, and spill). These were converted into an “irrigation inflow” and “non-irrigation inflow” categorization. Only water categorized as “irrigation inflow” can be used for surface water irrigation. Applied surface water irrigation is removed from the boundary inflows, with remaining flows passed on to the streamflow routing (SFR2) package in MODFLOW. All surface water diversions are assumed to take place at the margins of the groundwater basin where inflows are specified due to lack of detailed streamflow diversion data within the groundwater basin.

Annual streamflow is highly variable, ranging from about 35 to 360 thousand acre-feet per year (TAF/yr) (Figure 5-10). Surface water available for irrigation made up about 69 to 91% of total inflows, and averaged about 82% of total inflows over the 21-year simulation period. These streamflow estimates may change in the future if further calibration if performed on the PRMS model.

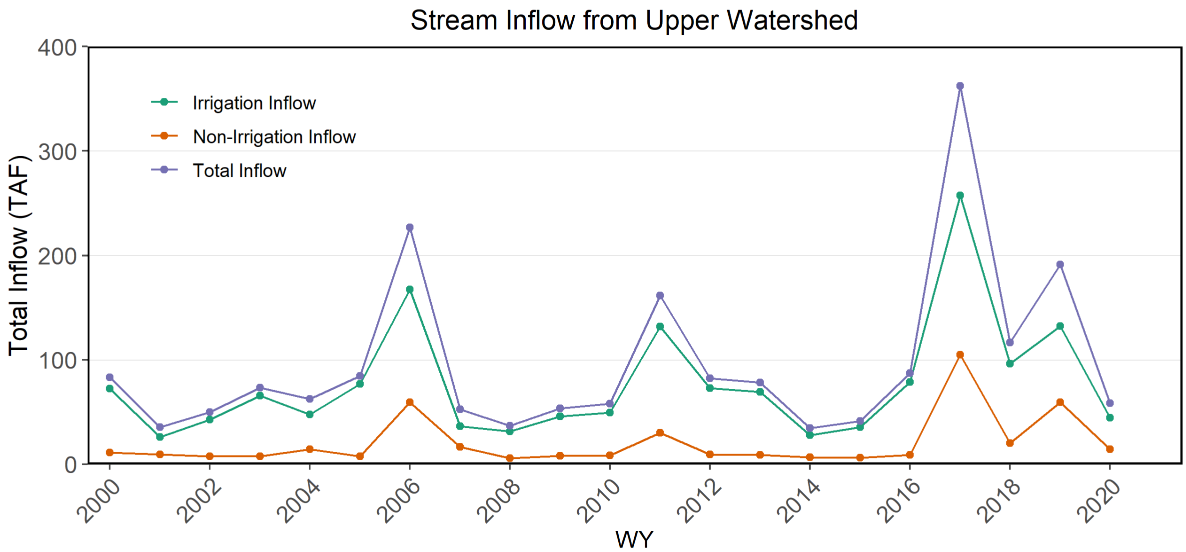


Figure 5-10. Annual surface water inflows input to the SWBM.

5.1.6 Specified Groundwater Pumping

The Sierra Valley is one of the few basins in California where agricultural groundwater pumping is metered. Because groundwater pumping is commonly one of the largest fluxes within an agricultural groundwater basin, this provides an additional dataset with which to calibrate SVHSM, as well as significantly reduces uncertainty of model results for the historical simulation period (WY 2000-2020). Agricultural and municipal pumping volumes in the SWBM can be specified for any well on a monthly basis in **ag_well_specified_volume.txt** and **muni_well_specified_volume.txt**, respectively. Specified pumping volumes define irrigation application rates for fields associated with a well.

Annual groundwater pumping volumes were provided by the District for agricultural production wells from 2003 to 2020 (Table 5-3). Municipal water suppliers in the valley provided monthly extraction data from 2005 to 2020. Annual agricultural pumping volumes fluctuate significantly depending on the water year type and management factors (e.g., well maintenance). Reported agricultural groundwater pumping volumes during the simulation period range from about 4,700 to 13,600 acre-feet per year (AFY). Municipal groundwater extractions show a much smaller proportion of total groundwater pumped and much less interannual variation, with reported values ranging from 195 to 652 AFY. The reported value of 195 AFY in 2005 appears to be missing extraction data from one or more wells based on data from other years. Municipal pumping data from the Sierra County Water Works District #1 (Calpine) was provided from 2009 to 2017, but not included in SVHSM because the wells are located outside of the groundwater basin boundary and screened exclusively in bedrock. Annual production volumes for these wells are less than 60 AFY, so their omission is not expected to be significant.

Table 5-3. Specified pumping volumes.

Year	Agricultrual Pumping Volume (AF)	Municpial Groundwater Pumping Volume[1] (AF)	Total Groundwater Pumping Volume (AF)
2003	6,956	650[a]	7,606
2004	9,023	613[a]	9,636
2005	6,406	195	6,601
2006	6,276	328	6,604
2007	8,198	409	8,607
2008	7,690	652	8,342
2009	4,748	650	5,398
2010	9,827	613	10,440
2011	5,049	544	5,592
2012	9,173	605	9,778
2013	12,121	642	12,763
2014	12,075	589	12,663
2015	13,609	492	14,101
2016	10,515	575	11,090
2017	6,973	374	7,347
2018	7,934	362	8,296
2019	7,474	406	7,879
2020	8,217	453	8,670

1. Excludes Calpine municipal groundwater pumping.
a. Records not available; estimated volume.

Annual total volume for each irrigation well was distributed throughout the growing season according to the proportion of growing season ET_0 that occurred during the month. For example, if 16% of total growing season ET_0 in 2004 occurred during the month of June, then 16% of the 2004 measured pumping volume was assumed to occur during that month.

5.2 SWBM Outputs

The daily water budgets estimated by the SWBM are upscaled to monthly periods for output to smooth out timing discrepancies between the model and real-world conditions caused by lack of detailed management information (e.g., knowledge of specific irrigation timing for a given field).

These are available for each field in linear and volumetric units. Some formatted input files (e.g., groundwater pumping, recharge, streamflow) to the groundwater-surface-water model (Section 7) are written directly by the SWBM. This allows for the SWBM and groundwater-surface water model to be calibrated as a single model. Tabulated water budgets from the SWBM submodel of SVHSM can be found in Appendix B.

5.2.1 Evapotranspiration (ET)

ET calculated by the SWBM is the product of the ET_0, the K_c, and the SWBM scaling factor (*kc_mult*). This processes is water limited, meaning that it only occurs when water is available for a given field. Figure 5-11 shows the spatially distributed annual average ET over the 21 year simulation period. Annual average ET within the groundwater basin boundary ranged from 0 to 34.5 in/yr (0 to 875 mm/yr) depending on landcover and if the field was irrigated or not. These rates are consistent with previously published values for the region (Hanson and others, 2010; Tolley and others, 2019).

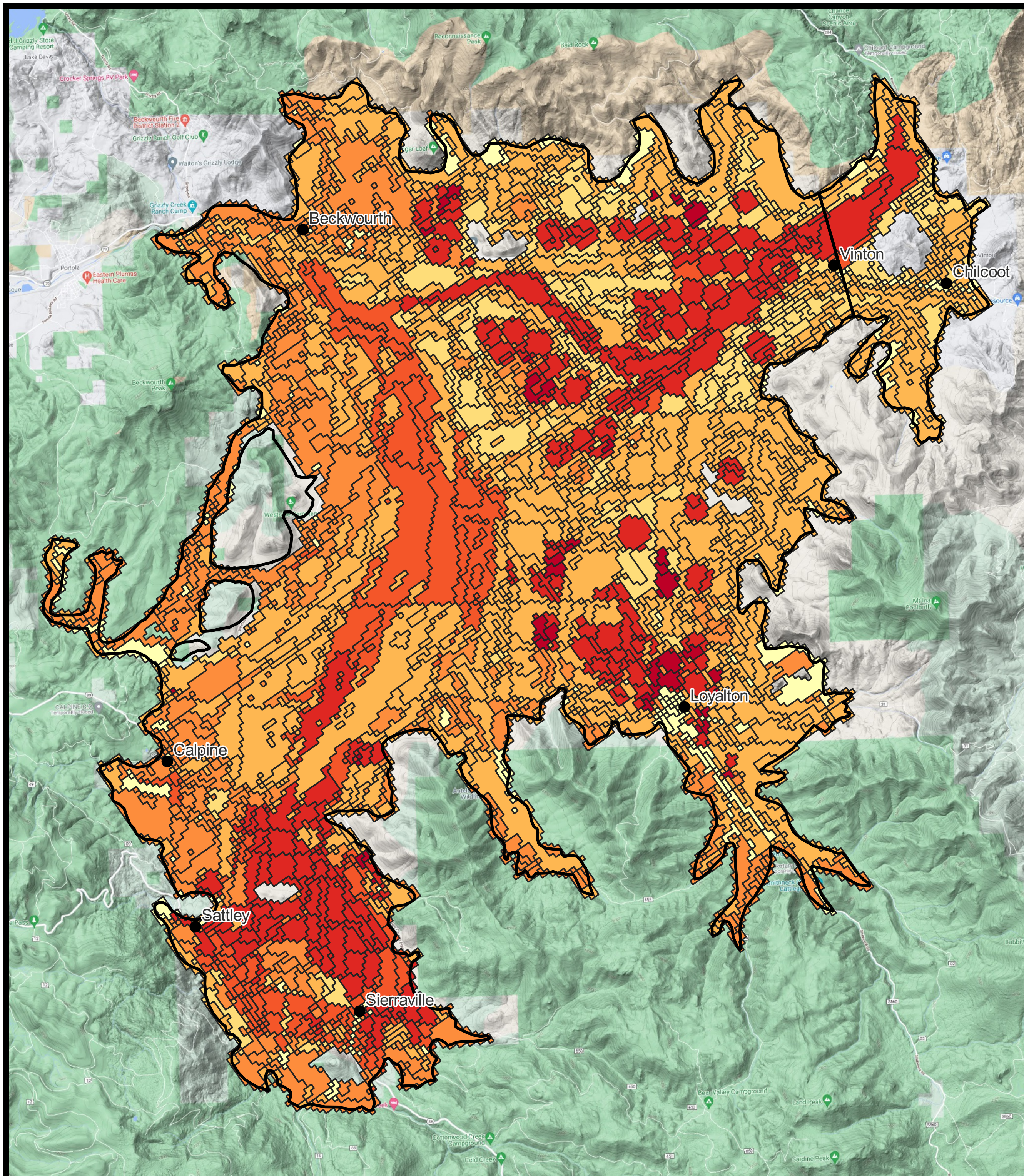
5.2.2 Irrigation

The SWBM tracks surface water and groundwater irrigation applied to each field. Average annual surface water irrigation rates ranged from 0 to 17.3 in/yr (0 to 439 mm) over the 21-year simulation period (Figure 5-12). The highest surface water application rates estimated by the model are located in the eastern portion of the basin, where soils are generally sandier and have lower capillary storage compared to the more silt and clay rich soils on the western side of the valley. Surface water used for irrigation is subtracted from the stream inflows entering the groundwater basin to ensure that water is not double counted as remaining streamflows are passed on to the MODFLOW submodel of SVHSM.

Groundwater irrigation simulated by the SWBM occurs almost exclusively in the eastern portion of the valley (Figure 5-13). Annual average application rates of groundwater range from about 6 to 27 inches. The combination of high water demand for alfalfa and the inability to apply irrigation water around cutting times results in deficit irrigation (applying less water than crop demand) over the season. Some of this deficit is met by seasonal reduction of soil-moisture storage.

5.2.3 Groundwater Pumping

Groundwater pumping is the portion of applied irrigation that is not sourced from surface water and specified extractions from municipal wells. All fields simulated in the SWBM are assigned a well, with one well able to service multiple fields. Applied groundwater irrigation is aggregated on a monthly basis by well for input to the groundwater-surface water model. Specified municipal pumping is not used by the SWBM and is simply passed through the model and included in groundwater-surface water model input file generated.



Explanation

Average Annual ET (in/yr)
- 0 - 5
- 5 - 10
- 10 - 15
- 15 - 20
- 20 - 25
- 25 - 30
- 30 - 34.5

Groundwater Basin
City or Town

0 1 2 mi

N

Sierra Valley Groundwater Management District

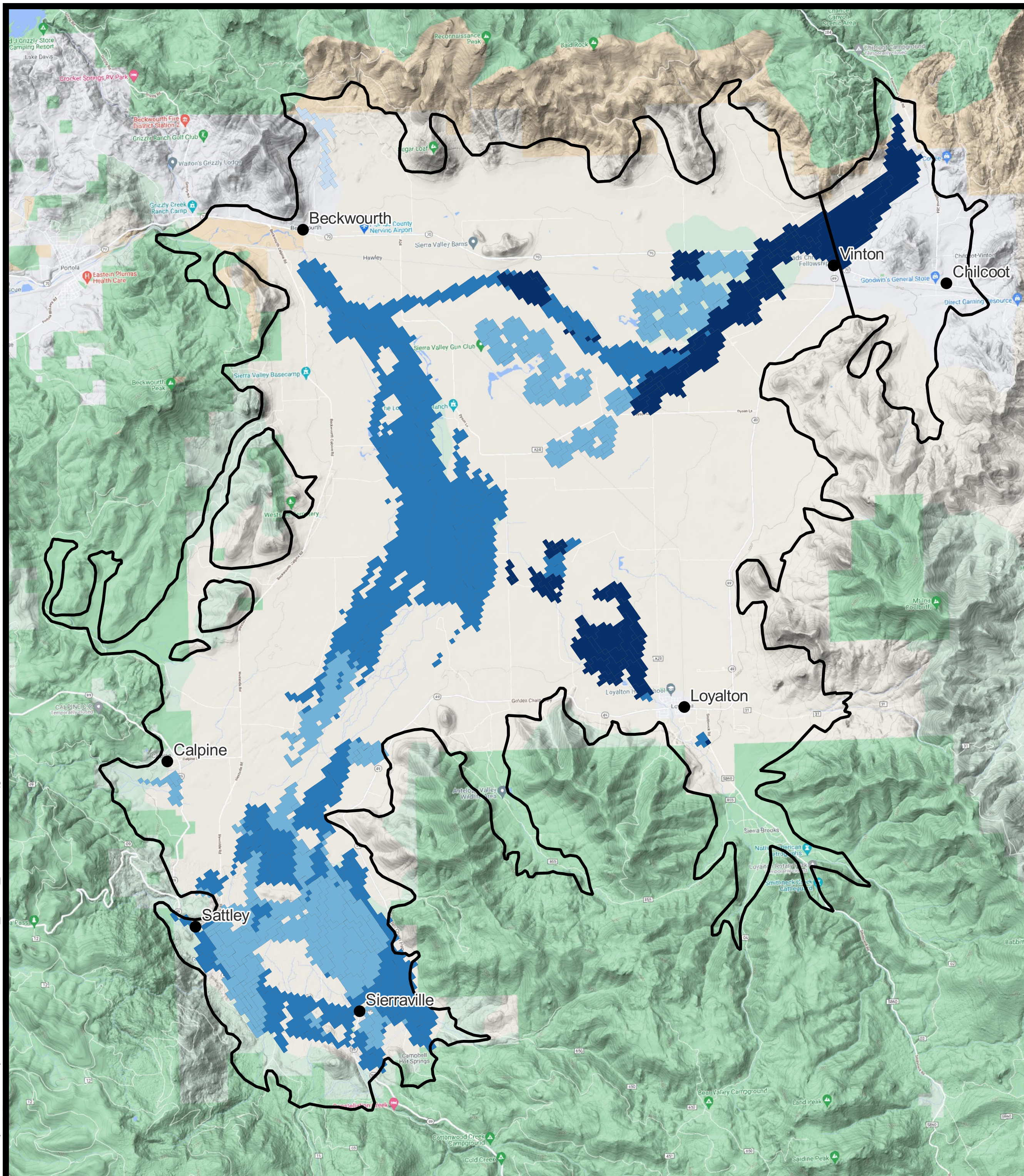
Notes:
1. SWBM fields shown are mapped to MODFLOW grid.
2. 21 year average (WY2000-2020)

SVHSM Documentation
SWBM Average Annual ET

C:\Users\500\Sierra Valley GSP Dropbox\Gus Tolley\Sierra Valley GSP\GIS\QGZs\SVHSM_Model_Documentation.qgz

12/09/2021

Figure 5-11



Explanation

Average Surface Water Irrigation (in/yr)

- <5
- 5 - 10
- 10 - 15
- 15 - 17.3

Groundwater Basin

City or Town

0 1 2 mi

N

Notes:
1. SWBM fields shown are mapped to MODFLOW grid.
2. 21 year average (WY2000-2020)

Sierra Valley Groundwater Management District

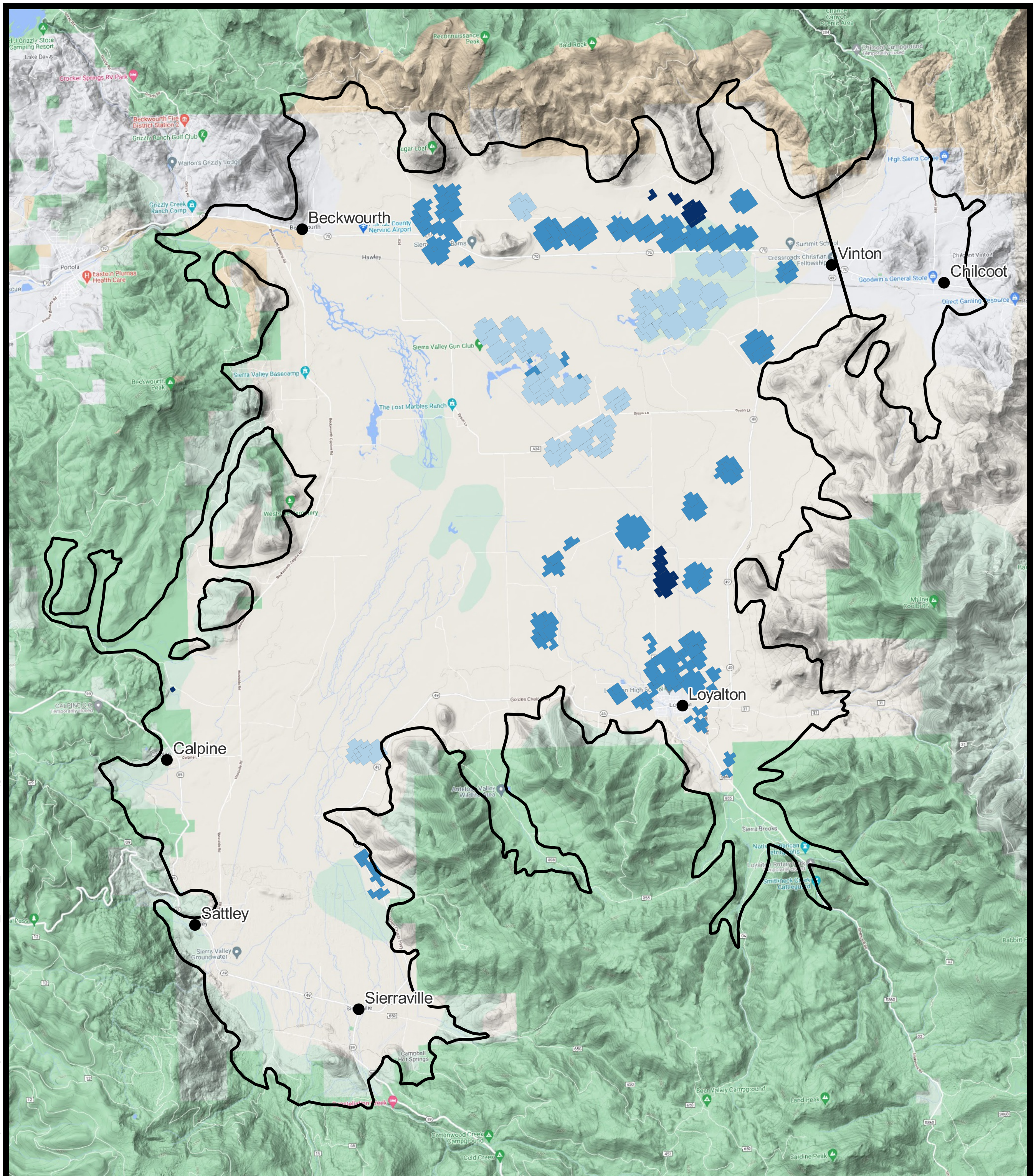
SVHSM Documentation

SWBM Average Annual Surface Water Irrigation

C:\Users\500\Sierra Valley GSP Dropbox\Gus Tolley\Sierra Valley GSP\GIS\QGZs\SVHSM_Model_Documentation.qgz

12/09/2021

Figure 5-12



Explanation

Average Groundwater Irrigation (in/yr)

- <10
- 10 - 20
- 20 - 27.2

Groundwater Basin

City or Town

0 1 2 mi

N

Notes:
1. SWBM fields shown are mapped to MODFLOW grid.
2. 21 year average (WY2000-2020)

Sierra Valley Groundwater Management District

SVHSM Documentation

SWBM Average Annual Groundwater Irrigation

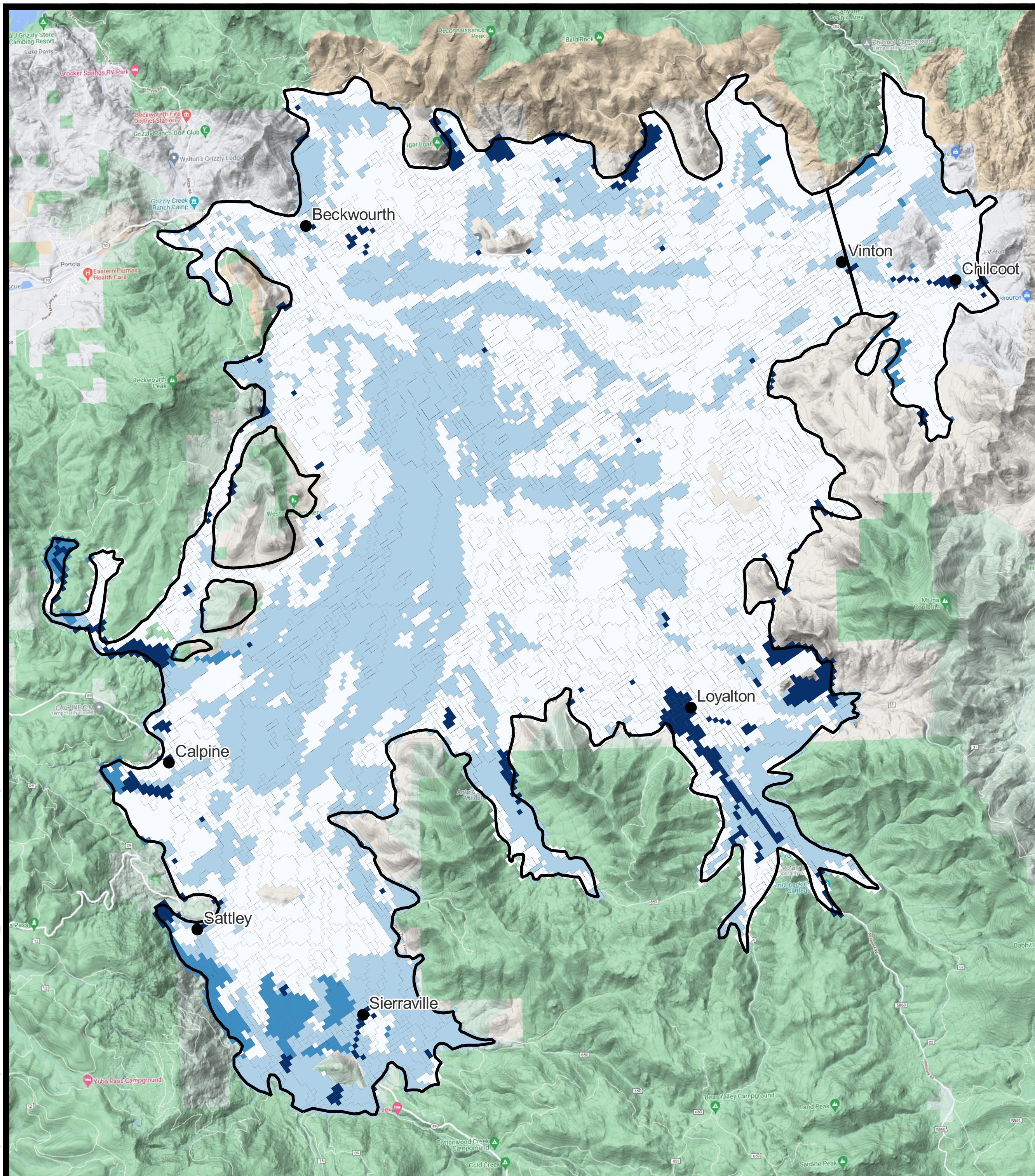
C:\Users\500\Sierra Valley GSP Dropbox\Gus Tolley\Sierra Valley GSP\GIS\QGZs\SVHSM_Model_Documentation.qgz

12/09/2021

Figure 5-13

5.2.4 Recharge

Soil moisture that exceeds the field capacity (gravity drainage threshold) for a given field is assumed to recharge groundwater. Figure 5-14 shows the average annual recharge estimated by the SWBM over the 21-year simulation period. Values range from less than 0.1 inch to 8.5 in/yr (0 to 215 mm/yr). Fields with the highest recharge rates are typically those assigned the urban/barren landcover class, as ET is assumed to be negligible, or flood irrigated pasture. Alfalfa/grain fields irrigated with center pivots typically have the lowest average recharge rates.



Explanation

Average Groundwater Recharge (in/yr)
- 0 - 2
- 2 - 4
- 4 - 6
- 6 - 8.5

Groundwater Basin
City or Town

0 1 2 mi

N

Notes:
1. SWBM fields shown are mapped to MODFLOW grid.
2. 21 year average (WY2000-2020)

Sierra Valley Groundwater Management District

SVHSM Documentation
SWBM Average Annual Groundwater Recharge

C:\Users\500\Sierra Valley GSP Dropbox\Gus Tolley\Sierra Valley GSP\GIS\QGZs\SVHSM_Model_Documentation.qgz

12/10/2021

Figure 5-14

6.0 3D Geologic Model (Leapfrog Works)

During the initial stages of GSP development in the Sierra Valley, several comments were made by stakeholders about incorporating geologic features (e.g., faults) into the model that may influence groundwater flow within the valley. The desire to represent these features and the lack of consistent stratigraphic layering in previously published geologic cross sections by Kenneth D. Schmidt and Associates (2003 and 2005) prompted the development of a 3D geologic model. The software Leapfrog Works (https://www.seequent.com/products-solutions/leapfrog-works/) with the hydrogeology extension was chosen, which allows for powerful 3D visualization, explicit separation of data and geologic interpretations, efficient model updates, the ability to export geologic models as MODFLOW input files, and the ability to import MODFLOW results into Leapfrog Works for 3D visualization purposes. While a license for the software is required to develop and make changes to a model, visualization and exploration of an existing model is available at no cost. The 3D geologic model developed for SVHSM is available at the SVGMD website (https://www.sierravalleygmd.org/).

Formatted Leapfrog Works input files were generated using a pre-processing script developed in R that extracts required data from the DMS. As new wells and/or lithology data are added to the database, the 3D geologic model can be updated as needed.

6.1 3D Geologic Model Inputs

All available and applicable subsurface datasets for the groundwater basin were used in the development of the 3D geologic model of the groundwater basin. The primary datasets were geologic logs from wells drilled in the basin, geologic maps, and geophysical studies. Data from these sources were used to develop the bedrock contact surface and sediment distribution within the basin. Leapfrog Works accomplishes this by creating contact surfaces between categorical geologic units and interpolating between them using the radial basis function (RBF) method to create volumes. Spatial variability and knowledge of depositional process are accounted for by applying a variogram (mathematical model that describes the spatial continuity of the data) to a given categorical geologic unit (e.g., sands and gravels) during volume creation. This allows for general process knowledge (e.g., silts and clays are more laterally expansive than sands and gravels) to be incorporated into the 3D geologic model. The model domain was defined by the DWR Bulletin 118 basin boundary.

6.1.1 Faults

A total of 10 different faults are represented in the 3D geologic submodel of SVHSM (Figure 6-1). The faults were identified from the USGS fault and fold database, geologic maps of the Sierra Valley (DWR, 1963; CGS, 1962 and 1992; Grose, 2000a, 2000b, and 2000c; Grose and Mergner, 2000), and USGS geophysical studies (Jackson and others, 1961; Gold and others, 2013). Locations and names (when available) of faults in the valley can differ depending on the source. An effort was made to amalgamate all available data from geologic maps, geophysical studies, and well logs, as well as to standardize the naming convention to reduce confusion