In Cooperation with the
California Department of Water Resources, Northern District

Lake County Watershed Protection District

Lake County Groundwater Management Plan

Final

March 31, 2006

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Section 1
Introduction

Lake County Watershed Protection District (District) has developed this Groundwater Management Plan (GMP) to provide guidance in managing the groundwater resources of the County. Like many other areas of California, Lake County is facing water supply reliability and water quality challenges. In recent years, the District has initiated a number of efforts to proactively address water resource issues, including documenting the current status of water use and supply, identifying areas of need, and developing recommendations to ensure a supply of high quality water into the future. To promote a collaborative, county-wide approach, the District has included local stakeholders in each of these efforts.

This GMP, together with the *Lake County Water Inventory and Analysis* (CDM 2006) and the *Lake County Water Demand Forecast* (CDM 2006), will serve to improve the understanding of the water resources in Lake County and provide a framework for the County and other water users to implement effective water resource management programs.

1.1 Lake County Watershed Protection District

The District works to protect and maintain water resources within Lake County. The District is part of the County Department of Public Works and reports to the County Board of Supervisors. Because of the District's responsibilities regarding water resources, it is an authorized groundwater management agency as defined by the California Water Code (CWC) §10753 (a) and (b). District responsibilities include:

- Water Resources Planning: plan for groundwater and watershed management;
- Flood Control: administer the National Flood Insurance Program for Lake County, plan and implement flood control projects, and maintain levees and creeks;
- Operations and Maintenance: operate and maintain the Kelsey Creek Detention Structure, Adobe Creek Reservoir, Highland Springs Reservoir, Highland Springs Park; and the Middle Creek Flood Control Project; and
- Prevent other environmental damage.

1.2 Plan Development Process and Public Outreach

The District is following the CWC guidance on GMP development, which follows 5 steps.

Step 1 – Provide public notification of a hearing on whether or not to adopt a resolution of intention to draft a GMP and subsequently complete a hearing on whether or not to adopt a resolution of intention to draft a GMP. Following the hearing, draft a resolution of intention to draft a GMP. The District provided notification in the Lake County Record Bee on September 14th, 2005 and September

21st 2005, and held a hearing on whether or not to adopt a resolution of intention on October 4th, 2005.

Step 2 – Adopt a resolution of intention to draft a GMP and publish the resolution of intention in accordance with public notification. The Lake County Board of Supervisors adopted the resolution of intention to develop a GMP on October 4th, 2005. The resolution is included as Appendix A.

Step 3 – Prepare a draft GMP within 2 years of resolution of intention adoption. Provide to the public a written statement describing the manner in which interested parties may participate in developing the GMP, discussed in Section 1.3 below. The District provided notification and held a public meeting on the GMP on September 28th, where meeting attendees gave input on management objectives for the GMP.

Groundwater Management Plan Meeting Attendees

Step 4 – Provide public notification of a hearing on whether or not to adopt the GMP, followed by a hearing on whether or not to adopt the GMP. The District anticipates holding this hearing in 2006.

Step 5 - If protests are received for less than 50 percent of the assessed value of property in the plan area, the plan may be adopted within 35 days after completion of Step 4 above. If protests are received for greater than 50 percent of the assessed value of the property in the plan area, the plan will not be adopted.

In addition to following the statutory requirements of the CWC, the District has also made additional efforts to involve the public in the development of the GMP and related documents. The District supplied a pamphlet describing Inventory and Analysis related information to interested stakeholders. The District also held a public meeting on May 25th, 2005 to solicit input from stakeholders on the Inventory and Analysis. Additionally, the District held six additional meetings to involve local stakeholders during the development of Basin Management Objectives (BMOs) for individual groundwater basins. Appendix B includes summaries for these meetings.

1.3 Management Objectives

The GMP supports the long-term maintenance of high quality groundwater resources within the 13 groundwater basins of the county. Specifically, the objectives of Lake County's GMP are:

- Improve the understanding of groundwater hydrology and quality in Lake County;
- Maintain a sustainable, high quality water supply for agricultural, environmental, and urban uses;
- Minimize the long-term drawdown of groundwater levels;
- Protect groundwater quality;
- Minimize changes to surface water flows and quality that directly affect groundwater levels or quality;
- Minimize the effect of groundwater pumping on surface water flows and quality;
- Facilitate groundwater replenishment and cooperative management projects; and
- Prevent inelastic land surface subsidence from occurring as a result of groundwater pumping.

1.4 Plan Area

The Lake County GMP includes those areas in Lake County overlying a groundwater basin or groundwater source area not within the service area of another local agency, water corporation regulated by the Public Utilities Commission, or mutual water company without the agreement of the overlying agency (CWC § 10750.7 (a)). Figure 1-1 shows the Lake County GMP plan area. Areas within Lake County not overlying a groundwater basin as defined in Bulletin 118-2003 nor designated a groundwater source area are not explicitly included in the GMP. The groundwater basins and source areas in the Lake County GMP are:

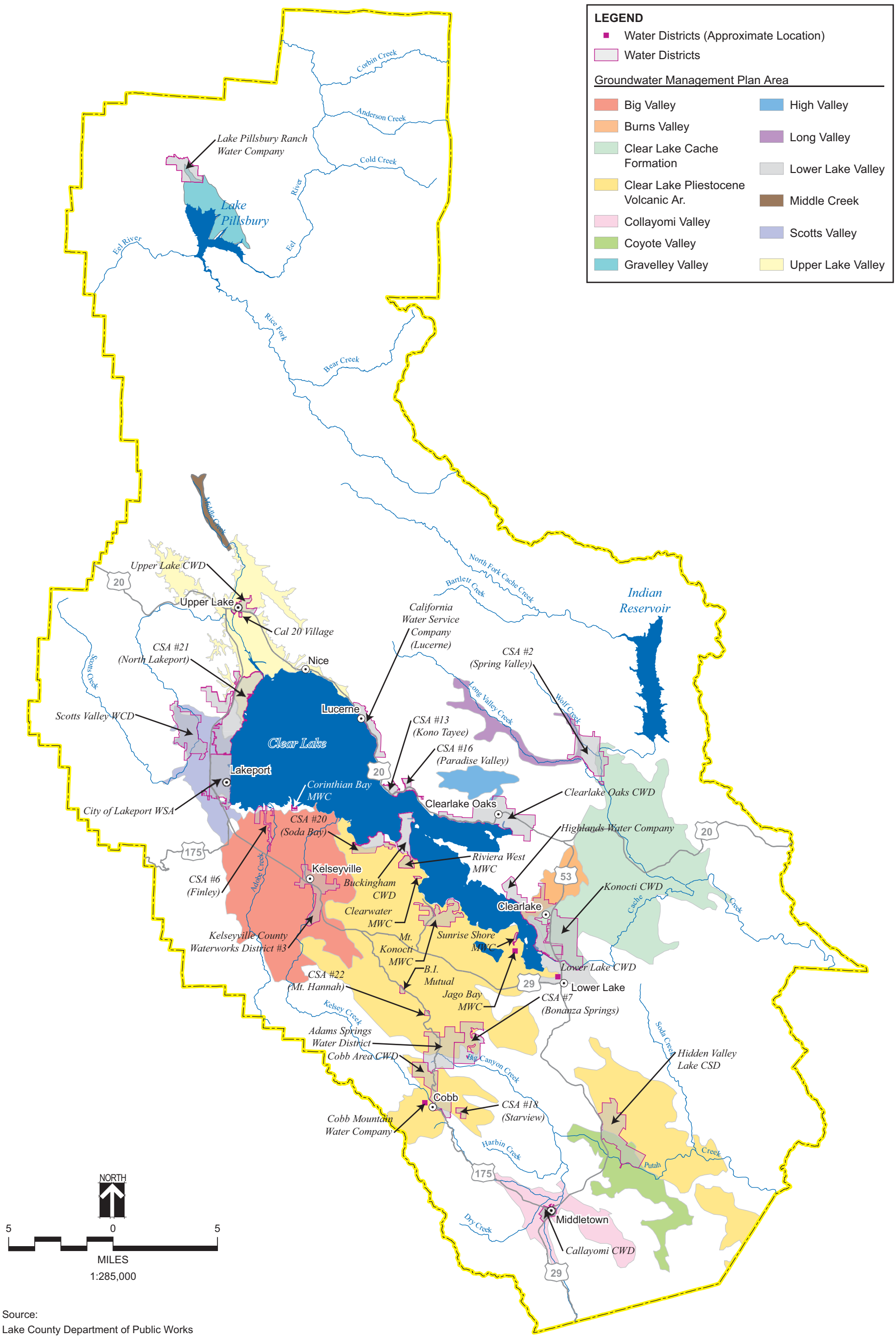
- Gravelly Valley
- Upper Lake
- Scotts Valley
- Big Valley
- High Valley
- Burns Valley
- Coyote Valley
- Collayomi Valley

- Lower Lake
- Long Valley
- Clear Lake Cache Formation
- Middle Creek
- Clear Lake Volcanics Groundwater Source Area

The District attempted to include as many overlying agencies as possible in the Lake County GMP to provide the most comprehensive and inclusive planning framework. To this end, the District sent letters to local water agencies requesting that they enter into an agreement with the District to be included in the GMP. Overlying agencies, after consulting with their boards of directors may agree to be a part of the GMP by signing a Memorandum of Understanding (MOU) with the District. Figure 1-1 also shows water agencies overlying groundwater basins in Lake County. Table 1-1 provides a listing of overlying agencies, the groundwater basins overlain, and the status of their agreement to be a part of the GMP.

Table 1-1
Overlying Agencies and Agreement to Join GMP

System Name	Groundwater Basin	Agreement Status
Adams Springs Water District - part of Cobb ACWD	Clear Lake Volcanics	
B.I. Mutual Water Company	Clear Lake Volcanics	
Cal 20 Village	Upper Lake Valley	
Callayomi County Water District	Collayomi Valley	
Clearwater Mutual Water Company	Clear Lake Volcanics	
Cobb Area County Water District	Clear Lake Volcanics	
Cobb Mountain Water Company	Clear Lake Volcanics	
Corinthian Bay Mutual Water Company	Big Valley	
Hidden Valley Lake CSD	Clear Lake Volcanics	
	Coyote Valley	
Highlands Mutual Water Company	Burns Valley,	
	Clear Lake Cache Formation,	
	Lower Lake Valley	
Jago Bay Mutual Water Company	Clear Lake Volcanics	
Kelseyville Co Waterworks District 3	Big Valley	
Konocti County Water District	Clear Lake Cache Formation	
Lake County CSA 18 - Starview	Clear Lake Volcanics	
Lake County CSA 2 - Spring Valley	Clear Lake Cache Formation	
	Long Valley	
Lake County CSA 20 - Soda Bay	Clear Lake Volcanics	
Lake County CSA 21 - North Lakeport	Upper Lake Valley	
	Scotts Valley	
Lake County CSA 22 - Mt. Hannah	Clear Lake Volcanics	
Lake County CSA 6 - Finley	Big Valley	
Lake County CSA 7 - Bonanza Springs	Clear Lake Volcanics	
Lake Pillsbury Ranch Water Company	Gravelly Valley	



Source:
Lake County Department of Public Works
California Spatial Information Library

Figure 1-1
Groundwater Management Plan Area
and Overlying Agencies

CDM

Table 1-1 Overlying Agencies and Agreement to Join GMP		
System Name	**Groundwater Basin**	**Agreement Status**
Lakeport, City of	Scotts Valley	
Loch Lomond Mutual Water Co - part of Cobb ACWD	Clear Lake Volcanics	
Lower Lake County Water District	Lower Lake Valley	
Mt. Konocti Mutual Water Company	Clear Lake Volcanics	
Pine Grove Water System - part of Cobb ACWD	Clear Lake Volcanics	
Riviera West Mutual Water Co.	Clear Lake Volcanics	
Sunrise Shore Mutual Water Company	Clear Lake Volcanics	
Upper Lake County Water District	Upper Lake Valley	

1.5 Plan Implementation

In 2004, to further its objective to improve water resource planning in the County, the District applied for an AB 303 grant to inventory existing groundwater conditions and uses and to develop a GMP.

In order for the County to acquire future state funding for groundwater resources projects, a GMP must be in place. Assembly Bill 3030 (AB3030), passed by the California Legislature in 1992, codified 12 *recommended* components of a GMP. Congress updated GMP requirements with Senate Bill 1938 (SB1938) in 2002. SB1938 added five *required* components of a GMP that must be included in order to acquire funding from the state. The California Department of Water Resources (DWR) added *suggested* components for a GMP in Bulletin 118-2003.

Table 1-2 lists the mandatory, voluntary, and suggested components included in the Lake County GMP. Table 1-2 also lists the section, figure, or table number within the Lake County GMP where each item is addressed.

Table 1-2 Groundwater Management Plan Components	
GMP Components	**Lake County GMP Section**
Required Components: (10753.7.)	
Establish Basin Management Objectives (BMOs)	3
Include components relating to the monitoring and management of: groundwater levels, groundwater quality, inelastic land subsidence, and surface water flow or quality that effects groundwater or groundwater pumping that effects surface water flow or quality	4.1
Prepare a plan that enables the district to work cooperatively with other public entities whose service area falls within the plan area and overlies the groundwater basin	1.3
Prepare a map that details the area of the groundwater basin, the area subject to the GMP, and the boundaries of other local agencies that overlie the basin	1.3
Adopt monitoring protocols that detect changes in: groundwater levels, groundwater quality, inelastic land subsidence, and surface water flow or quality that effects groundwater or groundwater pumping that effects surface water flow or quality	4.1

Table 1-2 ***Groundwater Management Plan Components***	
GMP Components	***Lake County GMP Section***
Suggested Components (From bulletin 118-2003 Appendix C)	
If the GMP area includes areas outside a groundwater basin as defined in Bulletin 118, the district will use the required components, and geologic and hydrologic principles appropriate for the area	Throughout Plan
Voluntary Components (10753.8.)	
Control of saline intrusion	4.1.2.1
Identification and management of wellhead protection areas and recharge areas	4.3.2
Regulation of the migration of contaminated groundwater	4.1.2.1
Administration of a well abandonment and well destruction program	4.3.1
Mitigation of conditions of overdraft	4.4
Replenishment of groundwater extracted by water producers	4.4
Monitoring of groundwater levels and storage	4.1.1
Facilitating conjunctive use operations	4.4
Identification of well construction policies	4.3.1
Construction and operation by the district of GW contamination cleanup, recharge, storage, conservation, water recycling, and extraction projects	4.4
Development of relationships with state and federal regulatory agencies	4.2
Review of land use plans and coordination with land use planning agencies to assess activities that create a reasonable risk of groundwater contamination	4.2
Document public involvement and ability of the public to participate in development of the GMP, this may include a Technical Advisory Committee (TAC)	1.2
Establish an advisory committee of stakeholders within the plan area that will help guide the development and implementation of the plan and provide a forum for the resolution of controversial issues	5.3
Describe the area to be managed under the GMP including	2
The physical structure of the aquifer system	
A summary of available historical data related to groundwater levels, groundwater quality, inelastic land subsidence, and surface water flow or quality that effects groundwater or groundwater pumping that effects surface water flow or quality	
A summary of issues of concern related to groundwater levels, groundwater quality, inelastic land subsidence, and surface water flow or quality that effects groundwater or groundwater pumping that effects surface water flow or quality	
A general discussion of historical and projected water demands and supplies	
Establish management objectives (MOs) for the groundwater basin subject to the GMP	1.4
Describe how meeting each MO will contribute to a more reliable water supply, and describe existing or planned actions to achieve MOs	5.1
Describe the GMP's monitoring program	4.1
Describe efforts to coordinate with land use, zoning, or water management planning agencies or activities	4.2
Create a summary of monitoring locations with frequency of wells monitored	4.1
Provide periodic reports summarizing groundwater conditions and management activities including:	5.1
A summary of monitoring results, with a discussion of historical trends	5.1
A summary of management actions during the period covered by the report	5.1
A discussion of whether actions are achieving progress towards meeting MOs	5.1
A summary of proposed management actions for the future	5.1
A summary of any GMP changes that occurred during the period covered by the report	5.1
A summary of actions taken to coordinate with other water and land agencies and other government agencies	5.1
Provide for the periodic re-evaluation of the entire plan by the managing entity	5.2

1.6 Document Organization

The Lake County GMP is organized into the following sections:

- Section 2 Plan Area Setting - describes the physical setting of Lake County including items such as geologic setting, land use, water sources, and physical hydrogeologic infrastructure;
- Section 3 Basin Management Objectives - discusses the development and implementation of Basin Management Objectives (BMOs);
- Section 4 Plan Components - discusses the individual components of the Lake County GMP as listed in Table 1-2;
- Section 5 Recommendations and Conclusion - summarizes the results of this document and presents recommendations for management of the County's groundwater resources; and
- Section 6 References.
- Appendices

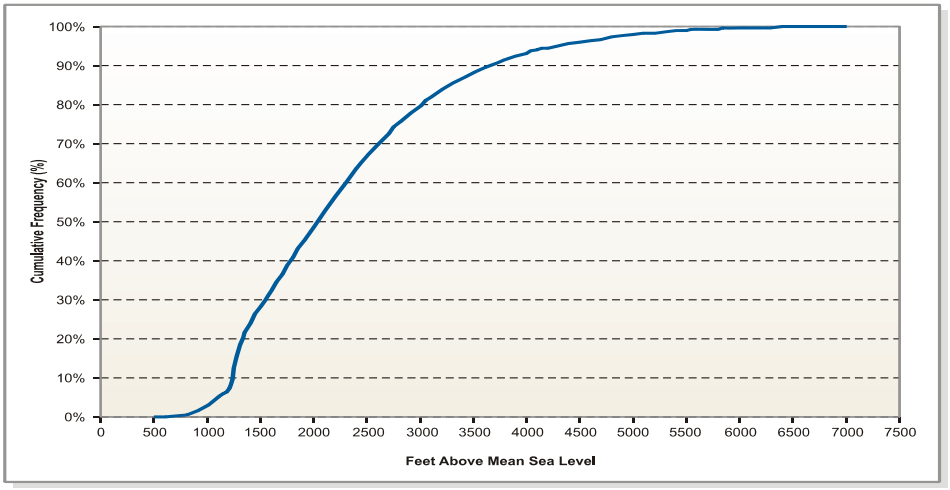
Section 2
Plan Area Setting

Lake County is a topographically diverse area in the Coast Ranges of California. Hills, mountains and valleys are the predominant landforms. The majority of agricultural and urban development uses groundwater. The geologic setting of the county is dominated by basement rock that forms the majority of ridges and mountains. There are 12 groundwater basins and one groundwater source area[1] in Lake County. The amount of information available for each basin varies significantly; however, the basins with the most development are generally better characterized.

2.1 Topography

Lake County encompasses roughly 1,261 square miles (807,000 acres) of varied topography in the Coastal Range (USDA 1989). Clear Lake is the largest water body in the county, and has an approximate elevation of 1,320 feet above mean sea level (msl). The highest point in Lake County is Snow Mountain with an elevation of 7,038 feet, and the lowest elevation is 500 feet above msl in the southeastern portion of the county in the Cache Creek drainage. Figure 2-1 illustrates Lake County topography.

Figure 2-2 identifies the area and elevation characteristics of Lake County. The figure shows the percent of land that is below each elevation. For example, the figure indicates that 50 percent of the county is below 2,000 feet and ninety percent is below 3,500 feet.



Source: Department of Water Resources

Figure 2-2
Cumulative Frequency Elevation

[1] A groundwater "Source Area" is an area that provides significant groundwater resources and is not a valley or basin.

2.2 Land Use and Water Source

Figure 2-3 (at the end of this section) shows the agricultural land use within Lake County.

Land use is generally in valleys and areas that have topography, soils, and water sources conducive to agricultural or municipal development. As shown in Figure 2-3, vineyards (shown as purple) are present in most groundwater basins in Lake County. Vineyards are the primary crop in the Clear Lake Volcanics groundwater source area. Deciduous orchard (shown as pink) land uses occur primarily in Big Valley, Scotts Valley, and Upper Lake groundwater basins. Lakeport is in the Scotts Valley Groundwater Basin, and the City of Clearlake is in the Lower Lake, Burns Valley, and Clear Lake Cache Formation Groundwater Basins.

The majority of agricultural water in Lake County is supplied by groundwater. Figure 2-4 (at the end of this section) shows water sources for agricultural land within Lake County. Figure 2-4 illustrates that groundwater is the primary source of water for agriculture, and that surface water use occurs primarily in the northwestern lake area near Scotts Creek and Middle Creek. Surface water use also occurs in Big Valley near Clear Lake.

2.3 Geology

This section presents an overview of the geologic features of Lake County. One of the primary influences on the county's geology is its location in the Coast Range province of California. Geology in the Coast Ranges consists of a metamorphic rock (basement rock) that forms many ridges and underlies most groundwater basins; volcanic rocks that form volcanoes, hills, geysers, and hot springs; and sedimentary rocks that form groundwater basins in valleys. The current extents of geologic formations are shown in a geologic map of Lake County (Figure 2-5 at the end of this section). Table 2-1 lists major geologic formations.

Table 2-1
Major Geologic Formations in Lake County

Formation Name	Rock Type	General Location	Age
Franciscan Formation	Metamorphic	Throughout Lake County	150-165 million years old
Cache Formation	Sedimentary	East of Clear Lake	1.6-1.8 million years old
Clear Lake Volcanics	Volcanic	South of Clear Lake	2.5 million years old to recently
Serpentinized Ultramafic Rocks	Metamorphic	Multiple small areas in Lake County	unknown
Quaternary Alluvium	Sedimentary	Groundwater basins	recent

The geologic history of the Coast Ranges includes underwater deposition, mountain building episodes, volcanism, and regional faulting. The Franciscan Formation was originally deposited 125 million years ago at the edge of the Pacific Ocean, and the fluctuating sea levels caused alternating deposition of shale and sandstone. After the formation was deposited, it was uplifted and squeezed by movement of tectonic plates, forming the majority of the Coast Ranges as they are today. The Franciscan Formation forms the bedrock in the majority of mountains and under valleys in Lake County

Faulting occurred in Lake County, lowering a prehistoric area in the Coast Ranges that filled with water and began to deposit lacustrine sediments (Sims 1988). Lava from a nearby volcano blocked the drainage of the lake, forming an early incarnation of Clear Lake. Volcanic activity occurred intermittently through the Pleistocene with the extrusion of a number of separate lava flows, beginning the deposition of the Clear Lake Pleistocene Volcanics, including Mount Konocti and the surrounding area. Other depressions and valleys in the Coast Ranges began to be filled with sands, silts and gravels carried by streams, resulting in the deposition of alluvial basins (Brice 1953).

2.4 Groundwater Basins

Lake County has 12 groundwater basins and one groundwater source area , as shown in Figure 2-6 at the end of this section. Groundwater basins are composed primarily of shallow alluvial deposits, and deposits of the Clear Lake Volcanics over the fractured basement rock of the Franciscan Formation. Groundwater levels in the majority of Lake County's groundwater basins are high in the spring and decrease over the summer.

As part of the development of the GMP, an inventory of available information for all of the County groundwater basins was conducted. As noted above, the information available for each groundwater basin varies widely, and some basins have little or no data information to characterize groundwater conditions. In general, significant information is available for sedimentary deposits in major groundwater basins; however, very little information is available for the smaller alluvial basins and the Clear Lake Volcanics groundwater source area. Groundwater quality monitoring is performed by DWR sporadically in Lake County, however not enough monitoring has been performed to indicate groundwater quality trends. Data from the California Department of Health Services regarding Lake County public water suppliers was analyzed for constituents of concern and compared to secondary water quality thresholds (SWQLs). The SWQLs are thresholds at which water may begin to have an effected taste or odor. Some constituents were detected at levels exceeding the (SWQLs) and are listed in the description of each groundwater basin. Table 2-2 lists the groundwater basins and identifies what information is available for each basin.

Table 2-2
Summary of Available Information for Lake County Groundwater Basins

Groundwater Basin	Water Bearing Formations	Groundwater Hydrogeology	Groundwater Levels	Groundwater Quality	Subsidence	Groundwater Wells
Gravelly Valley						X
Upper Lake	X	X	X	X		X
Scotts Valley	X	X	X	X	X	X
Big Valley	X	X	X	X	X	X
High Valley	X	X	X			X
Burns Valley	X		X			X
Coyote Valley	X	X	X	X		X
Collayomi Valley	X	X	X	X		X
Lower Lake	X	X	X			X
Long Valley						X
Clear Lake Cache Formation	X					X
Middle Creek						X
Clear Lake Volcanics	X	X				X

Several terms are typical when discussing groundwater and the productivity of groundwater aquifers. The following sections describe Lake County's individual groundwater basins using these terms, if information was available. These terms include:

- **Specific Capacity -** The specific capacity of a well depends on hydraulic characteristics of the aquifer and on the construction of the well. Specific capacity is determined by dividing the wells production by the drawdown that occurs during pumping. Higher specific capacities in wells tend to be indicative of higher aquifer production.

- **Specific Yield –** The specific yield is the percent of space in the ground that will drain by gravity when the water table drops. Specific yield is reported as a percent. Higher specific yields tend to be indicative of higher aquifer production. An example of a good specific yield is 7 percent, which is a typical average specific yield of aquifers in the Sacramento Valley.

- **Transmissivity –** Transmissivity is a term used to define the ability of an aquifer to convey or transport water, similar to the capacity of a pipeline. Transmissivity is related to hydraulic conductivity and saturated thickness of an aquifer or groundwater basin. Hydraulic conductivity is the rate at which groundwater moves through an aquifer. More porous aquifers, such as sand and gravel aquifers, have high hydraulic conductivities. The saturated thickness is the total depth of groundwater in an aquifer or basin. The term transmissivity combines both these terms so it is a good overall indication of the capacity of a groundwater basin to produce water. Higher transmissivity values tend to be indicative of higher aquifer production. An example of a good transmissivity is 100,000 gallons per day per foot (gpd/ft), which is the average transmissivity of a productive aquifer in the Sacramento Valley.

- **Well Production -** Well production is the amount of water that is produced from a well, typically reported in gallons per minute (gpm).

The following sections also contain information about the wells in each groundwater basin. DWR's Well Completion Report database provided well depth and well use data. This database identifies well categories and well depth. Table 2-3 shows the number of each type of well by groundwater basin and countywide. Lake County has approximately 5,300 wells. The wells are classified by purpose as domestic, irrigation, municipal, monitoring, and other. Approximately 3,400 of the 5,300 wells in the county are in a groundwater basin as defined by DWR. The remaining 1,900 wells are in areas of the county not in a groundwater basin.

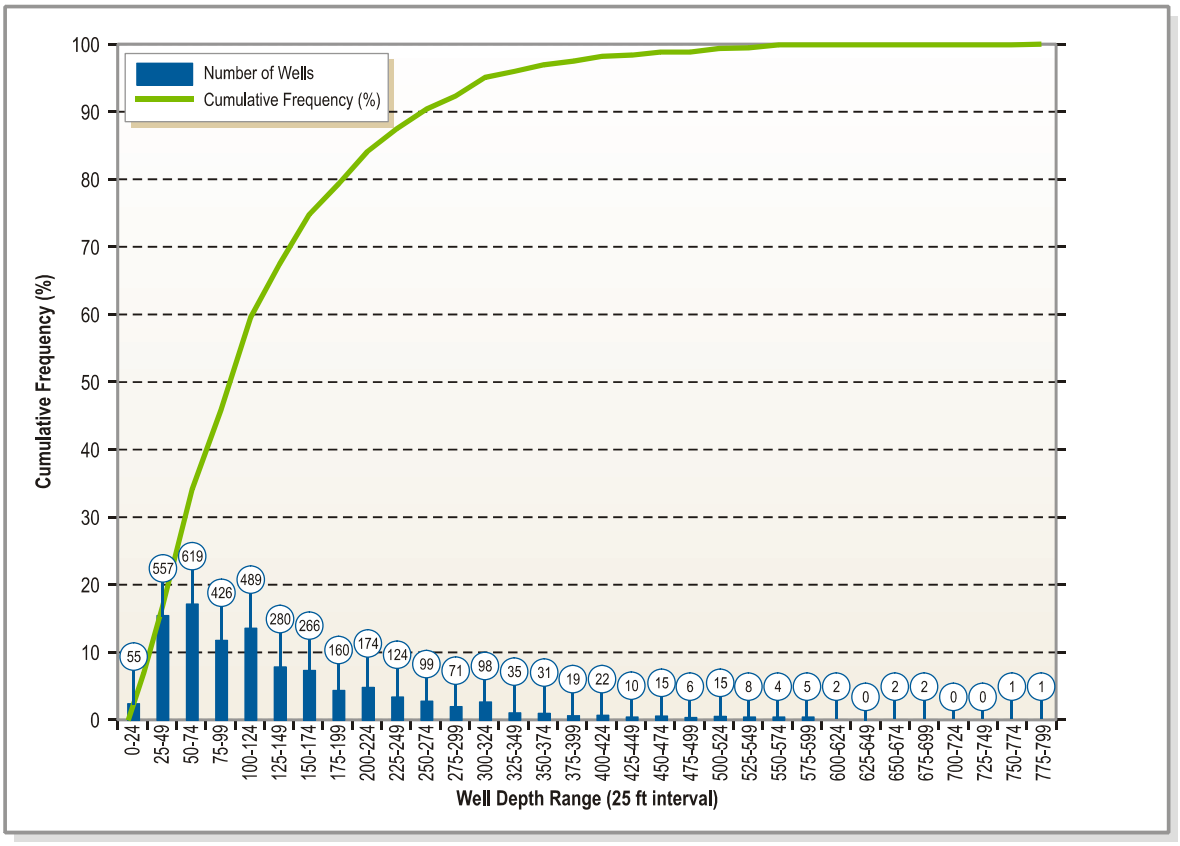
Table 2-3 presents the total number of wells by type within Lake County groundwater basins. Table 2-3 shows that of the 5,333 wells in Lake County, 3,596 wells are domestic, 813 wells are irrigation, 108 wells are municipal wells, 220 wells are monitoring wells, and 596 wells are listed as "other".

Table 2-3
Number of Wells by Use and Groundwater Basin

Groundwater Basin	Domestic Wells	Irrigation Wells	Municipal Wells	Monitoring Wells	Other Wells	Totals
Clear Lake Cache Formation	71	9	0	10	7	97
Scotts Valley	235	87	2	0	31	355
Long Valley	30	7	0	0	4	41
High Valley	19	10	0	0	8	37
Burns Valley	86	13	0	3	9	111
Collayomi Valley	141	34	1	16	22	214
Coyote Valley	86	17	5	6	13	127
Lower Lake	243	25	8	9	13	298
Gravelly Valley	13	0	1	0	3	17
Clear Lake Pleistocene Volcanics	537	59	11	8	52	667
Middle Creek	39	3	0	0	4	46
Upper Lake	243	99	6	22	68	438
Big Valley	463	297	9	29	162	960
Total of All GW Basins	2,219	664	67	101	399	3,450
All Wells not in a GW Basin	1,377	149	41	119	197	1,883
Total for Lake County	**3,596**	**813**	**108**	**220**	**596**	**5,333**

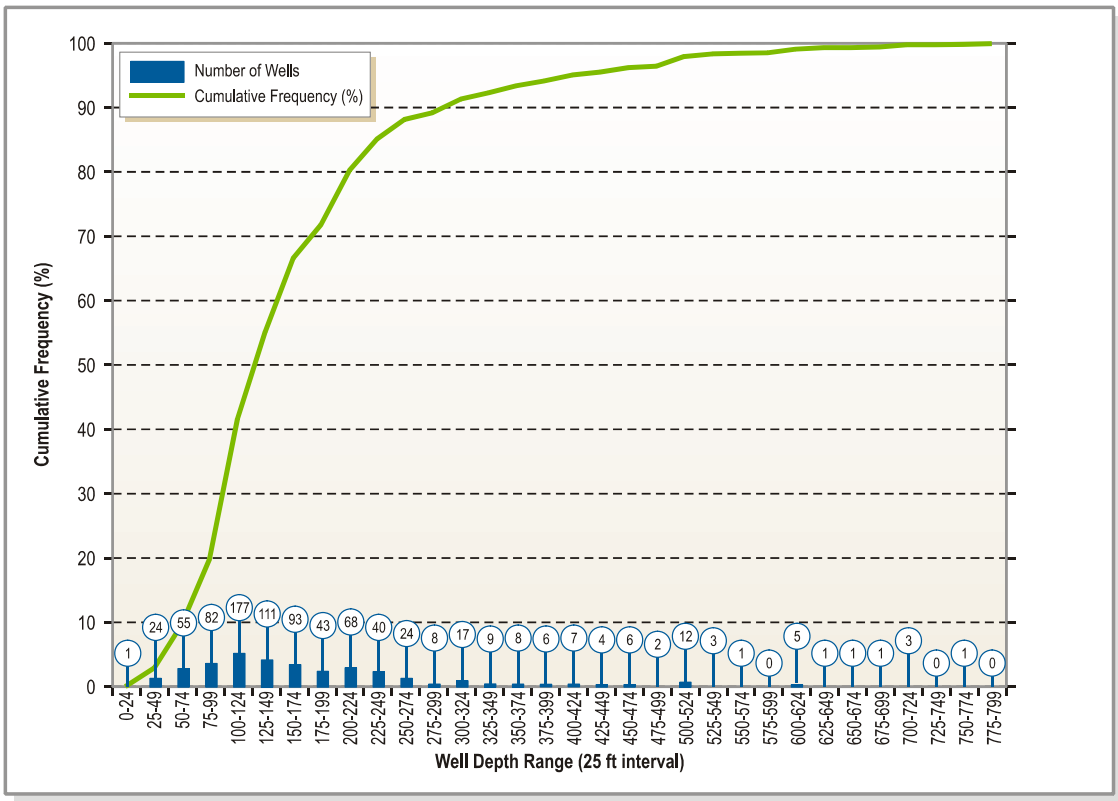
Note: "Municipal Wells" include wells listed as municipal or public. "Other Wells" Include wells listed as abandoned, exploratory other, stock, test, unknown, or unused.
Source: Department of Water Resources Well Completion Report

Each description of a groundwater basin includes cumulative frequency figures that illustrate the well depth range and cumulative frequency depth distribution for domestic and irrigation wells. Figures 2-7 and 2-8 show well depth frequency throughout Lake County. The cumulative frequency, on the left axis of the figure, shows the percent of all wells that are shallower than the line. For example, approximately 50 percent of all domestic wells are shallower than 100 feet deep, and approximately 50 percent of all irrigation wells are shallower than 125 feet deep.



Source: Department of Water Resources

Figure 2-7
Depth Distribution of Domestic Wells in Lake County



Source: Department of Water Resources

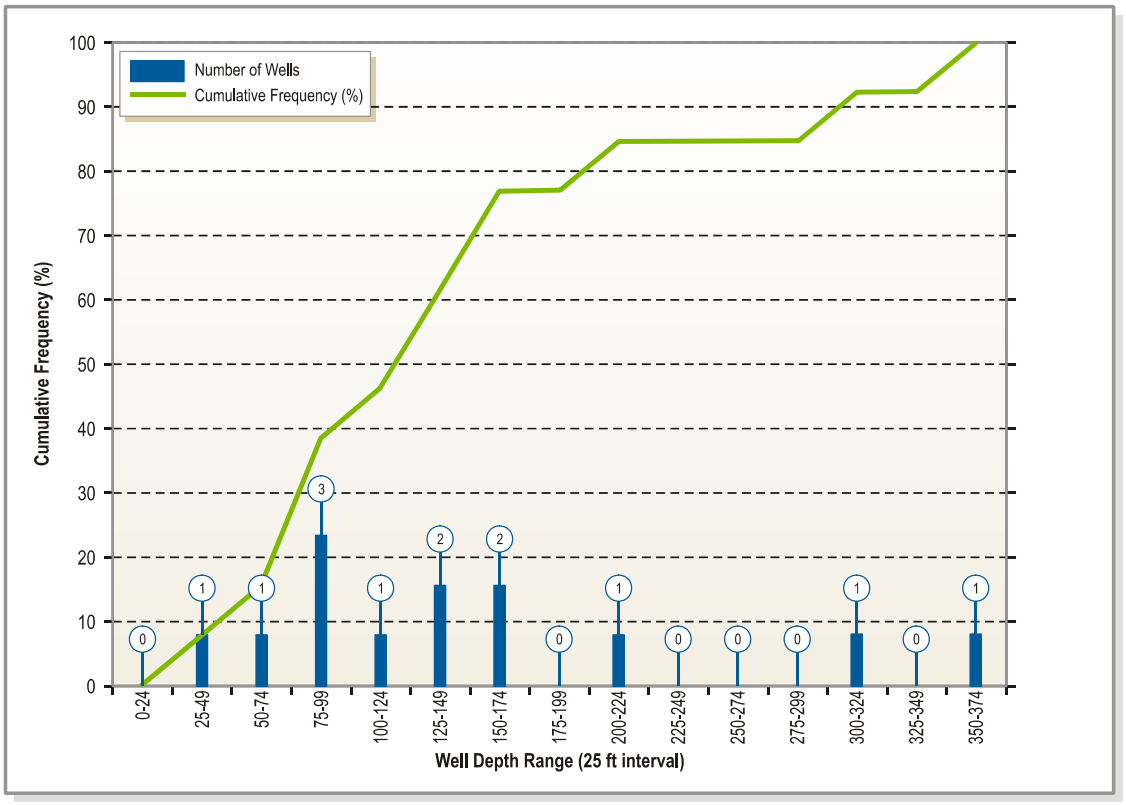
Figure 2-8
Depth Distribution of Irrigation Wells in Lake County

2.4.1 Gravelly Valley Groundwater Basin

The Gravelly Valley Groundwater Basin is in the northern portion of Lake County (Figure 2-6) in the Eel River Inventory Unit. Lake Pillsbury borders the basin to the south, and the Franciscan Formation borders the basin to the west, north, and east.

Groundwater Wells

Groundwater is used for domestic use in the Gravelly Valley Groundwater Basin. Figure 2-9 presents the well depth range and cumulative frequency depth distribution for domestic wells in the Gravelly Valley Groundwater Basin. Approximately 50 percent of all domestic wells (6 wells) are shallower than 125 feet deep. Gravelly Valley has only one irrigation well.



Source: Department of Water Resources

Figure 2-9
Depth Distribution of Domestic Wells in the Gravelly Valley Groundwater Basin

2.4.2 Upper Lake Basin

The Upper Lake Basin is northwest of the northern end of Clear Lake (Figure 2-6). The Upper Lake Basin is composed of three valleys: Middle Creek Valley, Clover Valley, and Bachelor Valley. Middle Creek and Clover Valleys are in the Middle Creek Inventory Unit, and are bordered to the east and north by the Franciscan Formation, and to the west by Lower Cretaceous Marine rocks. Bachelor Valley is in the Scott's Creek Inventory Unit and is bounded primarily by the Franciscan Formation and by Middle Creek Valley to the east.

Water-Bearing Formations

Quaternary Alluvium

Quaternary Alluvium includes channel deposits, fan deposits, and gravel, sand and fine materials (ESA 1978). The channel alluvium occurs along Middle, Alley, and Clover Creeks. The mouths of several ravines and small canyons that enter into the valley contain fan and older alluvial deposits that consist of gravel, sand, and fine materials. These deposits reach a thickness of 40 to 50 feet and decrease downstream to only a few feet (ESA 1978). Quaternary alluvium is generally a good water producing unit.

Pleistocene Terrace Deposits
The Pleistocene terrace deposits, consisting of poorly consolidated clay, silt, and sand with some gravel lenses, border the west and northwest of Middle Creek Valley. Because of the deposits' high clay content, they have a low permeability and are less significant as a groundwater source (ESA 1978).

Pleistocene Lake and Floodplain Deposits
Underlying the valley floors of Middle, Clover, and Alley creeks are fine-grained lacustrine sediments and coarser grained floodplain deposits. These deposits overlie bedrock and older unconsolidated sediments and generally range from 60 to 110 feet in thickness. Sediments in the Middle Creek Valley area form a confining layer for an underlying artesian aquifer system (ESA 1978). The floodplain deposits contain sand and gravel lenses from former stream channels. The fine-grained lake deposits have low permeability with specific yields from about 3 to 5 percent while wells screened in the sand and gravel lenses produce an average of 230 gpm (DWR 1957).

Groundwater Hydrogeology

Groundwater recharges the Upper Lake Basin at the mouths of canyons and around the periphery of the basin. Recharge also occurs along Middle Creek, Clover Creek, and Alley Creek (ESA 1978). Groundwater recharge occurs from the stream channels during the early part of the wet season, and the basin fully recharges and contributes to stream flow during most wet seasons. Lesser amounts of recharge occur to the groundwater basin through percolation of smaller streams and direct rainfall.

Groundwater levels in the Upper Lake Basin are shallow and have remained constant over the last 40 years. Figure 2-10 at the end of this section shows hydrographs in the Upper Lake Basin that indicate groundwater levels and trends. Water levels in the basin are generally within 10 feet of the ground surface in the spring. Groundwater levels have stayed constant spring to spring. The general direction of groundwater flow in Upper Lake Basin is southward toward Clear Lake. In Clover Valley, groundwater moves to the northwest, towards Middle Creek.

Groundwater in the Upper Lake Basin fluctuates between 5 and 15 feet from spring to fall. Total storage in the Upper Lake Basin is approximately 9,000 acre-feet (ESA 1978). DWR estimated total storage to be 10,900 acre-feet and usable storage to be 5,000 acre-feet. Specific yield for the depth interval of 0 to 100 feet is approximately 8 percent (DWR 1957). Average-year agricultural groundwater demand in the Upper Lake basin is approximately 4,075 acre-feet per year.

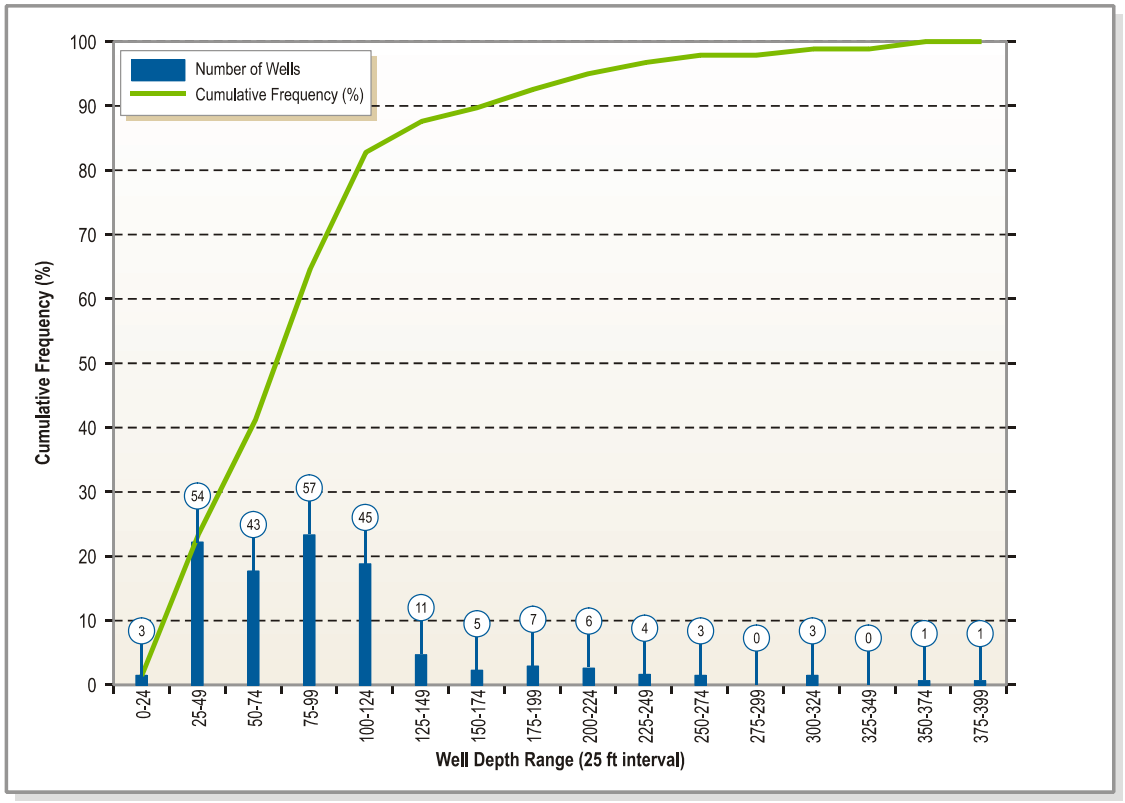
Groundwater Quality/ Inelastic Land Surface Subsidence

DWR monitors a number of wells for water quality in the Upper Lake Groundwater Basin. Monitoring is not extensive enough to determine trends in groundwater quality or the overall character of groundwater in the basin. Information obtained from DHS indicates that iron and manganese have been detected above SWQLs in the

Upper Lake Groundwater Basin. Current information regarding inelastic land surface subsidence is unavailable.

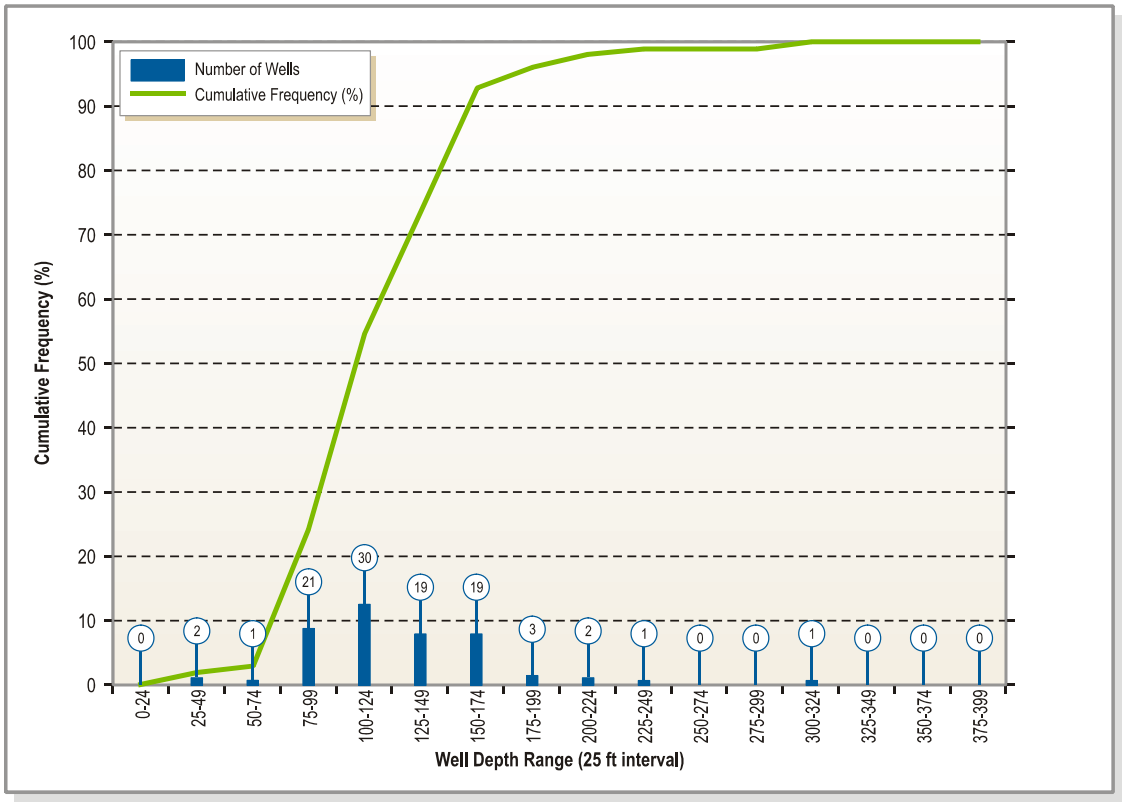
Groundwater Wells

There are 243 domestic wells and 99 irrigation wells in the Upper Lake Basin. Figures 2-11 and 2-12 present the well depth range and cumulative frequency depth distribution for domestic and irrigation wells in Upper Lake Basin. Approximately 50 percent of domestic wells are shallower than 75 feet deep, and approximately 50 percent of irrigation wells are shallower than 125 feet deep.



Source: Department of Water Resources

Figure 2-11
Depth Distribution of Domestic Wells in the Upper Lake Basin



Source: Department of Water Resources

Figure 2-12
Depth Distribution of Irrigation Wells in the Upper Lake Basin

2.4.3 Scotts Valley Basin

The Scotts Valley Basin is the source of water supply for Lakeport and adjacent agricultural areas. It is west of Clear Lake in the Scotts Valley Inventory Unit (Figure 2-6). The basin includes Scotts Valley, the foothills between Scotts Valley and Clear Lake, and the foothills immediately to the south of Lakeport. Clear Lake borders the basin to the east and the Franciscan Formation borders the basin to the north, west and south. Scotts Creek flows through Scotts Valley and drains to the northwest around White Rock Mountain into the Upper Lake Basin.

Over time, Scotts Creek has changed drainage directions and affected the development of the basin. Originally, Scotts Creek drained into Clear Lake during the deposition of the Quaternary Terrace Deposits. Clear Lake drained to the west, towards the Pacific Ocean at that time. Cache Creek then eroded back into the Cache Formation far enough to reach Clear Lake, and the lake started draining into Cache Creek to the east. Scotts Creek began to flow through Clear Lake's old drainage to the west, towards the Pacific Ocean. During this time, Scotts Creek eroded into the Quaternary Terrace Deposits, creating the depression that is now Scotts Valley. Scotts Creek deposited a layer of gravels in the bottom of Scotts Valley. Approximately 10,000 years ago, a large landslide occurred in the Scotts Creek drainage, blocking its drainage to the west and creating a lake in Scotts Valley. The lake deposited the clay

that makes up the floor of Scotts Valley today. Eventually Scotts Creek eroded a new channel, carving its present course to Clear Lake around Rock Mountain into the Upper Lake Basin to Clear Lake. The old drainage of Scotts Creek that was blocked by the landslide has filled up with water to form the Blue Lakes.

Water-Bearing Formations

Quaternary Alluvium

The channel deposits of Scotts Creek and the valley deposits in the southern portion of Scotts Valley are composed of Quaternary Alluvium. Older stream channels deposited by Scotts Creek also underlie Quaternary Lake and Floodplain Deposits in the northern portion of Scotts Valley. In the southern portion of the valley, the alluvium is exposed at the surface. It is 40 to 70 feet thick (Ott Water Engineers 1987) and is the recharge area for the valley. In the northern portion of the valley, where the alluvium is buried by lake deposits, the alluvium is 85-105 feet deep, is 5-10 feet thick, and is a confined groundwater aquifer (Wahler 1970). Wells completed in the confined portion of Quaternary Alluvium produce up to 600 gallons per minute, and specific yield is estimated to vary between 20 and 25 percent (Wahler 1970).

Quaternary Lake and Floodplain Deposits

The northern portion of Scotts Valley is underlain by lake deposits of clay ranging in thickness from 60 to 90 feet (DWR 1957). This clay layer acts as a confining layer for the northern portion of Scotts Valley, where it overlies Quaternary Alluvium. Permeability in lake deposits is low, and specific yield of the clays is about 3 percent (Wahler 1970).

Quaternary Terrace Deposits

Quaternary Terrace deposits lie directly on bedrock and consist of poorly consolidated clay, silt, and sand, with some gravel. Quaternary Terrace deposits form the ridge that separates Scotts Valley from Clear Lake, and are exposed in foothills in the western and southern portions of the Scotts Valley Basin. The Quaternary Terrace Deposits also underlie the alluvium and lake deposits in Scotts Valley. The specific yield of terrace deposits is estimated to be between 5 and 10 percent, and wells in the formations sustain small yields of up to 60 gallons per minute (Wahler 1970).

Groundwater Hydrogeology

The south end of Scotts Valley serves as the principal recharge area for the entire valley (Wahler 1970). Surface water flow in Scotts Creek percolates into the aquifer in the southern portion of Scotts Valley at a rate of approximately 1,000 acre-feet per month (Wahler 1970). When Scotts Creek is not flowing, this recharge does not take place

Hydrographs in Figure 2-16 at the end of this section show groundwater levels in the Scotts Valley Basin are shallow in the spring and experience wide fluctuations over the irrigation season. Water levels in the basin are on average 10 feet below the

ground surface in the spring, and spring groundwater levels have remained generally constant over the last 40 years.

Spring to summer drawdown of the water table varies by position in the Scotts Valley Basin, with Scotts Valley experiencing larger drawdown than the rest of the basin. Spring to summer drawdown in the Scotts Valley ranges from 30 to 60 feet, and drawdown near Burger Lake and south of Lakeport is roughly 10 feet. Anecdotal information from groundwater users in Scotts Valley indicates that the summer drawdown is far enough to de-water some pumps. The general direction of groundwater flow in the Scotts Valley Basin is northward along Scotts Creek in the Scotts Valley portion of the basin, and eastward towards Clear Lake in the eastern and southern portions of the basin (Wahler 1970). Groundwater levels in the basin seem to completely recover each wet season, and overall there does not appear to be any increasing or decreasing trend in long term groundwater levels.

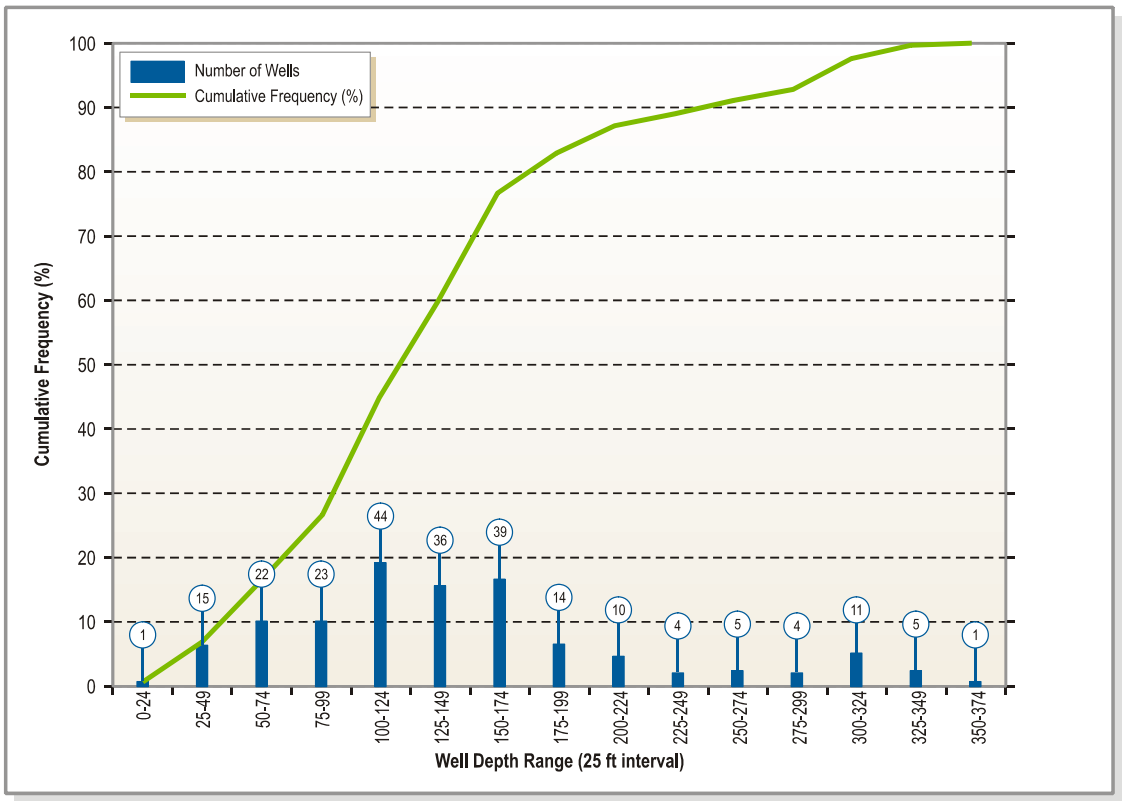
Total groundwater in storage in Scotts Valley is approximately 5,900 acre-feet (Wahler 1970). DWR estimated usable storage to be 4,500 acre-feet (DWR 1957). Specific yield for the depth interval of 0 to 100 feet is approximately 8 percent (DWR 1957). Average-year agricultural groundwater demand in the Scotts Valley Basin is approximately 2,369 acre-feet per year.

Groundwater Quality/Inelastic Land Surface Subsidence

Current published information regarding groundwater quality and inelastic land surface subsidence is unavailable. Information obtained from DHS indicates that iron, aluminum, barium and manganese have been detected above SWQLs in Scotts Valley. Anecdotal evidence in the form of elevated well casings (two to four feet above ground) indicates that the valley may have subsided by as much as four and one half feet. There have been no reports of groundwater quality issues associated with increased drawdown.

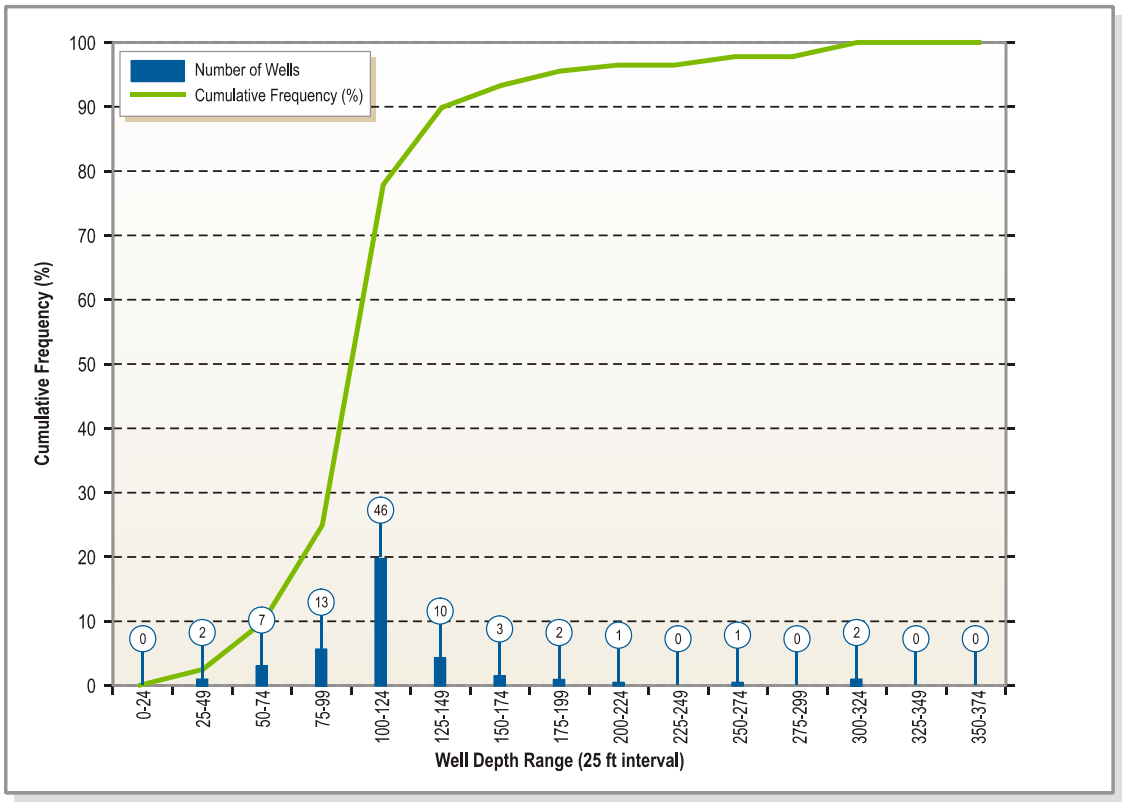
Groundwater Wells

There are 235 domestic wells and 87 irrigation wells in the Scotts Valley Basin. Figures 2-14 and 2-15 present the well depth range and cumulative frequency depth distribution for domestic and irrigation wells in Upper Lake Basin. Approximately 50 percent of domestic wells are shallower than 125 feet deep, and approximately 50 percent of irrigation wells are shallower than 100 feet deep.



Source: Department of Water Resources

Figure 2-14
Depth Distribution of Domestic Wells in the Scotts Valley Basin



Source: Department of Water Resources

Figure 2-15
Depth Distribution of Irrigation Wells in the Scotts Valley Basin

2.4.4 Big Valley Groundwater Basin

The Big Valley Basin is the source of water supply for Kelseyville and is the largest agricultural area in Lake County. It lies south of Clear Lake in the Big Valley Inventory Unit (Figure 2-6). The basin includes the lowlands portion of Big Valley near Clear Lake, and the southern uplands portion near Adobe and Kelsey Creeks. The Big Valley Groundwater Basin is bordered by Clear Lake to the north, the Clear Lake Volcanics to the east and the Franciscan Formation borders the basin to the west and south. Adobe and Kelsey Creeks flow through Big Valley and drain to the north into Clear Lake.

Big Valley is roughly triangular shaped, and is at most six miles wide and approximately eight miles long. The ground surface in the northern portion of the basin gently slopes to the north towards Clear Lake. There are uplands on the west side of the valley, and separate uplands in the south central portion of the valley that have been uplifted approximately 400 feet by faulting (Christensen 2003).

Water-Bearing Formations

Hydrogeology in Big Valley is comprised of two distinct areas: the younger alluvial and basin deposits in the north, and raised uplands comprised of the Kelseyville Formation in the south. The two areas are separated by the Big Valley Fault, which uplifted the Kelseyville Formation and created the uplands in the south.

Christenson Associates, Inc. identified 4 major aquifers in the Big Valley area in the *Big Valley Ground Water Recharge Investigation Update* (2003). The younger alluvial system in the northern portion of the basin contains two main aquifers, designated "A1" and "A2". A clay-rich lake deposits layer designated "C2" separates the aquifers from each other (Christensen 2003). The Kelseyville Formation also includes two aquifers, designated "A3", and "volcanic ash". The "A3" aquifer and "volcanic ash" aquifers are separated by a clay layer designated "C3". Figure 2-16 is a cross section of Big Valley's aquifers and shows the spatial relationships between the aquifers and clay layers.

"A1" Aquifer

Much of the northern portion of Big Valley is directly underlain by alluvial deposits ranging from 10 feet to 126 feet thick (Christensen 2003). The deposits are likely to be stream deposits, consisting of gravel, sand, and silt. The "A1" aquifer is generally unconfined except near and under Clear Lake, where it is confined by an overlying clay layer.

"A2" Aquifer

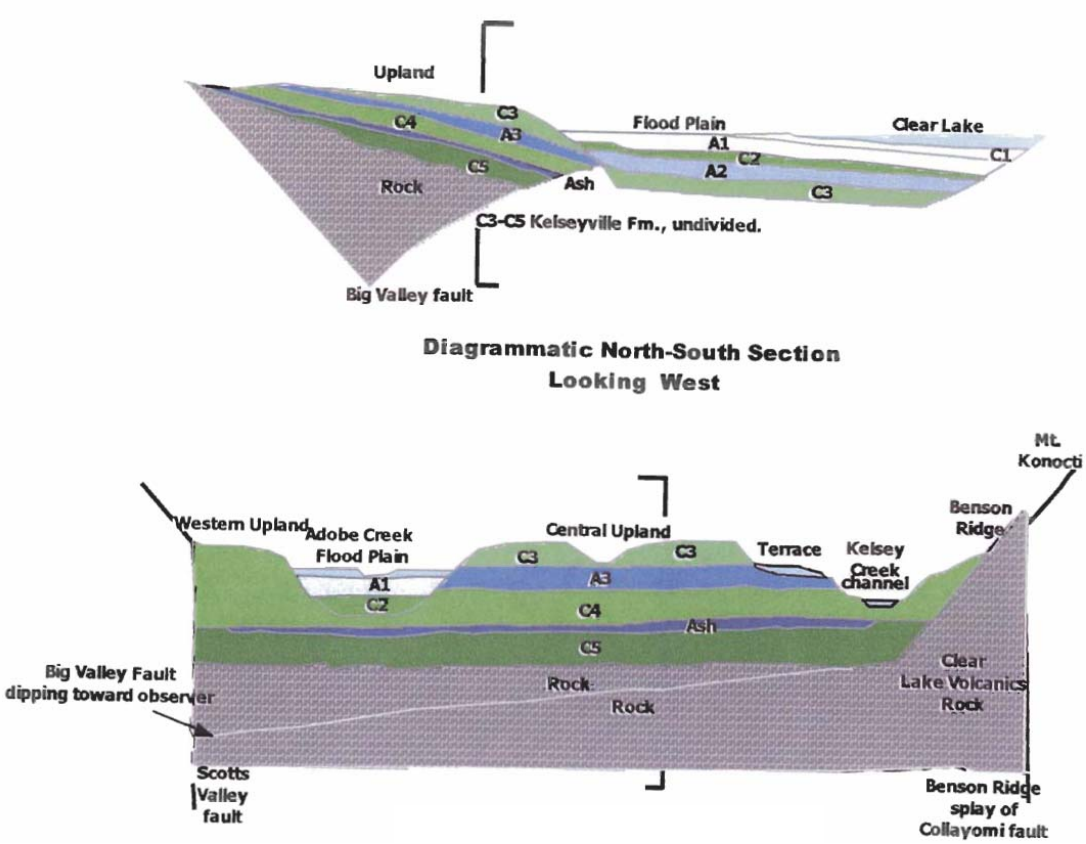
The "A2" aquifer is below the "A1" aquifer and a confining clay layer, designated "C2" (Christensen 2003). The "A2" aquifer ranges from 14 to 140 feet in thickness, and is likely to be composed of stream deposits of gravel, sand, and silt clay. The "A2" aquifer is generally confined or semi-confined.

"A3" Aquifer

Much of the uplands in the southern portion of Big Valley are underlain by the "A3" aquifer, ranging from 5 to 160 feet in thickness. The deposits in the "A3" aquifer are similar to the deposits in the "A1" and "A2" aquifers, likely being comprised of stream deposits, gravel, sand, and silt. The "A3" aquifer is generally unconfined (Christensen 2003)

"Volcanic Ash" Aquifer

The "Volcanic Ash" aquifer is below the "A3" aquifer and a confining clay layer, designated "C3" (Christensen 2003). The "Volcanic ash" aquifer is generally 2 to 5 feet thick, with thicknesses as high as 50 feet reported in two wells. The aquifer consists of volcanic tuff, and water throughout the aquifer is confined (Christensen 2003).



Source: Christensen Associates Inc.

Figure 2-16
Diagrammatic Cross Sections of Big Valley Water-bearing Formations

Groundwater Hydrogeology

The majority of recharge to groundwater in the "A1" and "A2" aquifers is from infiltration of surface flow from Kelsey and Adobe Creeks into the aquifer system. Additional recharge to the "A1" and "A2" aquifers occurs from percolation of rainfall, and underflow from the "A3" aquifer. The "A1" aquifer may also receive recharge from Clear Lake during the summer, when pumping has lowered the groundwater level below the level of Clear Lake (Christensen 2003).

The "A3" aquifer is recharged by percolation of rainfall and by infiltration of water from Kelsey Creek. Recharge of groundwater in the "Volcanic ash" aquifer is poorly understood. It is probably recharged by underflow from uplands, and infiltration of streamflow at surface exposures of the volcanic ash (Christensen 2003).

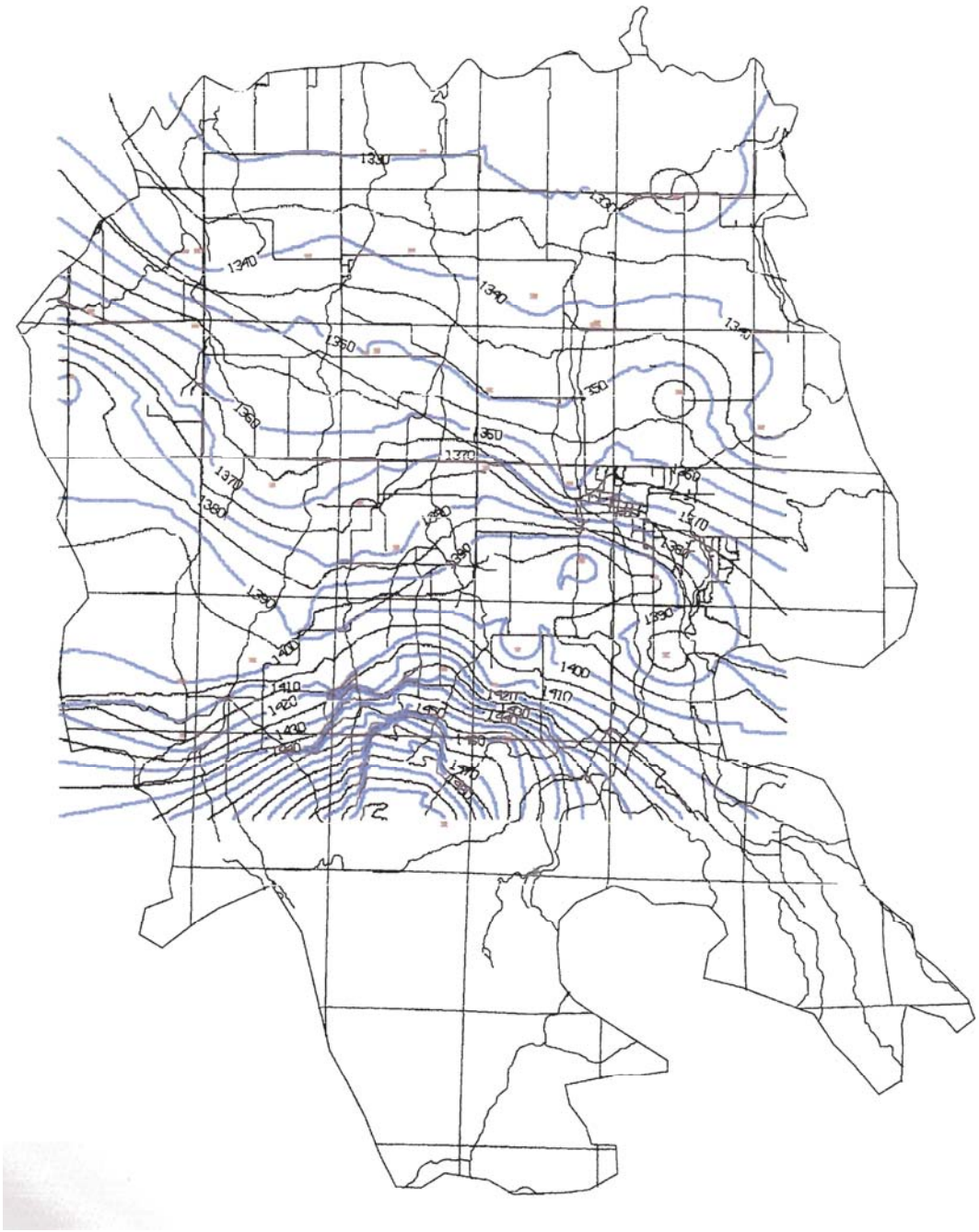
Hydrographs in Figure 2-17 at the end of this section show groundwater levels in the Big Valley Groundwater Basin behave differently in the northern portion than in the southern portion of the basin. Hydrographs in the northern portion, the alluvial system portion of Big Valley, are typically shallow in the spring and experience wide fluctuations over the irrigation season. Water levels in the northern portion are typically five feet below the ground surface in the spring, and decrease from 10 to 50 feet in the summer. Hydrographs in the southern portion, marked in Figure 2-17 by yellow, in the uplands in Big Valley, show that water levels in this area are significantly farther below ground surface than in the northern portion. Spring groundwater levels range from 70 to 90 feet below ground surface, while summer groundwater levels are typically 30 to 40 feet below spring levels. Spring groundwater levels have remained generally constant over the last 40 years except in drought periods. Drought periods can be seen in the hydrographs between 1975 and 1977, and between 1987 and 1992.

Figure 2-18 presents a groundwater contour map of groundwater levels observed in the spring of 2000. The direction of groundwater flow in Big Valley is generally northward towards Clear Lake. The groundwater gradient in the southern portion of the valley is approximately 70 feet per mile. The gradient in the northern portion of the valley is approximately 20 feet per mile.

Figure 2-19 presents a contour map showing the change in groundwater levels between the spring of 2000 and the summer of 2000. Figure 2-19 shows a number of areas in Big Valley where groundwater was significantly lower over the summer. There was a 50-foot decline in water levels around the town of Finley, a 50-foot decline southeast of Kelseyville, and two 20-foot areas of declines near Kelseyville.

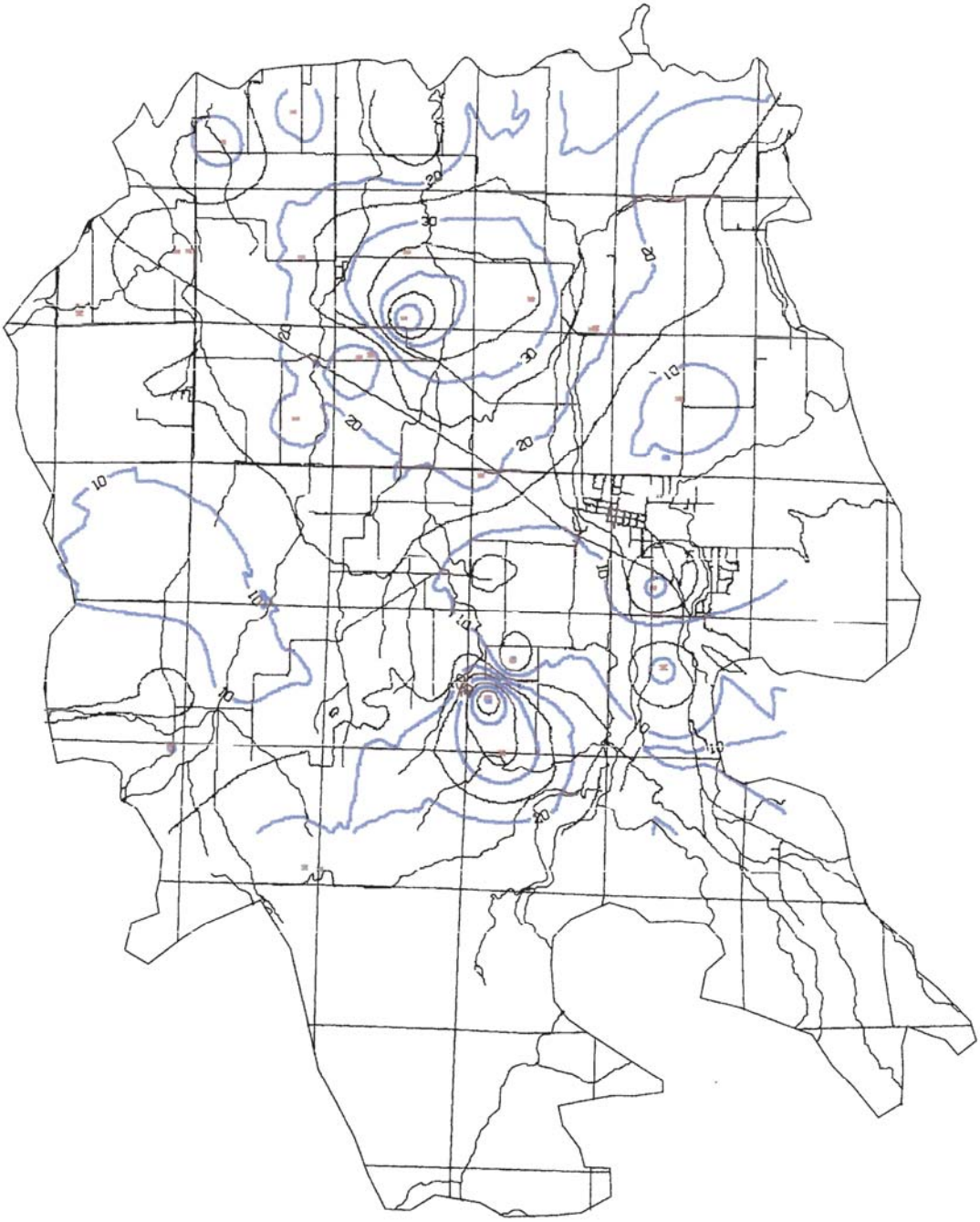
Groundwater in storage in Big Valley has been estimated several times. DWR estimated groundwater in storage to be 105,000 acre-feet for a saturated depth interval of 10 to 100 feet in 1960. In 2004, DWR estimated usable storage to be 60,000 acre-feet. DWR estimated specific yield in 1957 to be 8 percent. Well yields from PG&E reports

in 1957 average 374 gpm for unconfined wells and 495 gpm for 'confined' wells; specific capacities were estimated to be 31 gallons per minute per foot for unconfined wells and 77 for 'confined' wells (DWR 1957). Average-year agricultural groundwater demand in the Big Valley basin is approximately 11,363 acre-feet per year.



Source: Christensen Associates Inc.

Figure 2-18
Spring 2000 Big Valley Groundwater Contour Map



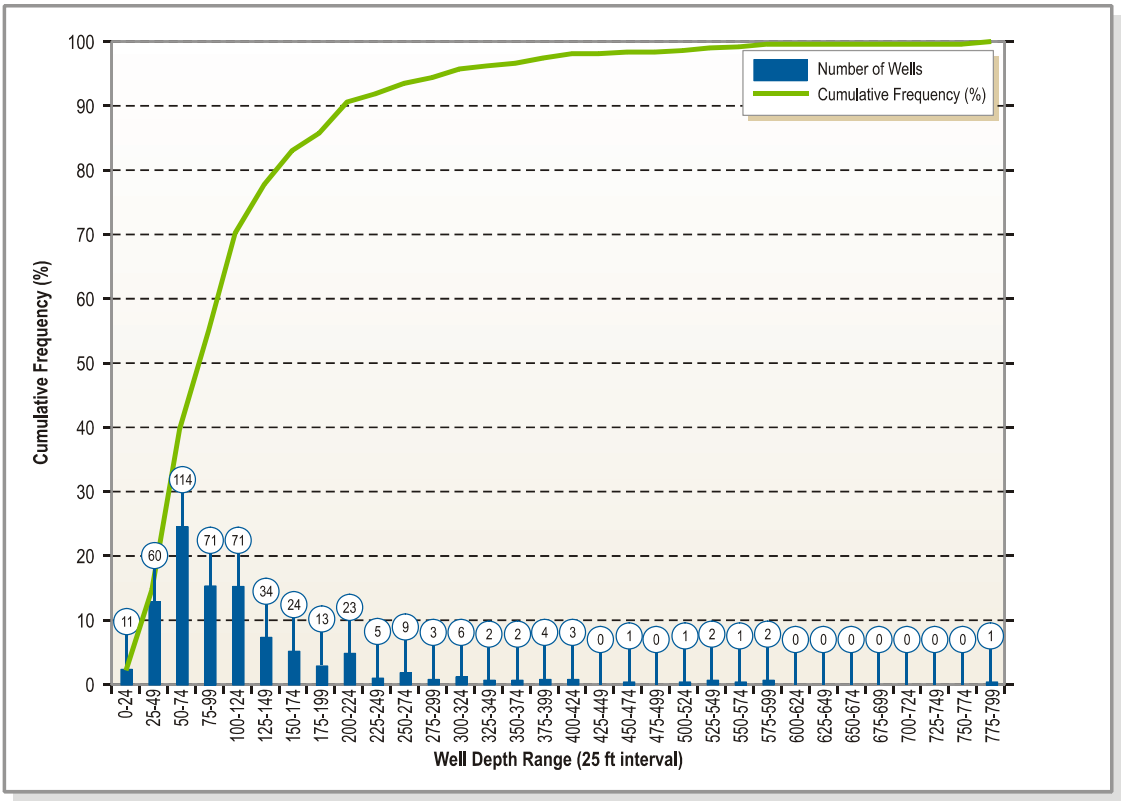
Source: Christensen Associates Inc.

Figure 2-19
Change in Big Valley Groundwater Elevations, Spring to Summer 2000

Groundwater in the Big Valley Groundwater Basin may be overdrafted during periods of drought, when there is inadequate recharge during winter months to replace water extracted during the summer months. Potential impacts of overdraft during these periods might include: water shortages for irrigation, water shortages for municipal use, deterioration of groundwater quality, dry wells, and ground subsidence.

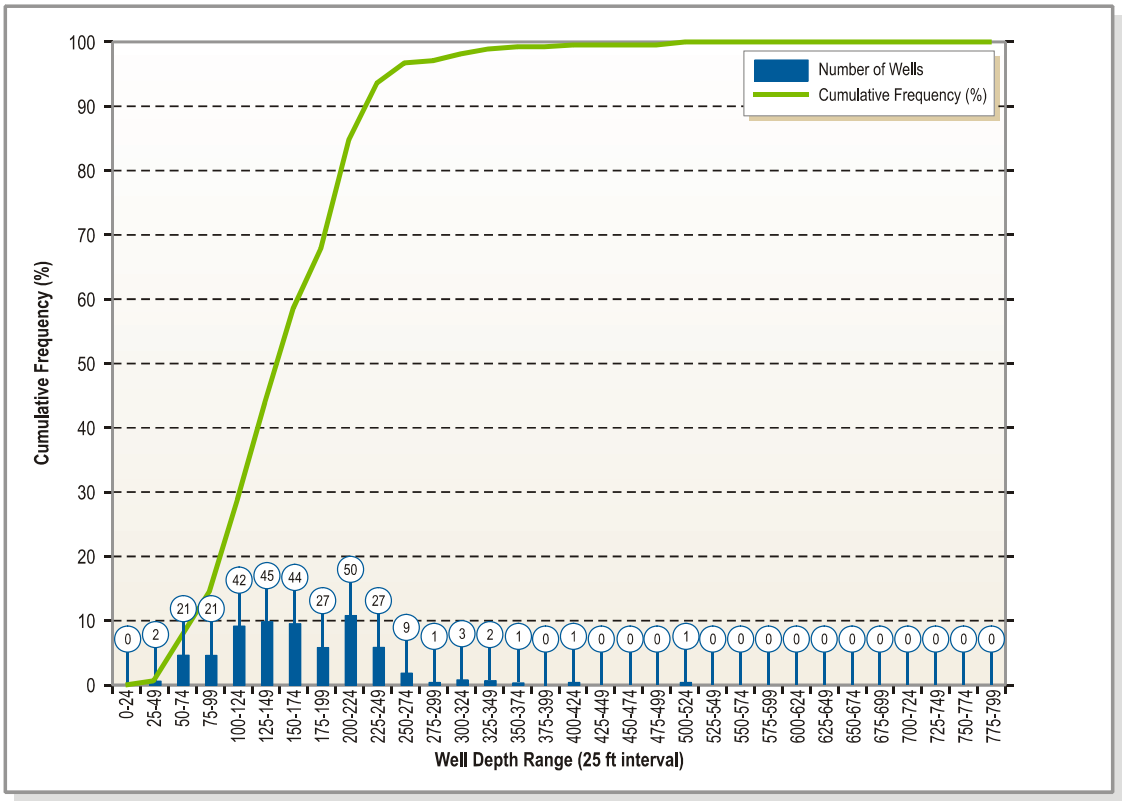
Groundwater Wells

There are 463 domestic wells and 297 irrigation wells in the Big Valley Groundwater Basin. Figures 2-20 and 2-21 present the well depth range and cumulative frequency depth distribution for domestic and irrigation wells in Big Valley Groundwater Basin. Approximately 50 percent of domestic wells are shallower than 75 feet deep, and approximately 50 percent of irrigation wells are shallower than 150 feet deep.



Source: Department of Water Resources

Figure 2-20
Depth Distribution of Domestic Wells in the Big Valley Groundwater Basin



Source: Department of Water Resources

Figure 2-21
Depth Distribution of Irrigation Wells in the Big Valley Groundwater Basin

2.4.5 High Valley Basin

The High Valley Basin includes High Valley, a small valley north of Clearlake Oaks (Figure 2-6) in the Shoreline Inventory Unit. The valley is three miles long and one mile wide. The Franciscan Formation borders High Valley on the north, west, and south, and an area of volcanic rocks near Round Mountain borders High Valley to the east. Drainage occurs through the narrow gorge of Schindler Creek to the southeast.

Water-Bearing Formations

Quaternary Alluvium

Quaternary Alluvium in High Valley consists of up to 100 feet of fine grained lake deposits. The perimeter of the deposit consists of alluvial fan deposits that may contain coarser sediments. Alluvium is generally a good water producing unit.

Holocene Volcanics

Holocene volcanics likely originated from the vicinity of Round Mountain. The volcanics underlie the fine grained alluvium in the valley and form a confined aquifer. The volcanics were initially a productive aquifer; however, well yield has reduced over time. Recharge is likely reduced by the fine grained alluvium preventing infiltration to the volcanics (DWR 2003).

Groundwater Hydrogeology

The alluvial aquifer portion of High Valley is recharged through direct precipitation. Recharge to the deeper volcanic aquifer is likely through the perimeter of the valley through alluvial fans (DWR 2003).

Hydrographs in Figure 2-22 at the end of this section show groundwater levels in High Valley have slow recovery after droughts. Water levels in the basin range from 10 to 30 feet below the ground surface in the spring. Spring groundwater levels have fluctuated considerably over the last 40 years. After the drought of 1976, spring groundwater levels had declined 45 feet, and it took 5 years for water levels to recover to pre-1976 levels. This trend of slow recovery is indicative of low recharge rates to the basin.

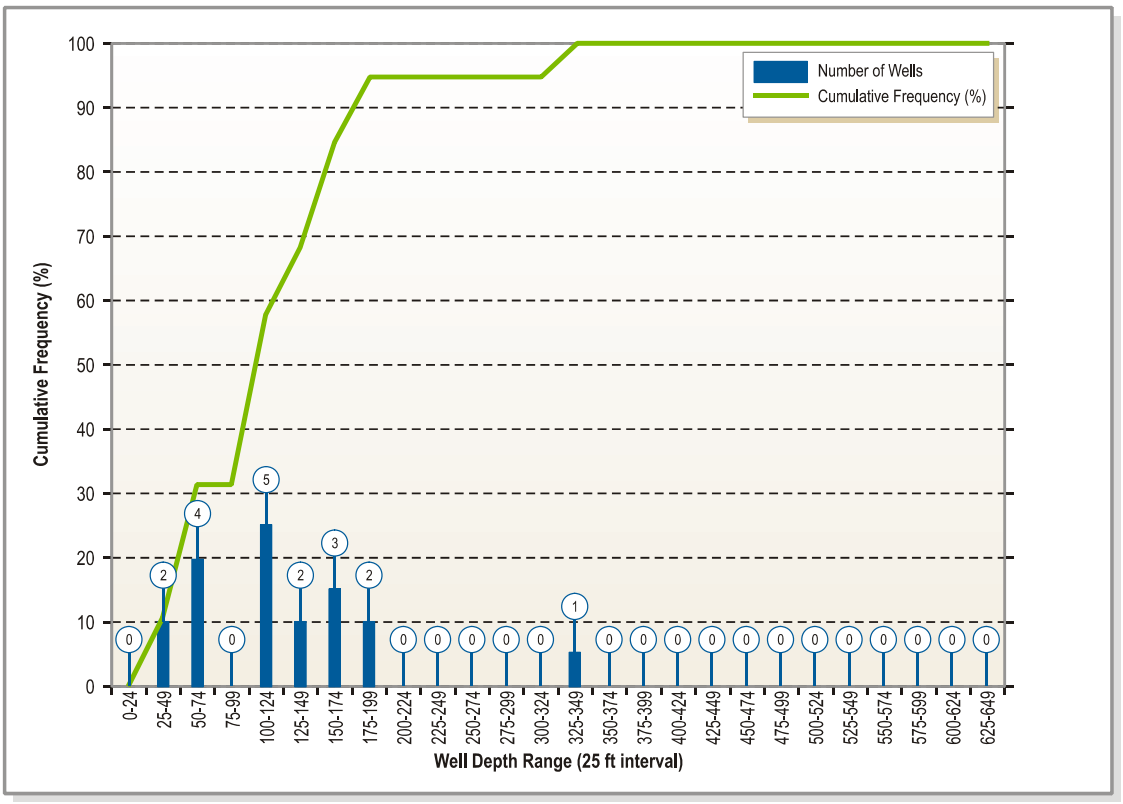
Spring to summer drawdown of the water table is 5 to 10 feet during an average year in High Valley. The general direction of groundwater flow in High Valley is unknown. Usable storage capacity is approximately 900 acre-feet (DWR 1960). Average-year agricultural groundwater demand in the High Valley basin is approximately 36 acre-feet per year.

Groundwater Quality/Inelastic Land Surface Subsidence

DWR monitors a number of wells for water quality in the High Valley Groundwater Basin. Monitoring is not extensive enough to determine trends in groundwater quality or the overall character of groundwater in the basin. Information was not available from DHS for the High Valley Groundwater Basin. Current information regarding inelastic land surface subsidence is unavailable.

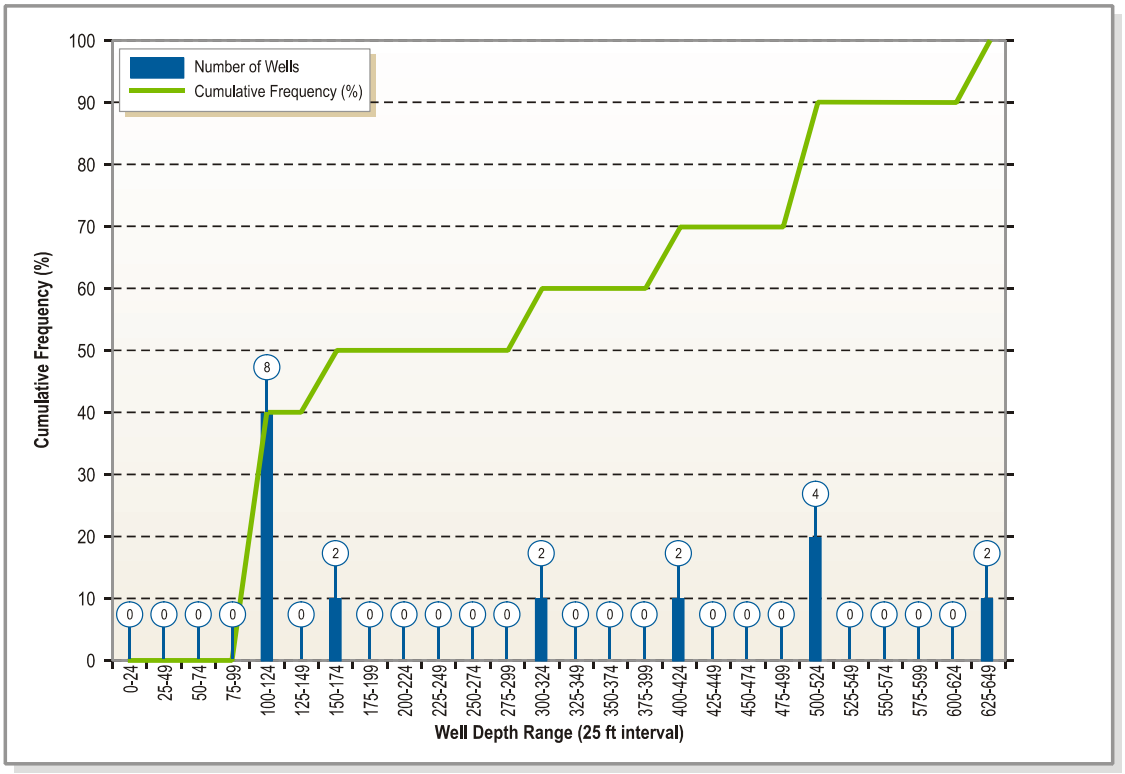
Groundwater Wells

There are 19 domestic wells and 10 irrigation wells in the High Valley Basin. Figures 2-23 and 2-24 present the well depth range and cumulative frequency depth distribution for domestic and irrigation wells in High Valley Basin. Approximately 50 percent of domestic wells are shallower than 125 feet deep, and approximately 50 percent of irrigation wells are shallower than 175 feet deep.



Source: Department of Water Resources

Figure 2-23
Depth Distribution of Domestic Wells in the High Valley Basin



Source: Department of Water Resources

Figure 2-24
Depth Distribution of Irrigation Wells in the High Valley Basin

2.4.6 Burns Valley Basin

Burns Valley Basin is in the Shoreline Inventory Unit (Figure 2-6). The Franciscan Formation borders the Burns Valley Basin on the north, Clear Lake borders the basin on the west, and the Cache Formation borders the basin on the south and east.

Water-Bearing Formations

Quaternary Alluvium

The valley lowlands contain stream channel gravel and adjacent floodplain deposits. These lowland deposits are Quaternary Alluvium and are composed of silt, sand, and gravel. The southern end of the valley has a maximum thickness of approximately 50 feet (DWR 2003). Groundwater in this formation is unconfined and typically provides water for domestic use.

Quaternary Terrace Deposits

Quaternary Terrace Deposits have been deposited on the sides of the alluvial plain in the Burns Valley Basin. The terrace deposits are approximately 15 feet above the valley floor and slope up the valley to a similar elevation as the foothill exposures of the Cache Formation. Groundwater in this formation is not well understood.

Lower Lake Formation

The Lower Lake Formation, consisting of lake deposits, underlies the alluvial and terrace deposits in the Burns Valley Basin. The formation consists of fine sands, silts, and thick interbeds of marl and limestone (Rymer 1981), and has a maximum thickness of 200 feet (DWR 2003). The formation has low permeability and provides water to wells at up to a few hundred gallons per minute (DWR 2003).

Groundwater Hydrogeology

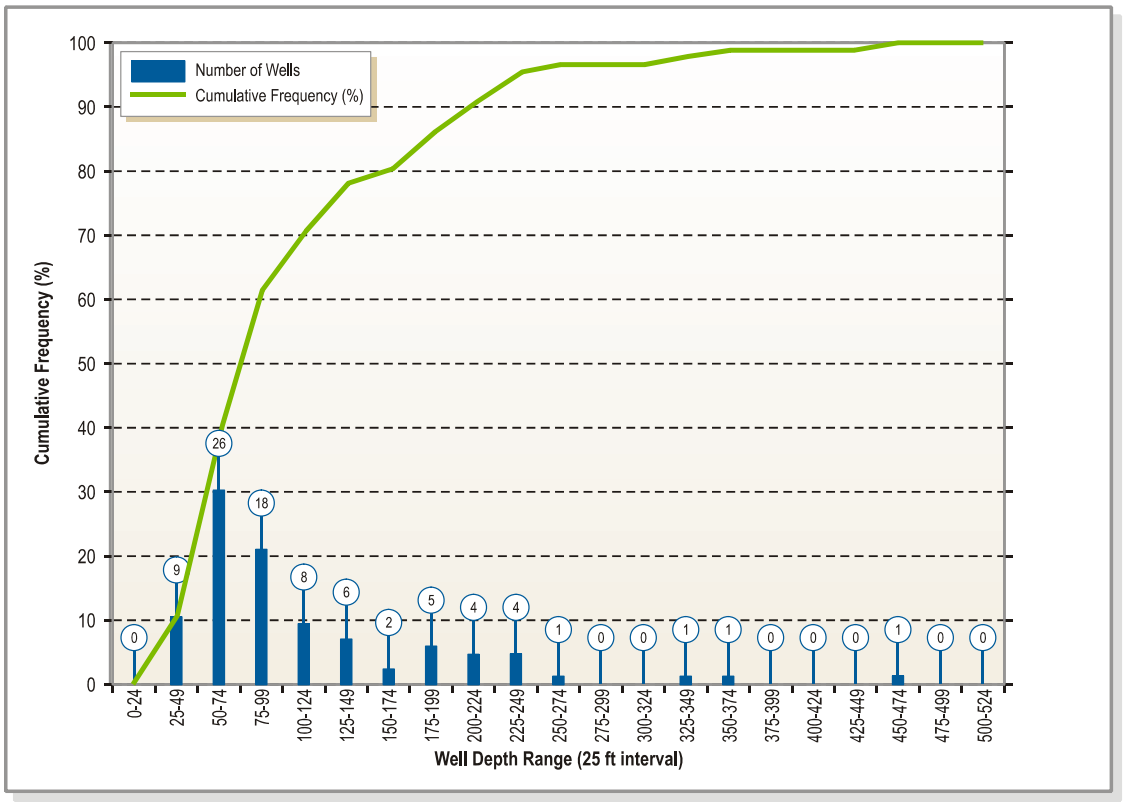
The District monitors one well in the Burns Valley Basin. The monitoring well indicates that groundwater levels fluctuate from 2 feet below ground surface in the spring to 10 feet below ground surface in the fall. The well also indicates that water levels rose in the Burns Valley Basin in 1981-1983. No information on groundwater movement is available. DWR estimates the useable storage capacity to be 1,400 acre-feet (DWR 1960). Average-year agricultural groundwater demand in the Burns Valley basin is approximately 14 acre-feet per year.

Groundwater Quality/Inelastic Land Surface Subsidence

DWR monitors a number of wells for water quality in the Burns Valley Basin. Monitoring is not extensive enough to determine trends in groundwater quality nor the overall character of groundwater in the basin. Information was not available from DHS for the High Valley Groundwater Basin. Current information regarding inelastic land surface subsidence is unavailable.

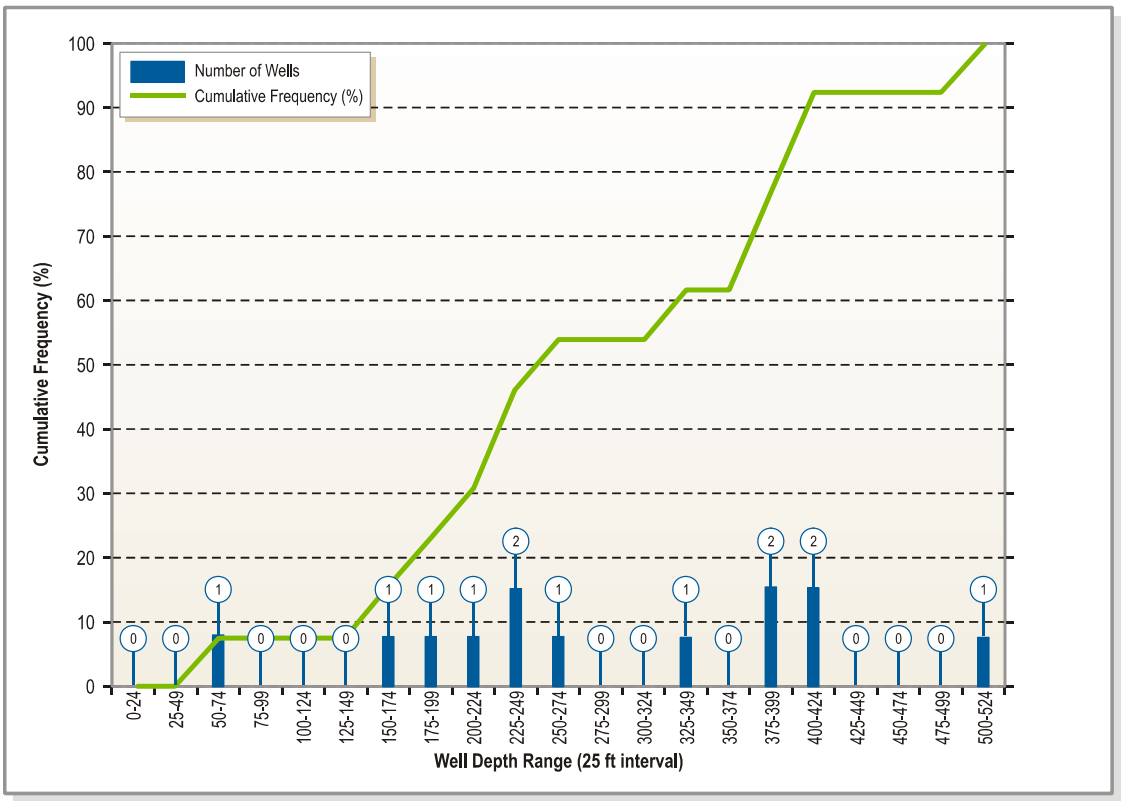
Groundwater Wells

There are 86 domestic wells and 13 irrigation wells in the Burns Valley Basin. Figures 2-25 and 2-26 present the well depth range and cumulative frequency depth distribution for domestic and irrigation wells in Burns Valley Basin. Approximately 50 percent of domestic wells are shallower than 75 feet deep, and approximately 50 percent of irrigation wells are shallower than 250 feet deep.



Source: Department of Water Resources

Figure 2-25
Depth Distribution of Domestic Wells in the Burns Valley Basin



Source: Department of Water Resources

Figure 2-26
Depth Distribution of Irrigation Wells in the Burns Valley Basin

2.4.7 Coyote Valley Basin

Coyote Valley Basin is in the southeastern portion of the county along Putah Creek (Figure 2-6) and is part of the Upper Putah Inventory Unit. Coyote Valley Basin is 5 miles long and 2.5 miles wide. Clear Lake Volcanics border Coyote Valley Basin to the east, Serpentinized ultramafic rocks border the basin to the south and west, and the Franciscan Formation borders the basin to the north. Low hills of basalt are found in the south and southeastern part of the valley.

Water-Bearing Formations

Holocene Alluvium

Holocene alluvium is the primary water-bearing unit in the basin and overlies the Cache Formation. The alluvium consists of floodplain and channel deposits of Putah Creek and alluvial fan deposits in the southwestern portion of the valley and at the valley boundaries. The deposits are primarily composed of poorly stratified sand and gravel, with limited fine grained material. The formation is predominantly interbedded coarse sand and gravel, and ranges from about 100 to 300 feet thick (DWR 1976). Groundwater within the upper 100 feet of the formation is largely unconfined (Peterson 1996). Wells drilled in the alluvium produce on average 1,000 gallons per minute (Aust 2006).

Plio-Pleistocene Volcanics and Cache Formation

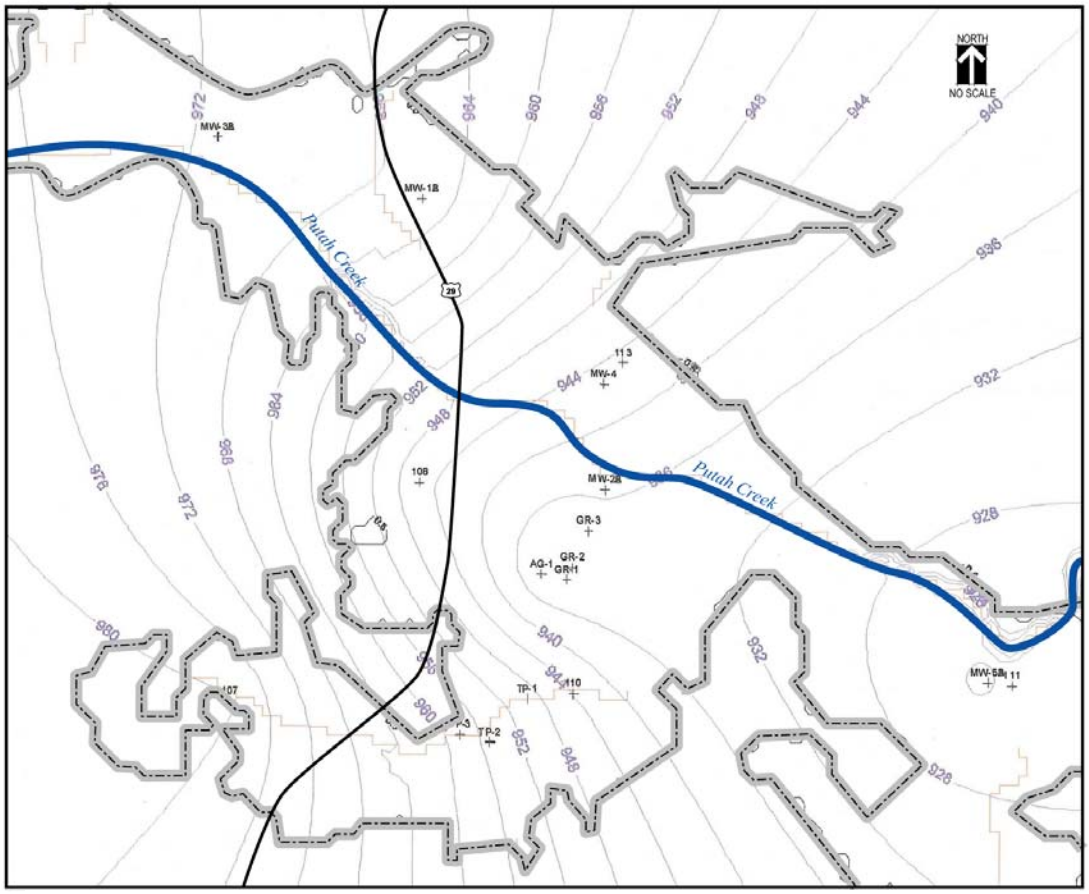
Underlying the valley alluvium is a poorly understood mixture of volcanic rocks and sediments that may be related to the Cache Formation. The southeastern part of the valley contains volcanic rocks and Cache Formation tuffaceous deposits that may be waterbearing. The poorly consolidated tuffaceous deposits are found fairly deep beneath the hills to the northeast where they are overlain and potentially interbedded with basaltic flows. The northeast edge of the valley contains Cache Formation outcrops that likely underlie much of the alluvium. The Cache Formation is made of gravel, silt, sand and the upper layers contain water-laid tuffs and tuffaceous sands become dominant (DOM 1953). The Cache Formation has low permeability because most of the strata are too high in clay or silt to allow for great water movement.

Groundwater Hydrogeology

Putah Creek is the main groundwater recharge source for Coyote Valley Basin. Some recharge occurs from precipitation on the alluvial plain and from side-stream runoff.

Hydrographs in Figure 2-27 at the end of this section show groundwater levels in the Coyote Valley Basin are shallow in the spring, decrease over the summer, and recover during the winter. Water levels in the basin are between 10 to 15 feet below ground surface on average in the spring. Spring groundwater levels have been generally stable throughout the valley.

Spring to summer drawdown of the water table varies by position in the Coyote Valley Basin, with areas in the west experiencing larger drawdown than the rest of the basin. Spring to summer drawdown in the western areas ranges from 20 to 25 feet, and drawdown on the eastern side of the valley ranges from 5 to 10 feet. The general direction of groundwater flow in the Coyote Valley is to the southeast, in the direction of Putah Creek flow (Figure 2-28). DWR estimated 29,000 acre feet of storage capacity and 7,000 acre feet of useable storage capacity in 1960. Average-year agricultural groundwater demand in the Coyote Valley basin is approximately 671 acre-feet per year.



Source: Hidden Valley Lake Community Services District

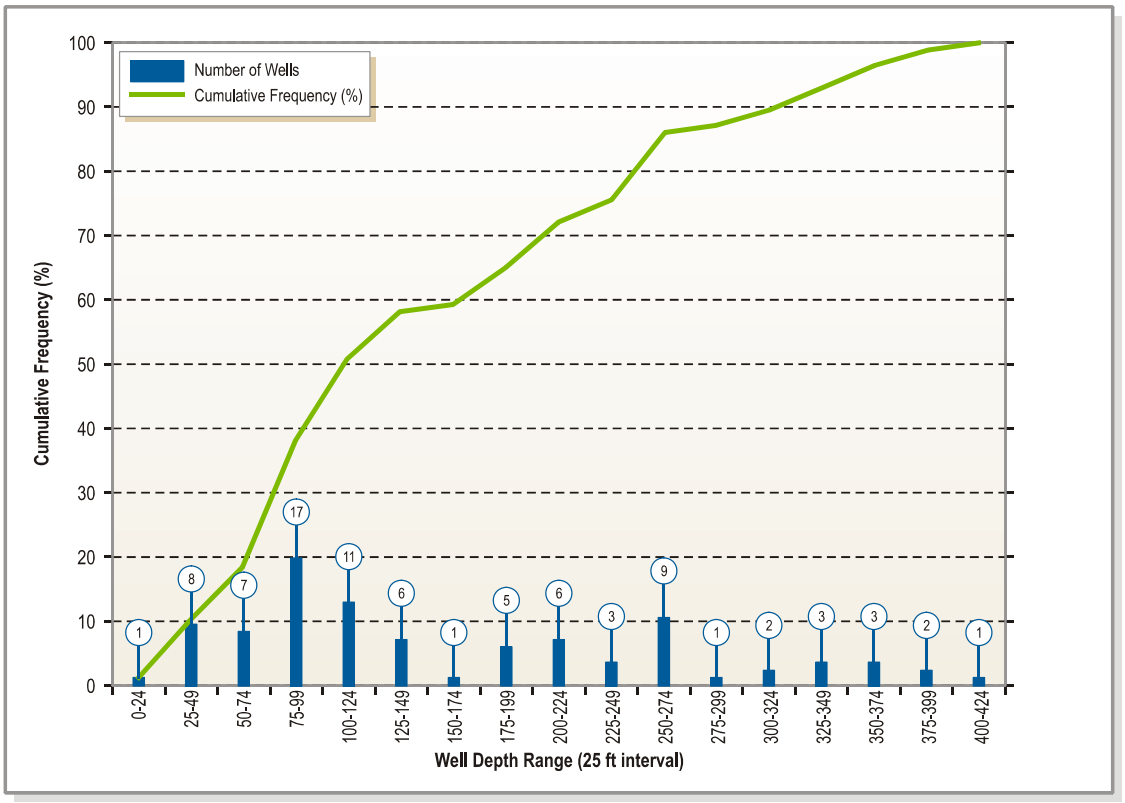
Figure 2-28
Coyote Valley Groundwater Level Contours, April 2001

Groundwater Quality/Inelastic Land Surface Subsidence

DWR monitors a number of wells for water quality in the Coyote Valley Groundwater Basin. Monitoring is not extensive enough to determine trends in groundwater quality or the overall character of groundwater in the basin. Information obtained from DHS indicates that iron and manganese have been detected above SWQLs in the Coyote Valley, and chromium was identified as a constituent of concern by Coyote Valley Stakeholders. Current information regarding inelastic land surface subsidence is unavailable.

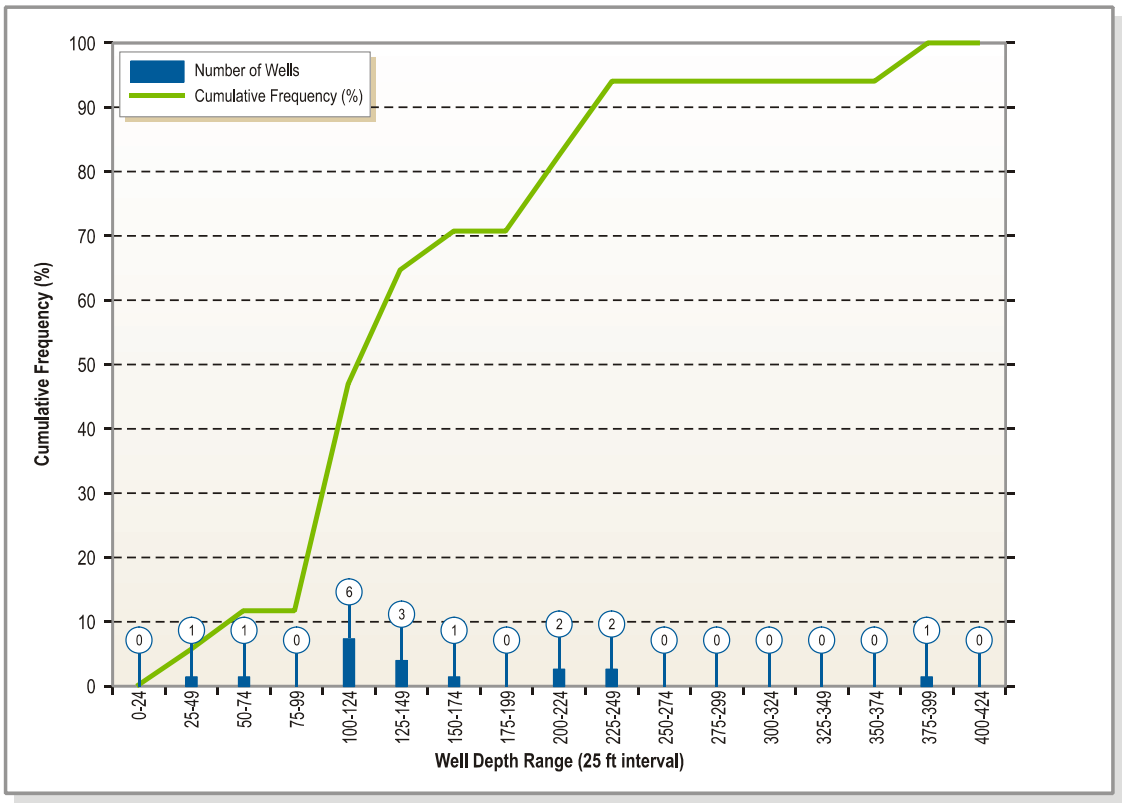
Groundwater Wells

There are 86 domestic wells and 17 irrigation wells in the Coyote Valley Basin. Figures 2-29 and 2-30 present the well depth range and cumulative frequency depth distribution for domestic and irrigation wells in Coyote Valley Basin. Approximately 50 percent of domestic wells are shallower than 125 feet deep, and approximately 50 percent of irrigation wells are shallower than 125 feet deep.



Source: Department of Water Resources

Figure 2-29
Depth Distribution of Domestic Wells in the Coyote Valley Basin



Source: Department of Water Resources

Figure 2-30
Depth Distribution of Irrigation Wells in the Coyote Valley Basin

2.4.8 Collayomi Valley Basin

The Collayomi Valley Basin is in the southern portion of Lake County (Figure 2-6) and is the source of water supply for Middletown and adjacent agricultural areas. The basin includes Collayomi and Long Valley, both in the Upper Putah Inventory Unit. The two valleys are considered a single groundwater basin due to their hydrologic continuity. The Franciscan Formation borders the basin to the west, and a mixture of Serpentinized Ultramafic Rocks and Franciscan Formation borders the basin to the north, east, and south. A small area of volcanic rocks borders the central southern portion of the valley. The boundary is typically the edge of the valley floor except where water bearing basalt and landslide debris extend beyond the valley floor.

Water-Bearing Formations

Quaternary Alluvium

Quaternary alluvium in the Collayomi Valley Basin consists of deposits of clay and silt, with localized areas of channelized gravel. Near Putah Creek, shallow deposits of fine sand and cobbles are present. The maximum thickness of alluvium in the basin is approximately 350 feet in Collayomi Valley, and 475 feet in Long Valley (DWR 1976). Alluvium generally is a productive water bearing unit.

Groundwater Hydrogeology

Recharge occurs in the Collayomi basin next to Putah, Dry, and St. Helena Creeks. Some recharge also occurs from infiltration of irrigation water and direct rainfall. Recharge in Long Valley may be impeded by hardpan conditions near the ground surface (DWR 1976).

Hydrographs in Figure 2-31 at the end of this section show groundwater levels in the Collayomi Valley Basin are shallow in the spring and experience fluctuations over the irrigation season. Water levels in the basin range from 3 to 15 feet below the ground surface in the spring, and spring groundwater levels have remained generally constant over the last 40 years.

Spring to summer drawdown of groundwater is generally between 5 and 20 feet throughout the Collayomi Valley Basin. The direction of groundwater flow in the Collayomi Valley is to the north where it discharges to Putah Creek. Groundwater flow in Long Valley is from the southeast to the northwest where it also discharges to Putah Creek. Groundwater in both valleys generally flows the same direction as surface flow (CMA 1987). Groundwater levels in the basin seem to completely recover each wet season, and overall there does not appear to be any increasing or decreasing trend in groundwater levels.

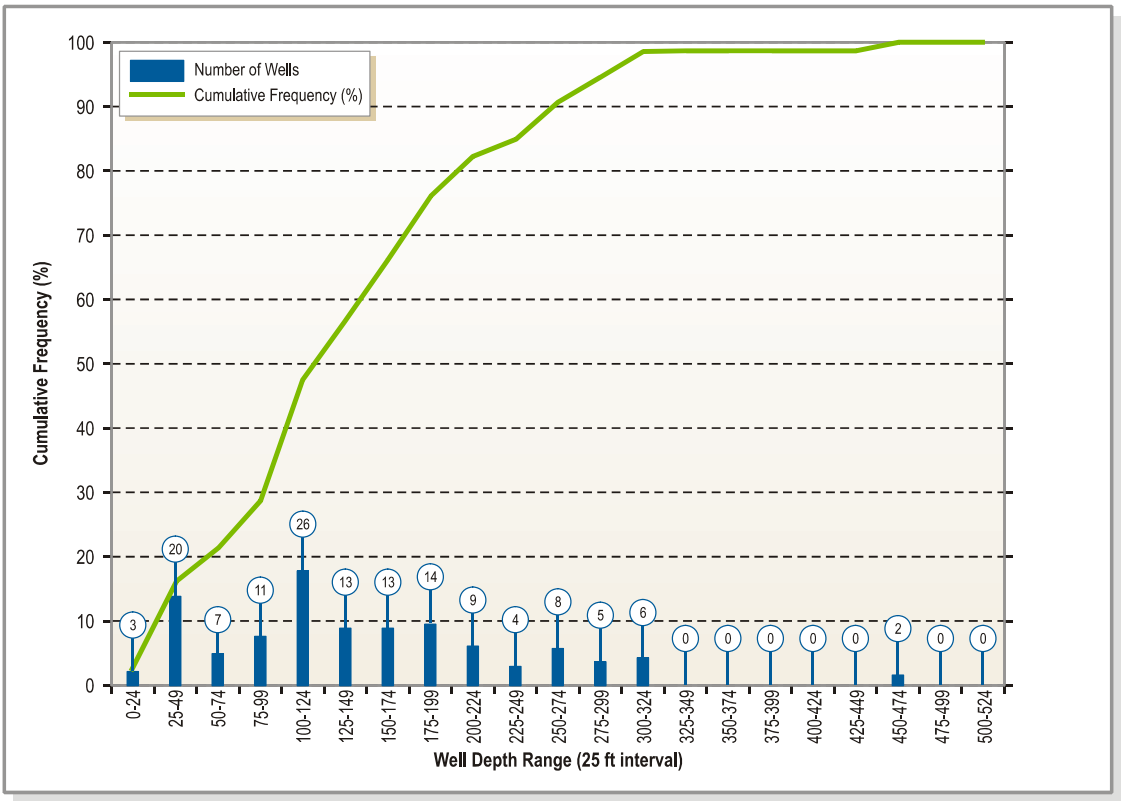
Total storage in the basin is approximately 37,000 acre-feet (CMA 1987). DWR estimates groundwater storage in the Collayomi Basin to be 29,000 acre-feet with a useable storage capacity of 7,000 acre-feet (DWR 1960).Average-year agricultural groundwater demand in the Collayomi Valley basin is 266 acre-feet per year.

Groundwater Quality/Inelastic Land Surface Subsidence

DWR monitors a number of wells for water quality in the Collayomi Valley Groundwater Basin. Monitoring is not extensive enough to determine trends in groundwater quality or the overall character of groundwater in the basin. Information obtained from DHS indicates that iron and manganese have been detected above SWQLs in Collayomi Valley and sulfide was identified as a constituent of concern by Collayomi Valley Stakeholders. Current information regarding inelastic land surface subsidence is unavailable.

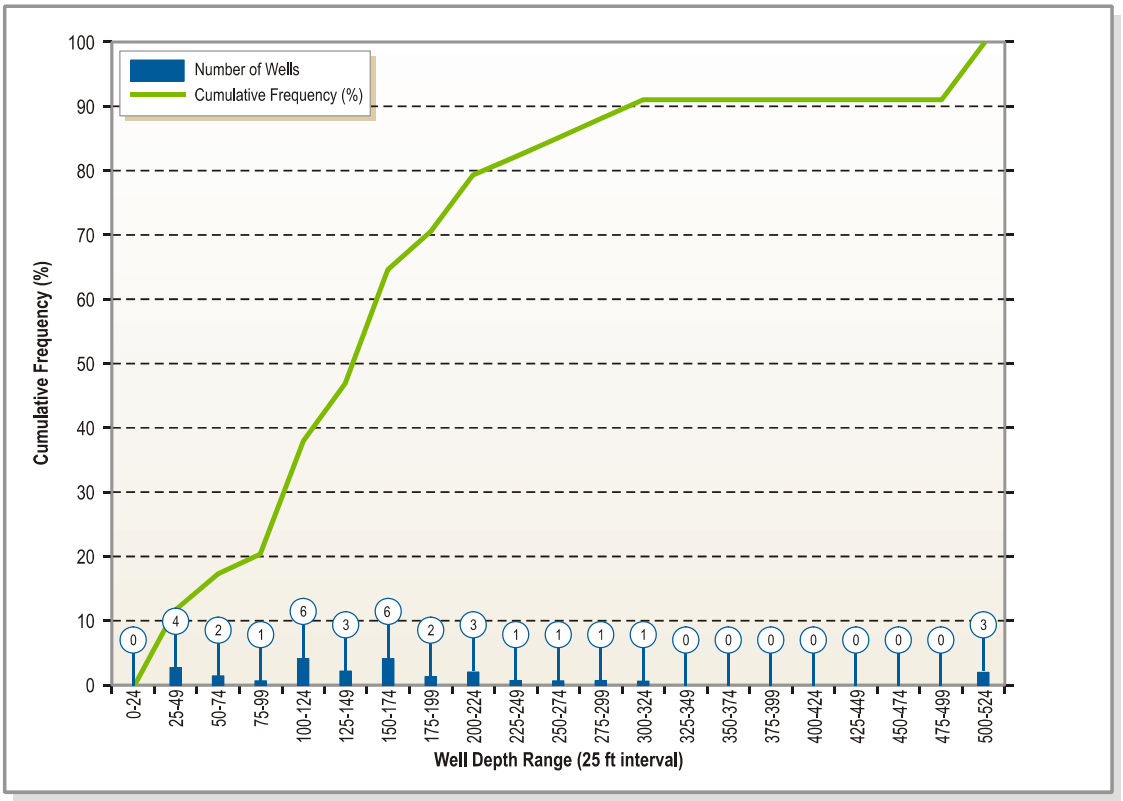
Groundwater Wells

There are 141 domestic wells and 34 irrigation wells in the Collayomi Valley Basin. Figures 2-32 and 2-33 present the well depth range and cumulative frequency depth distribution for domestic and irrigation wells in Collayomi Valley Basin. Approximately 50 percent of domestic wells are shallower than 125 feet deep, and approximately 50 percent of irrigation wells are shallower than 150 feet deep.



Source: Department of Water Resources

Figure 2-32
Depth Distribution of Domestic Wells in the Collayomi Valley Basin



Source: Department of Water Resources

Figure 2-33
Depth Distribution of Irrigation Wells in the Collayomi Valley Basin

2.4.9 Lower Lake Basin

The Lower Lake Basin is southeast of Clear Lake (Figure 2-6) in the Shoreline and Lower Lake Inventory Units. The rocks of the Great Valley sequence border the Lower Lake Basin on the south (Rymer 1981), and the Cache Formation and volcanic rock border the basin to the north. The Lower Lake Formation and volcanic rocks occur within this basin. Average-year agricultural groundwater demand in the Lower Lake basin is approximately 17 acre-feet per year.

Water-Bearing Formations

Quaternary Alluvium

Alluvial deposits consist of clay, silt, sand and gravel and are approximately 50 to 75 feet thick. Irrigation wells constructed near the alluvial deposits provide about 400 to 600 gpm (Upson 1955). The alluvial plain of Herndon Creek likely contains gravelly clay, and is interbedded with gravel layers. Wells in the area with depths of approximately 75 feet yield up to 250 gpm with 40 feet of drawdown (Upson 1955).

Lower Lake Formation

The Lower Lake Formation includes conglomerate, sandstone, siltstone, limestone, tuff, and diatomite (Rymer 1981). Younger alluvial deposits are found above the Lower Lake Formation and cover an area almost two-thirds of the basin. Permeability is variable but generally low because the strata are high in clay or silt. The formation thickness is unknown. Well yields are about 150 to 240 gpm (Upson 1955).

Groundwater Hydrogeology

Precipitation and seepage from Herndon Creek and Clear Lake are the main sources of recharge for the basin (Upson 1955). Recharge is also likely from Copsey and Seigler Canyon creeks. Infiltration of rain falling on the outcrop areas is the likely source of groundwater recharge in the Cache Formation (Upson 1955).

DWR monitored three groundwater wells in the Lower Lake Basin, but discontinued monitoring by 1995. Monitoring prior to 1995 indicates that groundwater levels fluctuated from an average of 10 feet below ground surface in the spring to an average of 20 feet below ground surface in the fall. There is no information on groundwater movement.

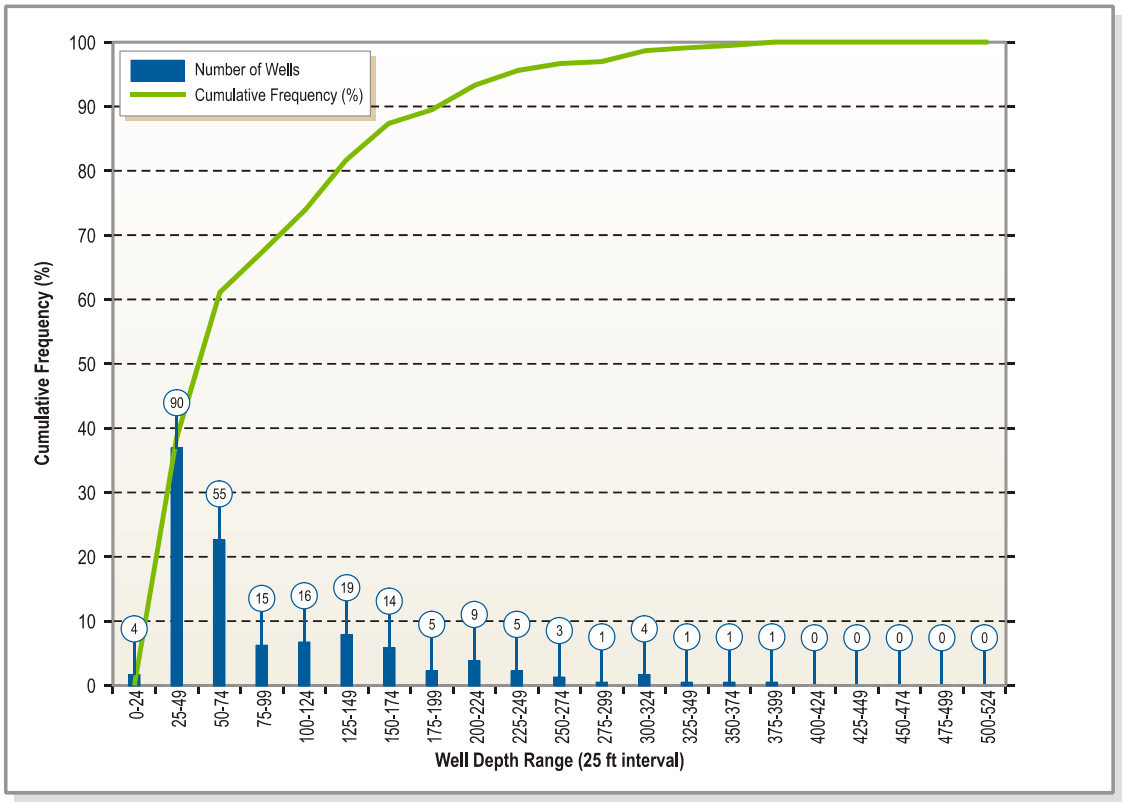
The basin's storage capacity is approximately 3,000 to 4,000 acre-feet (Upson 1955). Additional storage capacity is available as part of the Lower Lake Formation but thickness and yield are unknown.

Groundwater Quality/Inelastic Land Surface Subsidence

DWR monitors a number of wells for water quality in the Lower Lake Groundwater Basin. Monitoring is not extensive enough to determine trends in groundwater quality or the overall character of groundwater in the basin. Information was not available from DHS for the Lower Lake Basin. Current information regarding inelastic land surface subsidence is unavailable.

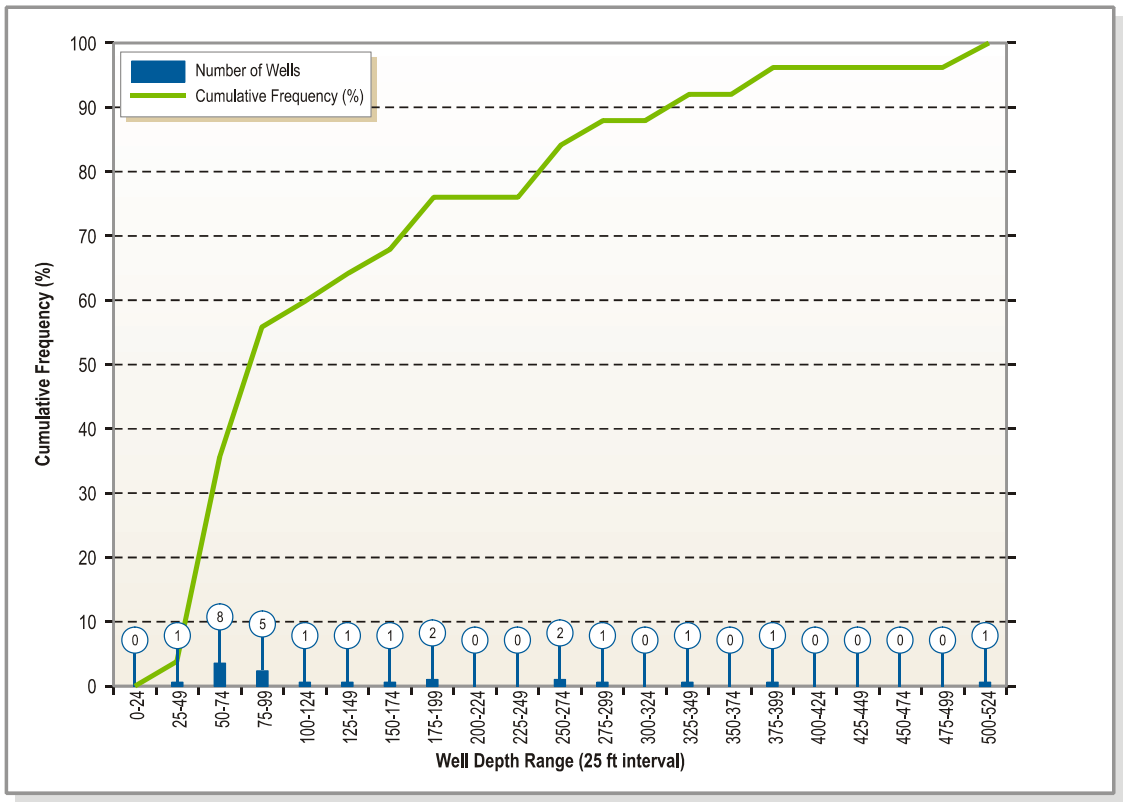
Groundwater Wells

There are 243 domestic wells and 25 irrigation wells in the Lower Lake Basin. Figures 2-34 and 2-35 present the well depth range and cumulative frequency depth distribution for domestic and irrigation wells in Lower Lake Basin. Approximately 50 percent of domestic wells are shallower than 50 feet deep, and approximately 50 percent of irrigation wells are shallower than 100 feet deep.



Source: Department of Water Resources

Figure 2-34
Depth Distribution of Domestic Wells in the Lower Lake Basin



Source: Department of Water Resources

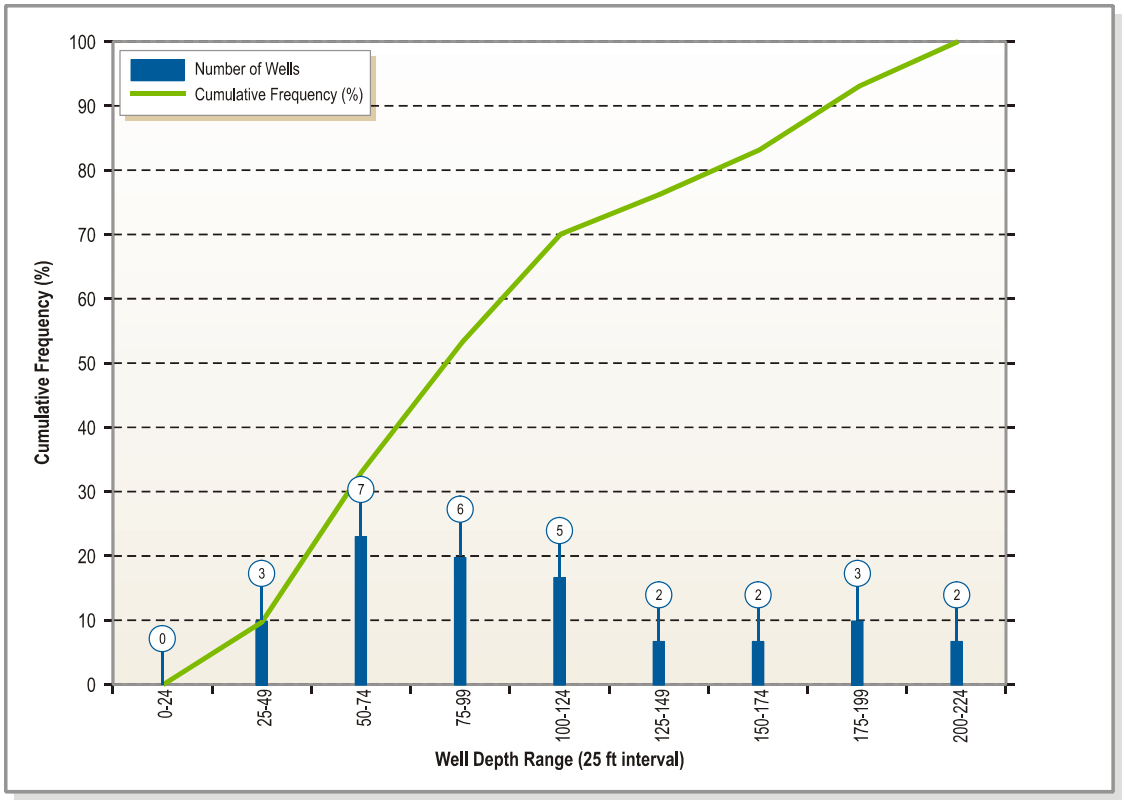
Figure 2-35
Depth Distribution of Irrigation Wells in the Lower Lake Basin

2.4.10 Long Valley Groundwater Basin

Long Valley Groundwater Basin is in the northeast portion of the county (Figure 2-6) in the Cache Creek Inventory Unit. The Franciscan Formation borders most of the Long Valley Groundwater Basin. Volcanic rocks form a small section of the southern boundary. The basin is made up of alluvial fill. Very little information exists about this groundwater basin. Average-year agricultural groundwater demand in the Long Valley basin is approximately 253 acre-feet per year.

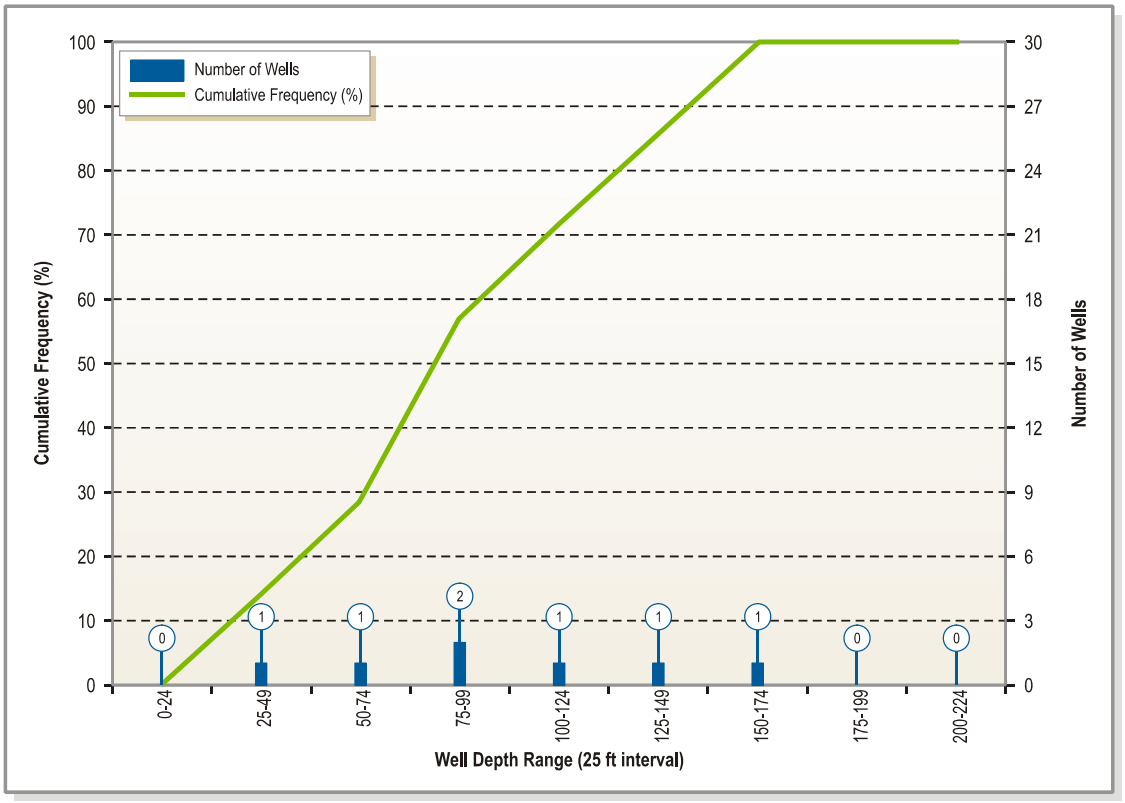
Groundwater Wells

There are 30 domestic wells and 7 irrigation wells in the Long Valley Groundwater Basin. Figures 2-36 and 2-37 present the well depth range and cumulative frequency depth distribution for domestic and irrigation wells in Long Valley Groundwater Basin. Approximately 50 percent of domestic wells are shallower than 100 feet deep, and approximately 50 percent of irrigation wells are shallower than 100 feet deep.



Source: Department of Water Resources

Figure 2-36
Depth Distribution of Domestic Wells in the Long Valley Groundwater Basin



Source: Department of Water Resources

Figure 2-37
Depth Distribution of Irrigation Wells in the Long Valley Groundwater Basin

2.4.11 Clear Lake Cache Formation Groundwater Basin

The Clear Lake Cache Formation Groundwater Basin is east of Clear Lake and is in both the Shoreline and Cache Creek Inventory Units (Figure 2-6). The Clear Lake Cache Formation Groundwater Basin shares a boundary with the Burns Valley Groundwater Basin in the southwest. Lower Cretaceous marine and Mesozoic ultra-basic intrusive rocks bound the south of the basin. Lower Cretaceous marine deposits border the east portion of the basin, and the Franciscan Formation borders the north and west portions of the basin.

Water-Bearing Formations

Cache Formation

The Cache Formation is generally of low porosity, and is the only water-bearing formation in the Clear Lake Cache Formation Groundwater Basin. The Cache Formation ranges in age from 1.6 to 1.8 million years old and is over 13,000 feet thick (Hearn 1988). The Cache Formation is characterized by sandstone, conglomerate, gray sandstone with light-olive-gray conglomerate lower in the section. It represents fluvial deposition, and was deposited in a fault-controlled, subsiding basin (Rymer 1981). The Cache Formation overlies the Franciscan Formation and Serpentinized Ultramafic Rocks, and is overlain by the Clear Lake Pleistocene Volcanics, and the Lower Lake Formation (Rymer 1981). The Cache Formation dips to the southwest.

Groundwater Hydrogeology

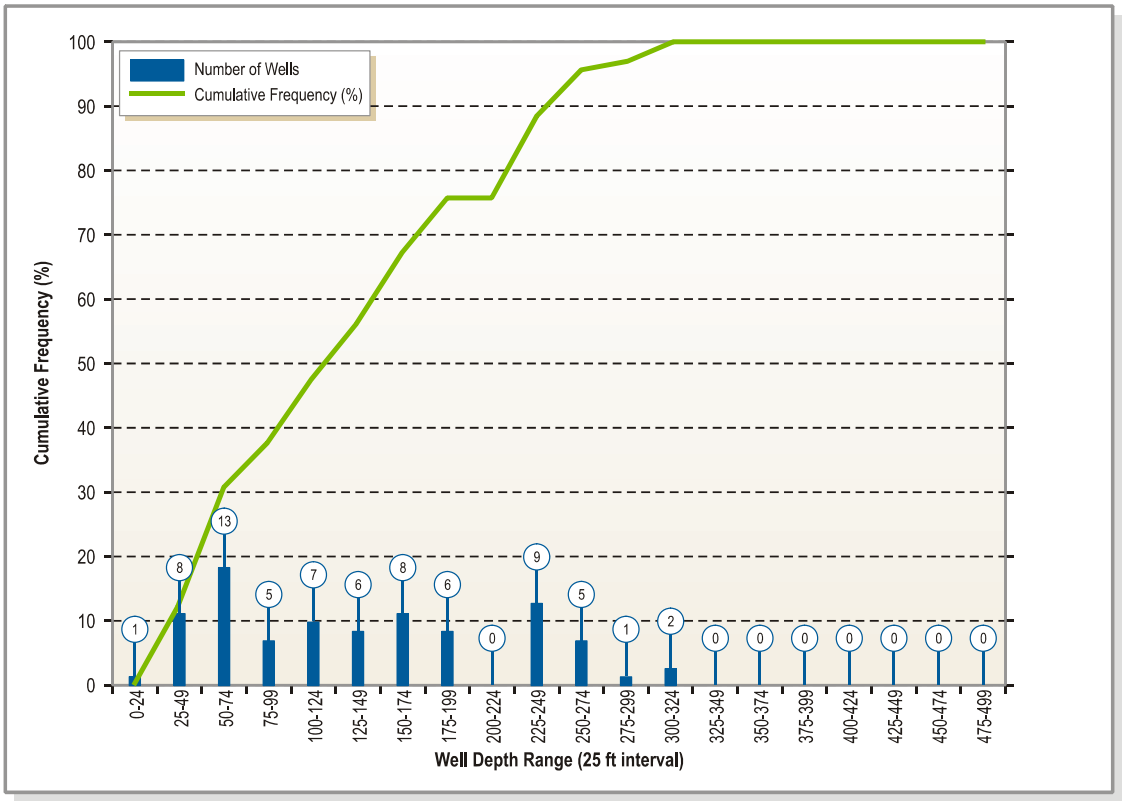
Groundwater levels have not been monitored in the Cache Formation. Other hydrogeologic information for the basin is unavailable. Average-year agricultural groundwater demand in the Clear Lake Cache Formation basin is approximately 85 acre-feet per year.

Groundwater Quality/Inelastic Land Surface Subsidence

Current information regarding groundwater quality and inelastic land surface subsidence is unavailable.

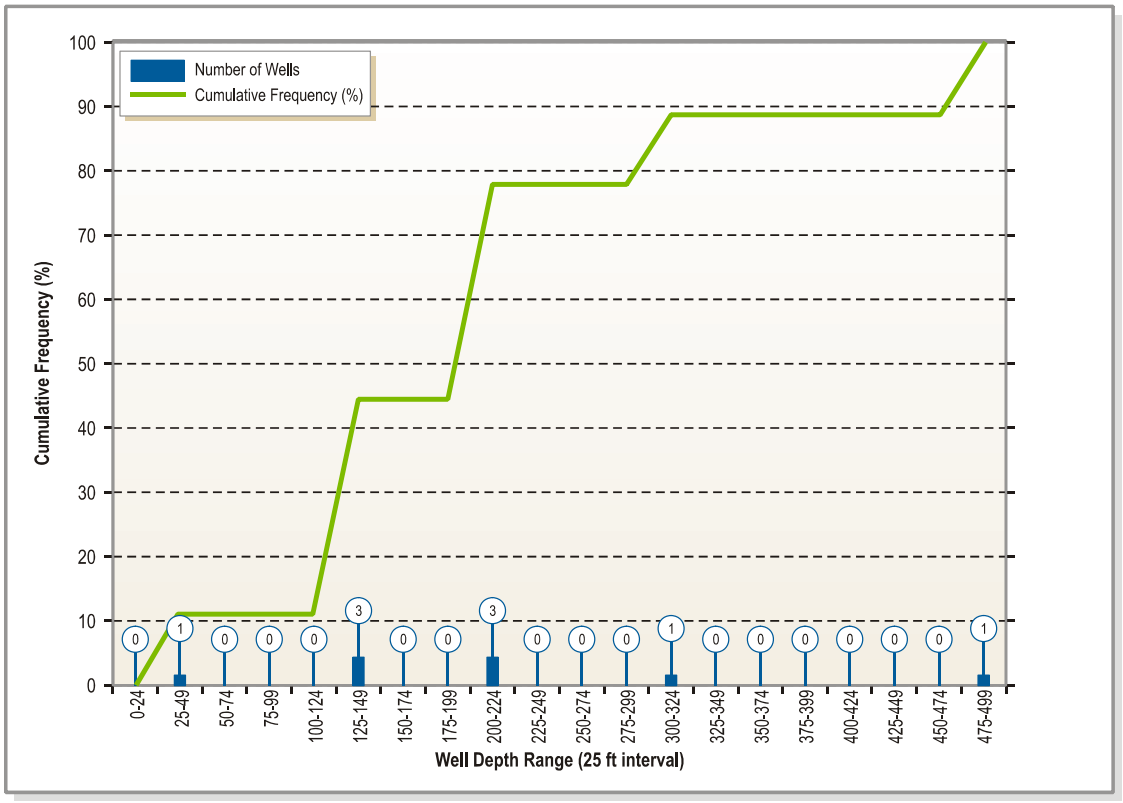
Groundwater Wells

There are 71 domestic wells and 9 irrigation wells in the Clear Lake Cache Formation Groundwater Basin. Figures 2-38 and 2-39 present the well depth range and cumulative frequency depth distribution for domestic and irrigation wells in Clear Lake Cache Formation Groundwater Basin. Approximately 50 percent of domestic wells are shallower than 125 feet deep, and approximately 50 percent of irrigation wells are shallower than 200 feet deep.



Source: Department of Water Resources

Figure 2-38
Depth Distribution of Domestic Wells in the Clear Lake Cache Formation Groundwater Basin



Source: Department of Water Resources

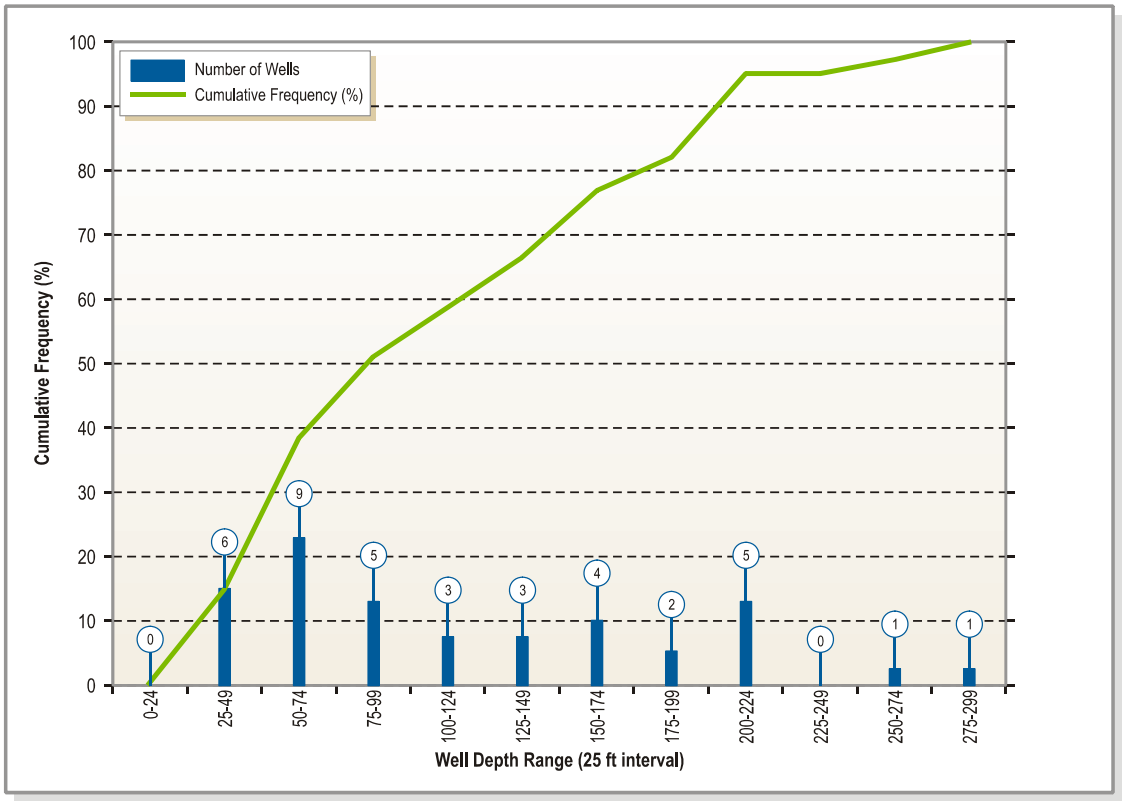
Figure 2-39
Depth Distribution of Irrigation Wells in the Clear Lake Cache Formation Groundwater Basin

2.4.12 Middle Creek Groundwater Basin

The Middle Creek Groundwater Basin is in the Middle Creek Inventory Unit (Figure 2-6). The Franciscan Formation borders the Middle Creek Groundwater Basin to the north and east. Lower Cretaceous Marine deposits bound the basin to the west. The basin is made up of alluvial fill. Little information is available about the Middle Creek Groundwater Basin. Average-year agricultural groundwater demand in the Middle Creek basin is approximately 73 acre-feet per year.

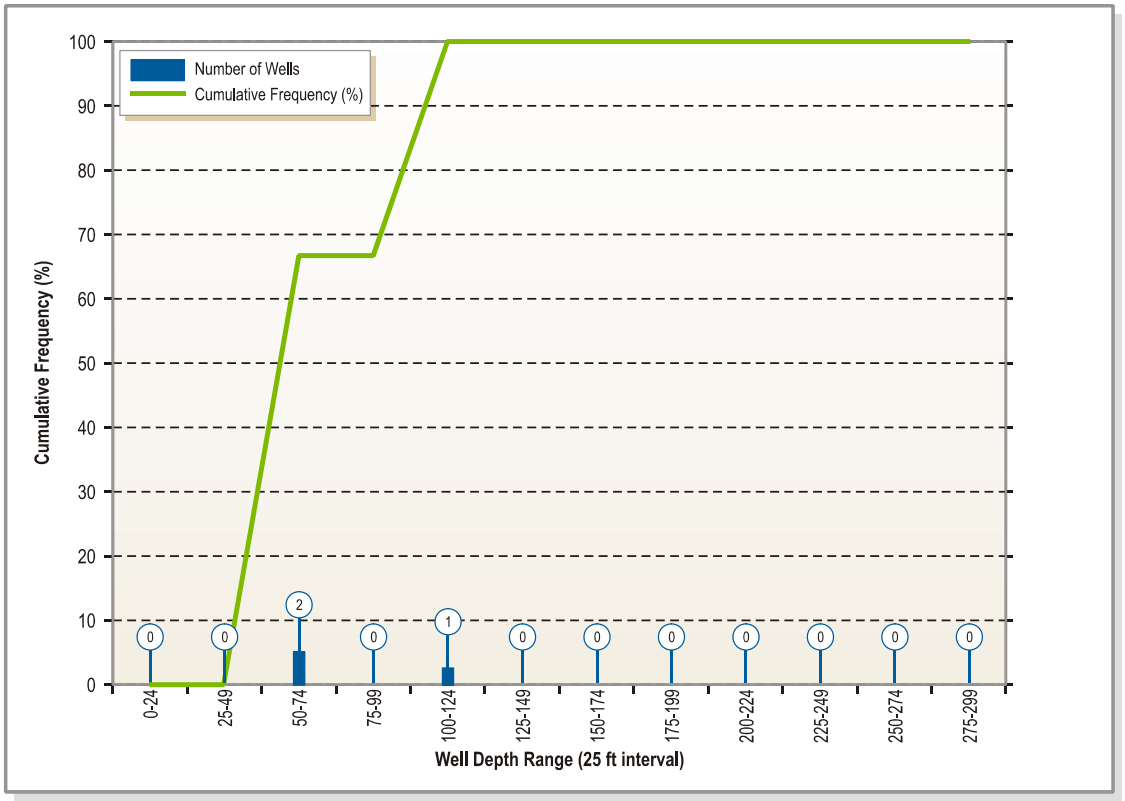
Groundwater Wells

There are 39 domestic wells and 3 irrigation wells in the Middle Creek Groundwater Basin. Figures 2-40 and 2-41 present the well depth range and cumulative frequency depth distribution for domestic and irrigation wells in Middle Creek Groundwater Basin. Approximately 50 percent of domestic wells are shallower than 100 feet deep, and approximately 50 percent of irrigation wells are shallower than 75 feet deep.



Source: Department of Water Resources

Figure 2-40
Depth Distribution of Domestic Wells in the Middle Creek Groundwater Basin



Source: Department of Water Resources

Figure 2-41
Depth Distribution of Irrigation Wells in the Middle Creek Groundwater Basin

2.4.13 Clear Lake Volcanics Groundwater Source Area

The Clear Lake Volcanics groundwater source area is south of Clear Lake and is in the Shoreline, Middle Putah, and Upper Putah Inventory Units. The Clear Lake Volcanics share a boundary with the Big Valley Groundwater Basin to the west (Figure 2-6). The Franciscan Formation bounds the south and east of the area.

Water-Bearing Formations

Clear Lake Volcanics

The Clear Lake Volcanics consist of basalt, andesite, and other volcanic rocks in a complex sequence. The Clear Lake Volcanics are heavily faulted and fractured, and are over 4,000 feet thick near Mount Konocti (Hearn 1988). A well drilled near the intersection of Red Hills Road and Highway 29 revealed that the formation was 1,600 feet thick at that location (Slade 2002). Groundwater in the Clear Lake Volcanics occurs primarily in fractures, joints, and within weathered zones that formed in between volcanic eruptions. The amount of groundwater available to a well in the formation is highly dependent on the size, openness, frequency, and interconnection of fractures and joints encountered in the well.

Groundwater Hydrogeology

Overall, the hydrogeologic properties of the Clear Lake Volcanics vary widely between different locations in the area, and are not well defined. In some areas, pump tests have been performed to determine aquifer properties. Pump tests determine an aquifer's characteristics at a particular well location. Pump tests typically reveal specific capacity and transmissivity. Specific capacity is a calculated number based on the pumping rate in gallons divided by a measurement of the difference of static and pumping levels in the well. Higher specific capacities indicate a productive well, and low specific capacities indicate an unproductive well. Transmissivity is the capacity of an aquifer to transmit water. A higher transmissivity indicates the aquifer is able to transmit more water.

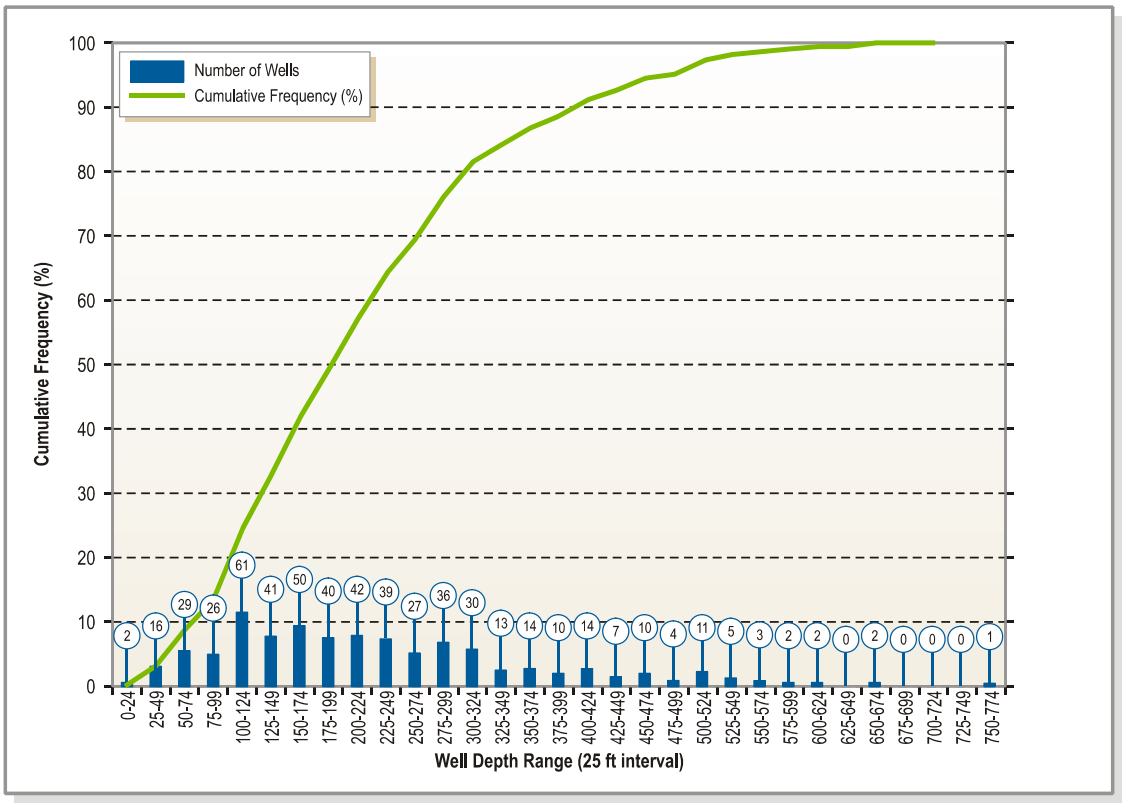
A pumping test performed on a well east of Soda Bay Road in the Clear Lake Volcanics revealed a specific capacity of 43 gpm/ft, and a transmissivity ranging between 20,000 and 86,000 gpd/ft (Hicke 2002). Other pump tests performed near the intersection of Red Hills Road and Highway 29 indicated specific capacities of 1.25, 47.6, and 18.7 gpm/ft, and pumping rates of 555 gpm, 150 gpm, and 670 gpm. Average-year agricultural groundwater demand in the Clear Lake Volcanics basin is approximately 2,271 acre-feet per year.

Groundwater Quality/Inelastic Land Surface Subsidence

Published information regarding groundwater quality and inelastic land surface subsidence is unavailable. Information obtained from DHS indicates that iron, aluminum and manganese have been detected above SWQLs in the Clear Lake Volcanics.

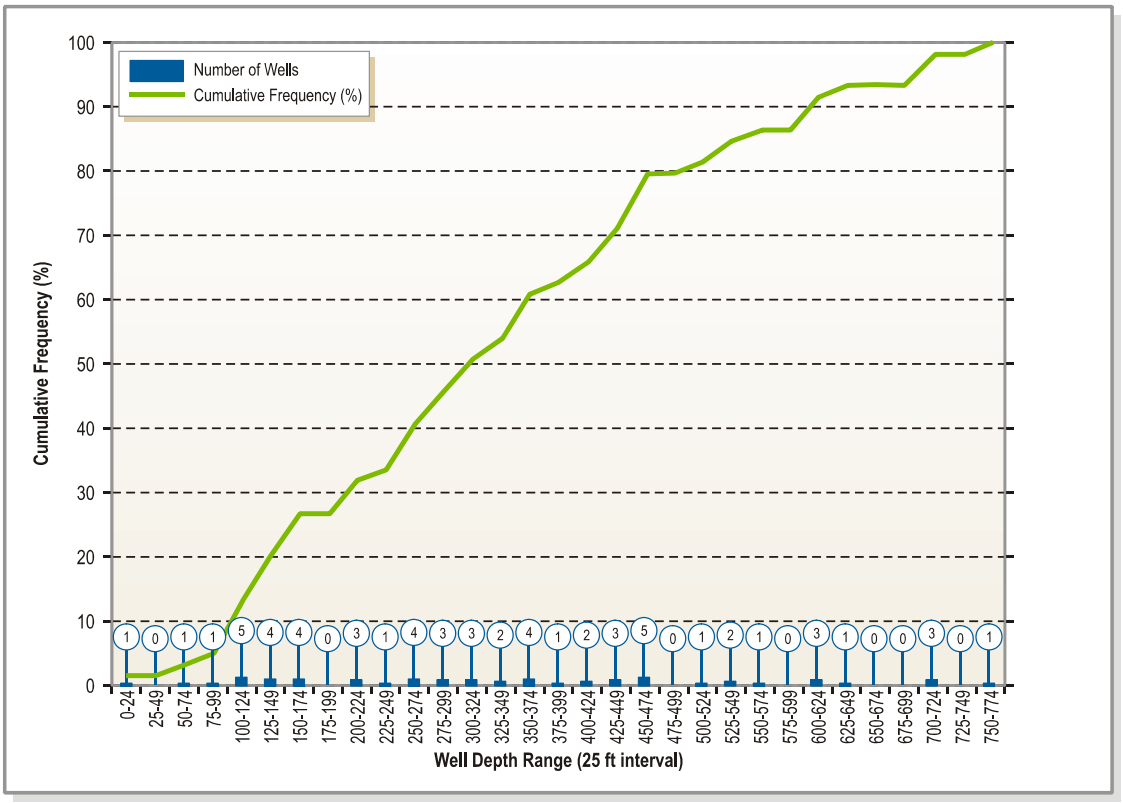
Groundwater Wells

There are 537 domestic wells and 59 irrigation wells in the Clear Lake Volcanics Groundwater Source Area. Figures 2-42 and 2-43 present the well depth range and cumulative frequency depth distribution for domestic and irrigation wells in Clear Lake Volcanics Groundwater Source Area. Approximately 50 percent of domestic wells are shallower than 200 feet deep, and approximately 50 percent of irrigation wells are shallower than 325 feet deep.



Source: Department of Water Resources

Figure 2-42
Depth Distribution of Domestic Wells in the Clear Lake Volcanics Groundwater Source Area



Source: Department of Water Resources

Figure 2-43
Depth Distribution of Irrigation Wells in the Clear Lake Volcanics Groundwater Source Area

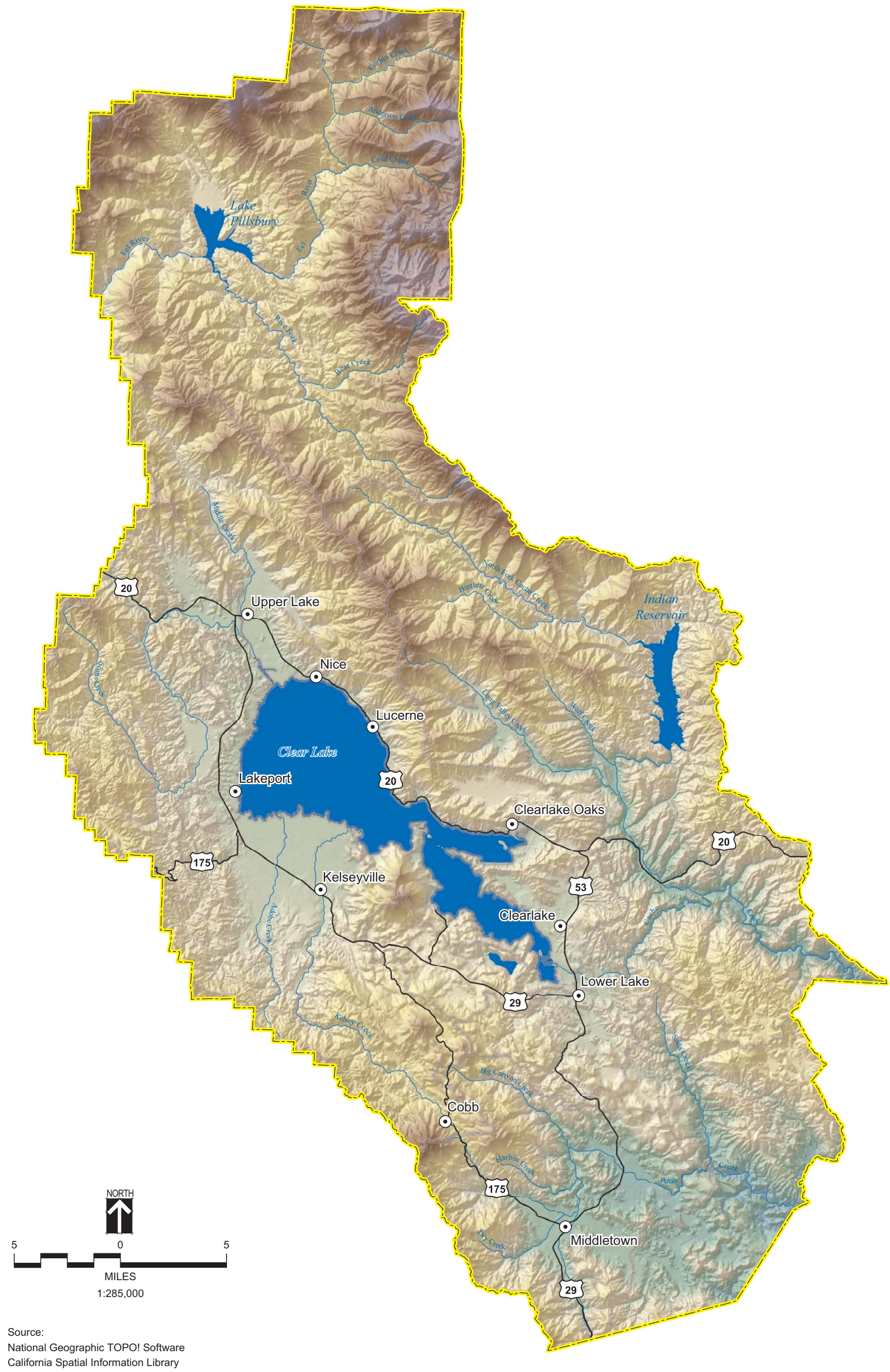
2.5 Agricultural Water Demand by Groundwater Basin

Water demand was calculated to estimate the average year agricultural water use overlying groundwater basins in Lake County. The calculation was performed using 2001 land use data from DWR, and crop irrigation requirements for an average water year from DWR. Acreage of land use of each crop was multiplied by the crop's water demand and a factor representing irrigation efficiency, and then demand for each crop was totaled by groundwater basin. Calculations for each groundwater basin are presented in Appendix B. This data provides a snapshot of approximate water demand near the year 2001; land use changes that occurred after 2001 are not represented by this calculation.

Table 2-4
Agricultural Demand in Lake County by Groundwater Basin During an Average Year

Groundwater Basin	Land Irrigated with Surface Water (acres)	Land Irrigated with Groundwater (acres)	Irrigated Land Total (acres)	Surface Water Demand (acre-ft)	Groundwater Demand (acre-ft)	Total Demand (acre-ft)
Gravelly Valley	0	0	0	0	0	**0**
Upper Lake Valley	1,117	1,509	2,920	4,182	4,075	**8,257**
Scotts Valley	0	856	856	0	2,369	**2,369**
Big Valley	23	6,765	6,788	91	11,363	**11,454**
High Valley	0	64	64	0	36	**36**
Burns Valley	162	5	167	91	14	**105**
Coyote Valley	1,059	348	1,407	3,402	671	**4,073**
Collayomi Valley	33	317	350	146	266	**412**
Lower Lake Valley	0	31	31	0	17	**17**
Long Valley	0	118	118	0	253	**253**
Clear Lake Cache Formation	26	132	158	15	85	**100**
Middle Creek	0	18	18	0	73	**73**
Clear Lake Volcanics	185	2,979	3,164	820	2,271	**3,091**

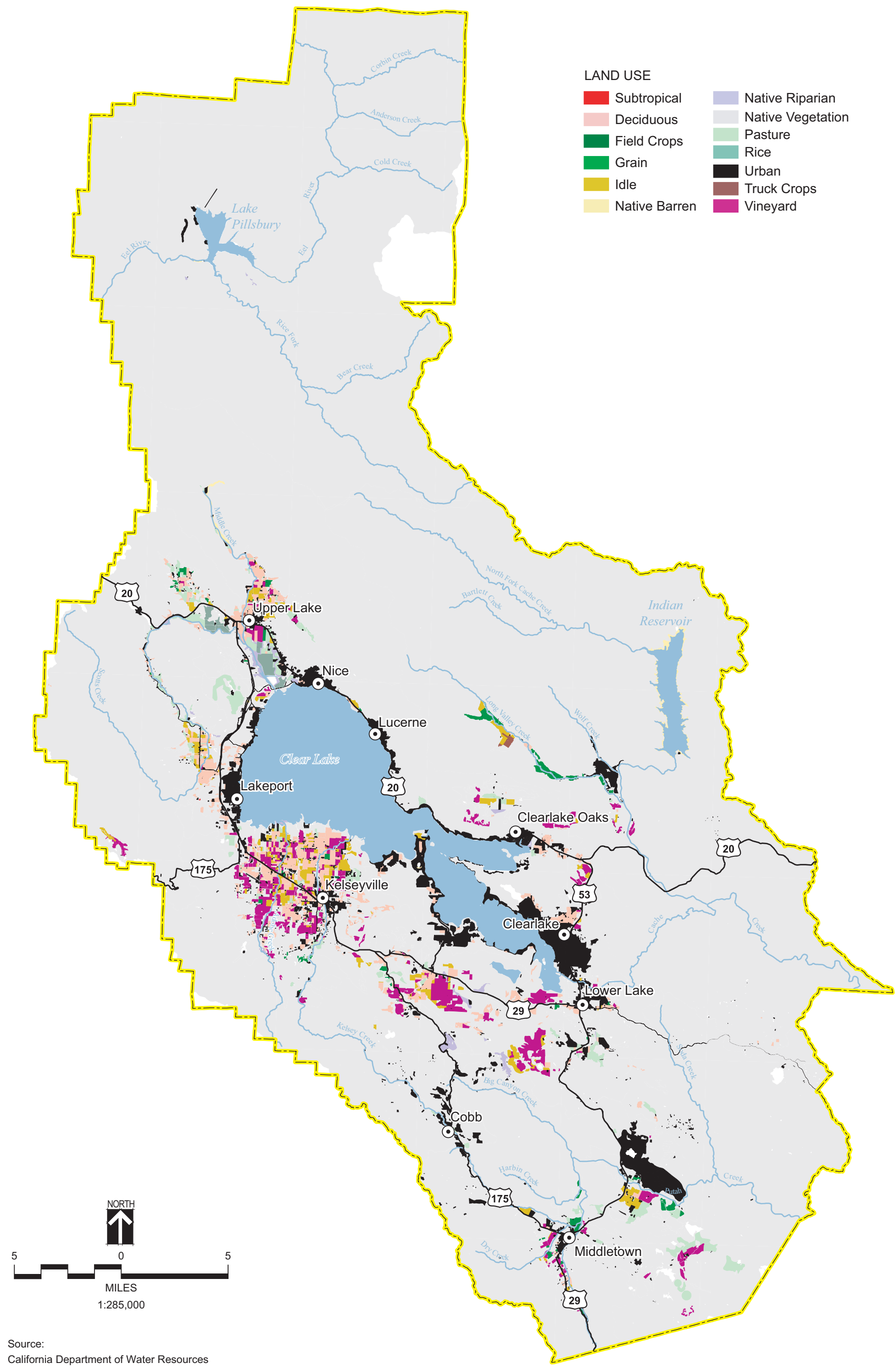
Table 2-4 presents the agricultural water demand for an average year by groundwater basin. Table 2-4 indicates that groundwater is the primary source of water for the Lake County groundwater basins. Groundwater basins with a groundwater demand over 1,000 acre-feet per year include: Upper Lake Valley, Scotts Valley, Big Valley, and the Clear Lake Volcanics Groundwater Source Area.



Source:
National Geographic TOPO! Software
California Spatial Information Library

CDM

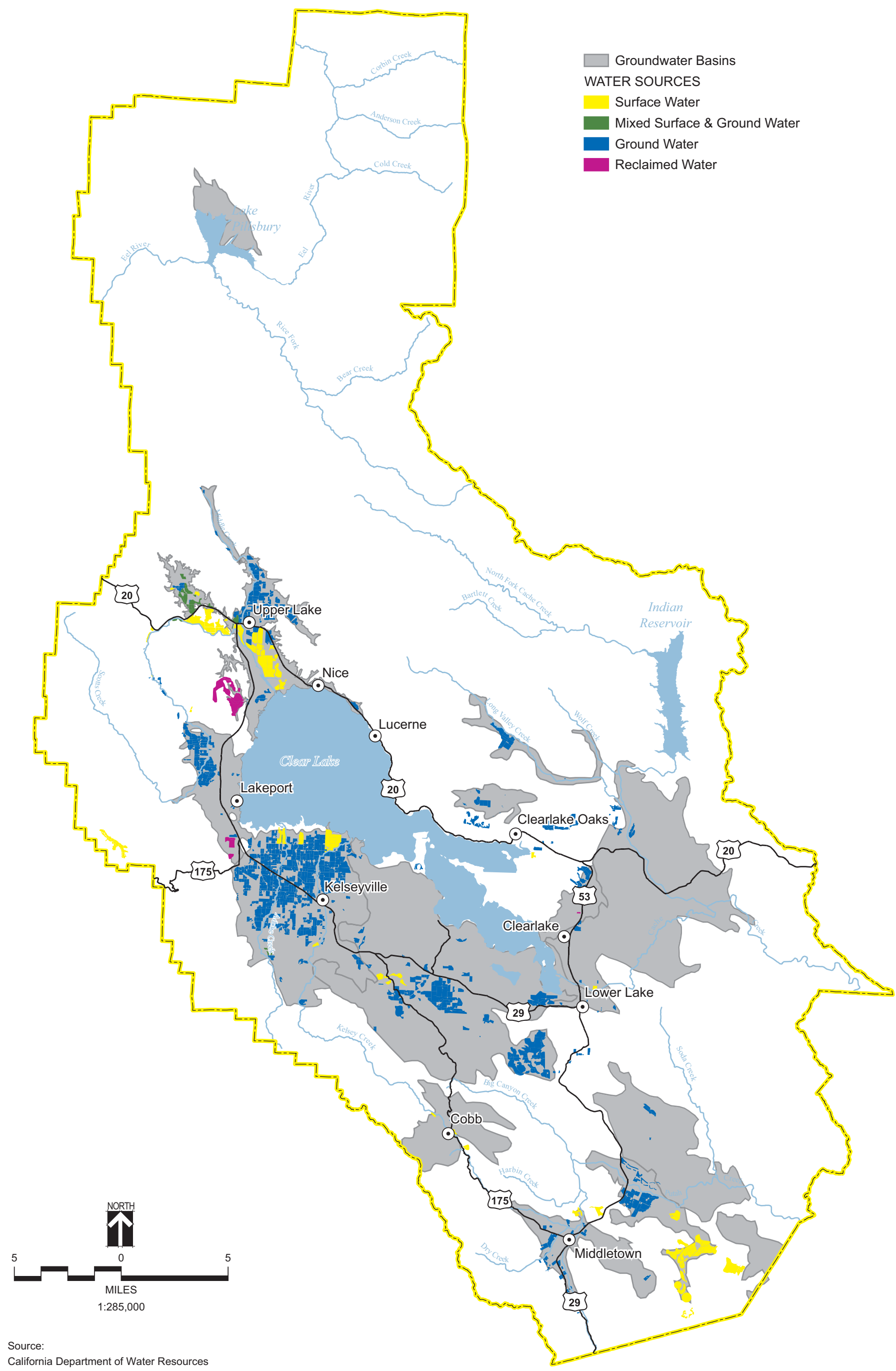
Figure 2-1
Topography



Source:
California Department of Water Resources
California Spatial Information Library

CDM

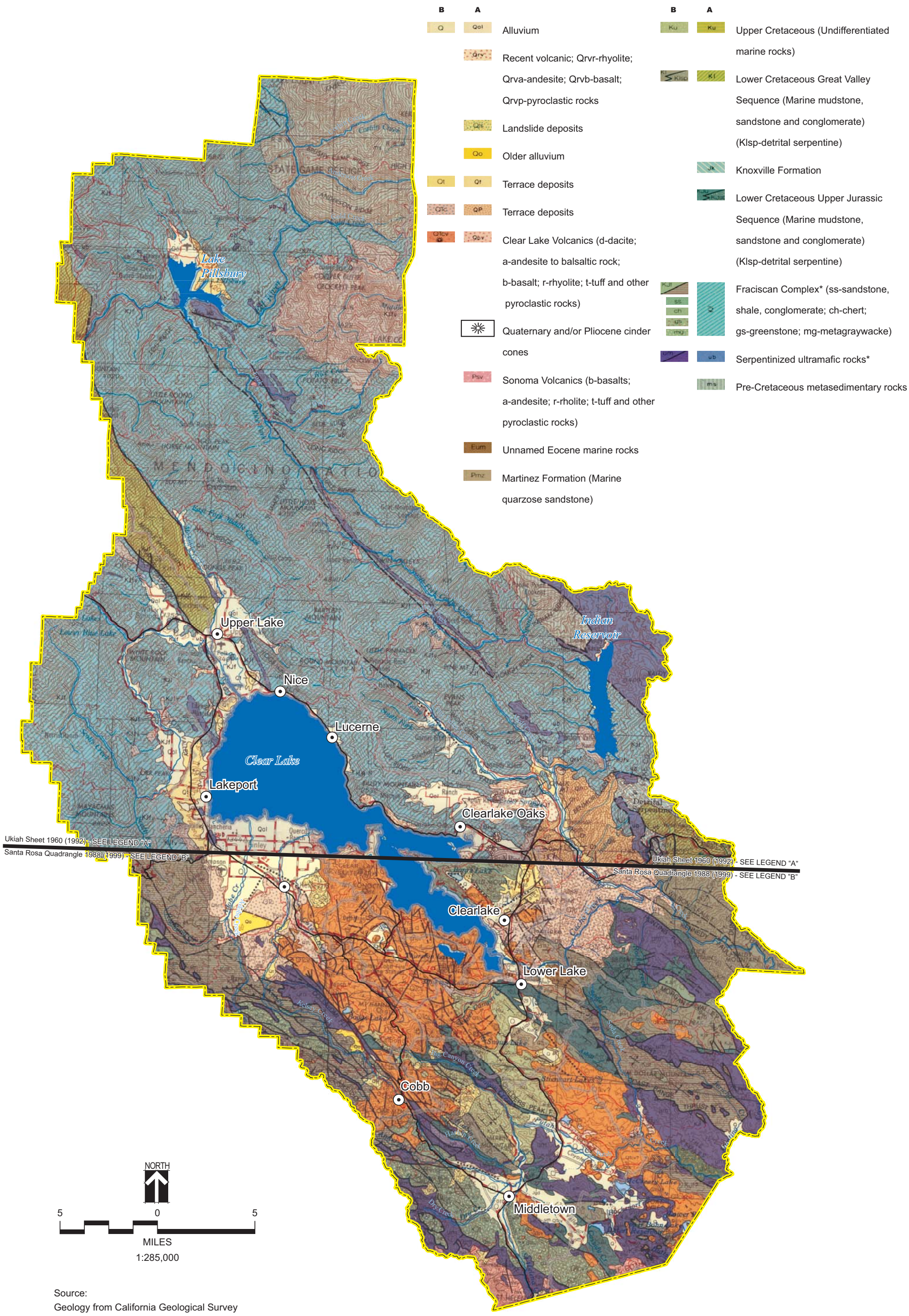
Figure 2-3
Land Use



Source:
California Department of Water Resources
California Spatial Information Library

CDM

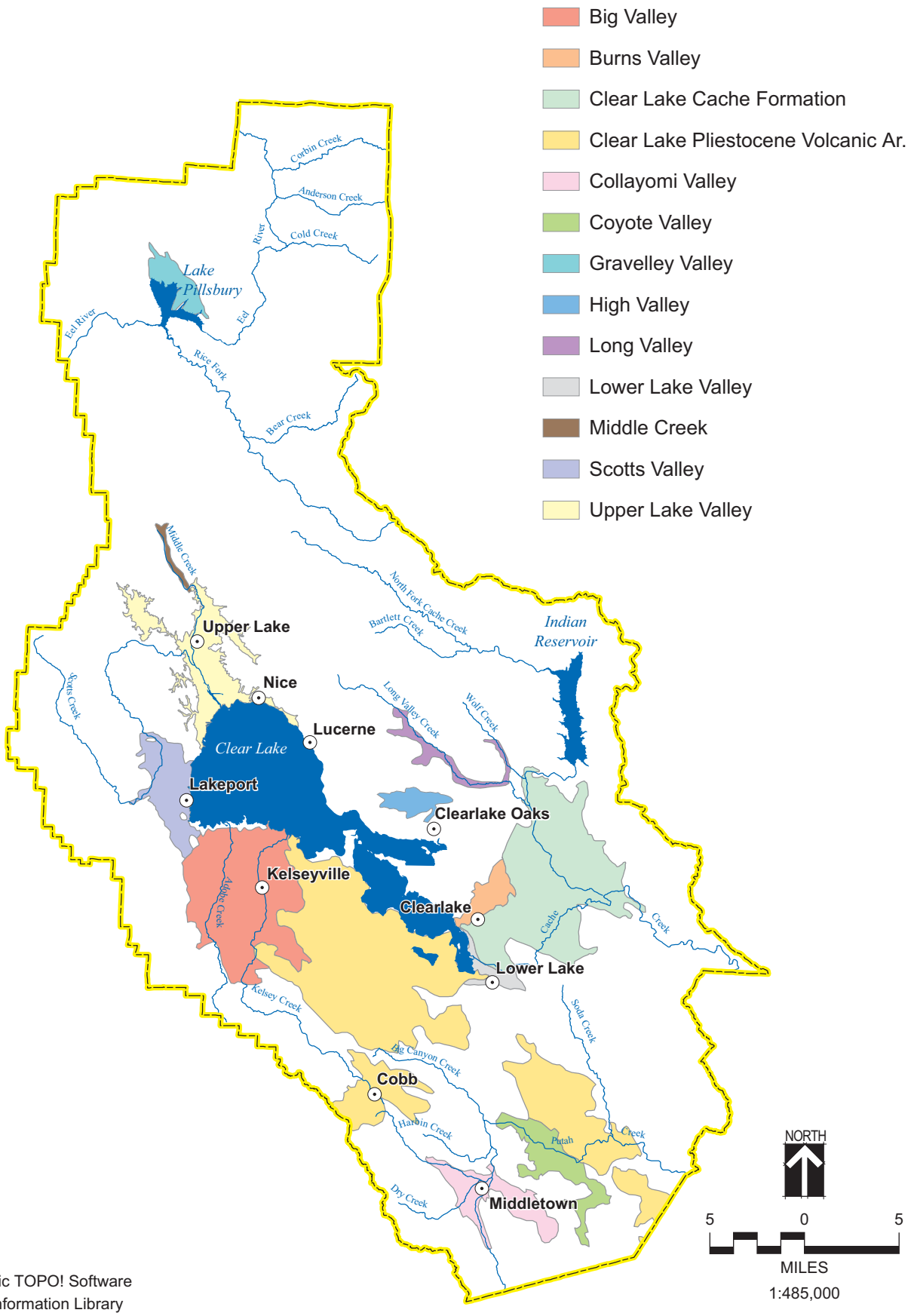
Figure 2-4
Water Sources



Source:
Geology from California Geological Survey
California Spatial Information Library

CDM

Figure 2-5
Geology



Source:
National Geographic TOPO! Software
California Spatial Information Library

CDM

Figure 2-6
Groundwater Basins

Mt. Hannah Water consupmtion and production

	Produced	Consumed	Variance	
2009	4,086,320	1,311,553	2,774,767	68%
2010	2,683,870	1,061,486	1,622,384	60%
2011	1,234,630	1,121,329	113,301	9%
2012	1,761,527	1,205,856	555,671	32%
2013	2,210,145	1,350,107	860,038	39%
2014	970,222	495,965	474,257	49%
Average	2,157,786	1,091,049	1,066,736	49%

Variance is the amount of water that is "lost" or unaccounted for. This is typically due to leaks ion the system.

2014 by billing cycle

		billed		produced	lost	
March	***12/14/13~02/12/14***	155,190		354,621	(199,431)	-56%
May	***2/13/14~4/14/14***	157,884		343,697	(185,813)	-54%
					-	
July	***4/15/14~6/16/14***	182,891		271,904	(89,013)	-33%

	Billed	Gallons per day	Per day/connection	per day/person
Mar-14	155190	2,587	72	33
May-14	157884	2,631	73	33
Jul-14	182891	3,048	85	39

California Department of Public Health

MEMORANDUM

DATE: **June 6, 2014**

TO: Dave M. Mazzera, Ph.D., Acting Division Chief
Division of Drinking Water and Environmental Management (DDWEM)

VIA: Lance Reese, Chief
Technical Programs Branch

Dat Tran, P.E., Chief
Engineering Technical Assistance Section

Bruce Burton, P.E., Chief
Drinking Water Field Operations Branch

Stefan Cajina, P.E., Chief
North Coast Regional Engineer

FROM: Michelle F. Fredrick, P.E.
District Engineer, Mendocino District

SUBJECT: **Lake County CSA 22 Mt. Hannah, System No. 1700563 - PUBLIC WATER SYSTEM DROUGHT EMERGENCY (PWSDE) FUNDING REQUEST**

This is a report from the CDPH Mendocino District Office regarding the findings as they relate to a request for PWSDE funding from Jan Coppinger, County of Lake Special Districts.

PWSDE FUNDING REQUEST

1) PWSDE requested contract type:

☐ **Oral** X **Written**

2) Name of person requesting PWSDE funding:
Jan Coppinger

3) Title of person requesting PWSDE funding:
County of Lake Special Districts, Compliance Coordinator

4) PWSDE emergency type:

☐ **Drought related drinking water emergency**

X **Threatened emergency (Drought)**

5) **Public water system(s)** Type:

X **Community water system**:

☐ **Public water system** owned by a public school district:

6) Provide name(s) of **public water system(s)** involved in this PWSDE funding request, please list the classifications for each public water system included (i.e. community, non-community or public water system owned by a public school district):

Lake County CSA 22 Mt. Hannah, 1700563, community

DROUGHT EMERGENCY DESCRIPTION

1) Describe the emergency and explain how this is a **drought related drinking water emergency** or **threatened emergency**. (attach any supporting documentation/calculations)

County of Lake Special Districts Community Services Area No. 22 Mt. Hannah water system (System) serves 36 single-family residential customers; an estimated population of 88, located in the rural Cobb Mountain area of Lake County. The System relies on one groundwater well for drinking water supply. The well capacity when permitted by the Mendocino District Office was 34 gallons per minute (gpm); however, as drought conditions have worsened, the well level has dropped 73-percent between January 2013 to May 1, 2014 and is not recovering like it used to.

Typical temperatures in Lake County, from *www.lakecounty.com*:

Average Temperatures	Highs	Lows
April-June	80°	48°
July-September	95°	57°

The well is 120 feet deep drilled through volcanic gravel, sand, clay and rock; and during the rainy season, has displayed artesian properties. The System informed the District Office that the normal static level for the well was 40 feet with a pumping capacity of 33 gpm. The pump is set at 110 feet. Currently when pumping, the level drops to 100 feet in 45 minutes at 22 gpm. If pumping longer

than 1 hour, the level drops to 110 feet and flow drops to 19 gpm with a lot of air. It takes approximately 2 hours for the well to recover to 55 feet.

The customers are under a mandatory conservation ordinance and have been successful in using water efficiently. For the month of April, the average daily demand per customer was 123 gallons or approximately 50 gallons per person per day.

Currently, the well is being pumped for approximately 30 minutes and then must be allowed to rest and recharge for two to three hours to prevent the pump from burning out. An operator must be on site to monitor the well and pump at a higher cost to the System. Running the well during a 12-hour day equates to about 2 hours of pump run time at 32 gpm which results in a total of 3,840 gallons or 107 gallons per connection or approximately 44 gallons per person.

County staff has altered the pumping schedule to try to keep up with the low demands, and the community has been told to refrain from all but very essential use. On May 29, the County reported to the District Office that the tank level at Mt. Hannah is declining faster than the well is able to fill it. The current usage is about 40 gallons per person per day.

The least cost option is to drill a replacement well. Two other options considered are: 1) temporarily haul water, or 2) connecting to a nearby public water system. The nearest public water system is over one mile so connecting to a neighboring system is not the least cost or quickest option. Costs for an intertie to Loch Lomond Mutual Water System are estimated at $600,000 plus engineering, environmental, and administrative costs. Due to the high cost, no contact was made to Loch Lomond to discuss this option. Hauling water to the storage tank is not feasible as the road to the tank is not in a condition to handle large trucks. The System has evaluated installing a temporary tank and pump at the well site; however, this would be a temporary measure, and estimated at $76,000 to supply water for June through November, is not the least cost option.

Water from the well is delivered through 900 feet of 6-inch steel transmission pipe to the System's only storage tank. Service connections are fed by gravity from the tank. The transmission line is deteriorated to the point that it is contributing to a 40-percent water loss. The System has performed leak detection and repaired the leaks found; however, as the water from the well must get to the tank to flow to customers, if the transmission main continues to leak or potential fail completely, there will be no water to the customers. District staff recently visited the System and walked a portion of the pipeline. The transmission main is constructed up a hill that is steep in places. Erosion of the ground cover over the pipe exposed multiple repair clamps, showing staff the vulnerability of the line (see attached photos). There were indications of possible leakage in places where the pipe was exposed. The County has estimated the cost to replace the transmission line at $81,000.

The County has applied to the West Sacramento Integrated Regional Water Management Program Prop 84 drought funding to replace the well and install a new transmission main. If selected, construction could start in 2015; however, the system is in critical need as the well capacity diminishes and the transmission main condition is very poor.

2) If the emergency is a **threatened emergency**, in what estimated timeframe is a water outage expected to occur?

It is estimated that hauling will be necessary in June 2014.

DROUGHT RESPONSE ACTIONS

1) Has the **public water system(s)** instituted water conservation measures?

X Yes ☐ No

a) If so, what are the conservation measures?

The County of Lake Board of Supervisors has approved an urgency ordinance on May 13 requiring each household to limit use to 124 gallons per day. Any water use over 124 gallons (500 cubic feet per month) is billed at $10.47 per 100 cubic feet; anything over 750 cubic feet per month is surcharged an additional $350. All outside water use is prohibited.

b) If so, are the conservation measures mandatory or voluntary?

X Mandatory ☐ Voluntary

c) If not, are the PWS's service connections metered?

X Yes ☐ No

i. If so, does the PWS charge a metered rate within their rate structure?

X Yes ☐ No

2) Has the public water system's Local Health Officer or Local Director of Environmental Health taken any drinking water drought response actions?

The County of Lake Board of Supervisors unanimously passed a local state of emergency due to the dry conditions on March 4, 2014.

PROJECT DESCRIPTION

1) Describe the project proposed to address the **drought related drinking water emergency** or **threatened emergency**?

The project will consist of drilling a new well, installing a well pump and associated piping, installing 900 feet of transmission main and completing all testing required to place the new source online.

2) How will the project achieve the most immediate and reliable supply of domestic water for the duration of the **drought related drinking water emergency** or **threatened emergency?**

It is estimated that a new well and transmission main will provide adequate capacity to serve the existing drinking water customers without having to construct a temporary hauled water facility.

3) Is the project for an interim or permanent solution, or both? Please explain.

☐ Interim X Permanent ☐ Both

This project will provide the System with a viable source.

4) When must project commence (interim and permanent solution)?

Ideally, the project should begin as soon as possible to limit the need for the temporary tank and hauling water.

5) How long will it take to complete the project? (Days/Months)

The project will take approximately 60 days.

a) What is the timeframe for the interim solution?(days/months)

Not applicable.

b) What is the timeframe for completion of the long term solution?(days/months)

The well will be constructed first and will take less than 30 days to complete. Due to the drought conditions in the area, well drillers are extremely busy, backlogged with work. The County is trying to find a reputable driller that will be able to do the work in a timely manner.

6) Estimated <u>total</u> project cost (including both interim and permanent solution):

$118,870

a) What is the project cost of the interim solution?

Not applicable.

b) What is the project cost of the permanent solution?

$118,870

7) Estimated total eligible project cost:

$118,870

8) PWSDE funding amount requested:

$118,870 (Note: The well cost is $37,870 and the transmission main is estimated at $81,000).

9) Is the project cost effective? (explain other alternatives evaluated, if applicable)

Yes, the other options (intertie, hauling) considered will cost more. See 1) above for explanation.

OTHER FUNDING SOURCES

1) Have you informed the **public water system(s)** representative that in order to receive PWSDE funding, they will have to self-certify as a condition of the funding agreement that the **public water system(s)** is applying any and all available emergency reserves and/or other unrestricted reserves to fund in part or whole the project prior to submitting claims for reimbursement to CDPH?

X Yes ☐ No

2) Does the **public water system(s)** have any available emergency reserves and/or other unrestricted reserves to fund the project in part or in whole?

☐ Yes **X** No

a) If so, what is the source?

Not applicable.

b) If so, how much is available for the project?

Not applicable.

c) If not, why?

The System has so few customers that there is no reserve built up.

3) Has the **public water system(s)** submitted a Safe Drinking Water State Revolving Fund ("SDWSRF") pre-application, or is a related project established on the PPL?

(Pre-app) ☐ Yes X No (PPL listing) Yes X No

a) If a SDWSRF pre-application has not been submitted, when is the public water system(s) expected to submit a SDWSRF pre-application?

Not applicable, historically single sources were not a fundable category.

b) If listed on the PPL, what is the SDWSRF project number?

Not applicable.

c) In what PPL category is the project listed?

Not applicable.

d) If the project is not ranked in a fundable range is the District requesting the project be re-ranked?

☐ Yes ☐ No X Not applicable.

Category recommended:

Not applicable.

e) Based upon coordination with the CDPH Technical Programs Branch, is SDWSRF funding readily available, at this time, to achieve a permanent solution meeting the time constraints of the emergency?

☐ Yes X No (explain)

No pre-application has been submitted.

f) If the SDWSRF pre-application/project is within or proposed to be within the SDWSRF fundable range, has the public water system submitted the following to the SDWSRF Fiscal Services Unit? (Please check the documents that have been submitted).

☐ Audited or unaudited financial statements and/or tax returns

☐ Average residential water rate

☐ Service area map

☐ Public water system ownership and formation documentation

☐ Water rights

☐ IRS 501(c) tax exemption determination, if a mutual water company
If not, explain

Not applicable.

4) Has the **public water system(s)** taken any actions to obtain funds from other sources?

X Yes ☐ No (explain)

a) If so, what is the source and type of action taken?

The System has submitted the well and transmission main project to the West Sacramento IRWM Program for drought related funding. If selected, funds will not be available until next year. If the IRWM funding is approved, the funds could be used to install the transmission main.

b) If so, what is the availability and timeline of award for such other funds?

Spring 2015

c) If not, why?

Not applicable.

5) District recommended PWSDE Funding Amount:

$118,870

DISTRICT OFFICE RECOMMENDED SPECIAL CONDITIONS

1. Apply to the District Office for a permit amendment to use the new well. The application needs to include plans for piping and construction of the new well features, quantity testing and chemical and bacteriological monitoring results prior to putting the well online.
2. Contact the District Office prior to placing the new well online.
3. Submit plans and specifications for the transmission main.
4. Ensure that if this project is funded via PWSDE that no IRWM funds are accepted for the project components covered by the funding agreement.

PUBLIC WATER SYSTEM INFORMATION

1) Public Water System Primary Contact Information:

Name/Title:
Mark Dellinger, Administrator
Physical Address:
230 N. Main Street
P.O. Box:

City:
Lakeport
California, Zip code:
CA, 95453
E-mail:
mark.dellinger@lakecountyca.gov
Phone no.:
707-263-0119

2) Population served:
88

3) Number of service connections:
36

4) County:
Lake

Attachments:
County of Lake letter to CDPH
Google Earth service area graphic
Mt. Hannah Urgency Conservation Ordinance
Well levels and pumping data for Jan. 2013, Jan. and April 2014
Estimated cost calculations for other options
Site visit photos, May 9, 2014

cc: Brian Kinney, P.E., ETAS
James Garrett, ETAS
Anne Novak, Chief, Project Support Unit
Joshua Ziese, Chief, Infrastructure Funding Administration Section
Thera Hearne, Chief, Disbursement Unit
Sylvester Okeke, PSU Pipeline Coordinator
Seresa Hartwell, PSU Analyst
Regional Funding Coordinator
DWPFUNDS@cdph.ca.gov

COUNTY OF LAKE
SPECIAL DISTRICTS ADMINISTRATION
230 N. Main Street
Lakeport, California 95453
Telephone 707/263-0119
Fax 707/263/3836

Mark Dellinger, Administrator

May 23, 2014

Michelle Frederick, District Engineer
California Department of Public Health
Drinking water program
50 D Street
Santa Rosa, CA 95404

Re: Emergency Drought Related Conditions for County Service Area 22, Mt Hannah Water

Ms. Frederick,

Lake County Special Districts is requesting an emergency grant for County Service Area #22, Mt. Hannah Water System. (CSA#22)
CSA #22 is a public water system serving 36 customers. CSA #22 relies on ground water for supply. Due to current drought conditions, the well level dropped 73% from January 2013 to May 1, 2014. The well has lost the ability to recharge and can only be pumped for approximately 30 minutes and then must be allowed to recharge for 2 to 3 hours. Due to over drawing the well, turbidity issues have become a problem. Filtering for turbidity requires even more water that is not available.
In addition to the loss of capacity, the system has a deteriorated transmission line that needs to be replaced. Although it is not leaking at this time, the line has experienced leaks in the past that accounted for a great deal of water to be lost.
The customers are economically disadvantaged. They are under a mandatory conservation ordinance and have been very successful in water conservation. The average consumption for the CSA is approx. 40 gallons per day per person.
Water rates for this CSA are considerably higher than the county average but due to the small number of customers, the CSA struggles financially and has not been able to build a capital reserve fund.
The CSA desperately needs a deeper well and a new transmission line installed.

We estimate the cost of the emergency measures to be as follows:

Drill new well (approximately 160 ft)	$15,000.00
Well permit	450.00
Casings & Sanitary Seal	3,000.00
Road prep to get rig onsite	2,500.00
Pump, motor & electrical components	4,500.00
8'x8' slab	2,400.00
Purge pumping and 8hr pump test	4,000.00
Lab tests	120.00
2' pvc sch80 (column pipe) & cable	3,000.00
Misc. sensors, wiring, transducer etc	2,900.00
Total projection for cost of new well	**$37,870.00**

To replace the transmission line, **$81,000.00**
(approximately 900 feet of 6" C-900)

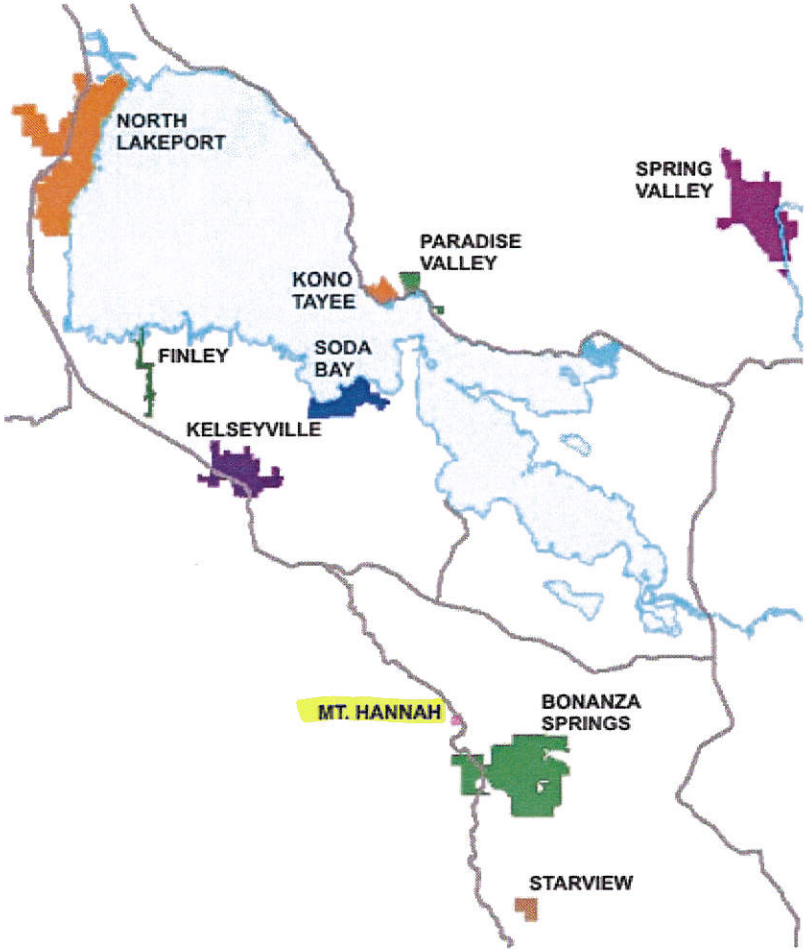
We are requesting $118,870.00 in emergency grant funds for CSA#22. If you have any questions about this request or the project, please contact me at 707-263-0119.

Thank you,

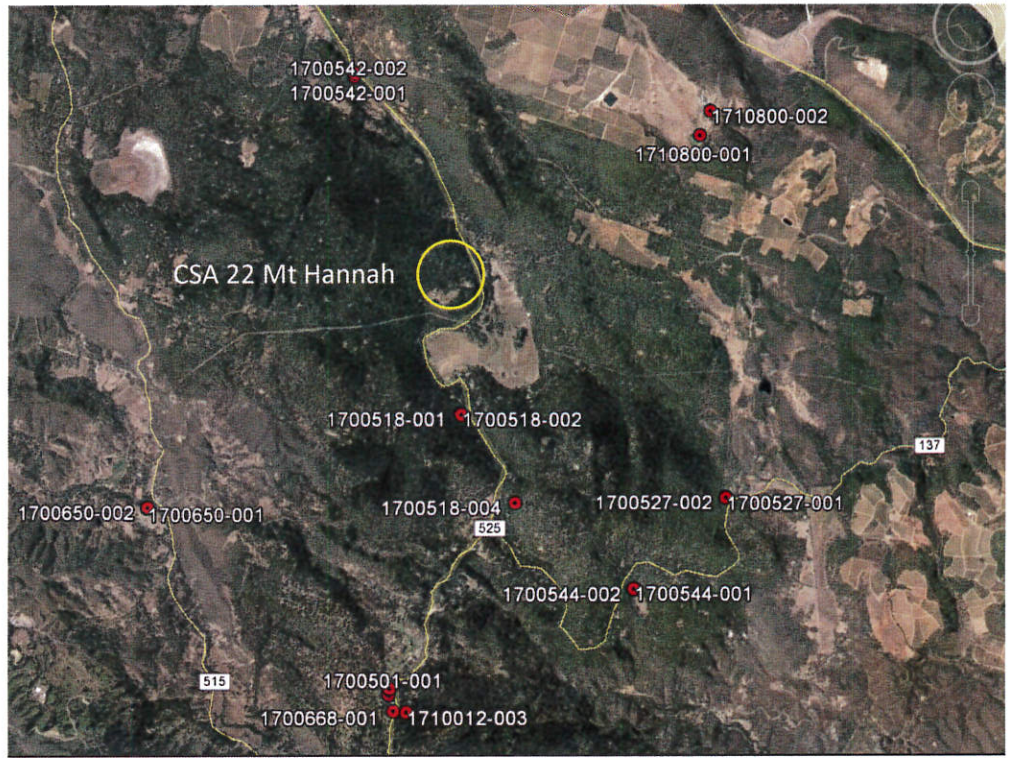
Jan Coppinger

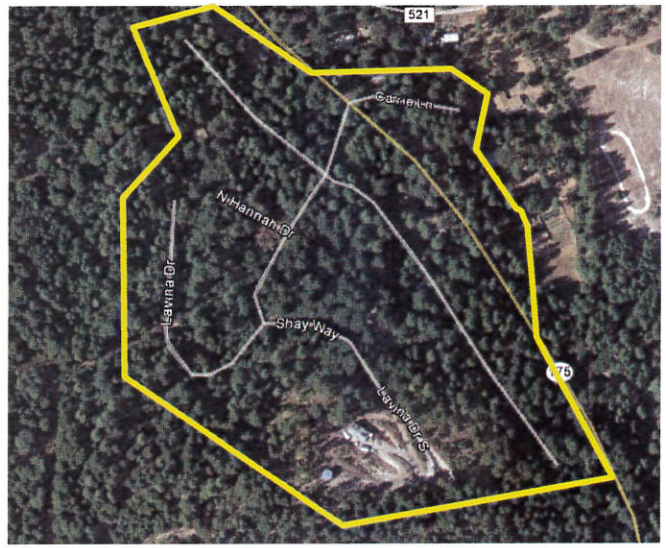
Jan Coppinger, Compliance Coordinator

County of Lake Special Districts – Water Systems



Mendocino District – nearby water systems





CSA 22 Mt. Hannah Service Area

BOARD OF SUPERVISORS, COUNTY OF LAKE, STATE OF CALIFORNIA
ORDINANCE NO. 3006
AN URGENCY ORDINANCE ADOPTING EMERGENCY WATER CONSERVATION RESTRICTIONS FOR COUNTY SERVICE AREA NO. 22, MT. HANNAH WATER

THE BOARD OF SUPERVISORS OF THE COUNTY OF LAKE, STATE OF CALIFORNIA, ORDAINS AS FOLLOWS:

SECTION 1: The Board of Supervisors adopts this ordinance to correct a serious water shortage and to meet emergency conditions in the water supply system of County Service Area No. 22 – Mt. Hannah (CSA No. 22) and to promote the public health, safety and welfare of the citizens of said area.

The Board finds these specific compelling reasons which necessitate the adoption of this ordinance. They are as follows:

1. The aquifer in which the CSA No. 22 well is located no longer produces a sufficient supply of water to serve the domestic water needs of CSA No. 22.
2. The current drought conditions throughout the State of California are further depleting the capacity of the well and production has decreased 53% over the most recent twelve month period.
3. Voluntary conservation is in place but current water usage within CSA No. 22 is straining the current well production and the ability to produce a sufficient supply of water.
4. During the summer months, more homes in CSA No. 22 will be occupied and the additional use may exceed the current well production which will result in a lack of water in the immediate future.
5. As a result of the above conditions, there has been and will be a serious water shortage emergency in said area resulting in the County being unable to meet the ordinary demands and requirements of water consumers in said area without depleting the water supply to a level that is insufficient to meet the needs for human consumption, sanitation, and fire protection.
6. This water shortage emergency in said area constitutes a substantial and imminent health and safety threat to the citizens of said county service area.
7. This ordinance needs to be adopted as an urgency measure to be able to meet this water shortage emergency and alleviate this problem.

8. A water shortage emergency condition has been declared to prevail within said area by this Board in accordance with the conditions and requirements set forth in Sections 350 et seq. of the California Water Code.

SECTION 2: Pursuant to Water Code Sections 350 et seq., the following regulations and restrictions on the delivery of and consumption of water within County Service Area No. 22 – Mt. Hannah are hereby approved and adopted, to be effective immediately:

1. Any water use exceeding 500 cubic feet per month per single family dwelling unit equivalent will be surcharged in the amount of $10.47 per each 100 cubic feet.
2. Any water use exceeding 750 cubic feet per month per single family dwelling unit equivalent will be surcharged $350.00 in addition to the $10.47 per each 100 cubic feet.
3. All landscape and other outdoor water usage (including filling of swimming pools and hot tubs) of water served by CSA No. 22 shall be prohibited.
4. The Special Districts Administrator is authorized to discontinue water service or install a water restrictor device at the water meter to any water user who willfully and continuously violates the restrictions of this ordinance.
5. Service Line Connection: No new service connections will be allowed throughout the duration of the effectiveness of this ordinance.

SECTION 3: This ordinance is an urgency ordinance for the immediate preservation of the public peace, health, and safety and shall take effect immediately in accordance with Section 25123 of the Government Code of the State of California. The facts constituting such urgency are:

1. There has arisen a water shortage emergency in County Service Area No. 22 – Mt. Hannah resulting in the depletion of the water supply to a level insufficient for ordinary demands for human consumption, sanitation and fire protection.
2. This water shortage emergency constitutes a health and safety threat due to the County's inability to effectively insure an adequate supply of water for health and safety purposes without the immediate adoption of the above regulations and use restrictions.

SECTION 4: Administrative penalties may be imposed, enforced, and collected for violations of this ordinance as set forth in Article VII of Chapter 13 of the Lake County Code.

SECTION 5: If any section, subsection, sentence, paragraph, phrase, or clause of this ordinance shall be declared invalid for any reason whatsoever, such decision shall not affect the remaining portions of this ordinance,

which shall remain in full force and effect; and to this end the provisions of this ordinance are hereby declared to be severable.

SECTION 6: This project qualifies for a Class 7 Categorical Exemption pursuant to Section 15307 of the California Environmental Quality Act (CEQA) Guidelines because the action being taken will protect an existing groundwater aquifer and provide an opportunity for restoration of said aquifer.

SECTION 7: This ordinance shall take effect June 13, 2014 and shall terminate at such time as the Board of Supervisors declares the water shortage emergency condition in said area to no longer exist.

SECTION 8: Before the expiration of fifteen days after the passage of this ordinance, it shall be published at least once in a newspaper of general circulation printed and published in the County of Lake.

The foregoing ordinance was introduced before the Board of Supervisors on the 13th day of May, 2014, and passed by the following vote on the 13th day of May, 2014:

AYES: Supervisors Comstock, Smith, Farrington, Brown and Rushing

NOS: None

ABSENT OR NOT VOTING: None

Denise Rushing, Chair, Board of Supervisors

ATTEST: Matt Perry
Clerk of the Board

By: Maria Flores

APPROVED AS TO FORM: Anita L. Grant, County Counsel

The within instrument is a correct copy of the Document on file in this office.
ATTEST: 05-14-2014
MATT PERRY
Clerk of the Board of Supervisors of the State of California in and for the County of Lake.
By Dana Shuman

January (Month) 2013

STATION NO. Mt. Hannah WELL NO. 2

Solution: 12.5 %

	MIX USED 1	+ 2	= TOTAL	÷ FLOW MGD.	× DOSE	/ RES.	PUMP RUN TIME	FLOW HRS X 60 = GPM	REMARKS
1			.0364	.004032			2.0	33.6	
2			.0364	.004032	1.13		2.0	33.6	
3			.0364	.003991		1.44F	2.0	33.3	
4			.0364	.003991			2.0	33.3	
5			.0364	.003992			2.0	33.3	
6			.0364	.003992			2.0	33.3	
7			.0364	.003992	1.14		2.0	33.3	
8			.0455	.005067		1.30F	3.0	33.8	
9			.0455	.005067	1.12		2.0	33.8	
10			.0364	.004039		1.36F	2.0	33.7	
11			.0364	.004039			2.0	33.7	
12			.0364	.004039			2.0	33.7	
13			.0364	.004040			2.0	33.7	
14			.0364	.004040	1.13		2.0	33.7	
15			.0455	.005127		1.34F	3.0	34.2	
16			.0455	.005127	1.11		2.0	34.2	
17			.0728	.008181		1.32F	4.0	34.1	
18			.0728	.008181			4.0	34.1	
19			.0728	.008181			4.0	34.1	
20			.0728	.008182			4.0	34.1	
21			.0728	.008182	1.06		4.0	34.1	
22			.0728	.008129		1.35F	4.0	33.9	
23			.0728	.008130	1.11		4.0	33.9	
24			.04368	.004859		1.33	2.0	33.7	
1			.04368	.004859			2.0	33.7	
			.04368	.004859			2.0	33.7	
			.04368	.004859			3.0	33.7	
			.04368	.004860	1.12		3.0	33.7	
			.0728	.008064		1.36F	4.0	33.6	
			.0728	.008065	1.13		4.0	33.6	
			.0364	.003984		1.34F	2.0	33.2	
			1.5288	170,182			84.0		

YMA

Mt. Hannah Water Pumping Station

Well #2

Mix Chlorine: ~~0.25%~~ 12.5 %

Month: January

Year: 2013

Day	Time	Oper. Int.	Chlorination Low	High	SP/ST	Use	Dose	Res. F	Res. T	Water Production Reading	Gallons Used	GPM	#2 Time Recorder	Run Time	Raw H2O NTU	PSI S	PSI R	Well Level	Tank Level	Filter PSI In	Filter PSI Out	Filter PSI In
1						.0364					4032	33.6		2.0								
2				(.1092)		.0364	1.13			(12075)	4032	33.6	(6.0)	2.0								
3	1000	KSL	6.3246	6.3246	20/70	.0364		1.44F		1435833	3991	33.3	25847.0	2.0		124S	25.3'S	18'0"	120S	118S	120S	
4						.0364					3991	33.3		2.0								
5						.0364					3992	33.3		2.0								
6						.0364					3992	33.3		2.0								
7				(.182)		.0364	1.14			(19958)	3992	33.3	(10.0)	2.0								
8	1000	KSL	6.1426	6.1426	20/70	.0455		1.30F		1455811	5067	33.8	25857.0	3.0	.84	124S	24.7'S	17'2"	120S	120S	120S	
9				(.091)		.0455	1.12			(10134)	5067	33.8	(5.0)	2.0								
10	1000	KSL	6.0516	6.0516	20/70	.0364		1.36F		1465945	4039	33.7	25862.0	2.0		124S	24.7'S	17'2"	120S	118S	120S	
11						.0364					4039	33.7		2.0								
12						.0364					4038	33.7		2.0								
13				(.182)		.0364				(20197)	4040	33.7	(10.0)	2.0								
14						.0364					4040	33.7		2.0		122S	~~24.1'S~~	~~12'4"~~	~~118S~~	~~120S~~	~~120S~~	
15	1000	KSL	5.8696	5.8696	20/70	.0455		1.34F		1486142	5127	34.2	25872.0	3.0	.78	122S	24.1'S	12'4"	118S	120S	120S	
16				(.091)		.0455	1.11			(10254)	5127	34.2	(5.0)	2.0								
17	1000	KSL	7.7786	7.7786	20/70	.0728		1.30F		1496396	8181	34.1	25877.0	4.0		122S	24.3'S	12'0"	118S	120S	118S	
18						.0728					8181	34.1		4.0								
19						.0728					8181	34.1		4.0								
20						.0728					8182	34.1		4.0								
21				(.364)		.0728	1.06			(40907)	8182	34.1	(20.0)	4.0								
22	1000	KSL	7.4146	7.4146	20/70	.0728		1.35F		1537368	8129	33.9	25897.0	4.0	.76	122S	24.7'S	15'0"	118S	120S	120S	
23				(.1456)		.0728	1.11			(16259)	8130	33.9	(8.0)	4.0								
24	1000	KSL	7.269	7.269	20/70	.0368		1.33F		1553562	4359	33.7	25905.0	2.0		122S	24.7'S	17'0"	118S	120S	120S	
25	1100	KSL				.0368					4859	33.7		2.0				18'0"				
26						.0368					4859	33.7		2.0								
27						.0368					4859	33.7		3.0								
28				(.2184)		.0368	1.12			(24286)	4860	33.7	(12.0)	3.0								
29	1000	KSL	7.0506	7.0506	20/70	.0728		1.36F		1577858	8064	33.6	25917.0	4.0	.72	124S	24.5'S	17'0"	118S	120S	120S	
30				(.1456)		.0728	1.13			(16129)	8065	33.6	8.0	4.0								
31	1000	KSL	6.905	6.905	20/70	.0364	1.14	1.34F		1583987	3984	33.2	25925.0	2.0		124S	24.8S	19'0"	118S	120S	120S	
Totals > >						0					0	0		0								

Comments > > 1/25/13 reduced run time by 2 hours - now on midnight until 2:00 am daily -
Average dose = 1.12 mg/l
Average gpm = 33.8 gpm

Mt. Hannah Water Pumping Station
Well #2

Month: January

Year: 2014

Mix Chlorine: 12.5%

Day	Time	Oper. Int.	Chlorination Low	High	SP/ST	Use	Dose	Res. F	Res. T	Water Production Reading	Gallons Used	GPM	#2 Time Recorder	Run Time	Raw H2O NTU	PSI S	PSI R	Well Level	Tank Level	Filter PSI In	Filter PSI Out	Filter PSI In
1				(.273)		.1365	2.87			(1885)	5943	33.0	(6.0)	3.0								
2	1000	KSP	8.0445	8.0445	50/70	.1365		.96F		3672031	5949	33.1	26993.0	3.0		128S		40.75	23'0"		0/S	
3						.1365					5949	33.1		3.0								
4						.1365					5949	33.1		3.0								
5						.1365					5949	33.1		3.0								
6				(.6825)		.1365	2.87			(29745)	5949	33.1	(15.0)	3.0								
7	1000	KSP	7.362	8.362	50/70	.091		.92F		3701773	3971	33.1	27008.0	2.0	.75	128S		43.15	23'4"		0/S	
8				(.182)		.091	2.86			(7943)	3972	33.1	(4.0)	2.0								
9	1000	KSP	8.18	9.18	50/70	.1001		.94F		3709716	4365	33.1	27012.0	2.0		128S		40.15	23'2"		0/S	
10						.1001					4365	33.1		2.0								
11						.1001					4365	33.1		2.0								
12						.1001					4365	33.1		2.0								
13				(.5000)		.1001	2.87			(21826)	4366	33.1	(11.0)	3.0								
14	1000	KSP	8.6795	9.6795	50/70	.1365		.95F		3723549	5967	33.2	27023.0	3.0	.76	128S		39.95	22'2"		0/S	
15				(.273)		.1365	2.86			(11935)	5968	33.2	(6.0)	3.0								
16	1000	KSP	9.4065	9.4065	50/70	.091		.97F		3743471	3972	33.1	27027.0	2.0		128S		43.45	22'8"		0/S	
17						.091					3972	33.1		2.0								
18						.091					3973	33.1		2.0								
19						.091					3973	33.1		2.0								
20				(.455)		.091	2.86			(19863)	3973	33.1	(10.0)	2.0								
21	1000	KSP	8.955	9.455	50/70	.1365		.95F		3763340	5984	33.2	27039.0	3.0	.74	128S		40.25	20'8"		0/S	
22				(.273)		.1365	2.85			(19868)	5984	33.2	(6.0)	3.0								
23	1000	KSP	8.6795	8.6795	50/70	.1365		.98F		3783081	6003	33.4	27045.0	3.0		128S		41.55	21'2"		0/S	
24						.1365					6003	33.4		3.0								
25						.1365					6003	33.4		3.0								
26						.1365					6003	33.4		3.0								
27				(.6825)		.1365	2.84			(30015)	6003	33.4	(15.0)	3.0								
28	1000	KSP	7.996	9.996	50/70	.091		.96F		3805333	3990	33.3	27060.0	2.0	.75	128S		43.95	22'8"		0/S	
29				(.182)		.091	2.84			(7980)	3990	33.3	(4.0)	2.0								
30	1000	KSP	9.814	9.814	50/70	.091		.97F		3813303	3984	33.2	27064.0	2.0		128S		40.95	22'2"		0/S	
31						.091					3984	33.2		2.0								
Totals >>						0					0	0		0								

Comments >>

Average dose = 2.86 mg/l
Average gpm = 33.2 gpm

Mt. Hannah Water Pumping Station

Well #2

Month: April

Year: 2014

Mix Chlorine: 12.5%

Day	Time	Oper. Int.	Chlorination Low	High	SP/ST	Use	Dose	Res. F	Res. T	Water Production Reading	Gallons Used	GPM	#2 Time Recorder	Run Time	Raw H2O NTU	PSI S	PSI R	Well Level	Tank Level	Filter PSI In	Filter PSI Out	Filter PSI In
1	1000	LSL	10.2673	10.2673	30/70	.0546		1.15F		4164978	3965	33.0	27342.0	2.0	.80	128S		41.2'S	21'0"		0/S	
2				(.1092)		.0546	1.72			(7930)	3965	33.0	(4.0)	2.0								
3	1000	LSL	10.1581	10.1581	30/70	.0546		1.29F		4172908	3965	33.0	27246.0	2.0		128S		40.8'S	21'2"		0/S	
4						.0546					3966	33.0		2.0								
5						.0546					3966	33.0		2.0								
6						.0546					3966	33.0		2.0								
7				(.273)		.0546	1.72			(19829)	3966	33.0	(10.0)	2.0								
8	1000	LSL	9.8851	10.8851	30/70	.0546		1.16F		4192737	3960	33.0	27256.0	2.0	.76	128S		40.5'S	21'4"		0/S	
9				(.1092)		.0546	1.72			(7921)	3961	33.0	(4.0)	2.0								
10	1000	LSL	10.7759	10.7759	30/70	.0606		1.18F		4200658	4359	33.0	27260.0	2.0		128S		40.6'S	21'8"		0/S	
11						.06006					4359	33.0		2.0								
12						.06006					4357	33.0		2.0								
13						.06006					4357	33.0		2.0								
14				(.3003)		.06006	1.72			(21795)	4357	33.0	(11.0)	3.0								
15	1000	LSL	10.4756	10.4756	30/70	.0546		1.09F		4222453	3971	33.1	27271.0	2.0	.78	128S		40.7'S	21'2"		0/S	
16				(.1092)		.0546	1.72			(7942)	3971	33.1	(4.0)	2.0								
17	1000	LSL	10.3664	10.3664	30/70	.0546		1.12F		4230395	3965	33.0	27275.0	2.0		128S		40.8'S	21'2"		0/S	
18						.0546					3965	33.0		2.0								
19						.0546					3965	33.0		2.0								
20						.0546					3965	33.0		2.0								
21						.0546					3965	33.0		2.0								
22				(.3276)		.0546	1.72			(23790)	3965	33.0	(12.0)	2.0								
23	1000	LSL	10.0388	11.0388	30/70	.0819		1.08F		4254185	5921	32.9	27287.0	3.0	.75	128S		40.5'S	19'8"		0/S	
24				(.1638)		.0819	1.73			(11843)	5922	32.9	(6.0)	3.0								
25	1000	LSL	10.875	10.875	30/70	.0819		1.03F		4266028	5864	32.6	27293.0	3.0		128S		42.6'S	20'8"		0/S	
26						.0819					5864	32.6		3.0								
27						.0819					5864	32.6		3.0								
28				(.3276)		.0819	1.75			(23456)	5864	32.6	(12.0)	3.0								
29	1000	LSL	10.5474	10.5474	30/70	.0546		1.14F		4289484	3895	32.5	27305.0	2.0	.85	128S		43.0'S	23'2"		0/S	
30				(.1092)		.0546	1.75			(7791)	3896	32.5	(4.0)	2.0								
31																						
Totals >>						0					0	0		0								

Comments >>

Average dose = 1.72 mg/l
Average gpm = 32.1 gpm

April (Month) 2014

STATION NO. Mt. Hannah WELL NO. 2

Solution: 12.5 %

DATE	MIX USED 1	+ 2	= TOTAL	÷ FLOW MGD.	× DOSE / RES.		PUMP RUN TIME	FLOW HRS X 60 = GPM	REMARKS
1			.0546	.003965		1.15F	2.0	33.0	
2			.0546	.003965	1.72		2.0	33.0	
3			.0546	.003965		1.29F	2.0	33.0	
4			.0546	.003966			2.0	33.0	
5			.0546	.003966			2.0	33.0	
6			.0546	.003966			2.0	33.0	
7			.0546	.003966	1.72		2.0	33.0	
8			.0546	.003960		1.16F	2.0	33.0	
9			.0546	.003961	1.72		2.0	33.0	
10			.06006	.004359		1.18F	2.0	33.0	
11			.06006	.004359			2.0	33.0	
12			.06006	.004359			2.0	33.0	
13			.06006	.004359			2.0	33.0	
14			.06006	.004359	1.72		3.0	33.0	
15			.0546	.003977		1.07F	3.0	33.1	
16			.0546	.003971	1.72		3.0	33.1	
17			.0546	.003965		1.12F	2.0	33.0	
18			.0546	.003965			2.0	33.0	
19			.0546	.003965			2.0	33.0	
20			.0546	.003965			2.0	33.0	
21			.0546	.003965			2.0	33.0	
22			.0546	.003965	1.72		2.0	33.0	
23			.0819	.005941		1.08F	3.0	32.9	
24			.0819	.005922	1.72		3.0	32.9	
25			.0819	.005864		1.03F	3.0	32.6	
26			.0819	.005864			3.0	32.6	
27			.0819	.005864			3.0	32.6	
28			.0819	.005864	1.75		3.0	32.6	
29			.0546	.003895		1.14F	2.0	32.5	
30			.0546	.003896	1.75		2.0	32.5	
31									
			1.8291	132927			69.0		

YHS

County of Lake CSA 22 Mt. Hannah #1700563

Options
Estimated calcs - SKM 6/2/14, Mendocino District, CDPH

To Haul water

Provide 50 gpdpe c = 88 ⟹ Need 4,400 gpd

Assumptions:

$250 for 3,500 gal tanker	1.26 tankers/day	
Need water June - Nov (180 days)	⟹ $56,700	
Pump cost	⟹ $2,000	
Pump power cost $50/day	⟹ $9,000	Similar to normal well pump cost
Water Storage tank rental $1200/mo	⟹ $7,200	
Tank Mob / Demob	⟹ 10,000	
	$75,900	

To Connect to Loch Lomond

Did not discuss with Loch Lomond, not sure if they have capacity

Estimate $100/ft to construct
Estimate 6,000 ft to connect ⟹ $600,000

does not include engineering, environ., LAFCO, add'l permitting administrative..

Lake County CSA 22 Mt. Hannah Drought Field Visit—May 9, 2014

Photos of Clamps on Transmission Main

by

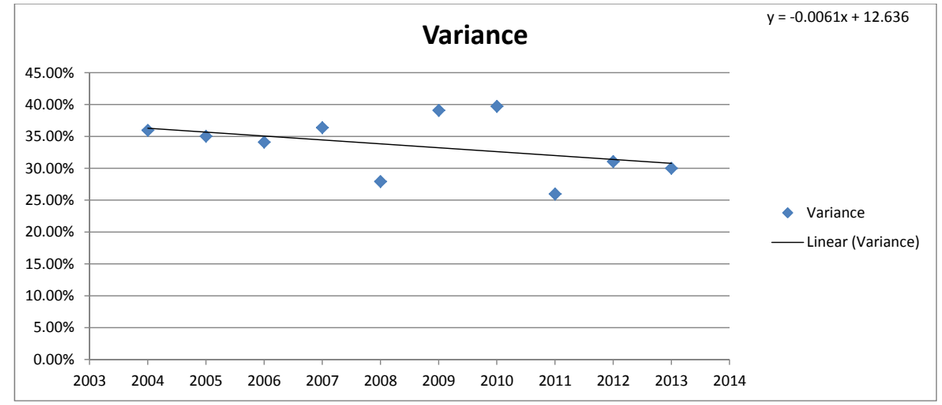
S. Miller and M. Frederick

Note:
Moss Growth
due to wetness

This is only a
sampling of the
clamps on the
transmission
line.

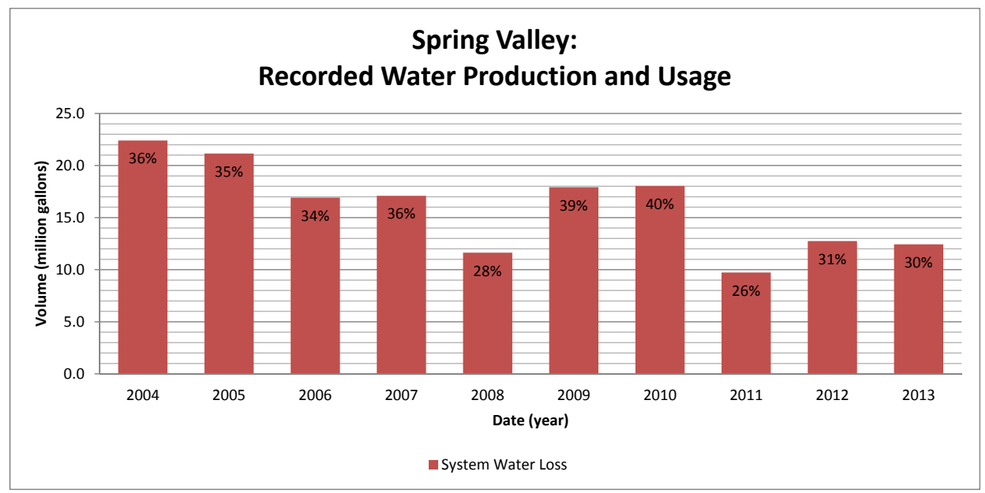
Million gallons/year?

Year	Produced	Consumed	Delta	Variance		Rainfall at Cobb Mtn\	# of connections	Persons/connection	Pop per 2010 census	GPCD (produced)	GPCD (consumed)	Water Loss GPCD	Water Loss GPD
2004	62,290,425	39,878,330	22,412,095	35.98%	0.3598	42.15	494	1.71	845	201.96	129.30	(72.67)	(61,403.00)
2005	60,360,555	39,204,180	21,156,375	35.05%	0.3505	100.34	494	1.71	845	195.71	127.11	(68.59)	(57,962.67)
2006	49,616,162	32,687,128	16,929,034	34.12%	0.3412	84.75	494	1.71	845	160.87	105.98	(54.89)	(46,380.92)
2007	46,969,921	29,878,137	17,091,784	36.39%	0.3639	53.48	494	1.71	845	152.29	96.87	(55.42)	(46,826.81)
2008	41,637,176	30,002,432	11,634,744	27.94%	0.2794	56.08	494	1.71	845	135.00	97.28	(37.72)	(31,876.01)
2009	45,820,580	27,900,668	17,919,912	39.11%	0.3911	64.12	494	1.71	845	148.56	90.46	(58.10)	(49,095.65)
2010	45,391,300	27,354,440	18,036,860	39.74%	0.3974	97.48	494	1.71	845	147.17	88.69	(58.48)	(49,416.05)
2011	37,480,333	27,741,939	9,738,394	25.98%	0.2598	55.73	494	1.71	845	121.52	89.95	(31.57)	(26,680.53)
2012	41,063,400	28,302,829	12,760,571	31.08%	0.3108	89.00	494	1.71	845	133.14	91.77	(41.37)	(34,960.47)
2013	41,469,280	29,025,305	12,443,975	30.01%	0.3001	13.77	494	1.71	845	134.45	94.11	(40.35)	(34,093.08)
Average	47,209,913	31,197,539	16,012,374	34%		35.70	through April 2014						
		Use 10 MGY of savings				65.69	Ave 2004-2013						



Year	Produced		Difference	Variance
2004	62.3		22.4	36%
2005	60.4		21.2	35%
2006	49.6		16.9	34%
2007	47.0		17.1	36%
2008	41.6		11.6	28%
2009	45.8		17.9	39%
2010	45.4		18.0	40%
2011	37.5		9.7	26%
2012	41.1		12.8	31%
2013	41.5		12.4	30%

412	connections
2	residents/connection
1,001	people
60	gpcd
365	days
21,900	gpcy
21,925,404	gpy
22	mgpy



IVR Storage

	AF	CF	Gallons
IVR usable storage	300,600		
2013 water in storage	96,411		
Current water in storage	27,753	1,208,920,680	
estimated Spring Valley dem	83.95	3,657,011	27,354,440
Annual fisheries use at 10 cf	7,239.67	315,360,000	
Storage remaining: Current wate		889,903,669	

Alterative 4 – Water Wells & Slow Sand Filtration

Alternative 4 would make use of the existing water treatment plant with 4 slow sand filters and well water to increase the overall supply of potable water to the distribution system. A private well driller has offered to sell water from multiple wells. A single well has been drilled and the initial pump test indicated adequate yield and good water quality. Additional yield testing is planned to further show the viability of this Alternative.

The estimated cost per gallon for well water is much less than for surface water treated with slow sand filters. If Alternative 4 is selected, it makes economic sense to maximize production of well water and minimize production of treated surface water. If the well field can continuously produce 135 gpm (194,440 gpd) as expected, the projected average water demand could be satisfied by well water alone through year 2011 and the WTP would only be needed to satisfy above average demand. After 2011, the WTP would also be needed to supply part of the average demand. This would theoretically be the most economical way to operate, predominantly with well water. However, slow sand filters are a biological system and cannot be left idle or the bio-population will be depressed or die. If this happens it could take several days of startup operation before the filters would again produce acceptable water. Poor quality water would have to be wasted, all of this happening when the treatment plant is needed online. Pilot testing is needed to determine how long the slow sand filters can be safely shut off and then recover without deteriorating finished water quality.

Ideally slow sand filters should operate continuously at steady state but the ideal situation is often not practical or desirable. Current practice at the WTP is to operate the filters during the daytime when demand is high and into the evening until the storage reservoir is filled. The plant then shuts off overnight when demand is low. The plant automatically resumes operation when morning demand begins to draw down the reservoir. When operation is resumed, no adverse effect on filtered water turbidity has been observed. From this we know that flow to the filters can be stopped for at least 10 to 12 hours and returned to full production without harm, contrary to the steady state ideal. To explore the maximum acceptable daily downtime, a full scale pilot test using the existing WTP is in recommended. One of the four filters could be designated as a pilot filter and shut off for progressively more hours per day until filtered water turbidity starts to increase. Operation at any given On/Off ratio should last at least 1 week to make sure the bio-population acclimates. Should turbidity from the pilot filter rise to 1 NTU, water from the filter would have to be wasted or retreated using the other 3 filters. In addition to turbidity, dissolved oxygen in the pilot filter effluent should be checked. Anoxic conditions in the effluent would indicate that the aerobic filter bio-population is in jeopardy. Similarly, the pilot filter could be operated at progressively lower hydraulic loading rates to determine the minimum flow rate at which the plant could maintain operation and still return to full production without detriment to finished water quality. It might be found that a combination of low loading rate and daily shut down of the WTP would result in optimum well water use. A new raw water pump station with appropriately sized pumps would likely be needed to implement full scale operation at a minimal maintenance flow rate. The pilot testing should take place during the irrigation off season when three filters can provide an adequate supply of water and would require 4 to 6 months to complete.

Table 12 lists major design criteria for Alternative 4, including an assumed well field capacity of 135 to 140 gpm. As mentioned above, additional well testing is needed to further prove viability for use in this Alternative. Well yield testing and aquifer modeling are often used to define well

capacity. However, as with any well, positive testing and modeling results can provide a basis for predicting performance but cannot guarantee future performance.

Appendix E contains a Technical Memorandum (TM) that discusses the feasibility of using the suggested groundwater source. The TM includes initial well testing results, geologic information, preliminary technical conclusions and recommendation for an aquifer test.

Figure 10 is a conceptual schematic diagram of Alternative 4.

TABLE 12
Alternative 4 – Water Wells & Slow Sand Filtration, Design Criteria

Item	Design Criteria
Max Flow Rating	420 gpm
Flow at 95% of Maximum	400 gpm (574,560 gpd)
Raw Water Pump Station	
Existing Pumps	
No. of Pumps	2
Capacity, ea	275
Firm Capacity	275
Slow Sand Filtration	
No. of Filters	4
Surface Area, ea	700 ft^2
Loading Rate	0.1 gpm/ft^2
Max Capacity	280 gpm
Capacity at 95%	266 gpm (383,040gpd)
Water Wells	
No. of Wells	5 or more
Firm Capacity	135 to 140 gpm
Treatment Required	Chlorination
Chlorination	
Sodium Hypochlorite	NaOCl
Max Feed Rate	10 lb/day
Typical Dosage	1.3 to 1.5 mg/l
Effective Vol. for Chlorination	
Cl_2 Chamber	5,625 gal
Clearwell No. 1	1,851 gal
Clearwell No. 2	71,100 gal
Transfer Pump Station	
Existing Pumps	
No. of Pumps	4
Capacity, ea	70 gpm
Firm Capacity	280 gpm
Clearwell No.2	
Vol. at 22-ft High Level	143,900 gal
Vol. for Cl_2 Contact	71,100 gal
Vol. Available for Storage	72,800 gal

Booster Pump Station	
Existing Pumps	
No. of Pumps	2
Capacity, ea	250 gpm
Firm Capacity	250 gpm
Turbidimeters	
Raw Water	1
Slow Sand Combined Effluent	1
Flowmeters	
Raw Water	1
Slow Sand Filter Effluent	4
Engine Generator 100KW	1

TABLE 15
Optional Improvements for each Alternative

Item	Alt 1 Slow Sand Filtration	Alt 2A Rapid Sand Filtration	Alt 2B Rapid Sand Filtration & Slow Sand Filtration	Alt 3 Micro-Filtration	Alt 4 Water Wells & Slow Sand Filtration
	Optional	Optional	Optional	Optional	Optional
Raw Water Turbidimeters	1 Redundant Turbidimeter		1 Redundant Turbidimeter	1 Redundant Turbidimeter	
Combined Filter Effluent (CFE) Turbidimeters	1 Redundant Turbidimeter		1 Redundant Turbidimeter	1 Redundant Turbidimeter	1 Redundant Turbidimeter
Individual Filter Effluent (IFE) Turbidimeters	1 each Filter (6 total)		1 each Filter (4 total)		
Engine Generator for Whole Plant	1 (250 KW)		1 (250 KW)	1 (250 KW)	1 (200 KW)
Filter Control Valves, Automatic Actuators	1 each Filter[1] (6 total)		1 each Filter (2 total)		1 each Filter[1] (4 total)
PC with Data Historian for Plant Monitoring and Compliance Reports	1		1	1	1

Notes:
1. Automating Slow Sand Filter Valves, would allow the flow through each filter to approach the maximum permitted flow of 70 gpm, resulting in a plant capacity increase of approximately 3 percent.

Economic Analysis

An economic analysis of the Alternatives has been prepared for comparison of capital cost, operation and maintenance (O&M) cost and present worth. Present worth costs include estimated O& M and capital costs through year 2028.

Capital Cost Comparison of Alternatives

Public works projects must be publicly tendered for bids from construction contractors. The capital costs shown in Table 16 include an estimate of the amount contractors will bid, assuming a bid date in late 2009. The capital cost also includes a 10 percent upward adjustment for the cost of construction in the Spring Valley locale, a construction cost contingency, engineering and construction management costs, legal and administration costs, and pilot testing for Alternatives 2, 3 and 4. The contingency is intended to cover construction costs that will be required but are not defined or known when planning level estimates are prepared. The contingency cost is not an estimate of construction change-order cost.

As shown in Table 16, Alternative 1 – Slow Sand Filtration and Alternative 4 - Water Wells and Slow Sand Filtration are essentially equal cost and more attractive than the other Alternatives based on total capital cost.

Alternatives 2A and 2B have nearly the same capital cost, 2B being slightly lower because the existing filters would be used to process part of the raw water. Alternative 2A would use larger and therefore more costly rapid sand filters for the entire plant flow. The O&M cost for 2A and 2B would be about the same. The higher power and chemical cost for 2A would be offset by the labor cost for operating the more complex 2B process. Further judgment of the differences between Alternatives 2A and 2B is not warranted considering that both have capital and O&M costs that are nearly the same. Either could be selected interchangeably. For the sake of simplifying subsequent analysis, from this point forward Alternative 2B and Alternative 2 will be considered one and the same.

TABLE 16
Estimated Capital Cost for each Alternative

Item	Alt 1 Slow Sand Filtration	Alt 2A Rapid Sand Filtration	Alt 2B Rapid Sand Filtration & Slow Sand Filtration	Alt 3 Micro-Filtration	Alt 4 Water Wells & Slow Sand Filtration
Treatment Plant	$1,390,000	$2,140,000	$2,040,000	$2,560,000	$385,000
Wells and Source water Pipeline	$0	$0	$0	$0	$1,155,000
Storage	$690,000	$690,000	$690,000	$690,000	600,000
Distribution Piping	$0	$0	$0	$0	$0
Contingency	$350,000	$480,000	$465,000	$560,000	$365,000
Total	$2,430,000	$3,310,000	$3,195,000	$3,810,000	$2,505,000

Operation and Maintenance Cost Comparison of Alternatives

In some cases alternatives are rejected due to high O&M cost even though attractive based on capital cost. This is not the case for Spring Valley. Alternative 4 has the apparent lowest O&M cost followed closely by Alternative 1. As shown in Table 17, the 20-year present worth of O&M cost for these Alternatives 1 and 4 are virtually the same, well within the range of accuracy of the estimate.

The O&M cost for Alternative 4 is strongly sensitive to the amount of well water used because pumping from relatively shallow wells is far less costly than treating surface water. The O&M cost for Alternative 4, as shown in Table 17, is based on an annual use of 50 million gallons per year (mgy) from wells and the remainder of the annual demand supplied from the WTP with its current complement of four slow sand filters. If wells become ready for service for 2010, 50 mgy would constitute 72 percent of the water supply. By 2028 the percentage from wells would drop to 60 percent if 50 mgy from wells remains constant. The actual amount of well water that can be used is dependent on two primary variables that are currently in a state of flux. Defining these variables is required in order to more accurately estimate the O&M cost of Alternative 4. First, well yield tests need to be done to better define how much well water could be made available. Second, pilot testing of the existing slow and filters is needed to determine their turndown capability. In this sense, turndown is the amount of time the filters can be out of service

and/or the minimum hydraulic loading that can be applied, followed by return to full capacity without deterioration of filtered water quality. See Section **Alternative 4 – Water Wells & Slow Sand Filtration** for additional discussion of pilot testing.

Alternative 3 has the highest O&M cost, primarily due to the electrical power used to pump water through the membrane system.

TABLE 17
20-year Net Present Value Comparison of Alternatives

Item	Alt 1 Slow Sand Filtration	Alt 2 Rapid Sand Filtration & Slow Sand Filtration	Alt 3 Micro-Filtration	Alt 4 Water Wells & Slow Sand Filtration
Treatment Plant	$1,390,000	$2,040,000	$2,560,000	$385,000
Wells and Source Water Pipeline	$0	$0	$0	$1,155,000
Storage	$690,000	$690,000	$690,000	$600,000
Distribution Piping	$0	$0	$0	$0
Contingency	$355,000	$465,000	$560,000	$365,000
Total Capital Cost	$2,430,000	$3,195,000	$3,810,000	$2,505,000
Net Present Value of Capital Cost	$2,220,000	$2,940,000	$3,520,000	$2,310,000
Net Present Value of 20-year O&M Cost	$4,785,000	$6,475,000	$6,630,000	$4,715,000
Total 20-year Net Present Value	$7,005,000	$9,415,000	$10,150,000	$7,025,000

Net Present Value Comparison of Alternatives

The story is the same when comparing the 20-year net present value (present worth) of the Alternatives. Alternatives 1 and 4 should be considered as having equal 20-year net present value as shown above in Table 17. Assuming that low cost is an important factor in selecting preferred alternatives, Alternatives 1 and 4 are the most attractive on the basis of capital cost, O&M cost and 20-year net present value cost.

Non-Economic Analysis

The factors listed in Table 18 are suggested as non-economic factors that may be helpful in selecting a preferred Alternative. Although the factors are called non-economic, it is apparent that each has a cost dimension whether direct or potential. The cost dimension is, however, ill defined or highly variable depending on unpredictable circumstances. For example, if water

COUNTY OF LAKE
SPECIAL DISTRICTS ADMINISTRATION
230A Main Street
Lakeport, California 95453
Telephone 707/263-0119
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NICHOLAS RING
Deputy Administrator

Abbreviated History,
CSA 16 – Paradise Valley Water System

July 15, 1982 – 12" dia. water well drilled to 178 ft. depth.
Static water level : 10'
Design drawdown: 102'
Design output : 120 gpm
Perforation zone : 108' – 168'
Pump setting : 130'.

August 1983 - Water system construction completed. Includes 100 gpm pressure filter chlorine disinfection system and 105,000 gallon storage tank.

April 1984 - CSA formed and water system permit issued by LCEH.

August 1986 - Water yield failure. Drawdown test performed. New yield: 50 gpm 20' of new column pipe added. New pump setting: 150'

1986/87 - Developer installs lake water irrigation system to reduce demand on drinking water.

August 2003 - Water yield failure. Pumping level : 150' Output: 12 gpm
Attempt to increase yield by superchlorinating well perforations; no success.

Weeks Well Drilling called in to 'swab and bail' well in attempt to redevelop aquifer; no success.

Water hauling commences with swab & bail operations.

New well construction targeted for Friday Aug. 22

Sept. 2003 - Water Well No. 2 construction completed 9/25/03 by Weeks Well Drilling. Depth 180'. Estimated yield 20 gpm.

June 2004 - Water Well No. 2 electrical, mechanical and piping systems designed, assembled and installed by Special Districts O&M staff.

Water well no. 2 placed into service 6/23/04.

August 2004 - Water conservation urgency ordinance enacted.

March 2005 - Water well no. 3 construction undertaken by Homeowners Association.

Water well no. 3 drilling completed 3/1/05

May 2005 - Paradise Valley group seeks separation from Special Districts and dissolution of County Service Area.

July 2005 - Water well no. 3 tested by homeowners group. Yield: 15.1 gpm.

Sept. 2005 - Special Districts prepares and submits Permit Application package to CDHS for Water Well No. 3.

9/29/05 - CDHS performs site visit inspection for water well no. 3 and stipulates construction requirements.

Dec. 2005 - Water well no. 3 conveyance piping partially installed.

May 2006 - Letter sent to M. Alioto requesting progress update. Response received from M. Alioto with request for construction assistance.

July 2006 - M. Alioto forecasts August 2006 for well completion.

Nov. 2006 - Letter to M. Alioto of intent to deny acceptance of installed pipe without drawings and approvals. Mr. Alioto responds that CalTrans encroachment permits and pipeline construction drawings are being mailed to Special Districts.

	Paradise Valley Water consupmtion and production				Average Gal per day
	Produced	Consumed	Varience		Per person
2007	4,151,530	4,103,334	48,196	1%	69
2008	4,208,248	3,720,437	487,811	12%	63
2009	3,407,580	3,152,290	255,290	7%	53
2010	3,391,537	3,031,106	360,431	11%	51
2011	3,480,828	3,265,993	214,835	6%	55
2012	2,900,392	2,405,732	494,660	17%	40
2013	1,297,190	1,051,013	246,177	19%	18

74 active connections with approx. 2.2 people per household is a population of 163.

SPECIAL DISTRICTS

Lake County's Water and Wastewater Agency

Source Capacity Study

for

CSA # 16 Paradise Valley Water System

October 16, 2011

Lake County Special Districts Administration
230 N. Main Street, Lakeport, CA 95453
(707) 263-0119

Paradise Valley Source Capacity Study

Introduction

On April 7, 2011, the California Department of Public Health (CDPH) conducted an inspection of the Lake County Paradise Valley (CSA #16) Water System serving the community of Paradise Valley. This annual inspection included a review of the facilities (treatment and distribution), monitoring review, as well as general management and fiscal management reviews. This Source Capacity Study (SCS) update was listed among the recommendations, as defined in Section 64558, Title 22 of the California Code of Regulations (CCR) as an evaluation of the treatment and storage capacity of the community water system in accordance with Section 64554 of the CCR.

This update includes a review of the recent production data submitted to the CDPH. The data identified a maximum day use of 27,000 gallons (during August of 2008). Based on the 72 connections at the time, the individual connection demand was 375 gallons per day per connection (gpdc). As a side note, this gpdc rate is higher than expected since Paradise residents have the ability to utilize lake water for outdoor irrigation.

A proposed rate increase is underway to establish a tiered rate whereby customers who use more water will pay significantly more for this consumption. It is anticipated that this tiered rate structure will reduce the daily consumption per connection. The final hearing for this increase will occur on October 18, 2011 before the Board of Supervisors.

Analysis Summary

Based on the review of the production data (Wells #1, 2, and 3) noted above, the Paradise Valley Water System appears to have adequate capacity during normal operations, meeting the requirements of Section 64554(a) of the CCR, including projected growth. However, Section 64554(c) also requires single well operations to meet the maximum day demand (MDD) which is not being demonstrated. Further analysis shows that the Paradise Valley water system has adequate storage capacity (100,000 gallons) exceeding the MDD by 370%.

Using the recent historical peak production values from Wells #1, 2, and 3, the system should have sufficient water production capabilities to meet the maximum day demand (MDD).

To meet the single well production requirement, Special Districts will need to develop an additional source of water. An investigation for an additional source is underway.

The 100,000 gallon tank will meet the projected 2031 storage requirements for MDD. However, given the additional need for fire protection (which can be 750-1000 gpm for a period of 2 hours), an additional 90,000 -120,000 gallons of storage may be needed in addition to the MDD. If fire flows are factored in, the total additional storage needed can range from 16,800 to 57,200 gallons.
Based upon the growth projections, improvements should be completed before 2015. Depending on the availability of funding, contractors, and materials, additional storage could be completed and online by the end of the construction season in 2014.

Anticipated Growth
Based on a study of Lake County demographics completed by the Center for Economic Development (CSU-Chico), Lake County is projected to have a variable growth rate. For the purpose of this study, a growth rate of 1.5% is projected from the present through 2021, followed by a slower growth rate of 1.1% from 2021 through 2031.

Table 1 - 20-Year Forecast Growth Within the Paradise Community

Year	Connections	Population
2011	77	142
2012	78	145
2013	79	147
2014	81	149
2015	82	151
2016	83	153
2017	84	156
2018	85	158
2019	87	160
2020	88	163
2021	89	165
2022	90	167
2023	91	169
2024	92	171
2025	93	173
2026	94	175
2027	95	177
2028	96	178
2029	98	180
2030	99	182
2031	100	184

The growth projections are used as the basis to estimate the growth of the Paradise community in terms of population and number of water service connections. These include only residential connections, and the Paradise system only serves residential properties. Table 1 summarizes these growth projections.

The total build-out of the Paradise community is 133 service connections. This build-out analysis was determined by a study conducted by Criterion Planners in 2006, and was recently updated in March of 2011.

Maximum Day Demand (MDD)

A review of the Paradise Water System production records for the last four-year period is summarized in Table 2 below. For each year, every month was reviewed and the highest production day was determined. The complete set of data is presented in Attachment 1. Table 2 shows the highest production month and day was determined for each year.

Table 2 - Highest Production Month and Day for 2008 - 2011

	Year	Month	Day	Production
WELL #1				
	2008	Oct	1	17,200
	2009	Oct	2	15,600
	2010	May	14	13,500
	2011	Sept	5	12,300
WELL #2				
	Year	Month	Day	Production
	2008	Aug	11	16,100
	2009	May	29	12,100
	2010	Aug	11	15,400
	2011	Mar	21	5,100
WELL #3 (started August 2010)				
	2010	Sept	3	13,900
	2011	Mar	21	4,900

During the period examined by this update, the highest production month and day occurred on August 11, 2008 in which 27,000 gallons were produced.

The production of 27,000 gallons occurred when Paradise Valley had 72 connections which translates to 375 gpdc. The 375 gpdc is used to calculate the MDD for each year from 2011 to 2031. Total annual demand is based on the 4-year average of the amount of water produced during the period For the purposes of this update, production for 2011 was annualized based on the Jan-Sept production data. The four year production average is 3,848,149 gallons per year. Table 3 shows the increase in connections, population, MDD and total annual demand over the growth projection extending through 2031.

Presently, the Paradise Water system shows sufficient MDD water production capacity and does have the capability to meet annual demand up to 2031, as noted. The Paradise water system will need to increase the daily well production

rates (or add an additional source) to meet the regulatory requirements during non standard operational conditions.

Pressure Zones within the System

The Paradise service area is served by one pressure zone and one 100,000 gallon capacity storage tank.

Table 3 - Total Annual Demand Projections through 2031

Year	Connections	Population	MDD (gal)	Tot. Annual Demand
2011	77	142	28,875	3,848,149
2012	78	145	29,308	3,905,871
2013	79	147	29,748	3,964,459
2014	81	149	30,194	4,023,926
2015	82	151	30,647	4,084,285
2016	83	153	31,107	4,145,549
2017	84	156	31,573	4,207,733
2018	85	158	32,047	4,270,849
2019	87	160	32,527	4,334,911
2020	88	163	33,015	4,399,935
2021	89	165	33,511	4,465,934
2022	90	167	33,879	4,532,923
2023	91	169	34,252	4,600,917
2024	92	171	34,629	4,669,931
2025	93	173	35,010	4,739,980
2026	94	175	35,395	4,811,079
2027	95	177	35,784	4,883,245
2028	96	178	36,178	4,956,494
2029	98	180	36,576	5,030,842
2030	99	182	36,978	5,106,304
2031	100	184	37,385	5,182,899

Options to increase daily production/ storage

1) Add an additional water source.
2) Add an additional storage tank (for fire flow)

Timeline

Mar 2012	Initiate Prop 218 rate increase to fund needed improvements		
Sept 2012	Obtain funding to capitalize project		
Dec 2012	Conduct preliminary engineering, Environmental Permitting and ROW acquisitions		
June 2013	Requests for Proposals	Sept 2013	Design Phase
May 2014	Construction Phase	Oct 2014	Project(s) Complete

Attachment 1

Jan-08	1	2	3	Tot	Gallons
1	9.9	0	0	9.9	9,900
2	8.4	0	0	8.4	8,400
3	8.3	0	0	8.3	8,300
4	9.4	0	0	9.4	9,400
5	9.3	0	0	9.3	9,300
6	9.3	0	0	9.3	9,300
7	9.1	0	0	9.1	9,100
8	9	0	0	9	9,000
9	9.2	0	0	9.2	9,200
10	9.2	0	0	9.2	9,200
11	11.9	0	0	11.9	11,900
12	11.9	0	0	11.9	11,900
13	11.8	0	0	11.8	11,800
14	10.6	0	0	10.6	10,600
15	10.6	0	0	10.6	10,600
16	8.6	0	0	8.6	8,600
17	8.6	0	0	8.6	8,600
18	8.8	0	0	8.8	8,800
19	8.8	0	0	8.8	8,800
20	8.8	0	0	8.8	8,800
21	8.8	0	0	8.8	8,800
22	8.8	0	0	8.8	8,800
23	9.5	0	0	9.5	9,500
24	9.4	0	0	9.4	9,400
25	12.8	0	0	12.8	12,800
26	12.8	0	0	12.8	12,800
27	12.7	0	0	12.7	12,700
28	11.2	8	0	19.2	19,200
29	11.2	7.9	0	19.1	19,100
30	13.3	0	0	13.3	13,300
31	13.2	0	0	13.2	13,200
963,800					351,100

Feb-08	1	2	3	Tot	Gallons
1	8.4	3.9	0	12.3	12,300
2	8.4	3.9	0	12.3	12,300
3	8.4	3.9	0	12.3	12,300
4	10.3	0	0	10.3	10,300
5	10.2	0	0	10.2	10,200
6	10.3	0	0	10.3	10,300
7	10.2	0	0	10.2	10,200
8	10.4	0	0	10.4	10,400
9	10.8	0	0	10.8	10,800
10	10.8	0	0	10.8	10,800
11	10.8	0	0	10.8	10,800
12	10.8	0	0	10.8	10,800
13	9.7	0	0	9.7	9,700
14	9.6	0	0	9.6	9,600
15	9.4	0	0	9.4	9,400
16	9.4	0	0	9.4	9,400
17	9.4	0	0	9.4	9,400
18	9.4	0	0	9.4	9,400
19	6.4	0	0	6.4	6,400
20	6.5	0	0	6.5	6,500
21	6.5	0	0	6.5	6,500
22	9.9	0	0	9.9	9,900
23	9.9	0	0	9.9	9,900
24	9.9	0	0	9.9	9,900
25	8.6	0	0	8.6	8,600
26	8.7	0	0	8.7	8,700
27	8.4	0	0	8.4	8,400
28	8.4	0	0	8.4	8,400
29	10.1	0	0	10.1	10,100
19,200					281,700

Mar-08	1	2	3	Tot	Gallons
1	10.1	0	0	10.1	10,100
2	10	0	0	10	10,000
3	8.3	0	0	8.3	8,300
4	8.3	0	0	8.3	8,300
5	9.1	0	0	9.1	9,100
6	9.1	0	0	9.1	9,100
7	8.7	0	0	8.7	8,700
8	8.6	0	0	8.6	8,600
9	8.6	0	0	8.6	8,600
10	9.8	0	0	9.8	9,800
11	9.8	0	0	9.8	9,800
12	9.7	0	0	9.7	9,700
13	9.7	0	0	9.7	9,700
14	11.5	0	0	11.5	11,500
15	11.5	0	0	11.5	11,500
16	11.5	0	0	11.5	11,500
17	12.8	0	0	12.8	12,800
18	12.8	0	0	12.8	12,800
19	11.2	0	0	11.2	11,200
20	11.2	0	0	11.2	11,200
21	9.3	0	0	9.3	9,300
22	9.3	0	0	9.3	9,300
23	9.2	0	0	9.2	9,200
24	10.6	0	0	10.6	10,600
25	10.5	0	0	10.5	10,500
26	8.6	0	0	8.6	8,600
27	8.7	0	0	8.7	8,700
28	13.6	0	0	13.6	13,600
29	13.6	0	0	13.6	13,600
30	13.6	0	0	13.6	13,600
31	10.2	0	0	10.2	10,200
12,300					219,900

13,600

Apr-08	1	2	3	Tot	Gallons
1	10.1	0	0	10.1	10,100
2	13	0	0	13	13,000
3	13.1	0	0	13.1	13,100
4	12.6	0	0	12.6	12,600
5	12.6	0	0	12.6	12,600
6	12.6	0	0	12.6	12,600
7	9.6	0	0	9.6	9,600
8	9.5	0	0	9.5	9,500
9	8.9	0	0	8.9	8,900
10	8.9	0	0	8.9	8,900
11	12.3	0	0	12.3	12,300
12	12.2	0	0	12.2	12,200
13	12.2	0	0	12.2	12,200
14	10.3	0	0	10.3	10,300
15	10.2	0	0	10.2	10,200
16	8.3	0	0	8.3	8,300
17	8.3	0	0	8.3	8,300
18	13.5	0	0	13.5	13,500
19	13.5	0	0	13.5	13,500
20	13.5	0	0	13.5	13,500
21	7.9	0	0	7.9	7,900
22	7.8	0	0	7.8	7,800
23	11.2	0	0	11.2	11,200
24	11.2	0	0	11.2	11,200
25	13	0	0	13	13,000
26	13	0	0	13	13,000
27	13	0	0	13	13,000
28	11	0	0	11	11,000
29	11	0	0	11	11,000
30	10.6	0	0	10.6	10,600
1,244,700					234,000

May-08	1	2	3	Tot	Gallons
1	10.6	0	0	10.6	10,600
2	12.5	0	0	12.5	12,500
3	12.5	0	0	12.5	12,500
4	12.4	0	0	12.4	12,400
5	12.1	0	0	12.1	12,100
6	12	0	0	12	12,000
7	12	0	0	12	12,000
8	12	0	0	12	12,000
9	12.5	0	0	12.5	12,500
10	12.4	0	0	12.4	12,400
11	12.4	0	0	12.4	12,400
12	14.6	0	0	14.6	14,600
13	14.5	0	0	14.5	14,500
14	12.4	0	0	12.4	12,400
15	12.3	0	0	12.3	12,300
16	15	0	0	15	15,000
17	14.9	0	0	14.9	14,900
18	14.9	0	0	14.9	14,900
19	14.3	0	0	14.3	14,300
20	14.3	0	0	14.3	14,300
21	14.5	0	0	14.5	14,500
22	14.5	0	0	14.5	14,500
23	13.7	5.6	0	19.3	19,300
24	13.2	5.6	0	18.8	18,800
25	13.6	5.6	0	19.2	19,200
26	13.6	5.6	0	19.2	19,200
27	13.3	0	0	13.3	13,300
28	13.4	0	0	13.4	13,400
29	13.4	0	0	13.4	13,400
30	12.9	2.5	0	15.4	15,400
31	12.9	2.5	0	15.4	15,400
13,500					437,000

Jun-08	1	2	3	Tot	Gallons
1	12.9	2.5	0	15.4	15,400
2	9.6	0	0	9.6	9,600
3	9.5	0	0	9.5	9,500
4	13	0	0	13	13,000
5	12.9	0	0	12.9	12,900
6	14.3	0	0	14.3	14,300
7	14.2	0	0	14.2	14,200
8	14.2	0	0	14.2	14,200
9	11.2	5.9	0	17.1	17,100
10	11.1	5.9	0	17	17,000
11	11.1	4.6	0	15.7	15,700
12	11.2	4.6	0	15.8	15,800
13	14.6	0	0	14.6	14,600
14	14.6	0	0	14.6	14,600
15	14.5	0	0	14.5	14,500
16	12.2	2.1	0	14.3	14,300
17	12.2	2.1	0	14.3	14,300
18	13	5.4	0	18.4	18,400
19	12.9	5.4	0	18.3	18,300
20	12.5	0	0	12.5	12,500
21	12.5	0	0	12.5	12,500
22	12.5	0	0	12.5	12,500
23	9.8	5.9	0	15.7	15,700
24	9.9	5.9	0	15.8	15,800
25	12.4	0	0	12.4	12,400
26	12.4	0	0	12.4	12,400
27	13.6	2.8	0	16.4	16,400
28	13.6	2.8	0	16.4	16,400
29	13.6	2.8	0	16.4	16,400
30	10.9	8.4	0	19.3	19,300
19,300					440,000

18,300

Jul-08	1	2	3	Tot	Gallons
1	10.9	8.4	0	19.3	19,300
2	10.9	8.4	0	19.3	19,300
3	11	12.3	0	23.3	23,300
4	10.9	12.3	0	23.2	23,200
5	10.9	12.3	0	23.2	23,200
6	10.9	12.3	0	23.2	23,200
7	11.1	3.8	0	14.9	14,900
8	11.1	3.8	0	14.9	14,900
9	11.1	3.8	0	14.9	14,900
10	11.1	3.8	0	14.9	14,900
11	12.1	6.1	0	18.2	18,200
12	12.1	6.1	0	18.2	18,200
13	12	6.1	0	18.1	18,100
14	11.7	0	0	11.7	11,700
15	11.6	0	0	11.6	11,600
16	11.4	0	0	11.4	11,400
17	11.3	0	0	11.3	11,300
18	12.6	7.5	0	20.1	20,100
19	12.6	7.5	0	20.1	20,100
20	12.5	7.5	0	20	20,000
21	12	0	0	12	12,000
22	11.9	0	0	11.9	11,900
23	12.9	0	0	12.9	12,900
24	12.9	0	0	12.9	12,900
25	11.6	7.8	0	19.4	19,400
26	11.6	7.8	0	19.4	19,400
27	11.6	7.8	0	19.4	19,400
28	10.7	5.5	0	16.2	16,200
29	10.8	5.5	0	16.3	16,300
30	11.1	3.8	0	14.9	14,900
31	11.2	3.9	0	15.1	15,100
1,636,400					572,200

Aug-08	1	2	3	Tot	Gallons
1	12.3	5.8	0	18.1	18,100
2	12.3	5.8	0	18.1	18,100
3	12.2	5.8	0	18	18,000
4	10.8	12	0	22.8	22,800
5	10.7	12	0	22.7	22,700
6	10.7	8.4	0	19.1	19,100
7	10.6	8.3	0	18.9	18,900
8	11	13.5	0	24.5	24,500
9	11	13.5	0	24.5	24,500
10	11	13.4	0	24.4	24,400
11	10.9	16.1	0	27	27,000
12	10.8	16	0	26.8	26,800
13	12.3	6.9	0	19.2	19,200
14	12.2	6.9	0	19.1	19,100
15	11	12.6	0	23.6	23,600
16	10.9	12.6	0	23.5	23,500
17	10.9	12.6	0	23.5	23,500
18	10.7	7.5	0	18.2	18,200
19	10.9	7.5	0	18.4	18,400
20	11.8	7.5	0	19.3	19,300
21	11.9	7.5	0	19.4	19,400
22	9.4	12.2	0	21.6	21,600
23	9.3	12.2	0	21.5	21,500
24	9.3	12.2	0	21.5	21,500
25	12.8	0	0	12.8	12,800
26	12.8	0	0	12.8	12,800
27	11.9	0	0	11.9	11,900
28	11.9	0	0	11.9	11,900
29	11.6	0.6	0	12.2	12,200
30	11.6	0.6	0	12.2	12,200
31	11.5	0.6	0	12.1	12,100
23,300					569,600

Sep-08	1	2	3	Tot	Gallons
1	11.5	0.6	0	12.1	12,100
2	11.9	0	0	11.9	11,900
3	11.9	0	0	11.9	11,900
4	12	0	0	12	12,000
5	12	3	0	15	15,000
6	12	3	0	15	15,000
7	10	3	0	22	22,000
8	12.3	0	0	12.3	12,300
9	12.2	0	0	12.2	12,200
10	11.8	13.7	0	25.5	25,500
11	11.8	13.7	0	25.5	25,500
12	12.8	5.1	0	17.9	17,900
13	12.8	5.1	0	17.9	17,900
14	12.8	5.1	0	17.9	17,900
15	12.7	0	0	12.7	12,700
16	12.7	0	0	12.7	12,700
17	7.3	11.6	0	18.9	18,900
18	7.2	11.6	0	18.8	18,800
19	7.3	8.9	0	16.2	16,200
20	7.3	8.9	0	16.2	16,200
21	7.3	8.9	0	16.2	16,200
22	8.4	5.7	0	14.1	14,100
23	8.3	5.7	0	14	14,000
24	6.1	4.1	0	10.2	10,200
25	6	4.1	0	10.1	10,100
26	10.4	13.4	0	23.8	23,800
27	10.4	13.4	0	23.8	23,800
28	10.3	13.4	0	23.7	23,700
29	0	1.9	0	1.9	1,900
30	0	1.9	0	1.9	1,900
27,000					464,300

25,500

Oct-08	1	2	3	Tot	Gallons
1	17.2	1.9	0	19.1	19,100
2	14.9	0	0	14.9	14,900
3	15	0	0	15	15,000
4	14.9	0	0	14.9	14,900
5	11.6	0	0	11.6	11,600
6	11.7	0	0	11.7	11,700
7	8.3	0	0	8.3	8,300
8	8.3	0	0	8.3	8,300
9	9.8	0	0	9.8	9,800
10	9.8	4.8	0	14.6	14,600
11	9.8	4.8	0	14.6	14,600
12	9.8	4.8	0	14.6	14,600
13	9.8	4.8	0	14.6	14,600
14	9.8	0	0	9.8	9,800
15	9.9	0	0	9.9	9,900
16	9.9	0	0	9.9	9,900
17	10.4	2.9	0	13.3	13,300
18	10.3	2.9	0	13.2	13,200
19	10.3	2.9	0	13.2	13,200
20	9.6	0	0	9.6	9,600
21	9.5	0	0	9.5	9,500
22	10	0	0	10	10,000
23	10	0	0	10	10,000
24	10.2	4.3	0	14.5	14,500
25	10.1	4.3	0	14.4	14,400
26	10.1	4.3	0	14.4	14,400
27	9.5	4.8	0	14.3	14,300
28	9.4	4.8	0	14.2	14,200
29	10.4	0	0	10.4	10,400
30	10.4	0	0	10.4	10,400
31	10	0	0	10	10,000
1,005,700					351,000
4,850,600					

Nov-08	1	2	3	Tot	Gallons
1	9.9	0	0	9.9	9,900
2	9.9	0	0	9.9	9,900
3	10.3	4	0	14.3	14,300
4	10.2	4	0	14.2	14,200
5	9.4	0	0	9.4	9,400
6	9.3	0	0	9.3	9,300
7	10.7	1.2	0	11.9	11,900
8	10.7	1.2	0	11.9	11,900
9	10.6	1.2	0	11.8	11,800
10	9.7	2	0	11.7	11,700
11	9.6	2	0	11.6	11,600
12	9.5	0	0	9.5	9,500
13	9.5	0	0	9.5	9,500
14	10.6	3.1	0	13.7	13,700
15	10.5	3.1	0	13.6	13,600
16	10.5	3.1	0	13.6	13,600
17	8.1	0	0	8.1	8,100
18	8.1	0	0	8.1	8,100
19	7.5	0	0	7.5	7,500
20	7.4	0	0	7.4	7,400
21	10.3	4.6	0	14.9	14,900
22	10.3	4.6	0	14.9	14,900
23	10.3	4.6	0	14.9	14,900
24	10	0	0	10	10,000
25	10	0	0	10	10,000
26	9.7	1.5	0	11.2	11,200
27	9.7	1.5	0	11.2	11,200
28	9.7	1.5	0	11.2	11,200
29	9.7	1.5	0	11.2	11,200
30	9.7	1.5	0	11.2	11,200
19,100					337,600

Dec-08	1	2	3	Tot	Gallons
1	4.5	0	0	4.5	4,500
2	4.5	0	0	4.5	4,500
3	10.1	0	0	10.1	10,100
4	10.1	0	0	10.1	10,100
5	10.8	0	0	10.8	10,800
6	10.7	0	0	10.7	10,700
7	10.7	0	0	10.7	10,700
8	4.4	0	0	4.4	4,400
9	4.4	0	0	4.4	4,400
10	9.6	0	0	9.6	9,600
11	9.6	0	0	9.6	9,600
12	6.5	0	0	6.5	6,500
13	6.5	0	0	6.5	6,500
14	6.4	0	0	6.4	6,400
15	8.6	0	0	8.6	8,600
16	8.6	0	0	8.6	8,600
17	4.3	0	0	4.3	4,300
18	4.3	0	0	4.3	4,300
19	6.8	0	0	6.8	6,800
20	6.7	0	0	6.7	6,700
21	6.7	0	0	6.7	6,700
22	8.5	0	0	8.5	8,500
23	8.5	0	0	8.5	8,500
24	8.5	0	0	8.5	8,500
25	8.4	0	0	8.4	8,400
26	10.5	0	0	10.5	10,500
27	10.5	0	0	10.5	10,500
28	10.5	0	0	10.5	10,500
29	10.5	0	0	10.5	10,500
30	10.5	0	0	10.5	10,500
31	9.9	0	0	9.9	9,900
14,900					251,100

10,800

Jan-09	1	2	3	Tot	Gallons
1	9.9	0	0	9.9	9,900
2	11	0	0	11	11,000
3	11	0	0	11	11,000
4	10.9	0	0	10.9	10,900
5	10.2	0	0	10.2	10,200
6	10.2	0	0	10.2	10,200
7	8.1	0	0	8.1	8,100
8	8.1	0	0	8.1	8,100
9	8.8	0	0	8.8	8,800
10	8.8	0	0	8.8	8,800
11	8.8	0	0	8.8	8,800
12	8.2	2	0	10.2	10,200
13	8.2	2	0	10.2	10,200
14	8.1	2	0	10.1	10,100
15	8.1	2	0	10.1	10,100
16	10.2	0	0	10.2	10,200
17	10.2	0	0	10.2	10,200
18	10.2	0	0	10.2	10,200
19	10.2	0	0	10.2	10,200
20	6	0	0	6	6,000
21	6	0	0	6	6,000
22	6	0	0	6	6,000
23	7.8	0	0	7.8	7,800
24	7.8	0	0	7.8	7,800
25	7.8	0	0	7.8	7,800
26	10.8	0	0	10.8	10,800
27	10.8	0	0	10.8	10,800
28	4.7	0	0	4.7	4,700
29	4.6	0	0	4.6	4,600
30	9.4	0	0	9.4	9,400
31	9.4	0	0	9.4	9,400
828,100					328,000

Feb-09	1	2	3	Tot	Gallons
1	9.4	0	0	9.4	9,400
2	9.5	0	0	9.5	9,500
3	9.5	0	0	9.5	9,500
4	3.9	0	0	3.9	3,900
5	3.9	0	0	3.9	3,900
6	11.6	0	0	11.6	11,600
7	11.5	0	0	11.5	11,500
8	11.5	0	0	11.5	11,500
9	10.5	0	0	10.5	10,500
10	10.4	0	0	10.4	10,400
11	10.6	0	0	10.6	10,600
12	10.6	0	0	10.6	10,600
13	8.6	1.8	0	10.4	10,400
14	8.6	1.8	0	10.4	10,400
15	8.6	1.8	0	10.4	10,400
16	8.6	1.8	0	10.4	10,400
17	9.4	0	0	9.4	9,400
18	9.4	0	0	9.4	9,400
19	9.5	0	0	9.5	9,500
20	11.3	2.6	0	13.9	13,900
21	11.3	2.6	0	13.9	13,900
22	11.3	2.6	0	13.9	13,900
23	8.3	0	0	8.3	8,300
24	8.3	0	0	8.3	8,300
25	11	0	0	11	11,000
26	11	0	0	11	11,000
27	8.7	0	0	8.7	8,700
28	0	0	0	0	0
11,000					271,000

Mar-09	1	2	3	Tot	Gallons
1	8.6	0	0	8.6	8,600
2	8.5	0	0	8.5	8,500
3	8.4	0	0	8.4	8,400
4	10.3	0	0	10.3	10,300
5	10.3	6.1	0	16.4	16,400
6	3	6.1	0	9.1	9,100
7	3	6.1	0	9.1	9,100
8	2.9	8.1	0	11	11,000
9	0	8.1	0	8.1	8,100
10	0	4.5	0	4.5	4,500
11	0	4.5	0	4.5	4,500
12	0	8.6	0	8.6	8,600
13	0	8.6	0	8.6	8,600
14	0	8.6	0	8.6	8,600
15	0	6.6	0	6.6	6,600
16	0	6.6	0	6.6	6,600
17	0	7.1	0	7.1	7,100
18	0	7.1	0	7.1	7,100
19	0	6.7	0	6.7	6,700
20	0	6.7	0	6.7	6,700
21	0	6.7	0	6.7	6,700
22	0	6.7	0	6.7	6,700
23	0	7.5	0	7.5	7,500
24	0	7.4	0	7.4	7,400
25	0	7.2	0	7.2	7,200
26	0	7.2	0	7.2	7,200
27	0	10.5	0	10.5	10,500
28	0	10.5	0	10.5	10,500
29	0	10.5	0	10.5	10,500
30	0	6.9	0	6.9	6,900
31	0	6.9	0	6.9	6,900
13,000					253,100

16,400

Apr-09	1	2	3	Tot	Gallons
1	0	7.3	0	7.3	7,300
2	0	7.3	0	7.3	7,300
3	0	8.5	0	8.5	8,500
4	0	8.5	0	8.5	8,500
5	0	8.5	0	8.5	8,500
6	0	6.2	0	6.2	6,200
7	0	6.2	0	6.2	6,200
8	0	2.5	0	2.5	2,500
9	0	2.5	0	2.5	2,500
10	0	11.2	0	11.2	11,200
11	0	11.2	0	11.2	11,200
12	0	11.2	0	11.2	11,200
13	0	5.8	0	5.8	5,800
14	0	5.8	0	5.8	5,800
15	0	7.3	0	7.3	7,300
16	0	7.3	0	7.3	7,300
17	0	10.4	0	10.4	10,400
18	0	10.4	0	10.4	10,400
19	0	10.4	0	10.4	10,400
20	0	6.3	0	6.3	6,300
21	0	6.3	0	6.3	6,300
22	0	9.2	0	9.2	9,200
23	0	9.2	0	9.2	9,200
24	0	6.2	0	6.2	6,200
25	0	6.2	0	6.2	6,200
26	0	6.2	0	6.2	6,200
27	0	5.5	0	5.5	5,500
28	0	5.5	0	5.5	5,500
29	0	6.8	0	6.8	6,800
30	0	6.8	0	6.8	6,800
974,900					222,700

May-09	1	2	3	Tot	Gallons
1	0	8.8	0	8.8	8,800
2	0	8.8	0	8.8	8,800
3	0	8.8	0	8.8	8,800
4	0	5.4	0	5.4	5,400
5	0	5.3	0	5.3	5,300
6	0	5.7	0	5.7	5,700
7	0	5.7	0	5.7	5,700
8	0	8.3	0	8.3	8,300
9	0	8.3	0	8.3	8,300
10	0	8.3	0	8.3	8,300
11	3.6	3.1	0	6.7	6,700
12	3.5	3.1	0	6.6	6,600
13	4	3.5	0	7.5	7,500
14	3.9	3.5	0	7.4	7,400
15	4.7	4.2	0	8.9	8,900
16	4.7	4.2	0	8.9	8,900
17	4.7	4.2	0	8.9	8,900
18	0.9	5.6	0	6.5	6,500
19	0.9	5.6	0	6.5	6,500
20	3.8	4.1	0	7.9	7,900
21	3.8	4.1	0	7.9	7,900
22	9.4	10.6	0	20	20,000
23	9.4	10.6	0	20	20,000
24	9.4	10.6	0	20	20,000
25	9.4	10.6	0	20	20,000
26	6.8	7.5	0	14.3	14,300
27	6.8	7.5	0	14.3	14,300
28	6.8	7.5	0	14.3	14,300
29	11.3	12.1	0	23.4	23,400
30	11.2	12.1	0	23.3	23,300
31	11.2	12.1	0	23.3	23,300
11,200					350,100

Jun-09	1	2	3	Tot	Gallons
1	8.6	9.2	0	17.8	17,800
2	8.6	9.2	0	17.8	17,800
3	8.9	9.5	0	18.4	18,400
4	8.9	9.5	0	18.4	18,400
5	5.7	6	0	11.7	11,700
6	5.7	6	0	11.7	11,700
7	5.6	6	0	11.6	11,600
8	6.5	6.8	0	13.3	13,300
9	6.5	6.8	0	13.3	13,300
10	0	0	0	0	0
11	0	0	0	0	0
12	9.8	10.4	0	20.2	20,200
13	9.7	10.4	0	20.1	20,100
14	6.2	10.4	0	16.6	16,600
15	6.1	6.5	0	12.6	12,600
16	4.7	6.5	0	11.2	11,200
17	4.6	4.9	0	9.5	9,500
18	5.5	4.9	0	10.4	10,400
19	5.4	5.8	0	11.2	11,200
20	5.4	5.8	0	11.2	11,200
21	5.9	5.8	0	11.7	11,700
22	5.3	5.5	0	10.8	10,800
23	4.7	5.5	0	10.2	10,200
24	4.7	5	0	9.7	9,700
25	6.4	5	0	11.4	11,400
26	6.3	6.6	0	12.9	12,900
27	6.3	6.6	0	12.9	12,900
28	6	6.6	0	12.6	12,600
29	6	6.2	0	12.2	12,200
30	0	6.2	0	6.2	6,200
23,400					337,300

20,200

Jul-09	1	2	3	Tot	Gallons
1	6	6.2	0	12.2	12,200
2	9.7	10	0	19.7	19,700
3	9.7	10	0	19.7	19,700
4	9.7	10	0	19.7	19,700
5	9.6	10	0	19.6	19,600
6	7.7	7.8	0	15.5	15,500
7	7.7	7.8	0	15.5	15,500
8	6.8	6.9	0	13.7	13,700
9	6.8	6.9	0	13.7	13,700
10	6.6	6.6	0	13.2	13,200
11	6.5	6.6	0	13.1	13,100
12	6.5	6.6	0	13.1	13,100
13	6.8	6.87	0	13.67	13,670
14	6.7	6.8	0	13.5	13,500
15	6	5.9	0	11.9	11,900
16	5.9	5.9	0	11.8	11,800
17	7.2	7.1	0	14.3	14,300
18	7.2	7	0	14.2	14,200
19	7.2	7	0	14.2	14,200
20	7.1	6.9	0	14	14,000
21	7.1	6.9	0	14	14,000
22	6.7	6.3	0	13	13,000
23	6.7	6.3	0	13	13,000
24	10.9	10.2	0	21.1	21,100
25	10.9	10.2	0	21.1	21,100
26	10.8	10.2	0	21	21,000
27	7.9	7.1	0	15	15,000
28	7.9	7.1	0	15	15,000
29	7.8	7.1	0	14.9	14,900
30	7.7	7.1	0	14.8	14,800
31	2.7	6.1	0	8.8	8,800
1,251,970					457,970

Aug-09	1	2	3	Tot	Gallons
1	6.7	6.1	0	12.8	12,800
2	6.6	6.1	0	12.7	12,700
3	7	6.8	0	13.8	13,800
4	6.9	6.2	0	13.1	13,100
5	4.9	4.3	0	9.2	9,200
6	4.9	4.3	0	9.2	9,200
7	10.7	9.3	0	20	20,000
8	10.6	9.3	0	19.9	19,900
9	10.6	9.3	0	19.9	19,900
10	7.3	6.3	0	13.6	13,600
11	7.2	6.3	0	13.5	13,500
12	8.2	7.1	0	15.3	15,300
13	8.3	7.1	0	15.4	15,400
14	12.3	10.2	0	22.5	22,500
15	12.3	10.2	0	22.5	22,500
16	12.3	10.2	0	22.5	22,500
17	5.3	4.3	0	9.6	9,600
18	5.2	4.3	0	9.5	9,500
19	6.1	4.9	0	11	11,000
20	6.2	4.9	0	11.1	11,100
21	8.2	6.8	0	15	15,000
22	8.2	6.8	0	15	15,000
23	8.2	6.8	0	15	15,000
24	8.3	6.8	0	15.1	15,100
25	8.4	6.8	0	15.2	15,200
26	8.4	6.7	0	15.1	15,100
27	8.4	6.7	0	15.1	15,100
28	7.8	6.1	0	13.9	13,900
29	7.8	6.1	0	13.9	13,900
30	7.7	6.1	0	13.8	13,800
31	4.6	3.6	0	8.2	8,200
21,100					407,400

Sep-09	1	2	3	Tot	Gallons
1	4.6	3.6	0	8.2	8,200
2	6.6	5.5	0	12.1	12,100
3	6.6	5.5	0	12.1	12,100
4	7.6	5.9	0	13.5	13,500
5	7.5	5.9	0	13.4	13,400
6	7.5	5.9	0	13.4	13,400
7	7.5	5.9	0	13.4	13,400
8	5	4	0	9	9,000
9	5	4	0	9	9,000
10	5.1	4	0	9.1	9,100
11	4.9	3.8	0	8.7	8,700
12	4.9	3.8	0	8.7	8,700
13	4.8	3.8	0	8.6	8,600
14	4.5	3.6	0	8.1	8,100
15	4.4	3.5	0	7.9	7,900
16	5	1.3	0	6.3	6,300
17	5	1.3	0	6.3	6,300
18	5.3	4.4	0	9.7	9,700
19	5.4	4.4	0	9.8	9,800
20	5.4	4.4	0	9.8	9,800
21	6.6	2.3	0	8.9	8,900
22	6.6	2.3	0	8.9	8,900
23	8.6	0	0	8.6	8,600
24	8.7	0	0	8.7	8,700
25	9.8	0	0	9.8	9,800
26	9.3	0	0	9.3	9,300
27	9.2	0	0	9.2	9,200
28	9.6	0	0	9.6	9,600
29	9.7	0	0	9.7	9,700
30	8	0	0	8	8,000
22,500					269,600

13,500

Oct-09	1	2	3	Tot	Gallons
1	7.9	0	0	7.9	7,900
2	15.6	0	0	15.6	15,600
3	15.5	0	0	15.5	15,500
4	15.5	0	0	15.5	15,500
5	9.1	0	0	9.1	9,100
6	9.1	0	0	9.1	9,100
7	13.6	0	0	13.6	13,600
8	13.6	0	0	13.6	13,600
9	6.9	0	0	6.9	6,900
10	6.9	0	0	6.9	6,900
11	6.9	0	0	6.9	6,900
12	6.8	0	0	6.8	6,800
13	7.6	0	0	7.6	7,600
14	7.6	0	0	7.6	7,600
15	7.7	0	0	7.7	7,700
16	7	0	0	7	7,000
17	7	0	0	7	7,000
18	7.1	0	0	7.1	7,100
19	0.6	0	0	0.6	600
20	0.6	0	0	0.6	600
21	7.3	0	0	7.3	7,300
22	7.3	0	0	7.3	7,300
23	7	0	0	7	7,000
24	7	0	0	7	7,000
25	7	0	0	7	7,000
26	6.5	0	0	6.5	6,500
27	6.4	0	0	6.4	6,400
28	7.8	0	0	7.8	7,800
29	7.7	0	0	7.7	7,700
30	9.6	0	0	9.6	9,600
31	9.8	0	0	9.8	9,800
732,200					264,300
3,787,170					

Nov-09	1	2	3	Tot	Gallons
1	9.9	0	0	9.9	9,900
2	8	0	0	8	8,000
3	7.9	0	0	7.9	7,900
4	3.5	0	0	3.5	3,500
5	3.5	0	0	3.5	3,500
6	10.5	0	0	10.5	10,500
7	10.4	0	0	10.4	10,400
8	10.4	0	0	10.4	10,400
9	4.8	0	0	4.8	4,800
10	4.8	0	0	4.8	4,800
11	4.8	0	0	4.8	4,800
12	4.8	0	0	4.8	4,800
13	8.9	0	0	8.9	8,900
14	8.9	0	0	8.9	8,900
15	8.9	0	0	8.9	8,900
16	3.1	0	0	3.1	3,100
17	3.1	0	0	3.1	3,100
18	5	0	0	5	5,000
19	5	0	0	5	5,000
20	6.2	0	0	6.2	6,200
21	6.3	0	0	6.3	6,300
22	6.3	0	0	6.3	6,300
23	6	0	0	6	6,000
24	6	0	0	6	6,000
25	7.9	0	0	7.9	7,900
26	7.9	0	0	7.9	7,900
27	7.9	0	0	7.9	7,900
28	7.9	0	0	7.9	7,900
29	7.8	0	0	7.8	7,800
30	7.3	0	0	7.3	7,300
15,600					309,700

Dec-09	1	2	3	Tot	Gallons
1	7.3	0	0	7.3	7,300
2	7.9	0	0	7.9	7,900
3	7.9	0	0	7.9	7,900
4	5.9	0	0	5.9	5,900
5	5.9	0	0	5.9	5,900
6	5.9	0	0	5.9	5,900
7	9.2	0	0	9.2	9,200
8	9.2	0	0	9.2	9,200
9	12.5	0	0	12.5	12,500
10	12.5	0	0	12.5	12,500
11	12.7	0	0	12.7	12,700
12	12.7	0	0	12.7	12,700
13	12.7	0	0	12.7	12,700
14	6.4	0	0	6.4	6,400
15	6.4	0	0	6.4	6,400
16	8.2	0	0	8.2	8,200
17	8.2	0	0	8.2	8,200
18	5.8	0	0	5.8	5,800
19	5.8	0	0	5.8	5,800
20	5.7	0	0	5.7	5,700
21	7.8	0	0	7.8	7,800
22	7.8	0	0	7.8	7,800
23	6.8	0	0	6.8	6,800
24	6.8	0	0	6.8	6,800
25	6.8	0	0	6.8	6,800
26	6.8	0	0	6.8	6,800
27	6.8	0	0	6.8	6,800
28	5.5	0	0	5.5	5,500
29	5.5	0	0	5.5	5,500
30	8.4	0	0	8.4	8,400
31	8.4	0	0	8.4	8,400
10,500					249,200

12,700

Jan-10	1	2	3	Tot	Gallons
1	8.4	0	0	8.4	8,400
2	8.4	0	0	8.4	8,400
3	8.3	0	0	8.3	8,300
4	6.3	0	0	6.3	6,300
5	6.2	0	0	6.2	6,200
6	7.8	0	0	7.8	7,800
7	7.7	0	0	7.7	7,700
8	4.8	0	0	4.8	4,800
9	4.7	0	0	4.7	4,700
10	4.7	0	0	4.7	4,700
11	6.3	0	0	6.3	6,300
12	6.3	0	0	6.3	6,300
13	7.1	0	0	7.1	7,100
14	7.1	0	0	7.1	7,100
15	4.5	0	0	4.5	4,500
16	4.5	0	0	4.5	4,500
17	4.4	0	0	4.4	4,400
18	4.4	0	0	4.4	4,400
19	8.5	0	0	8.5	8,500
20	8.4	0	0	8.4	8,400
21	8.4	0	0	8.4	8,400
22	6.1	0	0	6.1	6,100
23	6	0	0	6	6,000
24	6	0	0	6	6,000
25	1	0	0	1	1,000
26	1	0	0	1	1,000
27	8.3	0	0	8.3	8,300
28	8.4	0	0	8.4	8,400
29	5.5	0	0	5.5	5,500
30	5.5	0	0	5.5	5,500
31	5.6	0	0	5.6	5,600
364,600					364,600

Feb-10	1	2	3	Tot	Gallons
1	7.3	0	0	7.3	7,300
2	7.4	0	0	7.4	7,400
3	7.9	0	0	7.9	7,900
4	7.8	0	0	7.8	7,800
5	5.3	0	0	5.3	5,300
6	5.2	0	0	5.2	5,200
7	5.2	0	0	5.2	5,200
8	8.6	0	0	8.6	8,600
9	8.6	0	0	8.6	8,600
10	6.2	0	0	6.2	6,200
11	6.2	0	0	6.2	6,200
12	5.7	0	0	5.7	5,700
13	5.7	0	0	5.7	5,700
14	5.7	0	0	5.7	5,700
15	5.6	0	0	5.6	5,600
16	5.2	0	0	5.2	5,200
17	5.2	0	0	5.2	5,200
18	5.1	0	0	5.1	5,100
19	5.6	0	0	5.6	5,600
20	5.5	0	0	5.5	5,500
21	5.5	0	0	5.5	5,500
22	7.5	0	0	7.5	7,500
23	7.5	0	0	7.5	7,500
24	6.8	0	0	6.8	6,800
25	6.8	0	0	6.8	6,800
26	5.5	0	0	5.5	5,500
27	5.4	0	0	5.4	5,400
28	5.4	0	0	5.4	5,400
8,600					175,400

Mar-10	1	2	3	Tot	Gallons
1	4.6	0	0	4.6	4,600
2	4.6	0	0	4.6	4,600
3	3.3	0	0	3.3	3,300
4	3.3	0	0	3.3	3,300
5	6.3	0	0	6.3	6,300
6	6.3	0	0	6.3	6,300
7	6.3	0	0	6.3	6,300
8	7.4	0	0	7.4	7,400
9	7.4	0	0	7.4	7,400
10	8	0	0	8	8,000
11	8.1	0	0	8.1	8,100
12	5.6	0	0	5.6	5,600
13	5.5	0	0	5.5	5,500
14	5.5	0	0	5.5	5,500
15	7.3	0	0	7.3	7,300
16	7.2	0	0	7.2	7,200
17	2.1	0	0	2.1	2,100
18	2	0	0	2	2,000
19	9.5	0	0	9.5	9,500
20	9.5	0	0	9.5	9,500
21	9.4	0	0	9.4	9,400
22	6.9	0	0	6.9	6,900
23	6.9	0	0	6.9	6,900
24	7	0	0	7	7,000
25	6.9	0	0	6.9	6,900
26	6.4	0	0	6.4	6,400
27	6.4	0	0	6.4	6,400
28	6.4	0	0	6.4	6,400
29	10.3	0	0	10.3	10,300
30	10.2	0	0	10.2	10,200
31	4.9	0	0	4.9	4,900
8,600					261,500

Apr-10	1	2	3	Tot	Gallons
1	4.9	0	0	4.9	4,900
2	9.1	0	0	9.1	9,100
3	9	0	0	9	9,000
4	9	0	0	9	9,000
5	5.1	0	0	5.1	5,100
6	5.1	0	0	5.1	5,100
7	7.4	0	0	7.4	7,400
8	7.3	0	0	7.3	7,300
9	6.8	0	0	6.8	6,800
10	6.8	0	0	6.8	6,800
11	6.8	0	0	6.8	6,800
12	0	0	0	0	0
13	0	0	0	0	0
14	7.5	0	0	7.5	7,500
15	7.4	0	0	7.4	7,400
16	10.4	0	0	10.4	10,400
17	10.5	0	0	10.5	10,500
18	10.5	0	0	10.5	10,500
19	9.3	0	0	9.3	9,300
20	9.3	0	0	9.3	9,300
21	5.5	0	0	5.5	5,500
22	5.5	0	0	5.5	5,500
23	10.9	0	0	10.9	10,900
24	10.0	0	0	10.9	10,900
25	10.9	0	0	10.9	10,900
26	5.3	0	0	5.3	5,300
27	5.2	0	0	5.2	5,200
28	5.5	0	0	5.5	5,500
29	5.4	0	0	5.4	5,400
30	8.6	0	0	8.6	8,600
900,200					210,800

May-10	1	2	3	Tot	Gallons
1	8.6	0	0	8.6	8,600
2	8.5	0	0	8.5	8,500
3	6.9	0	0	6.9	6,900
4	6.8	0	0	6.8	6,800
5	4	0	0	4	4,000
6	4	0	0	4	4,000
7	9.5	0	0	9.5	9,500
8	9.4	0	0	9.4	9,400
9	9.4	0	0	9.4	9,400
10	9	0	0	9	9,000
11	9	0	0	9	9,000
12	8	0	0	8	8,000
13	8	0	0	8	8,000
14	13.5	0	0	13.5	13,500
15	13.5	0	0	13.5	13,500
16	13.5	0	0	13.5	13,500
17	10	0	0	10	10,000
18	9.9	0	0	9.9	9,900
19	8.6	0	0	8.6	8,600
20	8.7	0	0	8.7	8,700
21	6.7	0	0	6.7	6,700
22	6.6	0	0	6.6	6,600
23	6.6	0	0	6.6	6,600
24	9.9	0	0	9.9	9,900
25	9.8	0	0	9.8	9,800
26	8.7	0	0	8.7	8,700
27	8.7	0	0	8.7	8,700
28	12.7	0	0	12.7	12,700
29	12.7	0	0	12.7	12,700
30	12.7	0	0	12.7	12,700
31	12.7	0	0	12.7	12,700
10,900					286,600

Jun-10	1	2	3	Tot	Gallons
1	9.9	0	0	9.9	9,900
2	9.9	0	0	9.9	9,900
3	9.9	0	0	9.9	9,900
4	13.5	0	0	13.5	13,500
5	13.6	0	0	13.6	13,600
6	13.6	0	0	13.6	13,600
7	14	0	0	14	14,000
8	14.1	0	0	14.1	14,100
9	14	0	0	14	14,000
10	14	0	0	14	14,000
11	14.9	0	0	14.9	14,900
12	14.9	0	0	14.9	14,900
13	14.9	0	0	14.9	14,900
14	9.4	0	0	9.4	9,400
15	9.4	0	0	9.4	9,400
16	12.4	0	0	12.4	12,400
17	12.4	0	0	12.4	12,400
18	10.1	0	0	10.1	10,100
19	10.1	0	0	10.1	10,100
20	10.1	0	0	10.1	10,100
21	11.1	0	0	11.1	11,100
22	11	0	0	11	11,000
23	9.2	0	0	9.2	9,200
24	9.2	0	0	9.2	9,200
25	13.4	0	0	13.4	13,400
26	13.3	0	0	13.3	13,300
27	13.3	0	0	13.3	13,300
28	13.9	0	0	13.9	13,900
29	13.8	0	0	13.8	13,800
30	8.1	11.9	0	20	20,000
13,500					373,900

Jul-10	1	2	3	Tot	Gallons
1	8.1	11.9	0	20	20,000
2	7.5	11.2	0	18.7	18,700
3	7.4	11.2	0	18.6	18,600
4	7.4	11.2	0	18.6	18,600
5	7.4	11.2	0	18.6	18,600
6	5.4	7.9	0	13.3	13,300
7	5.4	7.9	0	13.3	13,300
8	5.3	7.9	0	13.2	13,200
9	5.3	7.9	0	13.2	13,200
10	5.3	7.9	0	13.2	13,200
11	5.2	7.9	0	13.1	13,100
12	2.7	4.1	0	6.8	6,800
13	2.7	4.1	0	6.8	6,800
14	6.1	9.2	0	15.3	15,300
15	6.1	9.2	0	15.3	15,300
16	7.4	11	0	18.4	18,400
17	7.3	11	0	18.3	18,300
18	7.3	11	0	18.3	18,300
19	3.6	5.2	0	8.8	8,800
20	3.5	5.2	0	8.7	8,700
21	5.4	7.9	0	13.3	13,300
22	5.4	7.9	0	13.3	13,300
23	5.8	8.4	0	14.2	14,200
24	5.7	8.4	0	14.1	14,100
25	5.7	8.4	0	14.1	14,100
26	0	0	0	0	0
27	0	0	0	0	0
28	7.4	10.9	0	18.3	18,300
29	7.4	10.9	0	18.3	18,300
30	6.4	9.4	0	15.8	15,800
31	6.4	9.4	0	15.8	15,800
1,164,100					427,700

Aug-10	1	2	3	Tot	Gallons
1	6.3	9.4	0	15.7	15,700
2	5.7	8.2	0	13.9	13,900
3	5.6	8.2	0	13.8	13,800
4	3	4.4	0	7.4	7,400
5	3	4.4	0	7.4	7,400
6	5.8	8.4	0	14.2	14,200
7	5.8	8.4	0	14.2	14,200
8	5.8	8.4	0	14.2	14,200
9	0	9	0	9	9,000
10	0	9	0	9	9,000
11	1.7	15.4	0	17.1	17,100
12	1.7	15.4	0	17.1	17,100
13	12.4	0	0	12.4	12,400
14	12.4	0	0	12.4	12,400
15	12.5	0	0	12.5	12,500
16	12.4	0	0	12.4	12,400
17	12.5	0	0	12.5	12,500
18	12.3	0	0	12.3	12,300
19	12.4	0	0	12.4	12,400
20	13	0	0	13	13,000
21	12.9	0	0	12.9	12,900
22	12.9	0	0	12.9	12,900
23	9	0	0	9	9,000
24	9	0	0	9	9,000
25	0.9	0	0	0.9	900
26	0.9	0	0	0.9	900
27	4	0	9.6	13.6	13,600
28	4	0	9.6	13.6	13,600
29	4	0	9.6	13.6	13,600
30	2.1	0	6.2	8.3	8,300
31	2	0	6.2	8.2	8,200
20,000					355,900

Sep-10	1	2	3	Tot	Gallons
1	2.5	0	10.1	12.6	12,600
2	2.5	0	10.1	12.6	12,600
3	3.5	0	13.9	17.4	17,400
4	3.5	0	13.9	17.4	17,400
5	3.5	0	13.9	17.4	17,400
6	3.4	0	13.9	17.3	17,300
7	2.5	0.2	5.9	8.6	8,600
8	2.5	0.2	5.9	8.6	8,600
9	2.5	0.2	5.9	8.6	8,600
10	4.8	3.3	2.6	10.7	10,700
11	4.7	3.3	2.6	10.6	10,600
12	4.7	3.3	2.6	10.6	10,600
13	5.8	3.9	2.8	12.5	12,500
14	5.7	3.9	2.8	12.4	12,400
15	5.5	4.5	2.7	12.7	12,700
16	5.4	4.5	2.7	12.6	12,600
17	4.8	3.8	2.7	11.3	11,300
18	4.7	3.7	2.7	11.1	11,100
19	4.7	3.7	2.7	11.1	11,100
20	5.5	4.4	3.1	13	13,000
21	5.4	4.8	3.1	13.3	13,300
22	3.2	2.6	1.9	7.7	7,700
23	3.3	2.6	1.9	7.8	7,800
24	6.3	5	3.7	15	15,000
25	6.2	5	3.7	14.9	14,900
26	6.2	5	3.7	14.9	14,900
27	5.2	4.1	3	12.3	12,300
28	5.2	4.1	3	12.3	12,300
29	3.4	2.7	2	8.1	8,100
30	3.4	2.7	2	8.1	8,100
17,100					353,300

Oct-10	1	2	3	Tot	Gallons
1	4.1	3.3	2.4	9.8	9,800
2	4.2	3.3	2.4	9.9	9,900
3	4.2	3.3	2.4	9.9	9,900
4	5.4	4.2	3.2	12.8	12,800
5	5.4	4.1	3.2	12.7	12,700
6	5.6	4.6	3.3	13.5	13,500
7	5.7	4.6	3.3	13.6	13,600
8	3.3	2.7	1.9	7.9	7,900
9	3.3	2.7	1.9	7.9	7,900
10	3.8	2.7	1.9	8.4	8,400
11	3.2	2.7	1.9	7.8	7,800
12	5.8	4.9	3.4	14.1	14,100
13	5.7	4.9	3.4	14	14,000
14	5.7	4.9	3.4	14	14,000
15	8.8	2.2	1.6	12.6	12,600
16	8.7	2.2	1.6	12.5	12,500
17	2.7	2.2	1.6	6.5	6,500
18	3.1	2.7	1.8	7.6	7,600
19	3.1	2.7	1.8	7.6	7,600
20	4.1	3.3	2.4	9.8	9,800
21	4	3.3	2.4	9.7	9,700
22	2.7	2.2	1.6	6.5	6,500
23	2.7	2.2	1.6	6.5	6,500
24	2.8	2.2	1.6	6.6	6,600
25	5.1	4.3	3	12.4	12,400
26	5.1	4.3	3	12.4	12,400
27	3.9	3.1	2.2	9.2	9,200
28	3.9	3.1	2.2	9.2	9,200
29	3	2.4	1.7	7.1	7,100
30	3	2.4	1.7	7.1	7,100
31	2.9	2.4	1.7	7	7,000
789,800					301,600
3,458,700					

Nov-10	1	2	3	Tot	Gallons
1	3	2.4	3.5	8.9	8,900
2	3	2.4	1.9	7.3	7,300
3	3.4	2.7	1.9	8	8,000
4	3.3	2.6	1.9	7.8	7,800
5	3.3	2.6	1.9	7.8	7,800
6	3.3	2.6	1.9	7.8	7,800
7	3.2	2.6	1.8	7.6	7,600
8	3.1	2.4	1.8	7.3	7,300
9	3.1	2.4	1.7	7.2	7,200
10	2.9	2.3	1.7	6.9	6,900
11	3	2.3	2	7.3	7,300
12	3.5	2.8	2	8.3	8,300
13	3.5	2.8	2	8.3	8,300
14	3.6	2.8	1.5	7.9	7,900
15	2.6	2	1.5	6.1	6,100
16	2.6	2	1.5	6.1	6,100
17	2.6	2	1.5	6.1	6,100
18	2.6	2	1.3	5.9	5,900
19	2.3	1.8	1.3	5.4	5,400
20	2.3	1.8	1.3	5.4	5,400
21	2.4	1.8	2.4	6.6	6,600
22	4.2	3.2	2.4	9.8	9,800
23	4.2	3.2	1.5	8.9	8,900
24	2.6	2	1.5	6.1	6,100
25	2.6	2	1.5	6.1	6,100
26	2.6	2	1.5	6.1	6,100
27	2.6	2	1.5	6.1	6,100
28	2.6	2	2.7	7.3	7,300
29	4.8	3.5	2.7	11	11,000
30	4.8	3.5	0	8.3	8,300
14,100					219,700

Dec-10	1	2	3	Tot	Gallons
1	2	1.5	1	4.5	4,500
2	2	1.5	1.1	4.6	4,600
3	3	2.2	1.7	6.9	6,900
4	3	2.2	1.7	6.9	6,900
5	3	2.2	1.7	6.9	6,900
6	3.7	2.7	2.1	8.5	8,500
7	3.7	2.3	2.1	8.1	8,100
8	4	3.2	2.2	9.4	9,400
9	4	3.2	2.2	9.4	9,400
10	2.4	1.8	1.3	5.5	5,500
11	2.4	1.8	1.3	5.5	5,500
12	2.5	1.8	1.3	5.6	5,600
13	2.5	1.9	1.3	5.7	5,700
14	2.5	1.9	1.3	5.7	5,700
15	3.2	2.7	1.8	7.7	7,700
16	3.2	2.7	1.8	7.7	7,700
17	3.5	2.7	1.9	8.1	8,100
18	3.6	2.7	1.9	8.2	8,200
19	3.6	2.7	1.9	8.2	8,200
20	2.8	2.1	1.5	6.4	6,400
21	2.8	2.1	1.5	6.4	6,400
22	4.3	3.2	2.3	9.8	9,800
23	4.3	3.2	2.3	9.8	9,800
24	4.3	3.2	2.3	9.8	9,800
25	4.3	3.2	2.3	9.8	9,800
26	4.3	3.2	2.3	9.8	9,800
27	3.7	2.8	2	8.5	8,500
28	3.8	2.8	2	8.6	8,600
29	3.8	2.8	2	8.6	8,600
30	3.9	2.9	2.1	8.9	8,900
31	3.9	2.9	2.1	8.9	8,900
11,000					235,400

Jan-11	1	2	3	Tot	Gallons
1	3.9	2.9	2.1	8.9	8,900
2	3.9	2.9	2.1	8.9	8,900
3	3	2.2	1.6	6.8	6,800
4	3	2.2	1.6	6.8	6,800
5	2.4	3.3	2.3	8	8,000
6	2.4	3.3	2.3	8	8,000
7	3.7	2.6	1.9	8.2	8,200
8	3.8	2.6	1.9	8.3	8,300
9	3.8	2.6	1.9	8.3	8,300
10	1.4	1	0.7	3.1	3,100
11	1.4	1	0.7	3.1	3,100
12	3.1	2.1	1.5	6.7	6,700
13	3.1	2.1	1.5	6.7	6,700
14	4.4	3.1	2.2	9.7	9,700
15	4.4	3.1	2.2	9.7	9,700
16	4.4	3.1	2.2	9.7	9,700
17	4.4	3.1	2.2	9.7	9,700
18	2.4	1.6	1.2	5.2	5,200
19	2.4	1.6	1.2	5.2	5,200
20	2.5	1.6	1.2	5.3	5,300
21	3.2	2.2	1.6	7	7,000
22	3.2	2.2	1.6	7	7,000
23	3.3	2.2	1.6	7.1	7,100
24	3.1	2.2	1.6	6.9	6,900
25	3.1	2.2	1.6	6.9	6,900
26	3.3	2.2	1.6	7.1	7,100
27	3.3	2.2	1.6	7.1	7,100
28	2.5	1.7	1.2	5.4	5,400
29	2.5	1.7	1.2	5.4	5,400
30	2.5	1.7	1.2	5.4	5,400
31	2.6	1.7	1.2	5.5	5,500
219,700					217,900

Feb-11	1	2	3	Tot	Gallons
1	3.7	2.6	1.9	8.2	8,200
2	3.8	2.6	1.9	8.3	8,300
3	3.8	2.6	1.9	8.3	8,300
4	1.8	1.2	0.9	3.9	3,900
5	1.9	1.2	0.9	4	4,000
6	1.9	1.2	0.9	4	4,000
7	3.4	1.4	1.7	6.5	6,500
8	3.4	1.4	1.7	6.5	6,500
9	3.8	1.4	1.8	7	7,000
10	3.8	1.4	1.8	7	7,000
11	4.9	1.9	2.5	9.3	9,300
12	4.9	1.9	2.5	9.3	9,300
13	5	1.9	2.5	9.4	9,400
14	3.8	1.9	1.8	7.5	7,500
15	3.8	1.9	1.8	7.5	7,500
16	3.2	1.6	1.6	6.4	6,400
17	3.2	1.6	1.6	6.4	6,400
18	5.3	2.5	2.6	10.4	10,400
19	5.3	2.5	2.6	10.4	10,400
20	5.3	2.5	2.6	10.4	10,400
21	5.3	2.5	2.6	10.4	10,400
22	4.9	2.4	2.4	9.7	9,700
23	5	2.4	2.4	9.8	9,800
24	5	2.4	2.4	9.8	9,800
25	0	1.6	1.6	3.2	3,200
26	0	1.6	1.6	3.2	3,200
27	0	1.6	1.6	3.2	3,200
28	0	1.6	1.6	3.2	3,200
9,700					283,200

Mar-11	1	2	3	Tot	Gallons
1	2.8	1.3	1.4	5.5	5,500
2	2.8	1.3	1.4	5.5	5,500
3	2.8	1.3	1.4	5.5	5,500
4	4.6	2.2	2.2	9	9,000
5	4.6	2.2	2.2	9	9,000
6	4.7	2.2	2.2	9.1	9,100
7	5	2.5	2.4	9.9	9,900
8	5	2.5	2.4	9.9	9,900
9	5.7	2.9	2.8	11.4	11,400
10	5.7	2.9	2.8	11.4	11,400
11	3.4	1.7	1.6	6.7	6,700
12	3.4	1.7	1.6	6.7	6,700
13	3.6	1.7	1.6	6.8	6,800
14	4.6	2.3	2.2	9.1	9,100
15	4.6	2.3	2.2	9.1	9,100
16	3.1	1.6	1.5	6.2	6,200
17	3.1	1.6	1.5	6.2	6,200
18	2.6	1.3	1.3	5.2	5,200
19	2.6	1.3	1.3	5.2	5,200
20	2.7	1.3	1.3	5.3	5,300
21	10.1	5.1	4.9	20.1	20,100
22	10.1	5.1	4.9	20.1	20,100
23	3.2	1.6	1.5	6.3	6,300
24	3.2	1.6	1.5	6.3	6,300
25	3.3	1.6	1.6	6.5	6,500
26	3.3	1.6	1.6	6.5	6,500
27	3.3	1.6	1.6	6.5	6,500
28	8	3.9	3.7	15.6	15,600
29	8.1	3.9	3.9	15.9	15,900
30	8.1	3.9	3.9	15.9	15,900
31	3.5	1.7	1.7	6.9	6,900
10,400					279,300

Apr-11	1	2	3	Tot	Gallons
1	3.5	1.7	0	5.2	5,200
2	3.5	1.7	0	5.2	5,200
3	3.5	1.7	0	5.2	5,200
4	4.3	2.2	0	6.5	6,500
5	4.3	2.2	0	6.5	6,500
6	4.6	2.2	0	6.8	6,800
7	4.6	2.2	0	6.8	6,800
8	4.7	2.1	0	6.8	6,800
9	4.8	2.1	0	6.9	6,900
10	4.8	2.1	0	6.9	6,900
11	3.7	1.7	0	5.4	5,400
12	3.7	1.7	0	5.4	5,400
13	3.5	1.6	0	5.1	5,100
14	3.5	1.6	0	5.1	5,100
15	3.6	1.6	0	5.2	5,200
16	3.6	1.6	0	5.2	5,200
17	3.6	1.6	0	5.2	5,200
18	3.6	1.6	0	5.2	5,200
19	5.6	2.6	0	8.2	8,200
20	5.6	2.6	0	8.2	8,200
21	5.7	2.6	0	8.3	8,300
22	5.4	2.5	0	7.9	7,900
23	5.4	2.5	0	7.9	7,900
24	5.4	2.5	0	7.9	7,900
25	3.7	1.7	0	5.4	5,400
26	3.7	1.7	0	5.4	5,400
27	4	1.9	0	5.9	5,900
28	4	1.9	0	5.9	5,900
29	5.5	2.5	0	8	8,000
30	5.5	2.5	0	8	8,000
164,520					161,600

May-11	1	2	3	Tot	Gallons
1	5.5	2.5	2.6	10.6	10,600
2	5.5	2.5	2.6	10.6	10,600
3	5.5	2.5	2.6	10.6	10,600
4	5.4	2.5	2.6	10.5	10,500
5	5.4	2.5	2.6	10.5	10,500
6	3.9	1.8	1.9	7.6	7,600
7	4	1.8	1.9	7.7	7,700
8	4	1.8	1.9	7.7	7,700
9	4.6	2.1	2.1	8.8	8,800
10	4.6	2.1	2.1	8.8	8,800
11	4.7	2.1	2.1	8.9	8,900
12	5.7	2.6	2.7	11	11,000
13	5.7	2.6	2.7	11	11,000
14	5.7	2.6	2.7	11	11,000
15	5.7	2.6	2.7	11	11,000
16	7	3.2	3.3	13.5	13,500
17	7	3.2	3.3	13.5	13,500
18	4	1.7	1.8	7.5	7,500
19	4	1.7	1.8	7.5	7,500
20	5.3	2.4	2.5	10.2	10,200
21	5.4	2.4	2.5	10.3	10,300
22	5.4	2.4	2.5	10.3	10,300
23	3.8	1.7	1.8	7.3	7,300
24	3.8	1.7	1.8	7.3	7,300
25	7.5	3.3	3.4	14.2	14,200
26	7.5	3.3	3.4	14.2	14,200
27	6.5	2.9	2.9	12.3	12,300
28	6.5	2.9	2.9	12.3	12,300
29	6.5	2.9	2.9	12.3	12,300
30	6.6	2.9	2.9	12.4	12,400
31	6.6	2.9	2.9	12.4	12,400
8,300					323,800

Jun-11	1	2	3	Tot	Gallons
1	6.4	2.9	2.9	12.2	12,200
2	6.4	2.9	2.9	12.2	12,200
3	3.4	1.5	0.04	4.94	4,940
4	3.4	1.5	0.04	4.94	4,940
5	3.5	1.5	0.04	5.04	5,040
6	7.6	3.4	3.2	14.2	14,200
7	7.6	3.4	3.2	14.2	14,200
8	7.2	3.2	3.2	13.6	13,600
9	7.2	3.2	3.2	13.6	13,600
10	6.9	3.1	3	13	13,000
11	6.9	3.1	3	13	13,000
12	6.9	3.1	3	13	13,000
13	5.5	2.4	2.3	10.2	10,200
14	5.5	2.4	2.3	10.2	10,200
15	8.5	4	3.5	16	16,000
16	8.5	4	3.5	16	16,000
17	9.5	4.5	0.6	14.6	14,600
18	9.6	4.5	0.6	14.7	14,700
19	9.6	4.5	0.6	14.7	14,700
20	6.5	3.1	2.9	12.5	12,500
21	6.5	3.1	2.9	12.5	12,500
22	10	4.6	1.8	16.4	16,400
23	10	4.6	1.8	16.4	16,400
24	7.9	3.7	0.2	11.8	11,800
25	7.9	3.7	0.2	11.8	11,800
26	8	3.7	0.2	11.9	11,900
27	6.6	3.2	3	12.8	12,800
28	6.7	3.2	3	12.9	12,900
29	4.5	2.1	2	8.6	8,600
30	4.6	2.1	2	8.7	8,700
14,200					378,600

Jul-11	1	2	3	Tot	Gallons
1	6.9	4.6	2.7	14.2	14,200
2	6.9	4.6	2.7	14.2	14,200
3	6.9	4.6	2.7	14.2	14,200
4	7	4.6	2.7	14.3	14,300
5	6.8	4.1	1.7	14.6	14,600
6	6.8	4.1	1.7	14.6	14,600
7	6.9	4.1	1.7	14.7	14,700
8	9.4	4.4	1.5	15.3	15,300
9	9.4	4.4	1.5	15.3	15,300
10	9.4	4.4	1.5	15.3	15,300
11	5.5	2.8	0.9	9.2	9,200
12	5.5	2.8	0.9	9.2	9,200
13	6.8	3.9	1.1	11.8	11,800
14	6.9	3.9	1.1	11.9	11,900
15	7.6	4.3	1.2	13.1	13,100
16	7.7	4.3	1.2	13.2	13,200
17	7.7	4.3	1.2	13.2	13,200
18	6.1	2.9	1	10	10,000
19	6.1	2.9	1	10	10,000
20	6.1	2.6	0.9	9.6	9,600
21	6.1	2.6	0.9	9.6	9,600
22	9.2	4.2	1.4	14.8	14,800
23	9.3	4.2	1.4	14.9	14,900
24	9.3	4.2	1.4	14.9	14,900
25	10.7	4.8	1.6	17.1	17,100
26	10.7	4.8	1.6	17.1	17,100
27	6.8	3.1	1	10.9	10,900
28	6.9	3.1	1	11	11,000
29	8.8	3.9	1.3	14	14,000
30	8.8	3.9	1.3	14	14,000
31	8.9	3.9	1.3	14.1	14,100
1,210,000					415,300

Aug-11	1	2	3	Tot	Gallons
1	9.8	4.4	1.5	15.7	15,700
2	9.8	4.4	1.5	15.7	15,700
3	9.2	4	1.4	14.6	14,600
4	9.2	4	1.4	14.6	14,600
5	8.9	3.9	1.4	14.2	14,200
6	9	3.9	1.4	14.3	14,300
7	9	3.9	1.4	14.3	14,300
8	7.5	3.1	1.1	11.7	11,700
9	7.5	3.1	1.1	11.7	11,700
10	7.4	3.1	1.1	11.6	11,600
11	7.4	3.1	1.1	11.6	11,600
12	8.9	3.9	1.4	14.2	14,200
13	8.9	3.9	1.4	14.2	14,200
14	9	3.9	1.4	14.3	14,300
15	5.5	2.3	0.8	8.6	8,600
16	5.5	2.3	0.8	8.6	8,600
17	10.4	4.3	1.6	16.3	16,300
18	10.4	4.3	1.6	16.3	16,300
19	8.2	3.3	1.3	12.8	12,800
20	8.2	3.3	1.3	12.8	12,800
21	8.2	3.3	1.3	12.8	12,800
22	5.5	2.2	0.8	8.5	8,500
23	5.5	2.2	0.8	8.5	8,500
24	6.7	2.8	1.1	10.6	10,600
25	6.7	2.8	1.1	10.6	10,600
26	7.3	3.1	1.1	11.5	11,500
27	7.3	3.1	1.1	11.5	11,500
28	7.4	3.1	1.1	11.6	11,600
29	9.3	3.9	1.5	14.7	14,700
30	9.3	3.9	1.5	14.7	14,700
31	10.2	4.1	1.6	15.9	15,900
17,100					395,000

Sep-11	1	2	3	Tot	Gallons
1	10.3	4.1	1.6	16	16,000
2	12.2	4.8	1.9	18.9	18,900
3	12.2	4.8	1.9	18.9	18,900
4	12.2	4.8	1.9	18.9	18,900
5	12.3	4.8	1.9	19	19,000
6	6.7	2.6	1.1	10.4	10,400
7	6.8	2.6	1.1	10.5	10,500
8	6.8	2.6	1.1	10.5	10,500
9	9.8	3.9	1.5	15.2	15,200
10	9.8	3.9	1.5	15.2	15,200
11	9.8	3.9	1.5	15.2	15,200
12	6.2	2.4	1	9.6	9,600
13	6.2	2.4	1	9.6	9,600
14	5.9	2.3	0.9	9.1	9,100
15	5.9	2.3	0.9	9.1	9,100
16	6.7	2.5	1.1	10.3	10,300
17	6.7	2.5	1.1	10.3	10,300
18	6.7	2.5	1.1	10.3	10,300
19	5.1	2	0.8	7.9	7,900
20	5.1	2	0.8	7.9	7,900
21	9.3	3.6	1.5	14.4	14,400
22	9.3	3.6	1.5	14.4	14,400
23	6	2.4	1	9.4	9,400
24	6	2.4	1	9.4	9,400
25	6.1	2.4	1	9.5	9,500
26	9.5	4	1.5	15	15,000
27	9.5	4	1.5	15	15,000
28	6.7	2.9	1.1	10.7	10,700
29	6.8	2.9	1.1	10.8	10,800
30	3.7	1.6	0.6	5.9	5,900
16,300					372,300

20,100	
16,400	
19,000	

Feasibility Study

Service Expansion from Clearlake Oaks County Water District Westerly to Serve
Lake County Special Districts County Service Area (CSA) 16
(Paradise Cove and Paradise Valley Ranch)

DRAFT

June 27, 2014

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FIGURE 1 4

1 Introduction and Background

Lake County Special Districts County Services Area 16 [(CSA) 16] includes Paradise Cove and Paradise Valley Ranch. Paradise Valley Ranch is a 92 Equivalent Dwelling Units (EDU) development planned directly to the north of the existing 88 EDU Paradise Cove development. The existing Paradise Cove development is currently under a building moratorium (there are currently only 70 of the existing 88 lots developed) because of limitations on the water supply. The purpose of this study is to assess the feasibility of supplying water to (CSA) 16 through a water main extension from the existing Clearlake Oaks County Water District water distribution system, westerly to the project location. The general project location is shown in Figure 1.

Figure 1. Project Location

2 Water Demand

2.1 Existing Water Demand from Paradise Cove within (CSA) 16

The existing Paradise Cove system has 70 active connections within CSA (16). The existing system supplies peak flow of 17-gpm, for a total daily flow of 25,000 gallons per day. The existing 70 active connections are using approximately 350 gallons per connection per day at peak. This is a relatively low per connection usage, which is explained primarily by the use of a secondary supply and distribution system for irrigation water. Because there is secondary supply for most irrigation needs, the peak day peaking factor is low, estimated at 1.5. For planning purposes, an average daily flow of 250 gpcd and a 1.5 peaking factor is reasonable for the Paradise Cove area.

2.2 Anticipated Water Demand within (CSA) 16

The planned Paradise Valley Ranch development will have 77 residential connections, a winery, 15,000 sf of commercial space and an equestrian center/clubhouse. The water system in Paradise Valley Ranch will also have a secondary supply for irrigation water, so residential use is expected to be the same as for Paradise Cove (250 gpd average with a 1.5 peaking factor). Paradise Cove will have 88 residential connections at build-out. Anticipated water demand for (CSA) 16 at build out is shown in Table 1.

Table 1. Anticipated Water Demand at Build-out, (CSA) 16

(CSA) 16 Demand	Equivalent Dwelling Units (EDU)	Unit Flow	Peak Day Peaking Factor	Daily Flow	
				Average	Peak
Paradise Cove at Build-out		gpd/EDU		gpd	gpd
Residential	88	250	1.5	22,000	33,000
Paradise Valley Ranch at Build-out					
Residential	77	250	1.5	19,250	28,875
Winery (20,000 cases/year)	3		4	522	2,087
Agricultural Commercial (15,000 sf)	10		1.5	1,745	2,618
Equestrian Center	2		2	500	1,000
Total Demand of (CSA) 16				44,017	67,579
Rounded total demand (CSA) 16	180			45,000	70,000

2.3 Existing Water Supply and Treatment Facilities

The existing (CSA) 16 water system consists of three wells and a treatment facility. Notably, the system also includes a separate surface water intake, filter system and distribution system for irrigation water. The three wells have capacities of 10-gpm, 4-gpm and 3-gpm, respectively. The treatment facility consists of sodium hypochlorite storage and feed equipment along with a 6-ft diameter manganese greensand filter.

2.4 Adequacy of Existing Water Supply

The existing groundwater wells are not adequate to supply the current 70 active connections and existing 18 undeveloped lots in the Paradise Cove subdivision and certainly not adequate to supply the proposed 92 EDU Paradise Valley Ranch subdivision. Additional groundwater resource potential has been separately investigated and additional reliable groundwater resources have not been identified. The low productivity of the existing wells is of even greater concern during drought conditions, such as those being experienced in 2014. With such a tenuous source, an additional, more reliable water source is critical not only for expansion of the community, but for maintenance of adequate water supply for those already being served by the existing water system. A conceptual design report was prepared examining the feasibility of a surface water supply from Clear Lake to serve the Paradise Cove and Paradise Valley Ranch communities. That report estimated that a 50-gpm surface water treatment plant would be required. Details of the treatment process required, plant costs, etc. are included in that previous report.

3 Clearlake Oaks County Water District Ability to Provide Service

The distribution system of the Clearlake Oaks County Water District extends west to Harvey Boulevard with a main line extending down to Harvey Boulevard running in the in-land shoulder of Highway 20.

3.1 General Intertie Arrangement

The general arrangement of the proposed intertie is 8900-ft of 8” water main extending along the Highway 20 alignment from Harvey Boulevard to the east end of the Paradise Cove water distribution system, tying in to the 6” main in Paradise Cove at the corner of Paradise Valley Boulevard and Highway 20. Figure 1 shows the general arrangement of the intertie, including the existing main line in Highway 20 up to Harvey Boulevard, the 8900-ft main line extension, and the main line on Paradise Valley Boulevard.

Insert Figure 1 of General Intertie Arrangement

3.2 Pressure and Flow

The pressure in the Paradise Cove distribution system is controlled by the level in the storage tank shown in Figure 1. The approximate elevation of that tank is 1460 with a water surface (hydraulic grade line, HGL) of approximately 1500. The tie-in to Clearlake Oaks County Water District at Harvey Boulevard is at approximately elevation 1350. A hydrant pressure and flow test was conducted in February, 2014. Water was released from the terminal hydrant at Harvey Boulevard, flow from that hydrant was estimated, and pressure in the distribution system was measured at a hydrant approximately 500-ft away. The results of that test are shown in Table 2.

Table 2. Hydrant Pressure Testing at Harvey Boulevard

Estimated Flowrate	Pressure	Head
gpm	psi	feet
0	120	277
15	115	266
100	100	231
200	35	81
400	25	58

The results of this testing indicate that flow from the Clearlake Oaks County Water District system should be limited to 100-gpm in order to not cause issues with pressure drop in the distribution system in the Harvey Boulevard area. 100-gpm is adequate to recover the 70,000 gallons/day peak day demand at build-out of Paradise Cove/Paradise Valley Ranch in approximately 12 hours, which is more than adequate. The 100-psi available pressure at that flowrate provides 231 feet of head above the tie-in elevation of 1350, setting the HGL at the tie-in at approximately 1581. That allows for 81-ft (35 psi) of friction losses in the intertie to keep the HGL of 1500-ft in the Paradise Cove/Paradise Valley Ranch distribution system. Friction losses in an 8-inch pipeline at 100-gpm flowrate are nearly zero and we would anticipate that the 1500-ft HGL in the Paradise Cove/Paradise Valley Ranch area to be easily maintained.

3.3 Intertie Pipeline Alignment

The alignment of the intertie pipeline generally follows Highway 20. A brief evaluation of the alignment suggests that approximately 30% of the route would be unavoidably in the travel lane and 70% would be in the shoulder, outside the fog line. In the travel lane, a full-lane overlay to the center stripe of the road and re-striping of the fog line should be anticipated, when outside the fog line, shoulder pavement replacement only is anticipated. When crossings are necessary, they should be as perpendicular as possible to the highway. A general examination of the route profile (shown in Figure 2) shows that approximately 5 air relief valves will be required along the alignment.

Figure 2. Approximate Profile of Intertie Alignment

3.4 Storage

Because water transfer rates from the Clearlake Oaks County Water District distribution system are limited, storage for peak day demand and fire flow will have to be accommodated locally to the Paradise Cove/Paradise Valley area. This will be initially accomplished with the existing storage tank. The adequacy of the existing storage tank should be assessed separately; new storage can be built to accommodate additional storage requirements as needed. Figure 1 shows the location of where future storage can be built.

4 Cost

4.1 Cost of Clear Lake Oaks County Water District Intertie

Table 3 presents the conceptual cost estimate for the Clear Lake Oaks County Water District Intertie.

Table 3. Conceptual Cost Estimate of Clearlake Oaks Intertie

Cost of pipeline	
Length (ft)	8900
Diameter (in)	8
$/in/foot (pipe and backfill only)	$7
$/foot	$56
Cost for pipe and trench installation	$498,400
Air Relief Valves	7
$/ARV installation	$6,000
Cost of ARVs	$42,000
Turnouts	
Cost of Turnouts as required	$28,400
Caltrans Pavement Restoration	
Length of Full Lane Replacement	3,000
Length of Shoulder Replacement	5,900
Crossings	1
Cost of Full Lane Replacement ($/ft)	$75
Cost of Shoulder Replacement ($/ft)	$18
Cost of Crossings ($/Crossing)	$25,000
Cost of Caltrans Restoration	$356,200
Subtotal, Pipeline Intertie Construction	*$925,000*
Modifications to Existing Water Systems	
Modifications to existing Paradise Cove Tank (aeration / filtration)	
Repair/Replace existing water mains connecting to Clearlake Oaks System	
Modification to Paradise Cove connections	
Replace Meters	
Remove existing wells offline	
Total Cost of Modifications	$260,000
Subtotal, Construction Costs	*$1,185,000*
10% Contingency	*$118,500*
Total Estimated Construction Cost	*$1,303,500*
15% Engineering, Construction Management, Permitting	*$195,525*
Total Estimated Project Cost	$1.5M

4.2 Water Treatment System Costs

Table 4 contains a conceptual level cost estimate for the proposed 50-gpm surface water treatment plant as developed in the previous report.

Table 4. Conceptual Cost Estimate for Water Treatment Plant for (CSA) 16

Unit Process	Estimated Equipment / Labor Cost
Raw Water Pumping[1]	$25,000
Initial Screening	$20,000
Pre-oxidation (Ozone)	$50,000
Coagulation	$10,000
pH Adjustment	$10,000
Groundwater Blending (pipeline)	$80,000
Rapid Mixing	$10,000
Dissolved Air Flotation (DAF)	$160,000
Secondary Oxidation (Potassium Permanganate)	$20,000
Booster Pumping	$10,000
Filtration	$70,000
Taste and Odor Control	$70,000
Disinfection (Sodium Hypochlorite)[2]	$10,000
Backwash	$30,000
Solids Dewatering	$35,000
Treatment Building (25 x 40)	$100,000
Electrical, Instrumentation and Control	$200,000
Raw Water Pipeline from Lake intake to Water Treatment Plant	$150,000
Chlorine Contact Pipeline from Treatment Plant to Storage Tank (No Services)	$140,000
Subtotal, Construction	*$1,200,000*
10% Contingency	*$120,000*
Total Estimated Construction Cost	*$1,320,000*
15% Engineering, Construction Management, Permitting	*$198,000*
Total Estimated Project Cost	$1,518,000

4.3 Comparison of Costs

The capital costs of the two project alternatives are comparable. When all of the facilities required for the water treatment plant are included, the costs are within the level of accuracy of conceptual cost estimates and can be considered to be generally equivalent. However, the cost of continued operation of the water treatment plant will be considerably higher than the costs of connecting to the Clear Lake Oaks County Water District system. While there are some additional costs in increasing the production from the water treatment plant at Clear Lake Oaks, the economy of scale of increasing production from that plant are considerably better than the costs of operating a stand-alone water treatment plant. The consolidation of

the Paradise Cove/Paradise Valley water system to the Clear Lake Oaks County Water District system is encouraged by the California Department of Health as it makes management and monitoring of the system more cost effective.