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GROUNDWATER MANAGEMENT PLAN

October 1998

BEAR VALLEY COMMUNITY SERVICES DISTRICT

October 10, 1998

To: BOARD OF DIRECTORS

From: JOHN YEAKLEY, GENERAL MANAGER

Subject: BEAR VALLEY COMMUNITY SERVICES DISTRICT GROUND WATER MANAGEMENT PLAN

The subject plan is forwarded as directed by Bear Valley Community Services District Resolution 98-923 of March 14, 1998. It is my opinion that this document fully addresses the requirements of California Water Code, Sections 10750, et seq (AB 3030).

As the Board is aware, development and maintenance of a reliable, high quality ground water supply is vitally important to the Bear Valley community. It is hoped that implementation of this plan will provide the District with the ability to establish a self-governing policy relating to ground water protection, extraction, and use. Through the proactivity of the Board and the actions taken by implementation of this plan, we now have the framework in place to implement a sound groundwater management strategy.

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BEAR VALLEY COMMUNITY SERVICES DISTRICT

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BEAR VALLEY COMMUNITY SERVICES DISTRICT

GROUNDWATER MANAGEMENT PLAN

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Bear Valley Community Services District

Prepared by:

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San Luis Obispo, California

October 1998

GROUNDWATER MANAGEMENT PLAN

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GROUNDWATER MANAGEMENT PLAN

1. INTRODUCTION

1.1 GENERAL

The preparation of a Groundwater Management Plan (the Plan) has been authorized by the Board of Directors of the Bear Valley Community Services District (BVCSD; District) by Resolution (Appendix A), in compliance with the provisions of Assembly Bill 3030, the Groundwater Management Act, California Water Code Sections 10750, et. seq., (the Act). The objectives of the Plan are to:

- Protect the quality of the District's groundwater basin
- Promote and improve existing monitoring activities
- Enable the District to identify and implement the necessary means to preserve and enhance our groundwater resource.

1.2 DISTRICT MANAGEMENT AND ADMINISTRATION

The District was formed in May 1970 under the California Community Services District Act, California Government Code, §61000, et seq., and includes all of the subdivisions plus certain other adjacent parcels of land within the Bear Valley Springs development. The District has a service area of approximately 26,000 acres in Kern County (Figure 1), with a current estimated population of about 5,600.

With a staff of 43, the District owns and operates the water system that supplies water to the development, and the sewage treatment plant that provides collection, treatment, and disposal of sewage to most of the community. It owns and maintains the roads, streets, and related drainage facilities in Bear Valley Springs and has established and maintains a police department. The District's services are funded by property taxes, special assessments and standby charges collected by Kern County on the regular property tax bill. Some funds are collected through user fees such as water and sewer charges and capacity fees for new water connections.

The governing body of the District is a five-member board of directors, which exercises all the powers of the District. Directors are elected by ballot by the registered voters of BVCSD at District elections. The Board employs a general manager who manages the District facilities and supervises day-to-day activities. The General Manager has authority over all District employees and is responsible for implementing Board decisions.

The District is the sole water purveyor for the community of Bear Valley Springs. The District currently serves approximately 2,000 active connections, with an average annual water production between 1989 and 1997 of approximately 925 acre-feet per year (AFY). The primary source of water supply to the District during that period was from 27 active water supply wells. Beginning in 1991, supplemental State Water Project (SWP) water imported through the Tehachapi-Cummings County Water District was used for non-potable, irrigation water. Of the average 925 AFY production, the District's 7 alluvial wells contribute an average of 205 AFY, the 20 bedrock wells contribute an average of 610 AFY, and the remainder of the annual supply is from the imported water supply. The summer of 1998 will witness implementation of the Cummings Valley importation project, the District's new water supply source. That project consists of an exchange of the District's State Water Project water to the Tehachapi-Cummings County Water District (TCCWD), in exchange for the rights to pump water out of the Cummings Groundwater Basin. The TCCWD, in turn, uses the District's SWP water to recharge the Cummings Basin. Upon implementation of the Cummings Valley importation project, SWP water will no longer be imported or used in-valley.

As discussed in the District's recently completed Water Supply Management Planning Analysis (Fugro, 1996), the community is continuing to expand. The projected water demand for the District is expected to eventually nearly double, to approximately 1,650 AFY. In order to keep up with this increasing demand on the system resources, the District has implemented a series of actions designed to increase water supplies. Of major significance is the Cummings Valley importation project, which will provide a source of potable groundwater from neighboring Cummings Valley. Based on the results of pumping tests conducted on the District's new Cummings Valley wells in March, 1996, an estimated 200 to 250 acre feet of water can be produced during the five month summer pumping season without causing excessive drawdown in the wells and basin. If both wells are pumped simultaneously during emergency pumping periods, it will be possible to produce an estimated 100 to 140 acre feet of water in one month. In whatever manner the wells are operated, the Cummings Valley wells and importation project is a significant water supply project for the District.

1.3 PURPOSE AND GOALS

The Bear Valley Community Services District is dependent on groundwater for its water supply source and for the life and vitality of its community. Thus, the Board has long recognized development of a reliable, high quality groundwater supply as vitally important to the community it serves. Preparation and implementation of the groundwater management plan will provide the District's Board of Directors with the ability to establish a self-governing policy relating to groundwater protection, extraction, and use, rather than expose itself to the possibility of outside management by an external agency or the State of California.

The Plan recognizes that a complete understanding of the water supply conditions that influence the District is necessary, and that the District's history of proactive management of the water supplies must be continued. To achieve this goal requires identification of future problems, and effective management of both local and imported water supplies. The long-term continuation of this balance will be the principal benefit to be derived from the Plan. Retaining not only the rights but also the ability to use all existing surface, ground, and imported water supplies within the District is critical to maintaining a water supply.

The principal action item of the Plan will be identification of potential future problems, and the compilation and evaluation of additional data related to the quantity and quality of groundwater. Action items will be developed to enhance the valuable groundwater resource by promoting those actions necessary to protect the groundwater resource from threats, whether the threats come from groundwater contamination, encroachment of water rights issues, or long-term groundwater level declines. Most of the action items identified in the Plan have been implemented by the District, or will begin with adoption of the Plan. A few of the action items will require further study before implementation.

Preparation of the Plan is funded by Bear Valley Community Services District. It is not likely that an additional funding source will be required to fully implement any future Plan activities. The Groundwater Management Act allows for the levying of groundwater assessments or fees under certain circumstances and according to specific procedures, however the District is the sole groundwater user in the Bear Valley Springs area, and is a party to the groundwater basin adjudication in the Cummings Valley. Thus, there are limited threats to the District's groundwater position, and limited to nil opportunities for the District to develop new stakeholder opportunities. Before instituting a new fee structure related to action outlined in this Plan, the District must hold an election on whether or not to proceed with the enactment of the assessments. A majority of the votes cast at the election will be required to implement an additional funding assessment.

1.4 INSTITUTIONAL REQUIREMENTS

Historically, the use of groundwater in the State of California has not been regulated except in a few basins where the courts have adjudicated the rights or special management districts have been authorized by the State Legislature. The District is in a unique and fortunate situation, whereby it is the sole pumper and user of the groundwater aquifers from which most of its supply originates. Its secondary supply source, which is a conjunctive use of State Water Project water in association with the adjudicated Cummings Basin groundwater supply, is a secure source of water that is managed by the District in association with the Cummings Valley (TCCWD) Watermaster.

1.5 PREPARATION AND ORGANIZATION OF THIS PLAN

This "Groundwater Management Plan" was prepared for the District by Fugro West, Inc., Paul A. Sorensen, Project Manager, and coordinated by John C. Yeakley, BVCSD General Manager. John Martin, Assistant General Manager, and the members of the Infrastructure

Committee, consisting of Directors Ron Samuels and William R. Miller provided technical review of the draft document.

The "Groundwater Management Plan" is organized into six chapters, including:

Chapter 1. INTRODUCTION: Contains background and historical information about the District, the purpose and goals of preparing this "Groundwater Management Plan," the institutional framework under which the District is generating the Plan, and some of the organizational details of the Plan.

Chapter 2. WATER SUPPLY AND DEMAND REVIEW: Contains a summary of the current and projected water supply and demand situation in the area. This chapter defines and explains the physical and legal structure of the District's water supply and outlines expected future demands.

Chapter 3. GEOLOGIC AND HYDROGEOLOGIC SETTING: Contains a review of the geologic and hydrogeologic conditions that provides the physical framework for the District's water supply. Because one of the first steps in developing a groundwater plan is to identify and review existing hydrogeologic data, this technical summary is an important review in formulating the foundation of the Plan and future action items.

Chapter 4. WATER QUALITY: Describes the groundwater and surface water quality conditions of the District's water supply, the institutional requirements and objectives of the District, and the current threats to the quality of the District's groundwater supply.

Chapter 5. GROUNDWATER CONDITIONS: Describes the current conditions of groundwater levels and groundwater movement in the aquifer from which the District obtains its supply.

Chapter 6. ACTION ITEMS: Contains a summary of future action tasks and studies to be undertaken to meet the previously defined water supply objectives.

2. WATER SUPPLY AND DEMAND REVIEW

2.1 SOURCES OF SUPPLY

The Bear Valley Community Services District is the sole water purveyor for the customers of the Bear Valley Springs community. The District currently serves about 2,000 active water service connections. An increased rate of growth in the past several years, coupled with the serious drought that plagued California between 1986 and 1992, resulted in a condition where the District's ability to produce water was barely able to keep up with demands for service. A series of actions was implemented, designed to increase water supplies as well as to provide an evaluation of options available to the District to develop an adequate supply to satisfy the needs of the community through buildout.

The District's entire potable water supply has historically been produced by local groundwater supplies, developed by a combination of alluvial wells drilled in the Bear Valley groundwater basin, and bedrock wells drilled into the granitic bedrock that forms the hills surrounding the community. Before implementation of the Cummings Valley importation project, the District's water supply capability was at a critical juncture in meeting heavy demands during the late summer seasonal demands. At the time of this writing, the Cummings Valley importation project has been in operation for a single summer season, and appears to exceed all expectations. The new project is expected to be capable of providing a surplus supply of water to the District for the next 15 to 20 years, depending on future growth rates. The importation project facilities have been designed for ease of future expansion, including a well site for a third supply well, oversized pipelines and other appurtenances, and additional pumping capacity at the pump station.

Groundwater production has steadily increased over the past 15 years, reaching a peak in 1997 when 911 acre feet of water were pumped. From 1990 through 1995, production declined to a relatively stable level of about 800 acre feet per year (AFY). However, 1996-97 saw an increase in production demands, reaching the historic high of 911 AFY in 1997 (Figure 2).

Of more significance than the overall annual production capability are the peak demands placed on the system during late summer (Figure 3). It is important to understand the difference between the total annual system demand or even total monthly demands, and the daily peak demands that are critical to the District's ability to adequately service its customers. Thus, the key to calculating District capabilities is in daily peak demands.

2.2 GROUNDWATER

2.2.1 Bear Valley Alluvial Wells

A breakdown of the component contribution of the alluvial wells and the bedrock wells is shown on Figure 4. For the past 12 years, the supply contribution of the alluvial aquifer has consistently hovered in the range of 200 AFY.

Water levels in the alluvial wells have fluctuated rapidly in response to seasonal changes, and in response to long-term rainfall patterns. Standing water levels in the alluvial wells have typically risen rapidly following the onset of the winter rainy season and likewise started a steady rate of decline during the summer as the aquifer is heavily stressed. These fluctuations are typical of small, shallow, relatively constrained, unconfined groundwater basins that one finds in intermontane environments and along narrow coastal valleys. The fluctuations indicate that recharge is rapid and although water levels decline during drought periods, they tend to recover quickly after the low rainfall period has concluded. Hence, the basin is clearly not in overdraft; in fact, it likely is not possible for the basin to enter a sustained period of overdraft conditions.

2.2.2 Bedrock Wells

The difference between the ±200 AFY alluvial basin contribution and the annual demand has historically been made up with the bedrock aquifer component that has varied over the past 10 years from a low of 383 AF in 1986 to a high of 702 AF in 1997 (Figure 4).

2.2.3 Cummings Valley Wells

The projected contribution of the Cummings Valley wells is estimated to be capable of augmenting existing supplies by approximately 700 gpm. Each of the two wells is likely capable of individually pumping continuously at 500 to 550 gpm; however, there will be significant mutual well interference when both wells are pumped at the same time. The wells will be pumped directly into a storage tank before introduction to the system, so entrained air that may be caused by pumping both wells simultaneously at pumping levels below the perforations will be mitigated. However, to minimize this condition, the wells will only be pumped at their design rate for 16 hours per day to decrease the potential for entrained air. Thus, the total future effective contribution of the two Cummings Valley wells is conservatively projected to be 700 gpm.

2.3 IMPORTED WATER

Beginning in 1991, supplemental State Water Project water imported through the Tehachapi-Cummings County Water District was piped into BVCSD for use as a non-potable, irrigation water source for lake fill and golf course irrigation. Figure 5 shows the volume of imported water used since 1991. With implementation of the Cummings Valley importation project, State Water will no longer be imported or used in-valley. It will, however, be purchased as exchange water for groundwater pumping rights to Cummings Valley groundwater, as described earlier.

2.4 EXISTING DEMAND

Historic total average annual water production over the past 9 years has ranged from about 767 AFY to as high as 911 AFY (Figures 6 and 7). Of that amount, approximately 85% of the demand serves metered residential customers, 5% to metered non-residential use (commercial usage and lake fill/irrigation demands), and approximately 10% to "unaccounted for" water (water lost in the system through leaks, faulty meters, construction water, etc.).

2.5 FUTURE DEMAND

Future domestic water requirements are shown on Table 1. It is likely that growth will not continue at the rates seen in the late 1980's, but will slow as more and more of the "easy" lots are developed. Thus, growth rates are shown as declining numbers as community buildout nears.

Using the average annual growth rates shown in Table 1, and average water duty factors for each category, the projected annual water delivery requirement is expected to reach approximately 1,650 AFY. This number is based on buildout projections of 3,750 active residential meters and a population of 10,000 to 10,500 (Table 1 and Figure 8).

Demands on the system are significantly greater on peak days during the summer pumping season. The ability of the District to produce the annual total volume demand is relatively unimportant when compared to the need to meet peak demands for several hours at a time. Thus, when analyzing the relationship between supply and future demands, it must be described in terms of peak gallons per minute demands.

The current maximum day demand is estimated at approximately 1,250 gpm. With the current estimated maximum day contribution of the existing Bear Valley wells at approximately 1,300 gpm, the Cummings Valley wells effective contribution of approximately 700 gpm, a maximum peak day demand (Peaking Factor) of 2.09 (calculation based on historic values), and a 10% safety factor, the District has a groundwater supply capable of meeting future demands out to approximately year 2016 (Figure 9).

2.6 MONITORING EFFORTS

The District monitors water levels, total production, and hours of operation of each well on a monthly basis.

Chemical water quality samples are taken as required under Federal and State Drinking Water Standards. General mineral, general physical, and inorganic chemical analyses are conducted every three years, and the latest test results comply with State standards. Volatile organic and synthetic organic chemical analyses are also conducted once every three years, and current test results are non-detectable for these organic chemicals. Radiological testing is done at each well once every four years, for four consecutive quarters and has been in compliance. Average test results for each of these constituents are listed on Table 2.

Bacteriological water quality samples are collected twice weekly on a rotating basis for every pressure zone in the system. Raw water well samples are also collected on a monthly basis from each of the chlorinated wells for bacteriological analysis. The District complies with all water quality standards.

2.7 WATER CONSERVATION

In 1995, the Board of Directors approved a resolution creating a water conservation plan and setting water production targets. The purpose of the program is to reduce per-capita potable water production compared with the base year of 1994. Targets and actual figures for the three full years following approval of the resolution were:

Year	Production (AF)		Production (HCF)		Population		Per-Capita Production (HCF)	
	Target	Actual	Target	Actual	Target	Actual	Target	Actual
1995	811.09	779.64	353,309	339,611	5,337	5,304	66.2	64.0
1996	821.8	877.62	357,975	382,291	5,550	5,531	64.5	69.1
1997	840.09	903.0	365,945	393,347	5,772	5,581	63.4	70.5

Although population increased at a slower pace than was projected, water production has increased significantly. The conservation target was met in 1995, but not in 1996 or 1997.

Per-capita water production has increased despite the fact that unaccounted-for water (system losses and meter inaccuracies) has been controlled. In 1995, unaccounted-for water was 13.9% of the production total. This dropped to 10.8% in 1996 and to 10.1% in 1997.

Residential consumption appears to be driving the production increase. In 1995 (a wet year), residential accounts consumed 622 acre feet; in 1996 they consumed 735 AF and in 1997 they consumed 763 AF.

Several factors contribute to the higher residential consumption:

- Hotter-than normal summers
- Lower-than-normal precipitation in the Spring
- Installation or expansion of landscaping at existing and newly-built houses
- Insensitivity to conservation water rates

The average active residential customer in the District used 0.43 AF in 1997, higher than the historical average of 0.39 AF, but substantially lower than other nearby communities. The city of Tehachapi used 0.70 AF in the same period and Bakersfield residents used 0.84 AF. Because Bear Valley residents already consume so little water comparatively, significant water savings will be difficult to achieve through water conservation regardless of the measures employed.

3. GEOLOGIC AND HYDROGEOLOGIC SETTING

3.1 GENERAL

One of the important components of a groundwater management plan is a review of the existing data available to determine conditions in the groundwater basin(s). Compilation of this technical information not only forms the foundation upon which a groundwater management plan can be built, but is necessary for implementation of the plan.

This chapter is a compilation of information taken from several sources, including Brown (1969), Dering (1970), BCI (1988), and Fugro (1996, 1997).

3.2 DESCRIPTION OF AREA

The Bear Valley Springs community is situated in an elevated valley, in the western portion of the Tehachapi Mountains. The physiographic features of Bear Valley and surrounding mountains are shown on Figure 1. The valley, coupled with the surrounding drainage areas, comprise an area of about 18 square miles. The main portion of the valley is actually three interconnected alluvial basins, designated the Upper, Middle, and Lower Valleys (from east to west, respectively). Surface elevations range from 4,100 feet in the Lower Valley to about 6,200 feet southeast of Bear Mountain, which at 6,913 feet is the highest peak in the area. The grassy hillsides are generally covered with oak and pine trees on all but the steepest slopes. Bear Valley is nearly fully enclosed by a ring of mountains of igneous origin, comprised generally of granitic rocks. The region is seismically active and several prominent faults traverse the area.

Average annual precipitation within Bear Valley is approximately 18.3 inches on the valley floor, and about 26.6 inches in the higher mountains. Annual precipitation in the valley has varied from a low of 10.1 inches in 1910-11 and 1917-18, to a high of 42.0 inches in 1982-83. Snowfall is a common occurrence during winter months. Temperature measurements at Tehachapi indicate a mean monthly range from a low of 39.5°F during January to a high of 72.4°F during July.

3.3 GEOLOGIC AND HYDROGEOLOGIC FRAMEWORK

The Bear Valley watershed covers approximately 18 square miles. Valley elevations range from 4,100 feet to 6,913 feet (Brown, 1969). The geology of the watershed is primarily composed of extensively fractured and faulted granitic rocks. Three small, alluvial valleys lie in the bottom of the watershed and have been referred to generally as the Upper, Middle, and Lower valleys. The alluvium in the three valleys is composed of coalescing alluvial fans and fine grained stream deposits, consisting of mixed sands, silts and clays.

3.3.1 Bedrock

The Cretaceous Bear Valley Springs (BVS) pluton dominates the Bear Valley region. Although the plutonic rocks are generally referred to as granitic rocks, they are technically a weakly to strongly foliated tonalite, and have been radiometrically dated at about 99 million years (BCI, 1988, Sames et al., 1983).

The only rocks to outcrop in the District service area are the BVS pluton and Quaternary alluvium. The alluvium ranges in thickness from about 40 to 200 feet in the three small sub-basins that form Bear Valley, and consists of mostly silty, fine- to medium-grained sands with discontinuous clay-rich horizons (Brown, 1969).

The topography and relief of the Tehachapi Mountains reflects widespread and relatively recent tectonic activity. The two major structural features of the region are the Garlock and San Andreas faults, which form the southeastern and southwestern boundaries of the Tehachapi Mountains, respectively. The northeast-trending, high-angle Garlock Fault has experienced mostly left-lateral movement in the past 10 million years (BCI, 1988; Burbank and Whistler, 1987). The San Andreas fault is a mostly northwest-trending, high-angle feature with right-lateral movement that is the major structural and tectonic feature of California's geology.

The White Wolf fault, located about 5 miles northwest of Bear Valley, is a significant tectonic structure near the area of interest. This fault trends northeast and marks the abrupt border between the Tehachapi Mountains and the adjacent San Joaquin Valley. A major earthquake during 1952 has been attributed to movement of the White Wolf fault, which resulted in the simultaneous development of prominent scarps. Geologists have estimated that between 3 and 10 feet of left-lateral reverse movement occurred during this event (BCI, 1988; Dibblee and Warne, 1970; Stein and Thatcher, 1981).

Within Bear Valley, several different studies have identified a number of northwest-trending faults that apparently cross the valley floor. Brown (1969) identified four mostly northwest-trending faults across Bear Valley, and suggested all movement on the faults as purely dip-slip. Building on the work of Brown (1969), Dering (1970) prepared a detailed geologic map of the valley and identified almost a dozen northwest structures as well as several more minor northeast-trending faults. Dibblee and Warne (1970) located two northwest faults in the valley coinciding with those spotted by Brown (1969) and Dering (1970), and also identified the Bear Mountain fault extending along the northeastern slope of Bear Mountain, 2 to 3 miles north of Bear Valley.

The bedrock aquifer surrounding Bear Valley is a critical component of the District's water supply, providing as much as 70% to 75% of the historic water supply. As described in Section 2, the District produces an average of about 600 acre-feet of groundwater per year from 20 active wells in the fractured plutonic bedrock. The wells range in depth from 152 feet deep to 977 feet deep, and range in production capability from less than 20 gallons per minute (gpm) to more than 300 gpm. All of the bedrock wells produce groundwater of good quality, with the exception of three of the wells that produce water with slightly elevated iron and manganese concentrations. Six of the bedrock wells were once discounted on the basis of elevated uranium concentrations, but three of those wells have now been inactivated and are in the process of being properly abandoned. The other three wells have met the minimum standard of 40 parts per billion uranium for two years; thus, all District wells now meet minimum State and Federal standards for radiochemical testing.

3.3.2 Bear Valley Alluvium

The Upper Valley is a separate and hydrogeologically distinct basin covering approximately 530 acres that lies upgradient and northeast of the Middle Valley. Wells in the Upper Valley have encountered alluvium to depths of 60 to 70 feet. The Middle Valley is the largest of the three valleys, covering approximately 2,000 acres. Alluvium in the Middle Valley has been encountered to depths of approximately 200 feet. The Lower Valley is a shallow valley of approximately 1,400 acres that lies west of the main, Middle Valley. Alluvium in the Lower Valley is generally a maximum of 50 to 80 feet thick.

Groundwater occurs in all three valleys, and in the fracture zones in the bedrock. The primary source of groundwater is infiltration of rainfall, although an unknown volume of groundwater discharges from the surrounding bedrock into the basins via fracture flow. Groundwater levels in the basins, particularly the Middle Valley where levels are depressed through pumping, respond rapidly upon receiving any significant volume of rainfall. During years of average rain, a shallow lake forms in the southwest part of Middle Valley, when the valley can accept no additional infiltration.

The alluvial deposits in the Upper Valley are relatively limited in extent and in thickness. Based on borings, the alluvial sediments consist of clayey silt and silty fine sand. Groundwater in the valley appears to be under semi-confined conditions. As discussed above, alluvium thickness varies from nil along the basin fringe, to as much as 60 to 70 feet in the deepest part of the basin. Discharge from the basin occurs during periods of high groundwater through the narrow stream channel in the northwest part of the basin, and perhaps as underflow through bedrock fractures below the basin, downgradient to the Middle Valley. There are no active, production water wells in the alluvium of the Upper Valley.

The alluvial sediments in the Middle Valley are slightly coarser than the Upper Valley, consisting of fine sandy silts and silty sand in the upper zone, to a silty fine to coarse sand in the more permeable lower aquifer zone below 100 feet. The deepest portion of the valley has approximately 200 feet of alluvium. At the outlet, where the Middle and Lower valleys join, the depth to bedrock is apparently about 45 to 50 feet at the maximum. Discharge from the Middle Valley is through evapotranspiration, pumpage, stream flow into the Lower Valley (both surface and subsurface), and probably through vertical leakage into the underlying fractures of the granitic bedrock. The Middle Valley constitutes the primary alluvial groundwater supply source for the District. Seven wells penetrate and extract groundwater from the alluvium in the valley, pumping an average of approximately 200 acre-feet per year. The wells range in depth from 182 feet deep to 200 feet deep, and range in production capability from 25 gpm to 50 gpm. All of the alluvial wells produce groundwater of good quality, meeting all minimum State and Federal standards.

Sediments in the Lower Valley are typically silty fine to medium sands. The thickness of the alluvial sediments probably averages about 50 to 60 feet, with a maximum thickness of approximately 80 feet. Discharge from the Lower Valley is by stream flow out the outlet stream during periods of high water, and through bedrock underflow. No domestic supply wells are located in the Lower Valley, although one well has been used in the past for lake fill/irrigation purposes.

3.3.3 Cummings Valley Alluvium

The Cummings Valley, located adjacent to and southeast of Bear Valley, is the site of the District's new Cummings Valley well field. The basin was adjudicated as a result of *Tehachapi-Cummings County Water District vs. Armstrong, et al*, ruled by the Superior Court of the State of California for the County of Kern, 1972.

The District purchased land in Cummings Valley, overlying the Cummings Groundwater Basin, thereby exercising the overlying landowner's adjudicated rights to the basin. In association with and approval by Tehachapi-Cummings County Water District, acting as Watermaster of the basin, the District will continue to purchase State Water Project water through its contract with TCCWD. The purchased SWP water will then be used as a source of active instream recharge at the head of Chanac Creek, in exchange for the District's right to pump water from wells located on its Cummings Valley property for use in Bear Valley. As of the time of this writing, the District is nearing completion of the new Cummings Valley water supply project, consisting of the requisite wells, pumps, pipelines, storage tanks, and booster pumps to pump Cummings Valley groundwater across the ridge into Bear Valley.

The District's property and Cummings Valley well field is located on the northern fringe of the Cummings Groundwater Basin. The Cummings Basin occupies a northeast trending elongate valley approximately 6 miles long and 2 ½ miles wide. The valley is fed mainly by Cummings Creek, as well as Chanac Creek that heads out of Brite Valley. The floor of the valley has a downward southwest gradient to Chanac Creek, which drains the valley.

The Cummings Valley, as part of the larger Tehachapi Mountain Range system, is a relatively young geologic feature that has evolved during the Recent time. The rocks that form the bedrock in the area were formed in the Jurassic and Cretaceous time periods, when repeated intrusions of igneous rock culminated in the metamorphosis of older sediments, and emplacement of the granitic rock basement.

During the Tertiary period, the Tehachapi area was the site of a series of uplifts, erosional intervals, and folding and faulting. In the late Pleistocene time, the final stage of mountain building resulted in formation of the Sierra Nevada and the mountains surrounding the Tehachapi system.

Normal faulting of a complex series of northwest trending faults dislocated many of the blocks that now form the Tehachapi system, including the Cummings Valley. Since then, the valleys have slowly filled with stream sediments.

The sediments that comprise the Cummings Valley were deposited in a complex series of alluvial fans by stream flow deposition from the surrounding mountain blocks. The District property lies near the head of the small alluvial fan complex that drains the valley that forms the entrance to Bear Valley Springs, which is one of several tributaries to the larger valley. The Cummings Basin covers approximately 8,500 acres, with a watershed area of approximately 16,000 acres.

The Cummings Basin contains Recent alluvial fill and alluvial fan sediments. Although there are numerous water bearing sedimentary deposits identified in the Tehachapi system, the only ones of consequence in Cummings Valley consist of Recent-age Alluvial Fan Deposits and Recent Stream Deposits/Floodplain Silts. Lithologically, these two formations are very similar in appearance and character, and are therefore often not distinguishable in well logs or drill cuttings, except when the alluvial fan deposits are coarse enough to contain cobbles and other remnants of high energy deposition. In the vicinity of the District property, the sediments generally reflect relatively uniform, low energy deposition of silts and fine-grained sands. On a regional scale, the basin sediments tend to become finer-grained towards the southern end of the valley.

Where saturated, the Recent-age sediments in the valley tend to be reasonably permeable, particularly in the northern part of the valley where the sediments are coarser. On the basis of well log records from TCCWD and the Michael-McCann (1962) report, the deepest part of the basin appears to be located in the vicinity of the District property, where the sediment thickness reaches about 450 feet. By comparison, the saturated sediment thickness in the southern part of the valley is estimated to be about 50 feet.

Underlying the Recent-age unconsolidated sediments throughout the valley, and forming the basin bedrock, are consolidated dioritic and granitic rocks. Although numerous wells penetrate the bedrock and withdraw water from the secondary fracture system that dominates the bedrock aquifer, the yield of the bedrock wells is generally much less than that of the alluvial wells.

The principal recharge to the Cummings Basin is by infiltration of stream flow, rainfall, and return agricultural irrigation water. To a lesser degree, basin recharge also occurs through subsurface flow from unconsolidated sediments that form the basin margins. Mann (1971) estimated that the Cummings Basin receives an annual natural recharge of approximately 3,560 acre-feet.

The Cummings Basin experienced significant groundwater withdrawal in the 1940's and 1950's, and as a result, the water levels began to decline precipitously. As a reaction to the overdraft condition, the Tehachapi-Cummings County Water District was formed, and adjudication proceedings were initiated in the mid-1960's. The steady decline of water levels started rebounding as TCCWD contracted for importation of State Water Project water, and the water levels have apparently stayed relatively stable since then. Presently, the depth to water in the aquifer in the vicinity of the District property is about 175 to 200 feet below ground surface.

4. WATER QUALITY

4.1 GROUNDWATER QUALITY

Overall, groundwater quality produced from the District's wells is excellent. A summary of the well water quality is presented in Table 2. The table shows that the District's groundwater supply is generally of good mineral quality (containing relatively low mineral concentrations). In the past four years, only one well produced water with iron concentrations that exceeded the State Primary Drinking Water Standards (or Maximum Contaminant Levels, MCLs), and one well exceeded the State MCL in manganese. In 1994, three wells that produce water from the granitic bedrock aquifer had uranium concentrations at levels that exceeded the State's standards at the time, and were taken off line.

The District is fortunate to have a water supply of excellent quality, that consistently meets or exceeds minimum State and Federal standards for both Primary and Secondary standards. Water supplies containing contaminants exceeding the Primary MCLs present risks to human health when continually used for drinking or culinary purposes. Water supplies containing substances exceeding the Secondary MCLs may be objectionable to an appreciable number of people, but are not generally hazardous to health.

Over the past several years, average nitrate concentrations as reported to the State Department of Health Services have been slowly increasing, reaching a high in 1998 of 13.8 mg/L (Table 2). Although this value is still significantly below the State Standard MCL of 45.0 mg/L, the steady upwards trend of values will be studied. Significantly, the wells with the highest nitrate concentrations have not increased over the past several years; the reason the average is creeping upwards is that the wells with the lower concentrations of nitrates are showing a slight upward trend.

Analysis of the Cummings Valley wells indicate that the water from those wells is also of very good quality, with Total Dissolved Solids content of about 325 mg/L. With the wells located on the valley floor in an area of heavy historical agricultural use, the presence of nitrates is of concern. When the wells were drilled, the results of the nitrate tests indicated a level of 33.2 mg/L.

4.2 WATER QUALITY REQUIREMENTS/OBJECTIVES

A primary objective of the Plan is to maintain the water quality within the District. This is of extreme importance because the municipal users need a dependable, high quality water supply. A reduction in the quality of the groundwater is equivalent to a loss of water supply, since the quality problems will require additional costs for the construction of treatment facilities. In addition, with the continual raising of drinking water standards, maintaining the quality of the groundwater supply becomes even more important.

One of the action items listed in the Plan is a recommendation to increase monitoring and evaluation of groundwater quality in the District's service area. This monitoring information will be collected and utilized to proactively evaluate the best management practices to minimize any deleterious effects of increased levels of any analytes.

The quality of groundwater within the District must be maintained, and one of the keys to maintaining good quality groundwater in the alluvial basin of Bear Valley is to assure that the surface water impoundments are not degraded. Since natural minerals occur in low concentrations, the major thrust of the water quality monitoring and recommended practices will be to prevent chemical contamination. The Plan provides a mechanism that will help achieve these long-term goals. The initial action of increasing the evaluation of and amount of monitoring will provide the additional data needed to proceed with future programs to maintain water quality.

5. GROUNDWATER CONDITIONS

5.1 GROUNDWATER LEVELS, STORAGE, AND YIELD

The District has monitored and recorded groundwater levels in its production water wells on a regular basis for several years. Compilation of this data, coupled with extensive reviews of the data, has provided the District with an understanding of the groundwater flow patterns of the alluvial aquifers, the trends in water levels in all its wells, and the yields of the aquifers from which it pumps.

Some of the conclusions that can be drawn from even a cursory inspection of the hydrogeologic data are a result of the differences between the alluvial and bedrock aquifers. The water level fluctuations in wells that extract water from the alluvium show that the aquifer is quickly recharged with even a minor amount of winter rainfall. This is common in all shallow alluvial aquifers, and creates a situation where long-term overdrafting of the aquifer is nearly impossible. The downside, of course, is that extended seasonal pumping from numerous wells in the same shallow aquifer results in a rapid decline of water levels, with a concomitant decline in production rates, until a significant source of recharge is available. Thus, the wells tend to lose production capability and/or cannot pump for as long a time towards the end of the summer pumping season.

The alluvial basins of Bear Valley contain appreciable quantities of groundwater in a confined to semi-confined condition. Because of the nature of the semi-confined aquifers, coupled with the comparatively low hydraulic conductivity of the aquifer materials, a relatively small percentage of this water is easily withdrawn by wells. The Middle Valley is the only one of the three alluvial basins that has proven to be an economically viable groundwater basin supply. The Upper and Lower valleys have been the sites of several test holes and wells, but neither basin is being utilized currently as a supply source.

Annual recharge to the Middle Valley has been estimated to be in the range of 500 to 550 acre feet per year. However, well production capability has historically been limited to about 200 AFY. Recent studies by Fugro (1997) looked at the Middle Valley in detail, and concluded that the operational yield of the Middle Valley, assuming current operational strategy, is in the range of 250 to 300 acre feet per year. In other words, there does not appear to be a significant surplus of additional groundwater available for the District to tap.

Although production out of the Middle Valley appears to be limited to the range of 250 to 300 AFY, it is likely that the basin cannot be overdrafted on a long-term basis, because of the ability of the basin to respond rapidly to slight increases in recharge. Given a reasonable rainfall, the District can expect the basin to recharge sufficiently to continue to produce the ±200 to 250 AFY.

It is likely that the District's alluvial production capability could be increased to ±250 to 300 acre feet per year through optimization of well spacing and well operations. Optimization modeling of the District's wells would identify optimal well spacing and production. However, it is questionable whether the costs of a new well project would justify the rather limited additional supply gained from the work. Further cost and benefit studies would be required to fully answer that issue.

The bedrock aquifers have greater storage capabilities than the alluvial basins because of the extensive and widespread fracture sets prevalent throughout the pluton. However, when the fractures are "dewatered," recharge may be slow. The result is that bedrock wells can be pumped at high discharge rates for longer time periods while the aquifer is slowly being dewatered or "mined," which results in a long-term decline in standing water levels and general overdrafting of the bedrock aquifer.

During the drought of the late 1980's and early 1990's, the water level trends of the bedrock wells suggested aquifer mining, resulting in a steady decline of both standing and pumping water levels. However, the return to normal to heavy rainfall years of the mid 1990's has resulted in a reversal of the trend and a general rise in water levels throughout the District's well field. What became apparent during the drought years was that the District did not have an adequate emergency supply. However, with implementation of the new Cummings Valley importation project, the District is now in a position of having a reliable, high-quality, long-term groundwater supply that can withstand drought periods equal to that experienced in the 1980's-90's.

The collection of water level and production data described in earlier sections of the Plan will be continued. The information that can be prepared will include maps of spring and fall water elevations, depths to groundwater, and changes in groundwater levels over time. In addition, the groundwater reports can include estimates of changes in groundwater storage, water delivered, and water use. This will allow an evaluation of the management activities to be made.

The water quality monitoring that is being proposed as one of the action items will be used to augment the information obtained through the historical water level readings. Criteria will be established to develop water quality "red flags," which with the compilation of the quality tests and the groundwater level measurements, the District will improve its ability to effectively manage its groundwater supply.

6. ACTION ITEMS

6.1 GROUNDWATER MANAGEMENT PROGRAM

Several action items have been identified for the Plan. Some of the items have already been implemented or are in the process of implementation; others will be implemented appropriately, as amended from time to time. Above all else, it is the objective of the District and this Plan to provide its customers with a long-term, reliable, high-quality water supply. All action items identified in this Plan are aimed, directly or indirectly, towards this overriding goal.

Not all of the action items identified here will be implemented immediately. Some items will be phased in as needed or as appropriate. The District believes it is important to identify all potential action items in the event any one of them becomes necessary. Many of the action items are in place and part of District policy. Others will be implemented immediately, while investigations into still other items may begin upon approval of the Plan or some time thereafter. Additional, new action items may be defined and will require further definition and implementation because of these investigations. Other items will require additional staff study, Board approval, and public hearings. It is felt that through the management activities listed in the Plan, and through the maintenance of this Plan as a living document, the District can preserve the groundwater resource to which it has been entrusted.

6.2 PERIODIC REVIEW OF HYDROGEOLOGIC DATA

Comprehensive assessments of the Bear Valley and Cummings Valley alluvial aquifers have been conducted. The yields of both basins, the hydrogeologic flow patterns, and production constraints are well known. It is important, however, to periodically review the data collected by the monitoring program to observe the various critical parameters controlling the District's ability to reliably serve its customers. Periodic reviews and reporting of the data will enhance the District's geologic understanding of the basins, and allow the District to more effectively protect its resource while planning for the eventual supplemental water needs identified for 15 to 20 years hence.

The District recognizes that the effectiveness of this task is dependent on the validity and accuracy of the monitoring data. The health of both the alluvial and bedrock aquifers, particularly the bedrock aquifer, can be effectively evaluated only with proper water level monitoring. The monitoring should include readings at the same intervals every week, month, or year, and when the well pump has been off for a sufficient time to allow full recovery.

6.3 WATER QUALITY MONITORING

The District's water supply is of excellent quality that consistently meets or exceeds minimum State and Federal standards for both Primary and Secondary standards. One of the primary objectives of this Plan is to maintain this high standard of water quality.

Over the past several years, average nitrate concentrations as reported to the State Department of Health Services have been slowly rising. Nitrate concentrations have risen approximately 1 mg/L per year over the past seven years, to reach a high in 1998 of 13.8 mg/L (the reported value represents an average of the wells included in the year of reporting). Although this value is still significantly below the State Standard MCL of 45.0 mg/L, the steady upwards trend will be evaluated through detailed inspection of nitrate concentrations of all the District wells, and possibly through increased sampling and monitoring. On preliminary inspection, it appears that the wells with the highest nitrate concentrations have not increased over the past several years. Rather, the reason the average is creeping upwards is that the wells with the lower concentrations of nitrates are showing a slight upward trend. These trends will be investigated and, depending on the results of the investigation, aquifer protection measures may be implemented to further protect the resource.

One of the growing concerns nationwide with groundwater production and the use of groundwater as a drinking water supply is the problem and threat of pathogens. To date, the Tehachapi area and California in general has been free of serious outbreaks of *Giardia*, *Cryptosporidium*, bacteria, and viruses being found in water from wells. However, the threat is real and very serious, and regulatory action to combat it will likely lead to disinfection requirements for groundwater. Current estimates from the EPA are that the Groundwater Disinfection Rule (GWDR) developed sometime in 1999, most likely to become effective sometime in 2002. Promulgation of this new rule will have a profound effect on many purveyors, with an unknown financial impact. The District intends to stay abreast of the status of the GWDR, and will proactively pursue proper disinfection methodologies as appropriate.

6.4 CONJUNCTIVE USE PROGRAM

The District has developed and implemented both active and passive conjunctive use programs, which is the integration of surface and groundwater supplies to meet current and future demand. In Bear Valley, the District stores Sycamore Creek water in Cub Lake and 4-Island Lake for golf course irrigation. During years of low stream flow, groundwater has been pumped into the lakes to supplement the surface water supply. In Cummings Valley, the District is nearing completion of the Cummings Valley importation project, which has as one of its components an active stream recharge project.

To continue this proactive approach, an objective review of both past and future programs will be conducted, including a review of the effectiveness of past surface water recharge efforts, the potential for increasing the Bear Valley conjunctive use program to store more storm runoff water, and, as appropriate, the potential for future augmentation of the Cummings Valley project. The siting and construction of new or additional recharge facilities, particularly in Bear Valley, will be assessed and developed in the most economical, effective manner possible.

6.5 WATER CONSERVATION PROGRAM

The District has always strongly supported programs that stress water conservation, and will continue to educate local water users and encourage water conservation efforts throughout the District. In conjunction with its mandate to provide a reliable water supply to its customers, one of the District's main goals is water conservation. The District endeavors to insure that:

- Water is reused to the maximum extent possible
- Water is priced in such a way as to encourage conservation through tiered monthly water rates
- Programs are in place to encourage water customers to voluntarily participate in personal conservation programs
- Programs are in place to educate water customers in conservation measures

The District is a signatory to the California Urban Water Conservation Council (CUWCC) Memorandum of Understanding (MOU) and is obligated to and committed to comply with the Best Management Practices (BMP) contained in the MOU, listed below.

BMP Measure	Action Date
Water surveys for residential customers	7/1/98
Residential plumbing retrofit	7/1/98
System water audit	Current
Metering with commodity rates	Current
Large landscape conservation	7/1/99
High-efficiency washing machine rebate	7/1/99
Public information	Current
School education	7/1/98
CII conservation	7/1/99
Conservation pricing	Current
Conservation coordinator	7/1/98
Water waste prohibition	Current
Residential ULFT rebate	7/1/98

The District has taken a proactive approach towards water conservation and towards implementation of the MOU's BMPs. Full implementation of the District's water conservation programs and policies will continue to be of critical importance to the Board.

6.6 DROUGHT MANAGEMENT AND DROUGHT CONTINGENCY PLANS

The District Board of Directors enacted District Ordinance 95-106 on January 14, 1995 (Appendix B). The Ordinance sets forth emergency conservation measures to be implemented in case of either a prolonged water shortage (drought) or a catastrophic event resulting in the temporary inability to deliver water.

The Ordinance defines three drought conditions: moderate, severe, and critical. The criteria for setting each condition is spelled out as well as the measures to be taken by both the District and the District's water customers. Specific actions that the District can take to enforce compliance, as well as the legal actions the District can take for non-compliance are all defined.

6.7 WELL FIELD MAINTENANCE

The District recently completed an extensive evaluation of the physical health of its entire well field. Several steps were taken to maximize production from some wells, rehabilitation efforts on certain wells were conducted, some inefficient or ineffective wells were taken off-line, and a new program to replace certain wells has been initiated. This proactive approach to maintaining the well field will protect the District from unscheduled and expensive repairs or outages. As part of the monitoring efforts and periodic reviews, data will be evaluated and the health of the wells will continue to be evaluated.

6.8 GROUNDWATER MONITORING

The District currently has in place a comprehensive monitoring program that regularly measures water levels in all District wells. The District shall continue to monitor water levels and sampling for water quality testing on a routine basis. To increase the effectiveness of the monitoring program and improve the water level data base, it is the District's intent to standardize the monitoring interval between measurements, and insure that all water level measurements are taken during times of full recovery or maximum drawdown. As described in earlier action items, the District will periodically review the data gathered in the monitoring phase, and prepare reports quantifying water demands and evaluating surface and groundwater supplies. These summaries will assist the District in evaluating the effectiveness of the various elements of the program.

The need for expansion of the existing monitoring plan and monitoring network will be evaluated. If appropriate, new monitoring wells can be obtained and/or drilled to monitor for groundwater gradient effects and potential well field contamination issues.

6.9 WELL HEAD AND AQUIFER PROTECTION

The federal Well Head Protection Program (WHPP) was established by Section 1428 of the Safe Drinking Water Act (SDWA) of 1986, which required states to develop a plan to protect the public drinking water supply. The 1996 amendment to the SDWA furthered the concept by enacting the Source Water Assessment Program (SWAP), again requiring each state to implement a SWAP or WHPP. These programs are designed to protect groundwater sources of public drinking water supplies from contamination, thereby eliminating the need for costly treatment to meet drinking water standards. The key elements of a WHPP include a source area delineation, contaminant inventory, and vulnerability assessment.

A Well Head Protection Area (WHPA) is defined as "The surface and subsurface area surrounding a water well or well field supplying a public water system, through which contaminants are reasonably likely to move toward and reach such water well or well field." The WHPA may also be the recharge area that provides the water to a well or well field. Thus, well head protection is a preventative measure to protect groundwater supplies. The elements of a WHPP are sufficiently similar to a SWAP such that BVCSD's efforts to protect its groundwater supplies through a WHPP-type program would be adequate to satisfy the SWAP requirements.

The District is in a unique situation in that it completely overlies the groundwater basin from which its water is produced. It is the only entity, public or private, that can drill and produce water from a water well in the community, and the land use decisions have already been established to form a *de facto* protection zone around the production wells. Furthermore, the entire watershed recharge zone for all the District's wells (excepting the Cummings Valley wells) lies within the District service area and is therefore protected.

To date, the State of California has not formally adopted a required WHPP program, and is not expected to enforce the guidelines for several years. So far, the State Department of Health Services (DHS) is taking the lead role in advising local agencies and purveyors on the published guidelines. As the DHS, Cal-EPA, SWRCB promulgate specific requirements, the District will respond promptly and responsibly. The District's jurisdictional position in Bear Valley will allow for effective implementation of any necessary future programs.

6.10 WELL CONSTRUCTION AND ABANDONMENT PLAN

All wells should be properly destroyed or decommissioned if they are not to be used in the future. Wells that are not properly decommissioned can pollute groundwater to the point where it is unusable or requires expensive treatment. Groundwater contamination is not the only threat to public health due to abandoned wells, but these wells could conceivably also pose a serious physical hazard to humans and animals.

The District has always constructed its wells in a manner to meet or exceed minimum standards established by the State of California and Kern County. Wells that are no longer in service that are also not necessary to the District's monitoring efforts will be destroyed according to minimum standards for the destruction of wells as specified in Department of Water Resources Bulletins 74-81 and 74-90.

Within Bear Valley, the District has control over the location, construction standards, and destruction procedures of all wells constructed within the District's service area.

As one of many landowners in Cummings Valley, the District does not have the broad jurisdictional control it enjoys in Bear Valley. Therefore, BVCSD will work with the Tehachapi-Cummings County Water District Watermaster and other Cummings Valley landowners to insure that the highest water well construction and abandonment standards are maintained.

7. REFERENCES

BCI Geonetics, 1988a. Bear Valley Phase I, Progress Report: unpublished consultant report prepared for Bear Valley community Services District.

BCI Geonetics, 1988b. Ground Water Exploration Program, Final Report, Bear Valley Community Services District: unpublished consultant report prepared for Bear Valley community Services District.

BCI Geonetics, 1990. Report on Groundwater Resource Development in the Upper Valley for the Bear Valley Community Services District, Bear Valley, California: unpublished consultant report prepared for Bear Valley community Services District.

Brown, Glenn A., and Associates, 1969. An Investigation of Water Sources in Bear Valley, Calif. and their Development Potential: unpublished consultant report prepared for David A. Dering & Associates Engineers, Monterey Park, California.

BSK & Associates, 1981. Geophysical Investigation of Bear Valley for Water Resource Development.

Burbank, D.W., and Whistler, D.P., 1987, Temporally constrained tectonic rotations derived from magnetostratigraphic data: Implications for the initiation of the Garlock fault, California: Geology, v. 15, p. 1172-1175.

Dering, David A., & Associates, 1970. Geologic Map, Bear Valley Ranch. 1:24,000

Dibblee, T.W., Jr., and Warne, A.H., 1970, Geologic map of the Cummings Mountain Quadrangle, Kern County, California: U.S. Geol. Survey Map I-611, scale 1/62,500 (with text).

Fugro West, Inc., 1996. Water Supply Management Planning, Phase I Results, Bear Valley Community Services District, Tehachapi, California, unpublished consultant report prepared for Bear Valley Community Services District.

Fugro West, Inc., 1997. Hydrogeologic Evaluation of the Bear Valley Springs Alluvial Ground Water Basins, unpublished consultant report prepared for Bear Valley Community Services District.

Krieger & Stewart, 1981. Bear Valley Community Services District, Study of Water Requirements, Sources of Water Supply, and Wells and Pumping Plant Utilization, unpublished consultant report to BVCSD, October 1981.

Krieger & Stewart, 1987. Portion of General Plan Update Report, Chpt. 2 -- Future Water Demands, Chpt. 3 -- Water Supply, Chpt. 4 -- Distribution System Analysis, reports and updates to BVCSD.

Krieger & Stewart, 1994. Bear Valley Community Services District, Imported Water Supply, unpublished consultant report to BVCSD, August, 1994.

Mann, J.F., Jr., 1971, Safe Yield -- Cummings Basin: unpublished consultant report.

Michael-McCann-Associates, 1962, Geology Ground-Water Survey, Tehachapi Soil Conservation District: unpublished consultant report submitted to the Tehachapi Soil Conservation District.

Sames, D., Saleeby, J., Ross, D., and Kistler, R., 1983, Cretaceous igneous and metamorphic deformational events of the southern Sierra Nevada, California: Geol. Soc. Am. Abs. W. Prog., v. 15, p. 294-295.

Stein, R. And Thatcher, W., 1981, Seismic and a seismic deformation associated with the 1952 Kern County, California, earthquake and relationship to the Quaternary history of the White Wolf fault: Jour. Geophy. Res., v. 86, #B6, p. 4913-4928.

Tables

BASED ON NUMBERS OF REGISTERED VOTERS

Year	Number of Registered Voters	Average Annual Growth (%/yr)	Delivered Water Residential AF/yr	Delivered Water Commercial AF/yr	Delivered Water Irrigation/Lake Fill AF/yr	Unaccounted for Water AF/yr	Total Water Delivery Requirement AF/yr
1996	2,430	4.0%	656	50	150	103	960
2000	2,770	3.5%	748	57	150	115	1070
2005	3,120	2.5%	842	64	150	127	1190
2010	3,510	2.5%	948	72	150	140	1320
2015	3,860	2.0%	1042	79	150	153	1430
2020	4,050	1.0%	1094	83	150	159	1490
2025	4,260	1.0%	1150	88	150	167	1560
2030	4,470	1.0%	1207	92	150	174	1630

BASED ON POPULATION

Year	Number of Residents	Average Annual Growth (%/yr)	Delivered Water Residential AF/yr	Delivered Water Commercial AF/yr	Delivered Water Irrigation/Lake Fill AF/yr	Unaccounted for Water AF/yr	Total Water Delivery Requirement AF/yr
1996	5,540	4.5%	665	50	150	104	970
2000	6,420	4.0%	770	58	150	117	1100
2005	7,550	3.5%	906	68	150	135	1260
2010	8,310	2.0%	997	75	150	147	1370
2015	8,930	1.5%	1072	81	150	156	1460
2020	9,380	1.0%	1126	85	150	163	1530
2025	9,840	1.0%	1181	89	150	170	1590
2030	10,340	1.0%	1241	93	150	178	1670

BASED ON ACTIVE RESIDENTIAL METERS

Year	Number of Residential Services	Average Annual Growth (%/yr)	Delivered Water Residential AF/yr	Delivered Water Commercial AF/yr	Delivered Water Irrigation/Lake Fill AF/yr	Unaccounted for Water AF/yr	Total Water Delivery Requirement AF/yr
1996	1,990	3.2%	637	50	150	100	940
2000	2,240	3.2%	717	56	150	111	1040
2005	2,530	2.6%	810	64	150	123	1150
2010	2,800	2.1%	896	70	150	134	1260
2015	3,070	1.9%	982	77	150	145	1360
2020	3,300	1.5%	1056	83	150	155	1450
2025	3,530	1.4%	1130	89	150	164	1540
2030	3,750	1.3%	1200	94	150	173	1620

PROJECTED WATER DELIVERY REQUIREMENTS

BEAR VALLEY COMMUNITY SERVICES DISTRICT
GROUNDWATER MANAGEMENT PLAN

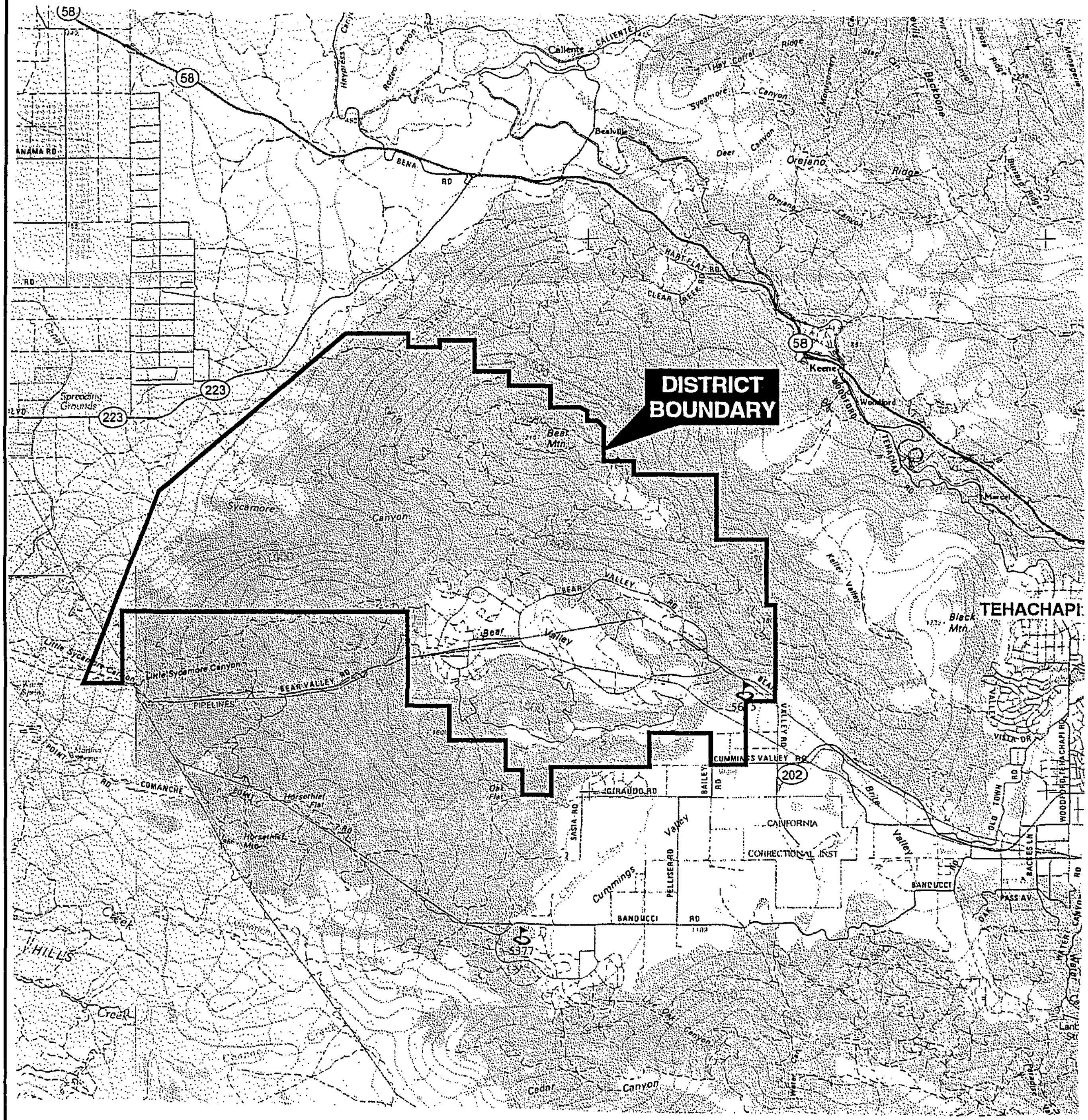
Table 1

FUGRO

CHEMICAL GROUP	CONSTITUENT	UNIT	FEDERAL MCL	STATE MCL	AVERAGE for all WELLS	RANGE for all WELLS
MINERALS (CATIONS)	Total Hardness (as CaCO3)	mg/L	NS	NS	157.7	14.0-200.0
	Calcium	mg/L	NS	NS	42.3	4.2-58.0
	Magnesium	mg/L	NS	NS	12.2	.7-17.0
	Sodium	mg/L	NS	NS	34.4	25.0-60.0
MINERALS (ANIONS)	Total Alkalinity (as CaCO3)	mg/L	NS	NS	162.7	89.0-220.0
	Hydroxide	mg/L	NS	NS	<0.8	<0.8
	Carbonate (CO3)	mg/L	NS	NS	3.0	<2.6-21.0
	Bicarbonate (HCO3)	mg/L	NS	NS	194.1	66.0-270.0
	Sulfate	mg/L	NS	600.0	22.1	13.0-25.0
	Chloride	mg/L	NS	600.0	22.0	11.0-34.0
	Nitrate (NO3)	mg/L	45.0	45.0	13.8	1.5-34.0
	Fluoride (Temp. depend.)	mg/L	4.0	1.4	0.2	.06-.34
PHYSICAL	pH (Lab)	Std units	NS	NS	8.0	7.73-9.19
	Specific Conductance	umho/cm	NS	900.0	455.6	301-555
	Total Filterable Residue	mg/L	NS	1500.0	269.0	182.0-326.0
	Apparent Color (Unfiltered)	UNITS	NS	15.0	4.3	2.0-18.0
	Odor Threshold@ 60 C	TON	NS	3.0	NONE	NONE
	Lab Turbidity	NTU	NS	3.0	1.0	.1-5.3
	MBAS	mg/L	NS	0.5	<0.5	<0.5
INORGANICS	Aluminum	ug/L	NS	1000.0	<50.0	<50.0
	Antimony	ug/L	NS	6.0	<1.0	<1.0
	Arsenic	ug/L	50.0	50.0	3.6	<2.0-9.3
	Barium	ug/L	2000.0	1000.0	<100.0	<100.0
	Beryllium	ug/L	NS	4.0	<1.0	<1.0
	Cadmium	ug/L	NS	10.0	<1.0	<1.0
	Chromium (Total)	ug/L	100.0	50.0	<10.0	<10.0
	Copper	ug/L	1300.0	1000.0	15.3	<10.0-46.0
	Iron	ug/L	NS	300.0	71.2	<50.01-119.0
	Lead	ug/L	50.0	50.0	<5.0	<5.0
	Manganese	ug/L	NS	50.0	24.7	<10.0-56.0
	Mercury	ug/L	2.0	2.0	<0.2	<0.2
	Nickel	ug/L	NS	100	<5.0	<5.0
	Selenium	ug/L	50.0	10.0	4.0	<2.0-12.0
	Silver	ug/L	50.0	50.0	<10.0	<10.0
	Thallium	ug/L	NS	2.0	<1.0	<1.0
	Zinc	ug/L	NS	5000.0	59.1	<50.0-72.0
	Nitrate as N (Nitrogen)	ug/L	NS	1000.0	77.1	<20.0-410.0
BIOLOGICAL	Coliform Bacteria		No. of tests	Pos.	% pos.	Period
	Presence/Absence		104	Tests	1	Jan-Dec
	No. Of Violations		0	1		

mg/L = Milligrams per liter=parts per million. Ug/L = Micrograms per liter = Parts per billion.
NS = No Standard. < = Less than.
Bear Valley CSD currently has 25 potable water wells. Each well is tested every three years for various constituents.
In 1997 wells #6,8,9,11,24,25, and 33 were tested.
These 7 wells were also tested for over 80 organic chemicals. All analysis results were less than the detection limit.

Figures



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DISTRICT BOUNDARY MAP

BEAR VALLEY COMMUNITY SERVICES DISTRICT
GROUNDWATER MANAGEMENT PLAN

Figure 1

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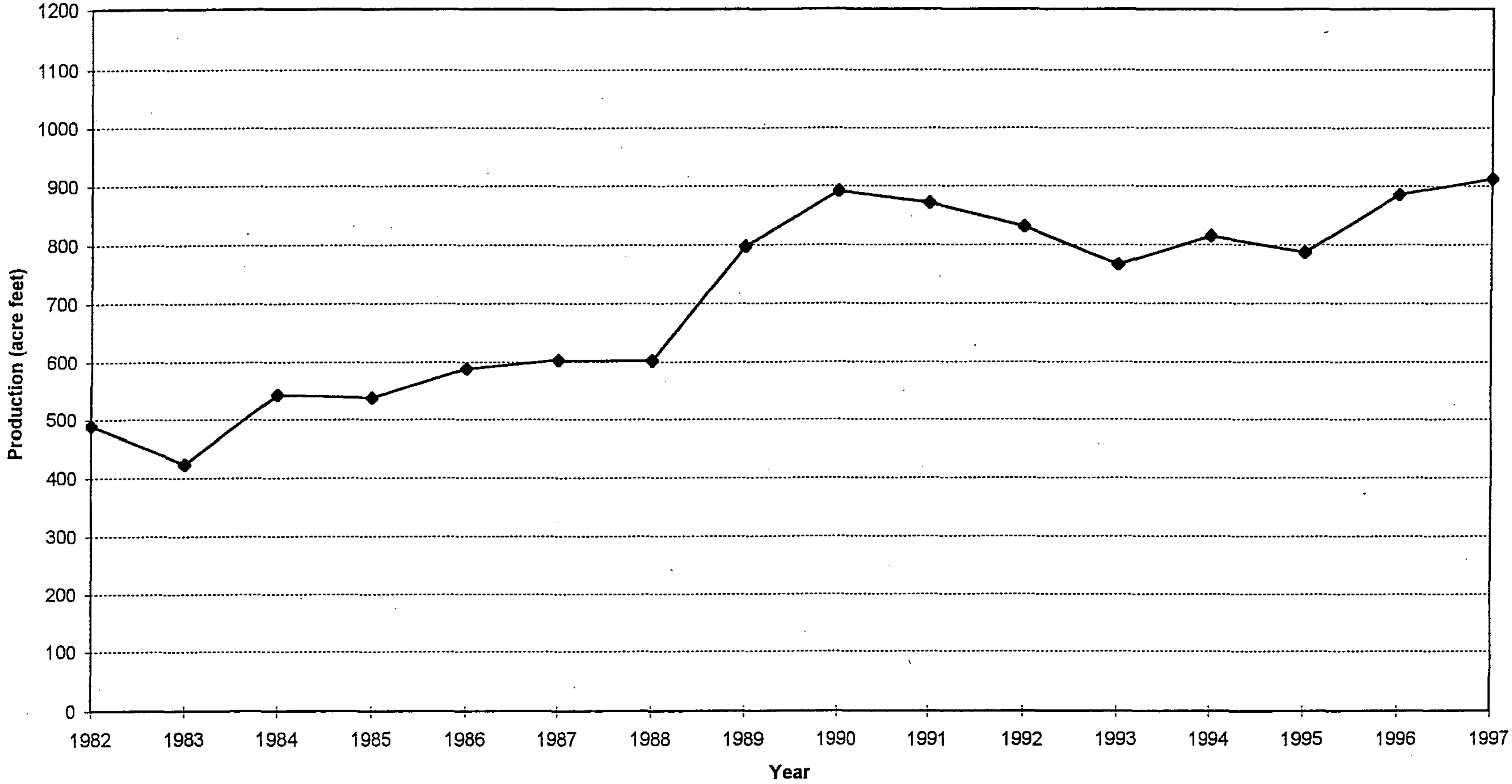
FUGRO

GMP XLS, Gw Prod by Month



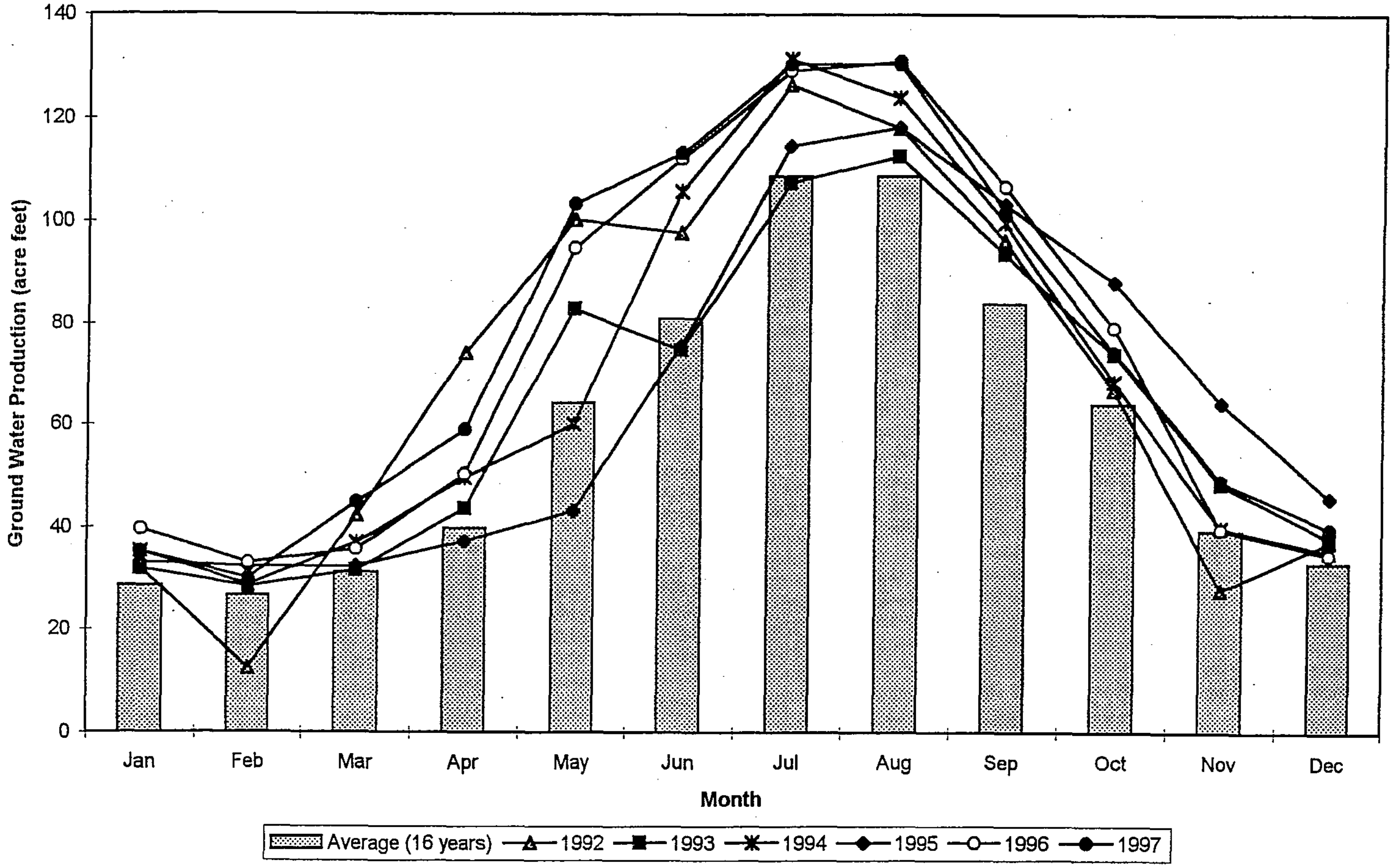
ANNUAL GROUNDWATER PRODUCTION

BEAR VALLEY COMMUNITY SERVICES DISTRICT
GROUNDWATER MANAGEMENT PLAN

Figure 2

FUGRO

GMP XLS, Gw Prod by Month

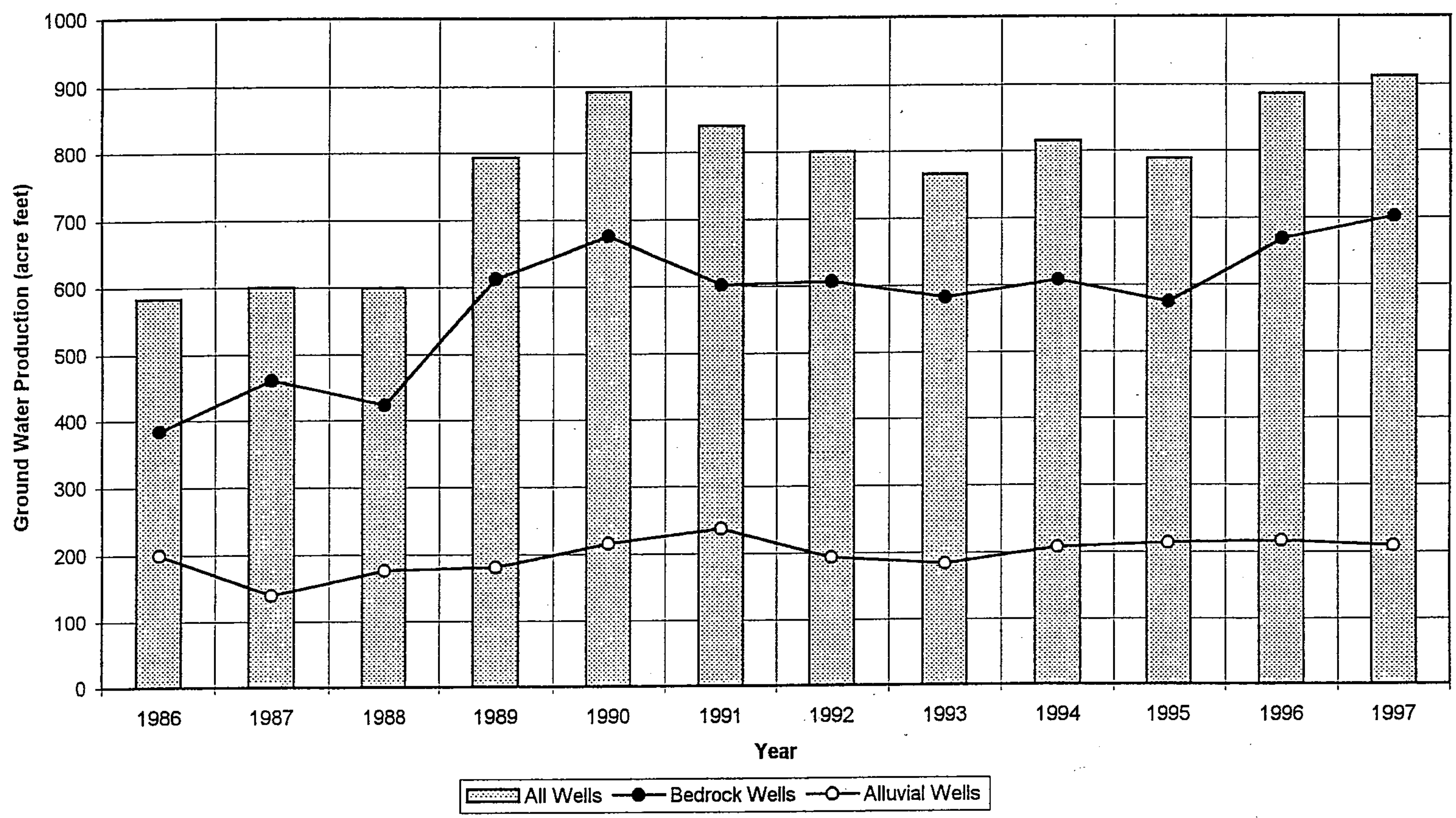


MONTHLY GROUNDWATER PRODUCTION

BEAR VALLEY COMMUNITY SERVICES DISTRICT
GROUNDWATER MANAGEMENT PLAN

Figure 3

FUGRO

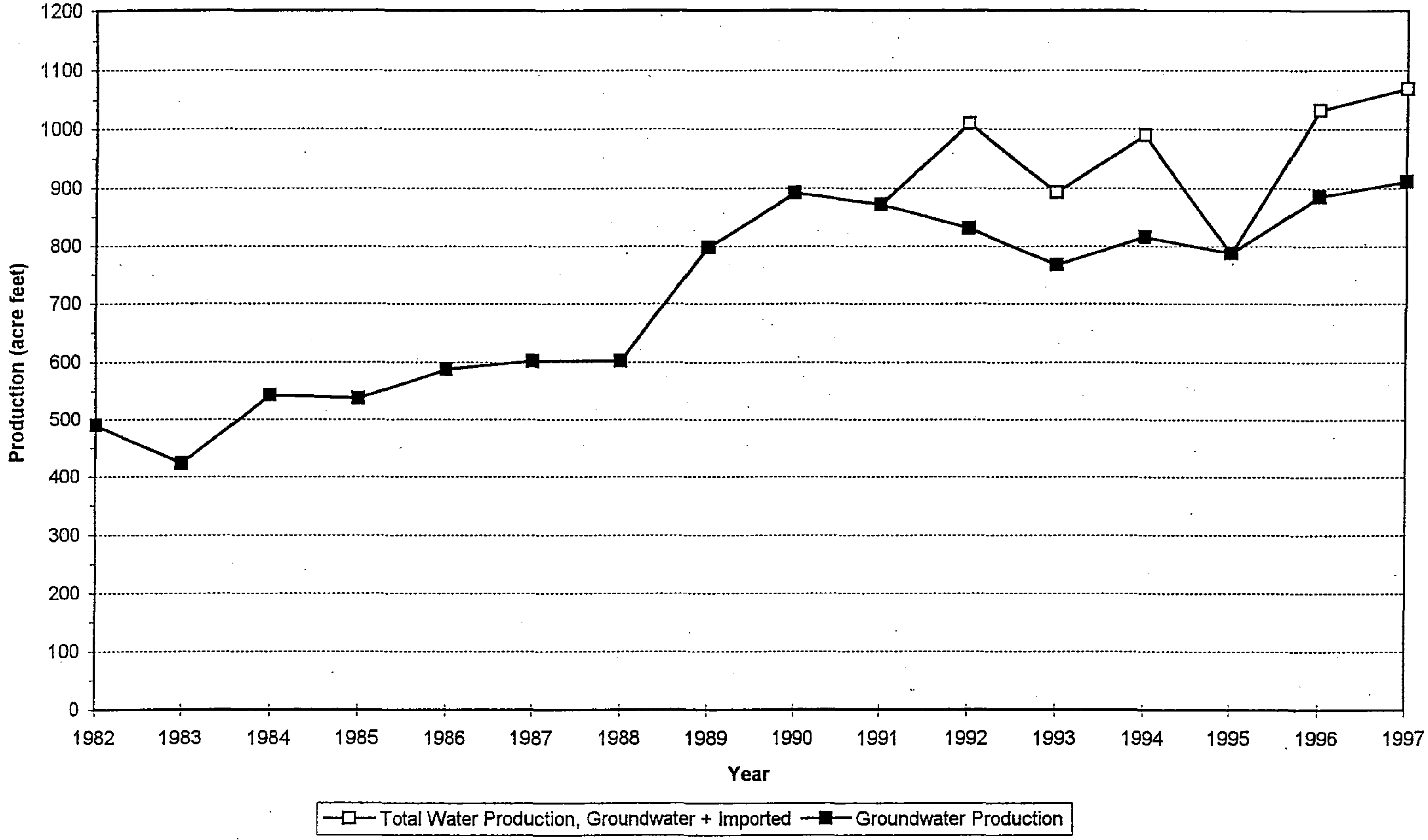


GROUNDWATER PRODUCTION SUMMARY

BEAR VALLEY COMMUNITY SERVICES DISTRICT
GROUNDWATER MANAGEMENT PLAN

Figure 4

FUGRO



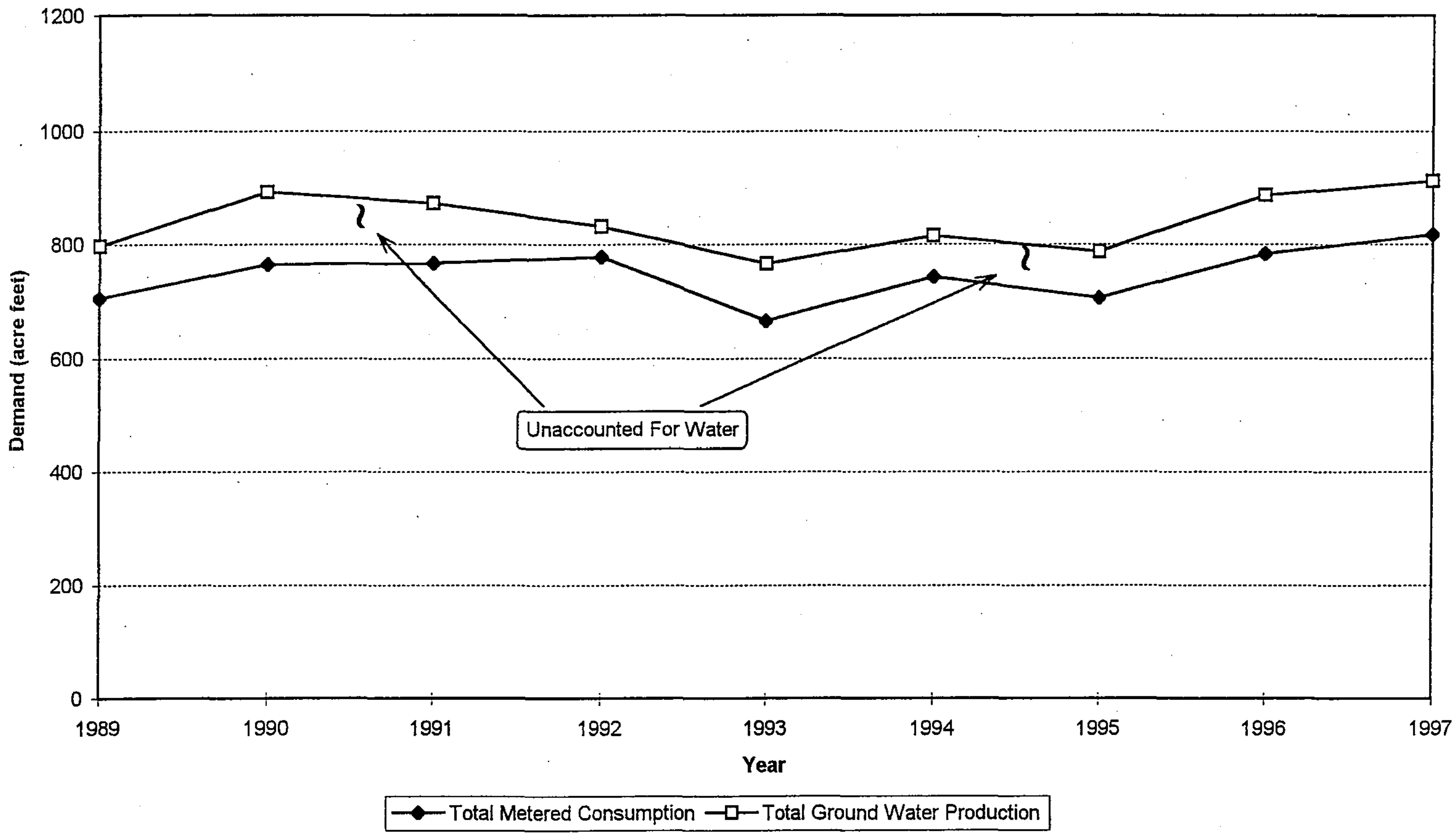
ANNUAL TOTAL WATER SYSTEM PRODUCTION

BEAR VALLEY COMMUNITY SERVICES DISTRICT
GROUNDWATER MANAGEMENT PLAN

Figure 5

FUGRO

GMP XLS, Unaccounted



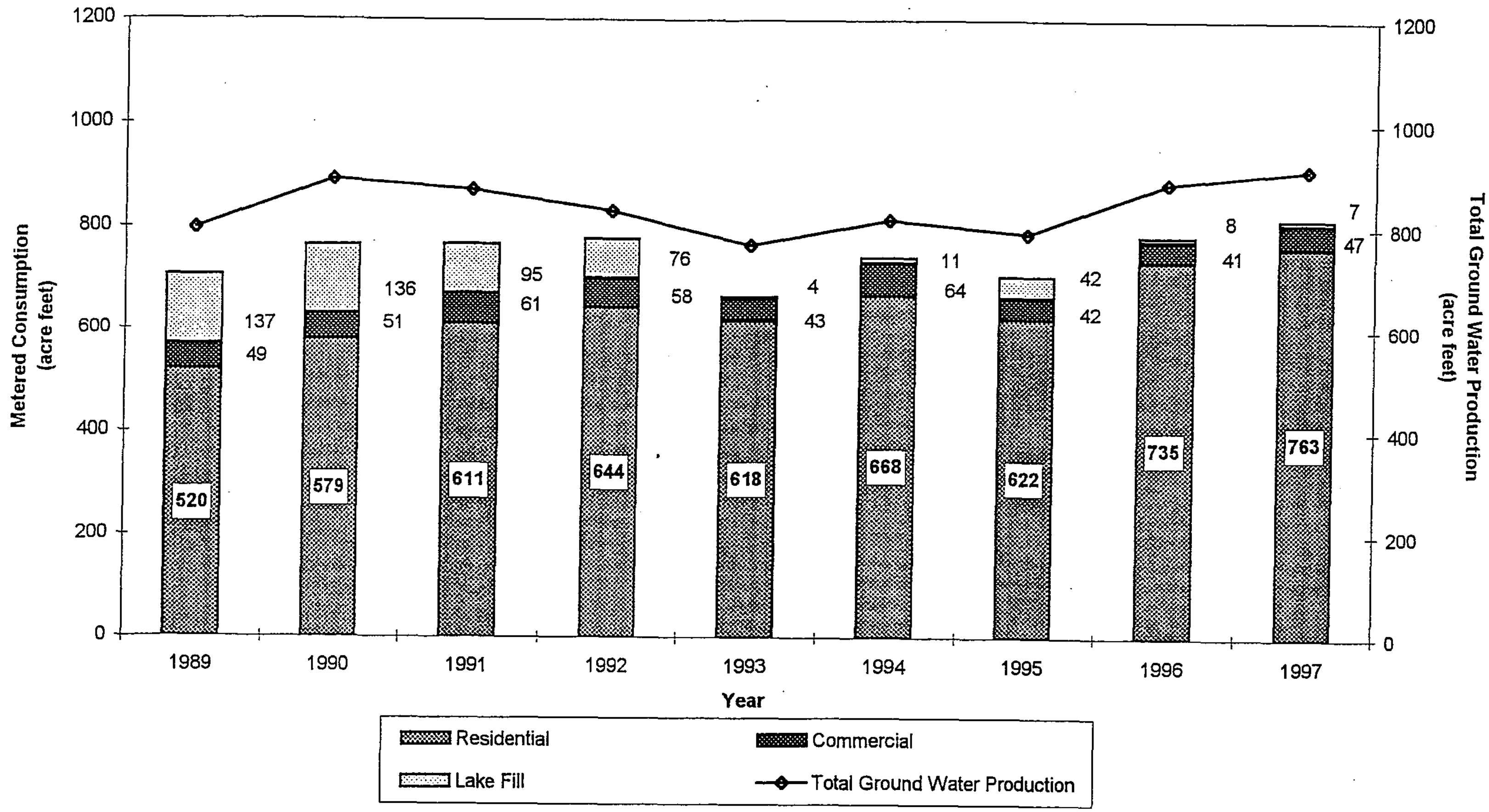
TOTAL WATER CONSUMPTION

BEAR VALLEY COMMUNITY SERVICES DISTRICT
GROUNDWATER MANAGEMENT PLAN

Figure 6

FUGRO

GMP XLS, Unaccounted

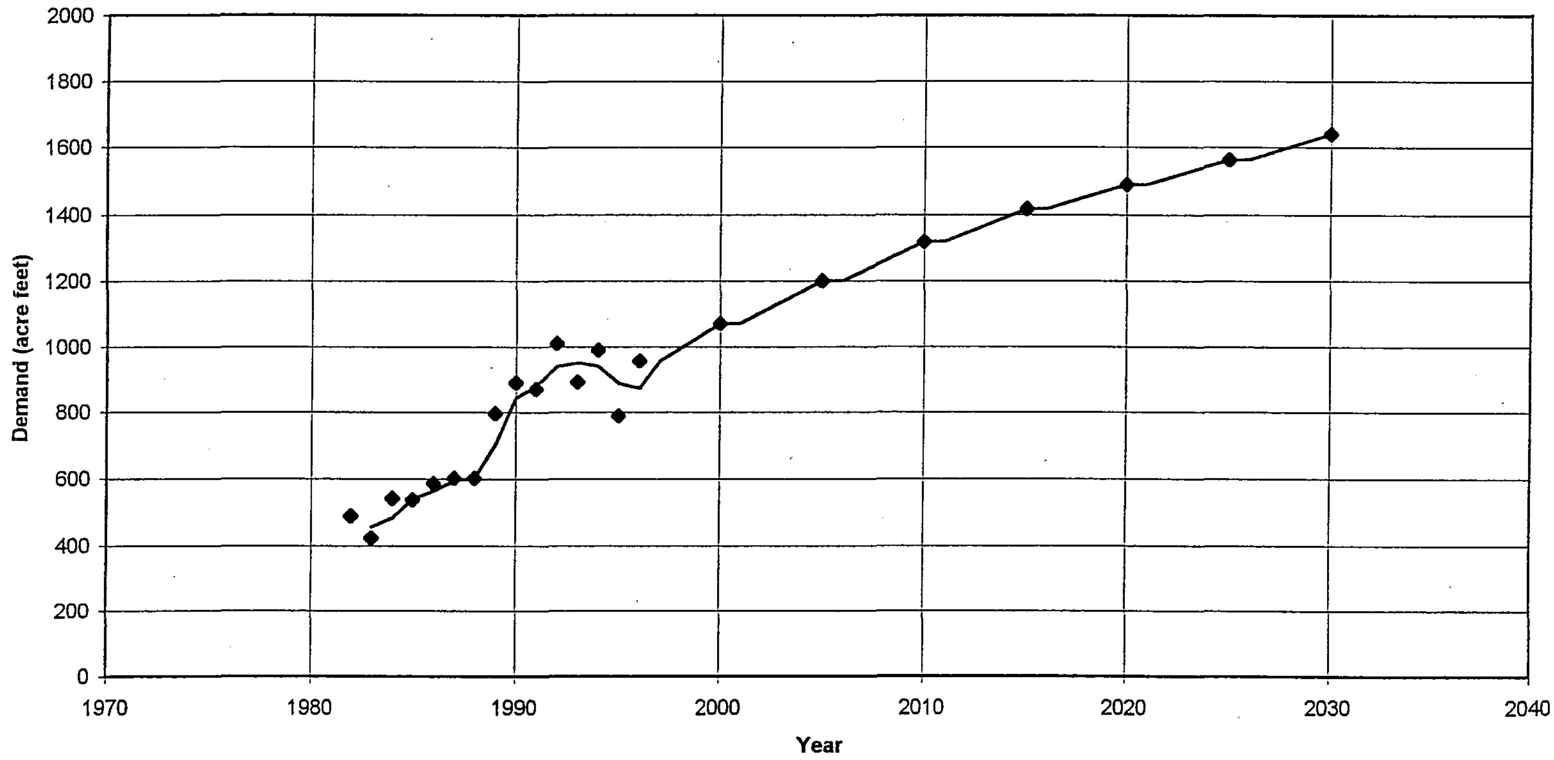


METERED CONSUMPTION vs TOTAL GROUNDWATER PRODUCTION

BEAR VALLEY COMMUNITY SERVICES DISTRICT
GROUNDWATER MANAGEMENT PLAN

Figure 7

FUGRO

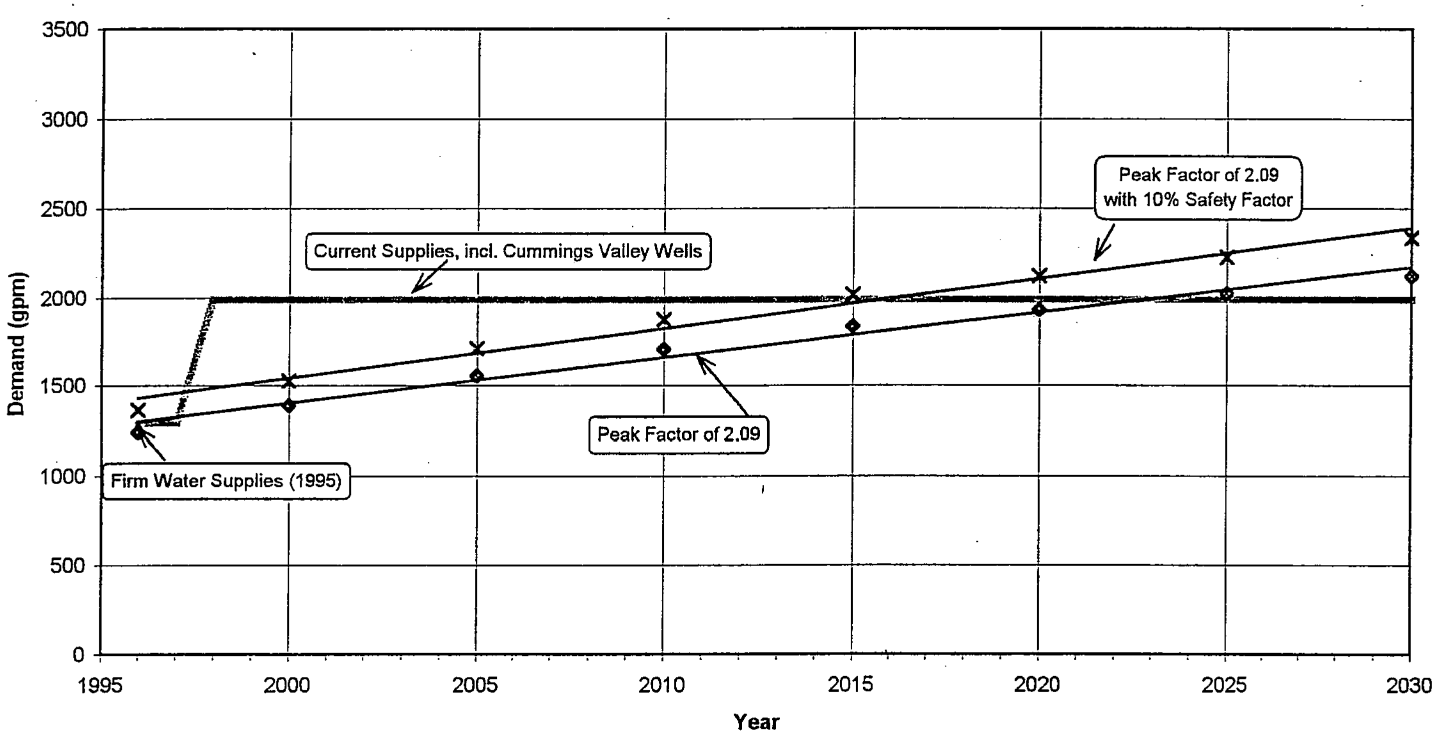


PROJECTED TOTAL WATER DELIVERY DEMAND

BEAR VALLEY COMMUNITY SERVICES DISTRICT
GROUNDWATER MANAGEMENT PLAN

Figure 8

FUGRO



PROJECTED FUTURE PEAK DEMANDS

BEAR VALLEY COMMUNITY SERVICES DISTRICT
GROUNDWATER MANAGEMENT PLAN

Figure 9

FUGRO

Appendix A

RESOLUTION NO. 98-923

RESOLUTION OF THE BOARD OF DIRECTORS OF THE BEAR VALLEY COMMUNITY SERVICES DISTRICT OF INTENTION TO DRAFT A GROUNDWATER MANAGEMENT PLAN

WHEREAS, in 1992 the California Legislature adopt AB 3030, effective January 1, 1993, and embodied in the California Water Code, Sections 10750, et seq., which permits local agencies to work cooperatively to manage groundwater resources within their jurisdictions; and

WHEREAS, Sections 10753 of the Water Code authorizes any local agency, whose service area includes a groundwater basin, or a portion of a groundwater basin, not subject to groundwater management pursuant to other provisions of law or court order, to adopt and implement a groundwater management plan; and

WHEREAS, pursuant to the requirements of the Groundwater Management Act a noticed hearing was held to allow for public participation and comment on the District's intention to draft a groundwater management plan;

WHEREAS, the Board of Directors has determined that it is in the best interest of the District and its customers to draft a groundwater management plan;

NOW, THEREFORE, BE IT RESOLVED as follows:

1. That the District's staff draft a groundwater management program, including plans and regulations to implement and enforce said plan, all as authorized by the Groundwater Management Act (California Water Code, Sections 10750, et seq.).

2. After the proposed groundwater program is drafted, the District's staff is directed to present said plan to the Board of Directors and the public at a second noticed hearing for the purpose of consideration of the adoption of said plan.

* * * * * * * * * *

I HEREBY CERTIFY that the foregoing Resolution was passed and adopted by the Board of Directors of the Bear Valley Community Services District at a regular meeting thereof held on the 14th day of March, 1998 by the following vote:

AYES: MCCLOSKEY, SAMUELS, MILLER

NOES: NONE

ABSENT: AUNGST, PRINCE

ABSTAIN: NONE

WILLLIAM R. MILLER, President
Board of Directors of the Bear
Valley Community Services District

ATTEST:

Roblee Thiesse, Secretary

Appendix B

ORDINANCE NO. 95-106

AN ORDINANCE OF THE BEAR VALLEY COMMUNITY SERVICES DISTRICT BOARD OF DIRECTORS REGARDING THE IMPLEMENTATION OF EMERGENCY WATER CONSERVATION MEASURES IN THE EVENT OF A WATER SUPPLY SHORTAGE

BE IT ORDAINED by the Board of Directors of the Bear Valley Community Services District as follows:

Section 1. Declaration of Policy.

California Water Code Sections 375 et seq. permit a Community Services District that supplies water for the benefit of persons within its service area to adopt and enforce a water conservation program to reduce the quantity of water used in order to conserve the District's water supplies. The Board of Directors ("Board") of the Bear Valley Community Services District ("District") hereby establishes a comprehensive water conservation program pursuant to California Water Code Sections 375 et seq., based on the need to conserve water supplies and to avoid or minimize the effects of any future shortage.

Section 2. Findings

(a) The Board finds that water shortages have occurred in the past and could occur in the future due to increased demand or limited supplies of potable water caused by drought or curtailment of supply.

(b) The Board also finds that for many years Southern California has been experiencing a gradual reduction in per capita water supply resulting from population growth and lack of supply replacement and that the demographic changes in population of the District have caused an increase in demand that cannot be met in time of supply shortages.

Section 3. Scope of the Conservation Program

The provisions of this ordinance respond to long-term and short-term water shortages by authorizing the Board to select the most appropriate level of conservation measures based on then current conditions. The Board shall conduct duly noticed public meetings to inform the District's water customers of any change in the level of water conservation needed to meet the limited supply of water resources and the measures needed to meet those limitations.

Section 4. Water Use In Landscaping

(a) The California Legislature has found and declared that:

(1) Landscapes are essential to the quality of life in California by providing areas for active and passive recreation and as an enhancement to the environment by cleaning air and water, preventing erosion, offering fire protection, and replacing ecosystems lost to development; and

(2) Landscape design, installation, and maintenance can and should be water efficient.

(b) The District finds and declares that:

(1) The current rate of home construction on unoccupied lots will in the future substantially increase the present demands for potable water.

(2) The amount of potable water used for landscaping during the months of summer is about three times the amount used for domestic household purposes, resulting in potential water shortages.

(c) It is the intent of the District, realizing that water shortages can develop at any time, to promote the most efficient use of water in landscaping throughout the year while respecting the economic, environmental, aesthetic, and lifestyle choices of property owners.

(d) In order to avoid unnecessary expenses that could be incurred by property owners during periods of water shortages, the District shall provide information to all property owners and renters regarding the design, installation, and maintenance of water efficient landscapes and the use of drought resistant plants and efficient irrigation systems.

Section 5. Authorization

Based on meter information provided by the District's Water Supervisor of the water supplies available, the General Manager is authorized and directed to implement the provisions of this ordinance. Additionally, the General Manager is authorized to make minor and limited exceptions to prevent undue hardship or unreasonable restrictions, provided that water shall not be wasted or used unreasonably and the purpose of this ordinance can be accomplished. Any exceptions shall be reported to the Board at its next meeting.

Section 6. Duration of Conservation Levels

As soon as a water shortage condition is determined to exist, the water conservation measures provided for by this ordinance for that condition shall apply to all District water service until a different condition is declared.

Section 7. Use of Non-potable Water

Nothing in this ordinance shall prohibit or limit the use of non-potable water on the golf course or for other irrigation purposes, provided the State Department of Health Services has determined that the use would not be detrimental to public health.

Section 8. Definition of Severity of Water Shortage Conditions

(a) Stage One Condition: Moderate water shortage. This condition exists when the District determines that it may not be able to meet 90 percent or more of the projected water demands of its customers, either now or within six months, and that water use should be reduced by not less than 10 percent. During a Stage One Condition customers are asked to use water wisely and to practice water conservation measures so that water is not wasted. All water withdrawn from District facilities shall be put to reasonable beneficial use. Water conservation measures include, but are not limited to:

(1) Preventing excessive water from flowing off the property served onto adjacent properties or sidewalks, gutters, surface drains, storm drains, or overland.

(2) Use of drip irrigation systems or other methods designed to prevent excessive surface irrigation of landscaped areas, resulting in conditions such as puddling or run-off.

(3) Immediate repair of all observable leaks of water on the customer's premises.

(4) Use of a broom or a blower instead of a hose to clean driveways and paved surfaces. Use of water in washing down of driveways and other paved surfaces only when necessary to alleviate immediate fire or sanitation hazards.

(5) Being careful not to leave a hose running while washing a vehicle.

(6) Use of low flow shower heads and shortening the time spent in the shower.

(7) Use of volume reduction devices in toilets and being careful not to use the toilet as an ashtray or wastebasket.

(8) Reduction in water consumption for bathing, hand dishwashing and irrigation by reduction of flow time for these activities.

(9) Running only full loads in the washing machine and dishwasher.

(10) Capturing cold tap water while waiting for hot water to come down the pipes, to be used later on house plants or garden.

(11) Serving water to customers at the Oak Tree Country Club and Mulligan Room only upon specific request.

(b) Stage Two Condition: Severe water shortage. This condition applies during periods when the District determines that it may not be able to meet 80 percent or more of the projected water demands of its customers, either now or within six months, and that water use should be reduced by not less than 20 percent. During a Stage Two Condition, the following water conservation measures shall apply, including all provisions of a Stage One Condition:

(1) (A) Lawn watering and landscape irrigation is permitted only Monday through Saturday between the hours of 5:00 p.m. and 8:00 a.m., local time. However, this watering is permitted at any time if a hand-held hose is used, equipped with a nozzle that automatically shuts off when released, or when a hand-held container or a drip irrigation system is used.

(B) Lawn watering and landscape irrigation is prohibited on Sundays.

(2) Construction water for grading and compacting may be used at any time providing the water is from a source other than the District's potable water system.

(3) Potable metered water may be used for other construction between 7:00 a.m. and 5:00 p.m., local time.

(4) Washing of vehicles or other equipment is permitted only if done using a hand-held bucket or a hand-held hose equipped with a nozzle that automatically shuts off when released.

(c) Stage Three Condition: Critical water shortage. A Stage Three Condition applies during periods when the District determines that it will not be able to meet 70 percent or more of the projected water demands of its customers now or within six months, and that a reduction of not less than 30 percent in potable water use is required to meet minimal needs of all its customers.

During a Stage Three Condition, all the provisions of Stages One and Two Conditions shall apply, and in addition, the following restriction shall apply: All high volume users (defined as over 4000 cubic feet per month) shall submit to the District water use curtailment plans for at least 30 percent overall reduction in water use. The plans shall be furnished on a District form within ten days of notice by the District of the declaration of a Stage Three Condition.

Section 9. Water Rates and Surcharges

Special Water Conservation Rates shall apply during Stage Conditions One, Two and Three, and in addition, surcharges shall apply during Stage Conditions Two and Three, as set out in Section 12.

Section 10. Implementation of Stages One, Two or Three Conditions

The General Manager or his designee shall monitor the District's projected supply and demand for water on a daily basis and determine the extent of the conservation required through the implementation or termination of Stages One, Two and Three Conditions in order for the District to prudently plan for and supply water to its customers. Thereafter, the General Manager may order that Stage One, Two or Three Conditions be implemented or terminated in accordance with the applicable provision of this ordinance. The declaration of a Stage Condition shall be made by public announcements, posting of notices in three locations accessible to the public and publication of the notice in the Tehachapi News. The Stage designated shall become effective immediately upon announcement. The declaration of any

Stage Condition shall be reported to the Board at its next meeting. The Board shall then ratify the declaration, rescind the declaration or direct the declaration of a different Stage.

Section 11. Remedies

(a) The General Manager is authorized to require filing of water use curtailment plans from high volume users in order to protect the minimum supplies necessary to provide for public health, sanitation, and fire protection. Failure to provide curtailment plans in a timely manner or plans that do not meet the required cutbacks shall authorize the District to install flow restrictors at the meter or termination of service.

(b) Remedies for violations of this ordinance are not exclusive and may be imposed cumulatively in the discretion of the District. For example, a violator may pay a surcharge, be subject to a flow restrictor, have water service be discontinued, and be prosecuted criminally.

(c) Surcharges and the cost of disconnecting or limiting service shall be the responsibility of the property owner and the person in whose name service is maintained. Surcharges shall be considered normal charges for water used, and collected through the District's routine water billing process.

(d) Any violation of this ordinance is a misdemeanor under Section 377 of the California Water Code and upon conviction a person shall be punished by imprisonment in the county jail for up to 30 days, or by a fine of up to $1000, or by both.

(e) The General Manager shall determine if and when violations occur and mail a Notice of Violation, together with a copy of this ordinance, to the property owner or to the person in whose name the service is maintained. In making this determination the General Manager may grant an exemption in emergency situations for health and safety reasons.

Section 12. Appeals of Violations

Any customer disagreeing with the Notice of Violation may appeal the Notice by written notice received by the District within ten days of the mailing of the Notice of Violation. Any Notice not appealed within ten days is final. Upon timely filing of an appeal, the District shall mail a notice to the property owner and the person in whose name service is maintained at least ten days prior to the regular or special meeting at which the appeal will be heard. The Board may, in its discretion, affirm, reverse, or modify the Notice of Violation.

Section 13. Water Rate and Surcharge Schedules

(a) Basic Normal Water Rate Schedule:

The Basic Normal Water Rate Schedule for the District is established by resolution of the District and reviewed annually.

(b) Stage One Condition Schedule (Moderate Water Shortage):

During a Stage One Condition the Basic Normal Water Rate
Schedule shall be increased by ten percent for all residential customers except for those whose monthly use does not exceed 1,000 cubic feet.

(c) Stage Two Condition Schedule (Severe Water Shortage):

(1) During a Severe Water Shortage the Basic Normal Water Rate Schedule for residential customers shall be increased by 20 percent except for those whose monthly usage does not exceed 1,000 cubic feet.

(2) If a violation of this ordinance occurs during a severe water shortage a surcharge of $100 shall be added to the charge under subdivision (1) if the monthly water usage exceeds 4000 cubic feet.

(d) Stage Three Condition Schedule (Critical Water Shortage):

(1) During a Critical Water Shortage the Basic Normal Water Rate Schedule for residential customers shall be increased by 30 percent except for those whose monthly usage does not exceed 1,000 cubic feet.

(2) If a violation of this ordinance occurs during a Critical Water Shortage a monthly surcharge of $100 shall be added to the charge under subdivision (1) for those customers whose water usage exceeds 4000 cubic feet for that month.

(3) When a monthly surcharge is added under subdivision (2), additional surcharges shall be added for that month as follows:

(A) An initial $100 if the customer fails to submit the water use curtailment plan required by Section 7(c), or having filed the plan, has failed to meet at least a 30 percent reduction in water use for that month.

(B) An additional $100 if the customer fails to file a plan and also fails to meet at least a 30 percent reduction in water use for that month.

Section 14. Exception

Notwithstanding any other provision of this ordinance, failure to practice the Stage One Condition water conservation measures specified in Section 7, subdivision (a), shall not be considered a violation of this ordinance. However, the 10 percent water rate increase provided in Section 12(b) shall apply.

Section 15. Effective Date and Publication

This ordinance shall become effective immediately upon adoption and the Secretary of the Board is directed to arrange for its posting in three locations in the District available to thepublic.

Section 16. Invalidity of Provisions

If any provision of this ordinance, or its application to any person or circumstance, is held invalid, the remainder of the ordinance, or its application to other persons or circumstances, shall not be affected.

The foregoing ordinance was duly and regularly adopted at a regular meeting of the Board of Directors held on the 14th day of January, 1995 by the following vote:

AYES: RUBIN, MILLER, MCCLOSKEY

NOES: VIOLETT

ABSTAIN: NONE

ABSENT: SAMUELS

MICHAEL J. MCCLOSKEY, PRESIDENT

ATTEST:

Roblee Thiesse, Secretary