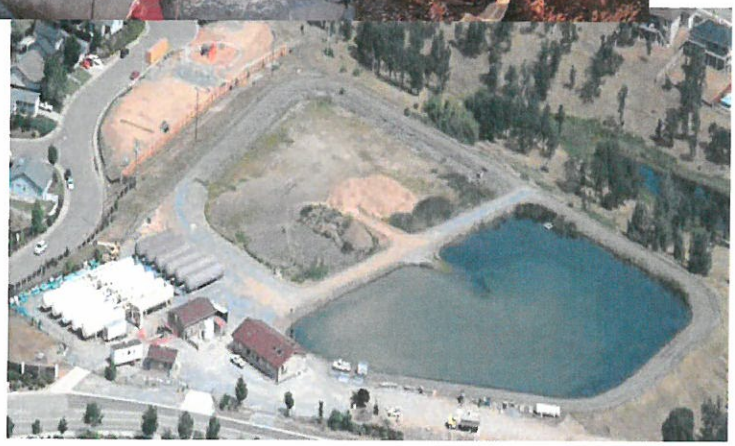
BELLA VISTA WATER DISTRICT

2005 MASTER PLAN



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MASTER WATER PLAN
STAFF SUMMARY

BELLA VISTA WATER DISTRICT

Board of Directors

Wallace "Wally" Wessel – President

Nancy L. Polk – Vice President

Robert "Bob" Nash – Director

Todd R. Sikes - Director

Jeff Thompson – Director

District Staff

David Coxey – General Manager

Don Groundwater – District Engineer

Tom Zaharris – Chief Production Operator

Jeff Tuchalski – Chief Distribution Operator

PACE Civil, Inc.

Tom Warnock – Project Manager

Paul Gregson – Staff Engineer

Eric Marshall, Engineering Technician/Photographer

MISSION STATEMENT OF

BELLA VISTA WATER DISTRICT

OUR MISSION IS TO PROVIDE:

- SAFE AND DEPENDABLE WATER FOR A VARIETY OF PRESENT AND FUTURE USES
- QUALITY CUSTOMER SERVICE
- A SAFE, HARMONIOUS WORKING ENVIRONMENT

EXECUTIVE SUMMARY AND RECOMMENDATIONS

EXECUTIVE SUMMARY

Purpose and scope: Preparation of this document is intended to serve as a planning guide in order to anticipate likely development and the capital facilities, improvements and associated costs necessary to accommodate those demands. This process included a thorough survey of existing facilities and anticipated growth and development; the development of a hydraulic computer model; and a thorough analysis of past, present and future water deliveries in order to identify and recommend appropriate engineering, financial and policy planning for the next 10 years. More frequent reviews, updates and revisions may be necessary if actual future development deviates significantly from the many assumptions which provided the basis for the Plan. Major maintenance items and replacement of capital facilities are considered by the District to be independent of this Plan and to be addressed through its maintenance program and funded by the monthly user fee.

The review of the Bella Vista Water District (District) water system consisted of an engineering analysis of water production and consumption, and each of the major water system components including water supply, storage reservoirs, pressure zones, pressure reducing stations, pump stations, and distribution piping. Analysis of the distribution system was accomplished with the aid of H_2ONet, a hydraulic computer modeling program. The model proved to be useful in the development of this Master Plan.

The District's existing water system boundary and major pressure zones are shown on Figure 1. The District takes in an area of about 53 square miles with approximately 16 percent located within the City of Redding and the remainder of the District located within unincorporated areas of Shasta County. More detailed maps of the existing water system showing pump stations, water treatment plant, wells, pipelines, hydrants, and valves are shown on Plates 1, 2, and 3 located in the pockets at the end of this report.

In June 2005, the District had approximately 5,817 customers (individual metered services), 148 vacant, and 2 inactive, for a total of 5,967 accounts. The customers are a combination of single-family homes, multi-family dwellings, farms, ranches, rural estates, commercial enterprises, and public institutions. The variety of users in the District requires extra attention when attempting to quantify, describe, and understand the "average user." The District's average water service uses 2,860 gallons per average day demand (ADD), and 6,700 gallon per maximum demand day (MDD); however, the average residential meter uses 790 gallons per day ADD and 1,600 gallons per day MDD.

The 2005 Master Plan reviews the growth in demand over the past 26 years and attempts to project what capital improvements will be required to meet the future demand. The projected capital improvements and funds required to meet future demands, will undoubtedly need to be adjusted in time, depending on where and when development actually takes place.

Supply and Treatment

The District's primary raw water supply is obtained from the Sacramento River through the Cow Creek Unit, Trinity River Division of the U.S. Bureau of Reclamation's (USBR) Central Valley Project (CVP). The District has a Water Service Contract for 24,578 acre-feet of CVP water to be used for irrigation, agricultural, municipal, or industrial purposes. The Contract quantity is subject to shortage provisions, and therefore, should in no way be construed as a guaranteed firm supply. Notwithstanding related ongoing litigation, the new contract was issued in 2005 and has a 25-year term.

With the exception of one raw water delivery point serving the McConnell Foundation's Arboretum, all water undergoes treatment and disinfection. Treatment of the Sacramento River water begins at the Wintu Pump Station (WPS) with the flow and residual based addition of gaseous chlorine as it is pumped to the Water Treatment Plant (WTP). Improvements under construction will provide the ability to also add coagulant at the Wintu Pump Station. At the WTP, water flows through pressure filters that contain dual media, sand and anthracite coal, and is post-chlorinated with sodium hypochlorite, if necessary, just before it enters the distribution

system. As of this writing, the Wintu Pump Station and the Water Treatment Plant are undergoing extensive improvements to increase capacity and bring the treatment system up to current California Department of Health Services (DHS) standards. There are currently more than a dozen regulations under development by DHS. Six of these regulations are Federal rules that DHS is required to adopt. The impact of these future regulations on the District's current surface and groundwater treatment technologies is indeterminate at this time.

Pump Stations

Presently, the District has ten pump stations which are summarized in Tables 1 and 3. The Wintu Pump Station provides the initial boost in water pressure from the Sacramento River into the Main Pressure Zone. Most of the remaining pump stations pump water from the Main Zone to delivery points/customers located at higher elevations; with the exceptions being the Palo Cedro and Regulating Station Pump Stations, which pump water from Well 3 into the Deschutes Zone and from the Deschutes Zone into the Main Zone, respectively. This Master Plan recommends construction of one new pump station, as well as improvements to several existing pump stations. A pump station near Spring Lake Road will be required to improve pumping capacity into the Old Oregon Trail Pressure Zone.

Storage

The District's 5 tanks totaling 5.6 million gallons (MG) in storage are summarized in Table 2. Only approximately 1.35 MG of this storage is useful flow equalizing storage. For example, the 4 MG Main Tank uses about 1 MG as flow equalizing storage to maintain proper pressures in the distribution system, and the remaining 3 MG is available as emergency storage at less than normal pressure. The Surge Tank is located before the Water Treatment Plant; therefore, it does not contribute any treated water storage. The Old Oregon Trail 1 MG Tank and Cow Creek I 0.2 MG Tank provide much needed storage to their respective pressure zones. All the storage tanks or reservoirs are welded steel tanks, except for the Old Alturas Regulating Tank, which is concrete. Two new reservoirs recommended in this Master Plan, totaling over 7.0 MG, will

improve pressures throughout major portions of the distribution system during high flows, and provide much needed storage.

Distribution System

The District was formed in 1957 pursuant to California Water District Law for the purposes of obtaining Central Valley Project water. The original water transmission and distribution system was installed in 1963 and was constructed primarily of pre-tensioned steel cylinder pipe with cement mortar lining and coating, ranging in sizes up to 54 inches in diameter. This pipe remains in service and has since been added onto with a combination of asbestos cement, ductile iron, and PVC pipe. Typically newly installed pipe is PVC, although ductile iron is often used in high-pressure applications, creek crossings, and within easements crossing private property.

Because of the diverse terrain and the large area the District encompasses, including service elevations ranging from a low of 450 feet to a high of 847 feet, there are 10 separate pressure zones to keep water pressures within reasonable limits. All of these zones are interconnected but are hydraulically separated by pump stations, the Regulating Station, closed valves, or pressure reducing valves (PRV). The pressure within each zone is typically controlled by a tank, PRV, or pump station with variable frequency drives or a pressure vessel. The system is complicated because of the many pressure zones serving a variety of different user requirements and demands. Most service pressures are in the ideal range of 50 to 120 PSI; however, there are some areas within pressure zones that may have inadequate pressures during peak demands. One such area is in the vicinity of Chicken Springs Road and the eastern portion of Bear Mountain Road in the Old Oregon Trail Pressure Zone. Substantial growth planned for the Old Oregon Trail Pressure Zone will require the addition of a 3.0 MG tank and a second pump station feeding into this zone.

District hydrants located in Shasta County were tested by the Insurance Services Office (ISO) on January 5, 2003, and substantially met Shasta County Fire Safety Standards fire flow requirements of 500 to 3,500 GPM at all but one test location - see Table 17. The hydrant next to the My T Fine Foods (Highway 299 and Deschutes) is on a 6-inch un-looped main and was

unable to meet the 2,500 GPM fire flow requirement. When the District was formed, its primary purpose was to supply water for agriculture; therefore, few if any fire hydrants were installed at that time. Since then, the local fire departments have required the installation of fire hydrants as a condition of lot splits and as a part of construction of water systems serving new subdivisions. The District is covered by two different fire codes. The portion of the District within the City of Redding is subject to the Uniform Fire Code, and the remaining portion of the District is subject to the Shasta County Fire Safety Standards.

There are a number of improvements recommended for the distribution system, including paralleling, and looping of dead end water mains. Some of the improvements address deficiencies in the distribution system, which are exacerbated as additional development occurs in the District. Improvements in the category of "As Developed" are shown on Plate 2 and Table 23 with letter designations. These improvements will typically be installed as development takes place. Some of the improvements calling for the paralleling of mains will most likely be installed by looping of mains in the developing area with these new mains having the same effect by diverting a portion of the flow around the existing over-utilized main.

Growth and Future Water Demand

During the last 26 years, the number of service connections in the District has increased at an average rate of 164 connections per year (198 Household Equivalents per year), based on the trend line from Figure 3, and over the same time period the growth in water production has increased roughly 238 acre-feet per year, based on the trend line from Figure 2. Growth in water production from 1992 to 2004 was 455 acre-feet per year due to a recent building boom in the greater Redding area and recovery in demand from the 1987-1992 drought. Redding's recent estimated service connection growth rate is 1.75 percent per year for the next 10 years. The California Department of Finance projects a 1.5 to 1.8 percent annual growth in population for Shasta County.

For the next 10 years, the water production growth rate used in this Master Water Plan is estimated at 238 acre-feet per year based upon the linear regression from Figure 2. The

historical 164 per year growth in service connections (198 HEs per year) within the District is projected to continue primarily on small acreage residential lots. Much of the District is not sewered, and therefore, development outside the City of Redding requires septic systems. These newer developments require more land per parcel, and often times consume more water for irrigation.

In 2003, the District's average day demand (ADD) metered consumption of 2,860 gallons per connection per day (GPCD) was considerably higher than that of the City of Redding's at 860 GPCD (2000 Master Water Plan), and also higher than the 1,296 GPCD for the Centerville Community Services District (2003 Master Water Plan). The higher use is due to the presence of large agricultural and aquaculture consumers. For example, in 2003, the District's largest water user consumed 8 percent of the District's total yearly water production for 2003.

At an annual increase of 238 acre feet per year, it is projected that the District's average annual demand will reach the existing USBR contract quantity of 24,578 acre-feet per year towards the end of the contract term. This projection does not include any supply contribution from the District's wells, or possible offsets through the use of reclaimed water for golf course irrigation and/or additional conservation. In the future, it will likely be necessary to obtain additional water supply from other sources.

Twelve local water agencies have joined together and created the Redding Area Water Council (RAWC) to investigate alternatives and solutions for future anticipated water shortages due to growth and water allocation cutbacks. The final plan is expected to be released in 2006; however, preliminary reports suggest that the plan will promote the availability of surplus waters from the ACID and the McConnell Foundation, and conjunctive use of groundwater. The RAWC has contracted with CH2M Hill to develop a groundwater model of the Redding area to estimate the availability of groundwater in the area, and the effects of droughts on the groundwater supplies.

The final report will likely recommend that BVWD drill more wells to produce up to 3,800 acre-feet of water to satisfy future demands, and to secure a long-term transfer of

4,000 acre-feet of water from ACID. The report will also likely recommend that the District enter into a joint groundwater pumping program with the City of Redding. The District should consider entering into a Memorandum of Understanding with the City of Redding, regarding local groundwater rights.

The District should apply for an implementation grant from the State Water Resources Control Board to study the quality of the groundwater in the District. By partnering with the City of Redding for such a study, the District is more likely to receive the funds, and by understanding the quality of the groundwater, will be in a better position to prepare for future water needs. This study is needed because the City of Redding has found unacceptable levels of arsenic, iron, and manganese in groundwater, slightly further to the south. The District needs to have confidence in the future availability and quality of its groundwater before it commits itself to such an alternative.

FINDINGS AND RECOMMENDATIONS

Findings

Water Demand

1. BVWD's annual water demand (production) in 2003 was 18,126 acre feet, for an average day demand (ADD) of 16.2 million gallons per day (MGD).

2. In 2003, the breakdown of metered water use (consumption) was 8,886 acre feet (55.7 percent) agricultural water and 7,079 acre feet (44.3 percent) Municipal and Industrial (M&I) water.

3. BVWD's annual water demand in 2004 was 18,817 acre feet, for an average day demand of 16.8 MGD.

4. Maximum day demand in 2003 was 39.7 MGD and in 2004, was 39.3 MGD.

5. Maximum hour demand in 2003 was approximately 48.4 MGD.

6. Based on a linear regression, the average annual growth in water demand over the last 26 years was 238 acre feet per year and was 689 acre feet per year from 1992 to 2004.

Growth Rate

1. Over the past 26 years, an average of 164 new meters per year were sold.

2. Based on the 5,817 active services at the end of June 2005, 164 meters per year represents an annual growth in the number of water customers of approximately 2.8 percent from 2004 to 2005.

3. The California Department of Finance projects a 1.5 to 1.8 percent annual growth in population for Shasta County over the next 10 years.

Projected Water Demand

1. Based on a linear regression of the historical increases in water demand over the last 26 years, the annual water demand is projected to increase by 238 acre feet per year over the next 10 years to approximately 21,435 acre feet per year in 2015.

2. Maximum day demand is projected to increase to 46.8 MGD by 2015.

3. Maximum hour demand in 2015 is projected to be approximately 69 MGD.

Existing Water Supply

1. The District's current United States Bureau of Reclamation (USBR) contract quantity is 24,578 acre feet in a normal year, subject to shortage provisions.

2. In a given water year, all water use above 80 percent of the total contract amount (all water use above 19,662.4 acre feet) will be subject to tiered pricing. Note that without the use of well water or water transfers, at the projected growth rate of 238 acre feet per year, the District usage could exceed 19,662 acre feet in less than four years.

3. Based on the USBR's 1996 Municipal and Industrial (M&I) Water Rates Book, Schedule A-12, the agricultural portion of this allocation is 17,000 acre feet, and the M&I portion is 7,000 acre feet. (Note: The 578 acre feet per year acquired from the Shasta County Water Agency are not included in these numbers).

4. Based on the needs assessment in the December 11, 2000, CVP Analysis of Needs for M&I Water, 2025 Projection of M&I Needs, the M&I portion would be 15,082 acre feet

and the remaining portion, 9,494 acre feet would be Agricultural water. (Note: The M&I Shortage Policy proposed in 2001 still has not been adopted).

5. If the M&I Shortage Policy uses the 1996 M&I Water Rates Book number of 7,000 acre feet for M&I water, this is less than the amount of M&I water the District used in 2003 (7,079 acre feet).

6. In the case of a water shortage, due to less than normal rainfall or regulatory requirements, the water deliveries under the District's contract with the USBR may be reduced in accordance with contract shortage provisions.

7. Reductions in contract deliveries will depend on a number of conditions; however, based on the USBR's September 11, 2001, draft M&I Shortage Policy, the reductions will generally be as follows, M&I deliveries will remain at 100 percent of historical use until Agricultural is reduced below 75 percent of contract entitlement. Thereafter, M&I and Agricultural water allocations will be reduced equally until the M&I allocation reaches 75 percent of historical use (e.g., the Agricultural allocation would be 50 percent and the M&I allocation would be 75 percent). No further reductions in the M&I allocation would be made until the Agricultural allocation is reduced below 25 percent of the contract entitlement. If the Agricultural allocation is reduced below 25 percent, the M&I allocation may be reduced below 75 percent.

8. The District has five groundwater wells that are capable of producing 2,762 acre feet annually (based on 180 days of operation) and up to 5.0 MGD on a daily basis.

9. For the past three years, the District has contracted on a year-to-year basis, to purchase approximately 4,800 acre feet of supplemental water; however, the entity providing the supply for sale has not been willing to enter into a long-term contract for the sale of this water.

Based on the above projected growth in water demand, and the District's current USBR water

allotment, the demand is projected to exceed the District's USBR contract amount in approximately 2030 in a normal water year, assuming limited well use.

Treated Water Storage

1. The District has approximately 1.35 MG of usable equalizing storage in the following zones:
    a. Main Zone (4 MG Tank) = 1.0 MG
    b. Old Oregon Trail Zone (Old Oregon Trail Tank) = 0.25 MG
    c. Cow Creek I Zone (Cow Creek I Tank) = 0.10 MG
    d. Deschutes Zone (Regulating Station Reservoir) = 0.0 MG

2. In the design of a water system, storage capacity is normally designed to meet the following needs: maximum hour water demand (equalizing storage); emergency demand in case of a power outage (emergency storage); and fire flow demand (fire storage).

3. Typical design values for these water storage needs are as follows:
    a. Equalizing storage = 20 percent of MDD
    b. Emergency storage = 25 percent of MDD
    c. Fire storage = 60,000 to 960,000 gallons (depending on what structures are within each pressure zone and the applicable fire agency's standards)

4. Based on the above criteria, the District's current usable water storage needs are as follows:
    a. Main Zone = 4.6 MG
    b. Old Oregon Trail Zone = 2.4 MG
    c. Cow Creek I Zone = 0.56 MG

5. Based on estimated growth, the District's water storage needs in 2015 are as follows:
    a. Main Zone = 4.7 MG
    b. Old Oregon Trail Zone = 3.4 MG

c. Cow Creek I Zone = 0.6 MG

6. In order to meet the above treated water storage needs, the additional water storage requirements are summarized below:
   a. Main Zone = 3.6 MG by 2005 and 3.9 MG by 2015
   b. Old Oregon Trail Zone = 1.4 MG by 2005 and 2.4 MG by 2015
   c. Cow Creek I Zone = 0.36 MG by 2005 and 0.4 MG by 2015

7. Due to the lack of suitable sites within the Main Zone for construction of a standard water storage tank (i.e., sites at an elevation of approximately 710 feet), and the high cost to construct an elevated tank or standpipe to provide the required storage for the Main Zone, it may be more practical to provide the same total system storage capacity by providing additional storage capacity in zones other than the Main Zone where suitable storage sites are available.

8. With construction of the Palo Cedro Booster Pump Station and PRV, the operation of the Palo Cedro Pressure Zone and Deschutes Pressure Zone are closely integrated. Construction of a single, large, storage tank at the Old Alturas Regulating Station serving both areas would be more cost effective than construction of a separate tank to serve only the Palo Cedro Zone.

Water Quality/Water Treatment

1. With the treatment improvements currently under construction, the District's surface water supply and water treatment facilities are expected to provide the District's customers with excellent quality water that meets or exceeds all current EPA and DHS drinking water standards by the end of 2006.

2. There are currently more than a dozen regulations under development by DHS. Six of these regulations are Federal rules that DHS is required to adopt. The impact of these

future regulations on the District's current surface and groundwater treatment technologies is indeterminate at this time.

3. Water from the District's wells requires treatment in order to meet secondary drinking water standards for iron and manganese.

4. The District has installed iron and manganese treatment facilities at all five of its wells that are effective in reducing the iron and manganese concentrations to below the secondary drinking water standards.

Water Pressure

1. Currently, Department of Health Services Waterworks Standards for operation of water distribution systems call for a minimum operating pressure at a service meter of not less than 20 PSI and 5 PSI minimum in a main.

2. The static water pressures shown in Table 1 are the pressures that could be expected during periods of no, or very low, flow. Under the average day demand, maximum day demand, and the maximum hour demand, the actual (dynamic) pressure at an individual service will be less than the listed static pressures. How much less will depend on a number of factors, including system and local water demands, water main sizes, service line size, meter size, and the customer's plumbing system.

3. Typically, the lowest dynamic water pressures will be experienced in areas of higher elevation, at the extreme end of a pressure zone, at or near the end of an un-looped water line, served by undersized water mains, and services adjacent to some of the largest water users.

Water Metering

1. The American Water Works Association (AWWA) has developed standards for the design and operation of water meters. These standards were developed to both ensure that water usage is accurately measured and that the water meters have a reasonable service life before they need to be replaced.

2. Based on an analysis of individual water meters, it is apparent that there are some existing meters that are undersized (i.e., the flow rate through the meter exceeds AWWA Standards for maximum continuous flow) and many meters that are oversized for the parcel that they serve and/or are operated at a flow that is too low to ensure accurate flow measurement.

3. The minimum meter size that the District currently installs is a 3/4-inch meter.

4. Based on a review of the water usage in areas with smaller "city" lots, most of these parcels could be adequately served by a 5/8-inch meter.

Projected Growth and Required Water System Improvements

1. Based on tentative subdivision maps that have been submitted to Shasta County, the areas of the District that are anticipated to have the largest growth within the next 10 years are primarily within the City of Redding, or adjacent to the current city limits.

2. The areas projected to have the largest growth fall largely within the Old Oregon Trail and Simpson Pressure Zones, in areas that can be sewered, which allows higher density development.

3. While some pressure zones can accommodate modest growth with minor improvements, the facilities in the Old Oregon Trail and Simpson Pressure Zones are already at or near

their limits, and significant improvements or action will be required in each of these zones in order to accommodate the projected new growth.

4. Based on the estimated costs of the required improvements and the projected growth within each pressure zone, there is a significant difference in the cost per new service from zone to zone.

5. Reducing demands during maximum hour demand could curtail some improvements and result in significant savings to the District. The District may be able to accomplish this by encouraging "Scheduled Ag" users to not irrigate during peak demand hours. Also, the District may offer incentives to other Ag or M&I users to modify their use to coincide with off-peak system demands in order to reduce MHD

6. The BVWD system is 40 years old and significant maintenance costs are beginning to be incurred by the District. The District should anticipate this maintenance and plan accordingly by developing a long-term major maintenance and replacement plan for existing facilities

Reclaimed Water Supplies

1. With continued growth within the City of Shasta Lake, the city has a growing need to dispose of its treated wastewater.

2. There is a potential to use reclaimed water within the District to meet irrigation needs, especially for the irrigation of golf courses.

Recommendations

1. In order to secure additional water supplies for both periods of water shortage and future growth, the District should consider entering into a Memorandum of Understanding with the Redding Area Water Council regarding local groundwater rights.

2. In order to better assess the quality and quantity of groundwater available from the Redding groundwater basin, the District should apply for an implementation grant from the State Water Resources Control Board to study the quality of the groundwater in the District. The District should consider applying for the grant through Redding Area Water Council. The District needs to have better confidence in the future availability and quality of its groundwater before it commits itself to relying on groundwater.

3. The District is investigating alternative water sources such as the "Shasta Lake Feasibility Study" to be able to provide water for growth after the Wintu Pump Station reaches its pumping capacity. The District should consider funding an alternative water intake location, which would also provide a backup to the Wintu Pump Station.

4. In order to reduce maximum hour demands in the system and in certain pressure zones, the District should begin utilizing some of the conditions in the agreements for purchase of "Scheduled Ag" meters and require Scheduled Ag irrigators to irrigate during non-peak hours.

5. In addition to shifting the water demands for Scheduled Ag customers, the District should consider developing creative alternatives to discourage on-peak water usage and to encourage off-peak water usage in order to reduce MHD for each zone. The District should be creative in implementing such a policy, such as establishing specific water irrigation watering time periods, offering incentives to alter irrigation times, or educating users of potential benefits of irrigation at certain hours.

6. In order to ensure the accurate measurement of water deliveries, the District should consider developing a policy of replacing meters 20 years old or older. This would help maintain accurate metering, most likely increase revenues, and potentially reduce the amount of unaccounted for water. In addition, the larger meters (3-inch meters and larger) should be tested every five to ten years because of the potential for greater amounts of unaccounted for water.

7. The District should consider reviewing existing meter sizes with regards to their water use and develop a meter sizing policy to ensure that water meters are properly sized for the parcel that they serve and are based on reasonable water delivery requirements for the water use on the parcel.

8. Based on the projected development within different District pressure zones and the cost of the corresponding water system improvements that will be required to serve the new growth, the District should consider adoption of pressure zone specific connection fees that allocate the cost of the required improvements to the properties that receive the benefit of the improvements, which is consistent with the principles of "fair and the equitable" and the "beneficiary pays" rather than the current single connection fee schedule for all properties within the District.

9. Where, in the absence of any growth, water system improvements would be required to improve service to existing customers the District should consider alternative financing means other than capital improvement fees, such as formation of an assessment district or improvement district, to spread the cost among all properties that will benefit from the improvements.

10. To ease the potable water demand in the Old Oregon Trail Pressure Zone, and to make more potable water available to the District for future growth, it is recommended that the District continue negotiations with the City of Shasta Lake to obtain reclaimed water for use on golf courses within the District.

11. Based on the high cost of energy and the pumping requirements to deliver water to higher elevation areas of the District, the District should consider implementing a water rate schedule that allocates the cost of operations and maintenance of the pumping facilities to the properties that receive the benefit of the pumping.

12. Due to the age of major components of the District's water system, the District should prepare for what could be significant expenses and develop a maintenance budget to pay

for the system upkeep, and should consider developing a multi-year Extraordinary Operations and Maintenance (EO&M) budget in order to develop appropriate reserves to replace and/or improve older facilities.

13. In order to avoid potential damage to District mains in the event of a line break and air/vacuum valve failure, the District should initiate air/vacuum valve exchanges based on manufacturer's recommendations. Air/vacuum valves are a critical part of the distribution system and their working condition cannot be determined in the field. Also, the District needs to modify some of its air/vacuum valves to eliminate the possibility of any cross-connection between the air/vacuum valves and surface waters.

14. The District should review and consider rewriting its annexation policy to ensure that existing District landowners are not adversely impacted economically and/or by diminished water allocations. Based on the potential for growth within the District's existing service area boundary, the District does not have enough water allotment to supply District growth beyond the year 2030, and development beyond the existing boundary of the District may overburden some pressure zones and require significant improvements. Should any annexation proposals include an offer to bring water into the District, then those water contracts should be at least as reliable as the District's existing contract with the USBR. Any proposed annexation should be reviewed by the District with great care to fully anticipate short-term and long-term impacts and costs.

15. In order to accommodate growth in the number of customers, implement some of the recommendations contained in this Master Plan, and provide for easier and better analysis of water usage the District should consider updating its customer information system. This would also facilitate improved billing flexibility if additional or alternative zone-specific rate structures are pursued at a later date (for example, a zone specific pumping rate).

Capital Improvement Schedule and Costs

The proposed 2005 Master Plan of Improvements is shown on Plate 2 and Executive Summary Table ES1, with numbered (1, 2, 3...) designations for system improvements, and on Table 22 lettered (A, B, C...) designations for growth accommodating "As Developed" improvements. The numbered improvements are planned to be completed over the next 10 years. Funding will need to be adjusted accordingly, to compensate for the projects brought forward or delayed and the District may need to secure a loan to complete portions of the improvements.

The total current cost of the next 10 years of capital projects is estimated in 2005, at about $9.5 million. The costs pertain to new facilities and upgrades of existing facilities to accommodate growth in the District. It is recommended that funding of these projects will come from a Capital Improvement Fee (CIF) portion of the service connection fees. Much of the projected growth is expected to be within the Redding city limits, especially in the Old Oregon Trail Pressure Zone. Areas with the highest projected growth will also require a greater portion of the projected improvements. Therefore, it is recommended that the District establish specific connection fees for five general pressure zones. The Main, Old Oregon Trail, Simpson, and Cow Creek I and II, and Welch Pressure Zones will pay for the improvements within the respective zones, as well as a proportional share of the improvements that benefit everyone within the District. The CIF fee for a standard 5/8-inch meter ranges from a high of $7,325 in the Old Oregon Trail Pressure Zone to the low of $4,375 (including the existing debt service) in the Main Pressure Zone fee. This is a change from the previous Master Plan methodology that distributed the cost of the improvements uniformly across all pressure zones. Developing different CIF fees in proportion to the improvements required within a given pressure zone, is in keeping with the legal definition of a Capacity Charge, pursuant to Section 66013(b)(3), California Code of Regulations. Furthermore, this approach is consistent with a "beneficiary pays" philosophy in acknowledgment that costs are not uniform through the District.

It is recommended that the CIF be adjusted annually by the increase in the Engineering News Record Construction Cost Index (ENR CCI), which was 7,422 (ENR CCI, July 2005). It is recommended that the District offer 5/8-inch meters and that a 5/8-inch meter be the basis of an

HE. It is also recommended that the CIF fee for meters greater than the District's standard 5/8-inch, be proportionately increased based upon the American Water Works Association (AWWA) maximum continuous duty rated capacity of the meter size installed. The service connection growth was converted to an HE basis to determine the expected growth in connections. The District has typically had a 6:1 ratio of 3/4- and 5/8-inch meters to 1-inch meters, and using an AWWA, a 2.5:1 HE ratio of 1-inch to 5/8-inch meter, water usage translates to 198 HEs per year growth rate as described on Table ES1.

The District presently has outstanding debt principal of approximately $3.9 million from previous capacity improvements. This debt is currently being funded through the collection of the existing CIF. The estimated share per future HE of this debt is $1,955 and is added to the proposed CIF. This fee should be held constant every year, and not be increased using the ENR adjustment referenced above.

It is important for the District to better understand how its water is used by its customers. The computer program presently used by the District continues to function for billing purposes, but does not allow data to be easily retrieved and interpreted. For this Master Plan, the District's 2003 information was downloaded into a text file and it took a considerable effort to extract the needed information. The District cannot easily proof, verify, retrieve or make comparisons with important consumption information. Consequently, it is recommended that the District update its existing consumption data collection and billing software.

Executive Summary Table 1 ES 1

INTRODUCTION

BACKGROUND

The Bella Vista Water District (District or BVWD) is a publicly owned water agency operating under the direction of a five member elected Board of Directors. The District supplies agricultural, municipal, and industrial water to individual customers within the District. The District is located east of the City of Redding, south of Shasta Lake, bounded on the south generally by State Highway 44, and with an eastern boundary extending only slightly beyond Little Cow Creek. This area includes an overlapping eastern part of the City of Redding and the rural communities of Bella Vista and Palo Cedro. The existing District boundary, shown on Plate 1, encompasses approximately 34,000 acres or 53 square miles with service currently to 5,967 connections (June 2005). Water use for 2004 exceeded 18,817 acre-feet with a maximum day demand (MDD) of 39.3 million gallons per day (MGD). In 2001, the MDD was 45.9 MGD, the largest single day flow recorded by the District.

The BVWD was formed in 1957 and construction began in 1963 primarily to provide irrigation water for agriculture. Since then the District has added rural and residential services; however, agriculture still represents roughly 60 percent of the water demand. The primary water source is the Sacramento River augmented by five groundwater wells. The appropriated water is authorized through the Cow Creek Unit of the Trinity River Division of the U.S. Bureau of Reclamation's (USBR) Central Valley Project (CVP). The Contract allows for up to 24,578 acre-feet of water per year, subject to shortage provisions. During the severe drought year of 1990, the CVP allocation was reduced by 50 percent, providing 12,000 acre-feet of available water. In addition, about 2,000 to 3,000 acre-feet were produced from the then existing three wells. As a result, the District imposed drought restrictions resulting in only about 71 percent usage compared to the record 1987 usage. The supplementary water provided by the three wells constituted about 10 percent of the normal river source, but constituted about 15 to 20 percent of the reduced supply during the 1990 drought.

Based upon a linear regression of the data, the District has experienced since 1978, an average of 238 acre-feet per year growth in water production, and approximately 164 new service connections as shown in Figures 2 and 3, respectively. Approximately 138 to 158 services have been added each year during the last two years, which represents a growth rate of about 2.8 percent from 2004 to 2005.

The District supply and distribution system, as shown on Plate 1, includes:

- Wintu Pump Station
- Water Treatment Plant
- Approximately 220 miles of water mains
- Five water storage/control tanks
- Nine additional pump stations
- District Office and Distribution Operations Facilities

The major piping distribution system was initially installed by the USBR, and has been extended considerably to serve many areas. Funding for construction of the system was through a Central Valley Project loan administered by the USBR. The loan will be retired in 2016. The Wintu Pump Station, Main Conduit, and original transmission and distribution system are still owned by the U.S. Government, but were constructed solely for use by the District.

Presently, the primary responsibilities of the District are to provide safe and aesthetically pleasing drinking water that meets state and federal standards and meet peak agricultural demands with the same high quality water. The District's goals, adopted in 1991 include:

1. Provide sufficient quantities of quality water at a minimal cost.
2. Encourage the continuation of agriculture and allow for the preservation of the rural lifestyle within the District.
3. Allow for new residential and commercial development within the District as long-term resources are available.
4. Provide quality services to our customers.

5. Change District boundaries only where the resources are available, and existing District properties are not unfavorably impacted.
6. Provide uniform policy and guidelines for Water District operation.
7. Provide safe conditions for District employees and the public.
8. Encourage wise use of water.
9. Provide for long-term financial planning.

PREVIOUS STUDIES

A number of District studies precede this plan, including:

1964	*Reconnaissance Report*, Shasta County Water Agency.
1964	*Cow Creek Unit Central Valley Project*, U.S. Bureau of Reclamation.
1975	*Redding Region Water Supply Alternative*, CH2M HILL.
1979	*Master Plan*, OTT Engineering.
June 1985	*Pumping Alternatives Investigation*, PACE Engineering.
December 1985	*Dry Creek Road & Bear Mountain Road Water System Feasibility Study,* PACE Engineering.
May 1986	*Revised Feasibility Study to Serve Water to Palo Cedro, California*, PACE Engineering.
November 1988	*Engineering Investigation of Low Pressure Areas in Southwest Portion of District,* PACE Engineering.
August 1989	*Hydraulic Study of Main Conduit*, PACE Engineering.
December 1990	*Master Water Plan*, Bella Vista Water District Staff & PACE Engineering.
December 1990	*Feasibility Study for the Expansion of Ground-water Supplies for the Bella Vista Water District,* Lawrence & Associates.
March 1991	*Pilot Filter Study for the Removal of Manganese and Iron at Well,* PACE Engineering.

February 1992	*Aquifer Test Analysis on Pumping Well BVP-6 and Monitoring Well BVM-6,* Lawrence & Associates.
October 1997	*Shasta County Water Resources Master Plan Phase 1 Report and Future Water Needs*, by Shasta County Water Agency, CH2M HILL, California Department of Water Resources.
November 1998	*Coordinate AB 3030 Groundwater Management Plan for the Redding Groundwater Basin*, Redding Area Water Council, Shasta County Water Agency.
2000	*Water Management Plan,* USBR Contract requirement, requirement of the AWMC signatories
2000	*Urban Water Management Plan,* required by CA Urban Water Management Planning Act
September 2001	*Redding Basin Water Resources Management Plan, Phase 2B Report,* CH2M HILL.
July 2002	*Water Treatment Study & Pre-Design Report*, PACE Civil, Inc.
August 2003	*Redding Basin Water Resources Management Plan, Phase 2C Report,* CH2M HILL.

SCOPE OF CURRENT STUDY

This study, referred to as the *Bella Vista Water District, 2005 Master Plan* (Plan), includes the following items:

- A determination of historical and projected future water usage
- Development of three computer models of the distribution system for the years 2003, 2005, and 2015
- An evaluation of the existing water production and distribution system
- Determination of design criteria
- Development of a staged 10-year plan of capital improvements
- Estimate of the current cost of the proposed capital improvements

- Determination of appropriate CIF fees to fund the recommended capital improvements

The scope of this plan does not include routine operations and maintenance (RO&M) or extraordinary operations and maintenance (EO&M inclusive of capital replacement).

This study is a joint project by District staff and PACE. District staff provided much of the record search, water main inventory, and review so we are indebted to their service in making this a useful Master Plan.

ABBREVIATIONS AND GLOSSARY OF TERMS

The following abbreviations are used in this report:

ACH	Polyaluminum chloride/cationic blend
ADD	Average Daily Demand. This is the average rate of water usage per day within a year. It can be expressed on an individual basis such as gallons per connection per day (GPCD), or on a community basis in million gallons per day (MGD), acre-feet per day or per year.
AC	Asbestos Cement Pipe
AC-FT or AF	Acre-Feet
ARV	Air Vacuum Release Valve
AWWA	American Water Works Association
BVWD	Bella Vista Water District
CAPACITY CHARGES	Charges for facilities in existence at the time the charge is imposed or charges for new facilities to be constructed in the future, which are of benefit to the person or property being charged.

CCI	Cow Creek I Pump Station or Reservoir
CCII	Cow Creek II Pump Station
CDF	California Department of Forestry
CF	Cubic Feet
CFS	Cubic Feet per Second
CI	Cast Iron Pipe
CIF	Capital Improvement Fee
COR	City of Redding
CP	Capital Projects
CV	Check Valve
CVP	Central Valley Project
DHS	California Department of Health Services
DI	Ductile Iron Pipe
GPD	Gallons per Day
GPCD	Gallons per Connection per Day
GPM	Gallons per Minute
GPM/SF	Gallons per Minute per Square Foot
GSP	Galvanized Steel Pipe
HE	Household Equivalent
HGL	Hydraulic Grade Line
HP	Horsepower
HWY	Highway
ISO	Insurance Services Office (National Board of Fire Underwriters)
KWH	Kilowatt Hour
MCC	Motor Control Center
MDD	Maximum Daily Demand. Same units as ADD.
MG	Million Gallons
MGD	Million Gallons per Day. NOTE: 1 MGD = 694 GPM = 3.07 AC-FT/Day
MHD	Maximum Hourly Demand. Same units as ADD.
MMD	Maximum Month Demand. Same units as ADD.

MSL	Mean Sea Level
MTU	Master Telemetry Unit
NTU	Nephelometric Turbidity Units
OOT	Old Oregon Trail
PCCP	Pre-stressed Concrete Cylinder Pipe
PRV	Pressure Reducing Valve
PVC	Polyvinyl Chloride Pipe
PS	Pump Station
PSI	Pounds per Square Inch
PZ	Pressure Zone
RTU	Remote Telemetry Unit
SCADA	Supervisory Control and Data Acquisition
SCS	Soil Conservation Service
SERVICE CONNECTION FEE	Fees levied to cover the cost of constructing water system improvements to serve new customers
SF	Square Feet
SLR	Surface Loading Rate
TDH	Total Dynamic Head
TTHM	Total Trihalomethanes
USGS	United States Geological Service
USFS	United States Forest Service
USBR	United States Bureau of Reclamation
VFD	Variable Frequency Drive
WPS	Wintu Pump Station
WTP	Water Treatment Plant