City of Bishop
Water Master Plan

Prepared For:

The City of Bishop
Department of Public Works

Submitted By:

Nolte Associates, Inc.

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1.0 Executive Summary

Introduction

The City of Bishop (City) requested the assistance of Nolte Associates, Inc. to provide a comprehensive evaluation of the City's water facilities and present recommended improvements in a Water Master Plan. The Water Master Plan was developed concurrently with the Wastewater Master Plan.

The primary goals of this Master Plan are to guide the development and operation of the City's water system, and to develop a Capital Improvements Plan that is responsible, realistic, and appropriate for the City. From this, the City will have a solid foundation to continue providing water service to the City and to proceed with projects to improve and maintain that service.

The main objectives that Nolte considered encompass the fundamental concerns of the Master Plan are listed below:

1. Provide Adequate Fire Protection
2. Reduce Operation Costs
3. Comply with Regulatory Requirements
4. Improve System Reliability and Redundancy
5. Increase Utilization of Capacity/Increase Revenue
6. Improve Customer Service
7. Improve Water Quality
8. Improve System Operations

Methodology

The City of Bishop currently provides water to all of the residents and businesses (customers) inside the city limits and to four customers outside the city limits. Nolte investigated the facilities owned and operated by the City: three wells, one steel water storage tank, 21.3 miles of pipelines, fire hydrants, and a disinfection facility. Nolte also evaluated the City's budget information and billing. This process assisted Nolte in the identification of the City's water system deficiencies, outline the potential project alternatives to address these deficiencies, and research financial resources that will help fund the construction of such projects.

The Master Plan was developed through a series of steps. The investigation of the existing facilities, operations, and billing system provided the foundation for the Master Plan. Following the investigation of existing facilities, a comprehensive evaluation of the facilities and the City's needs was performed to develop improvement alternatives for the City's infrastructure and operations. Each improvement alternative was analyzed using a selection matrix to help determine the recommended improvement alternatives for the City. Finally, the recommended improvement alternatives were incorporated into a Capital Improvements Plan, outlining and prioritizing future infrastructure projects for the City.

Major Water System Deficiencies

Some of the major deficiencies identified through the investigation of existing facilities process are:

1. The City has no back up supply well. One of the City's production wells has historically been operated as stand-by well by California Department of Public Health due to water quality (Fluoride and Arsenic). Without the ability to use this well during a peak water

demand period, or failure of one of the existing wells, the summer demand could not be met solely by the remaining active well.

2. Many existing water mains in the City of Bishop are too small to provide adequate fire flows. Many water mains are in poor condition, are old, and of out-of-date materials. Many of these lines require frequent repair and could cause water quality concerns. It can be difficult to stock the variety of materials necessary to repair older and small diameter parts of the system.

3. There is a potential for impact to service if the power goes out or if there is a major water infrastructure failure (primarily the wells). The City has a one million gallon storage tank but no emergency interconnections have been established with nearby agencies to supply water to its customers in case of a major power outage, or an infrastructure failure.

4. There are several dead end pipelines within the water system which can potentially cause water to stagnate at different locations and reduce the paths for water to travel. This can affect the capacity of the system to distribute flow during periods of high demand or a fire event.

5. The City operates the water distribution system utilizing legacy telemetry hardware. This technology is outdated and in the City's case, it has not been working properly. It does not offer provisions for the automatic gathering and reporting of system data or operator access to operate the entire system from one location. Operators cannot communicate with, or monitor systems (tanks, wells).

6. Additional, smaller deficiencies were evaluated and are described in the Master Plan.

Solution Alternatives

Alternatives were developed to address the water system deficiencies identified in the evaluation phase. Project cost opinions were prepared by Nolte for each alternative. Each solution alternative addresses one or more of the main objectives that are considered in the Master Plan.

Project Selection

There are several projects that have more than one solution alternative to address them. A selection matrix was created to score each alternative based on different criteria. The selection matrix outlines all of the alternatives, their scores for each criteria, the weighing factor for each criteria, and their overall ranking. The preferred alternative for each project is that which resulted in the highest total score. The criteria applied to select the solutions to deficiencies with multiple solutions are listed below:

- Capital costs
- Operation and maintenance costs
- Land requirement/environmental impacts
- Funding agency assistance
- Operational complexity
- Correspondence with other City projects
- Legal/water rights
- Reliability
- Time for implementation

Project Prioritization

A prioritization process was implemented among the selected projects, and the projects that only have one alternative solution. This process allowed the City and Nolte to determine the urgency and

time horizon to complete each project. Their priority was established based on a scoring system similar to the one in the selection process. The following criteria were used to score each alternative:

- System Reliability
- Capital Cost
- Employee Health and Safety
- Correspondence with Other projects
- Revenue and Operational Cost
- Funding Agency Assistance
- Regulatory Requirements

Top Priority Projects

The City identified four projects (top priority projects) necessary to achieve the objectives of the Master Plan:

1. **New Well 3 Site:**
   In order for the City to guarantee the provision of water during periods of high demands and on the event of a fire, the exploration of a new well site and the construction of a new water supply well are recommended capital projects. The construction of a new water supply facility offers more reliability and redundancy to the system, will improve fire fighting capacity, and will guarantee that customers receive the best quality water.

   The components of the new well project include a test well, a new well and equipment, a controls building, new 12 inch pipelines to feed the system and a new one million gallon storage tank.

   An evaluation of the existing water wells (Well 2 and Well 4) to assess well infrastructure, improve operation efficiency and improve water quality should be performed.

   The City of Bishop wants to build the new test well, and the new production well on City owned property. The new well will be in production regularly on a rotational basis with the other two operating wells (Well 2 and Well 4). If water demands increases, Well 3 can be used as a primary well. The estimated cost of the projects is $2,280,000 (Phase 1). The City has applied to the State for grant funds to implement this project.

2. **SCADA System:**
   To fully integrate all water facilities on a data gathering and communications system, the City should install a SCADA (Supervisory Control and Data Acquisition) system. A SCADA system can integrate and monitor well status, alarms, and pressures. It can also record well daily production and run hours, and monitor the reservoir level. Some of the advantages of installing a new communications system include tracking the behavior of the system and its operating conditions, allowing operators to remotely control the system, and reducing response times to system alarms.

   This project consists on integrating the existing water facilities (Well 1, Well 4, Well 2, Reservoir, Public Works Yard, City Hall future Well 3) utilizing programmable logic controllers (PLCs). The installation of a SCADA system will allow the City staff to remotely view water distribution system status and make control system changes safely and securely via the internet. The estimated cost of this project is $155,500 (cost does not include wastewater component).

3. **Interconnection with Indian Creek Community Services District (ICCSD):**
   To provide a low cost redundancy for water supply, an interconnection for fire-flows or other unplanned emergencies (major water system shut down), would be beneficial. Indian Creek Community Services District (ICCSD) is a nearby agency that currently operates

several wells but lacks storage capacity. By establishing an interconnection with this agency, the City's one million gallon tank can contribute to increase ICCSD's water system reliability by providing some emergency storage that ICCSD currently lacks, and the City can add redundancy to its water supply system if an unforeseen system shutdown or failure occurred.

Since Well 1 cannot be used as a source of drinking water for an extended period of time due to its high levels of Fluoride, an interconnection for fire-flows or other unplanned emergencies (major water system shut down), would be beneficial. The City's 1 million gallon tank can contribute to increase ICCSD's water system reliability by providing some emergency storage that the District currently lacks. The City could purchase water in an ongoing or intermittent basis from ICCSD which has excess capacity.

In July 2007, Nolte completed a preliminary study called "Indian Creek Community Services District Emergency Interconnection" for the City of Bishop. The emergency interconnection project was discussed in more depth and alternatives for the location of the proposed interconnection were described. The estimated cost of this project ranges between $518,000-620,000. The City has applied to the State for grant funds to implement this project.

4. **Refurbishing of Well 2 and Well 4/Tank Valves**:
   The City of Bishop wants to conduct well examinations to assess the condition of the two existing production wells and review the operation of both pumps and motors to ensure they are appropriate for their planned operations. Also, the existing 12-inch fill line from Well 4 to the reservoir empties during times of low demands, exposing the fill line to potential infiltration and contamination problems. A new valve configuration is recommended to be constructed at the tank site to alleviate this problem. The estimated cost of this project is $262,000.

Capital Improvements Plan

The capital improvements plan for the City of Bishop water system lays out the anticipated improvements, their year of implementation, and their costs. The time horizon for the Capital Improvement Plan is 20 years (2008-2027). The solution alternatives for the proposed projects were broken up into phases depending on the type of project. The project cost of each proposed improvement was estimated for each project in 2007 dollar amounts.

An annual inflation rate of 8% was used based the recent rapid increase in construction material and labor cost. The main criterion for spreading out the capital projects and their costs in the next 20 year period is the correspondence of any of the projects with a top priority project. The future value for the completion of each phase was calculated on the estimated year of completion of the project phase.

For many of the 20 years in the Capital Improvements Plan's time horizon, the projected capital expenditure exceeds the City's annual capital projects budget. To address this, the City has applied to outside agencies for financial assistance. Sources of funding include USDA and Proposition 84. The City has the option of financing projects in part through debt. In addition, many projects with a long term horizon (2014-2027) can be further phased or postponed. Reasonable increases in user rates will not permit the City to pay for these projects on a cash basis.

The following table lists some of the major proposed projects and their time for implementation:

Time Horizon	Project	Cost ($2007)
Immediate Projects 2008	Environmental documentation/Application for funding New Well 3	$75,600
	Refurbish Well 2 and Well 4	$222,000
	Emergency interconnection with Indian Creek Community Services District: Application for funding, PER, Environmental, Legal, Permitting	$58,750
Future projects 2009-2013	Design Phase 1 New Well 3 (2009)	$770,000
	SCADA system (2009)	$181,000
	Design emergency interconnection with Indian Creek Community Services District (2009)	$277,000
	Construction Phase 1 New Well 3 (2010)	$3,147,000
	Design Phase 2 New Well 3 (2011)	$234,000
	Construction Phase 2 New Well 3 (2012)	$2,033,000
	Full rate study (2013)	$32,000
Long Term Projects 2014-2027	Design II replacement of small pipes (2014)	$392,000
	Construction II small diameter pipes (2015)	$4,038,000
	Relocation II water services (2015)	$1,100,000
	Installation water meters (2016)	$2,300,000
	Construction intertie with Bishop Airport (2017)	$5,730,000
	Water Master Plan (2017)	$130,000

2.0 Introduction and Purpose

The City of Bishop (City) requested the assistance of Nolte Associates, Inc. to provide a comprehensive evaluation of the City's water facilities and present recommended improvements in a Water Master Plan.

The City engaged in an opportunity to determine deficiencies in its systems, examine the potential for further cooperation and/or consolidation with adjacent water and wastewater systems, and develop a Capital Improvements Plan to enable the City to continue to provide service to its customers for decades.

The Water Master Plan had several objectives:

- Identify the system's deficiencies and means to address them
- Foresee future system trends, needs, and improvements
- Enable the City to operate and maintain the systems more efficiently
- Evaluate financial impact to the water and wastewater funds, and user rates
- Contain a detailed analysis of the first four capital improvements projects
- Guide the City's water and wastewater efforts for the next decade

The primary goals of this Master Plan are to present a plan to guide the development and operation of the City's water system, and to develop a Capital Improvements Plan that is responsible, realistic, and appropriate for the City. From this, the City will have a solid foundation to proceed with projects.

The Master Plan was completed concurrently with the development of the Wastewater Master Plan and a Geographic Information System (GIS) for the City.

2.1 Geographic Location and Study Area

The City of Bishop is located in Inyo County, 250 miles north of the City of Los Angeles in the northern end of the Owens Valley. Bishop is in a desert valley at an elevation of 4,000 feet. The City is surrounded by the Sierra Nevada mountain range on the west and the White Mountains east of the City. Most of the land west of the City is part of the Bishop Paiute Reservation. Elevation increases west of the City towards the Sierra Nevada Mountains.

The City is located at the intersection of Highways 6, 168, and 395. Highway 395 is Main Street through most of Bishop and bisects the City in a north and south direction. It also serves as a northern boundary for this Master Plan since it branches off of Main Street in a westerly direction and becomes the Northern Sierra Highway. Highway 6 continues northward along Main Street. Highway 168 follows West Line Street bisecting the City in an east and west direction from Main Street.

The majority of water in Bishop is melted snow. Numerous creeks and streams from the Sierra Nevada Mountains drain into Owens River. The surface water runoff is due to rainfall and snowmelt. The groundwater table is close to the surface throughout the valley; it is less than 10 feet in the Bishop area (Water System Improvement Study for the City of Bishop, October 1990). Precipitation is virtually insignificant, as the springs in the area are fed by melted snow from the mountains.

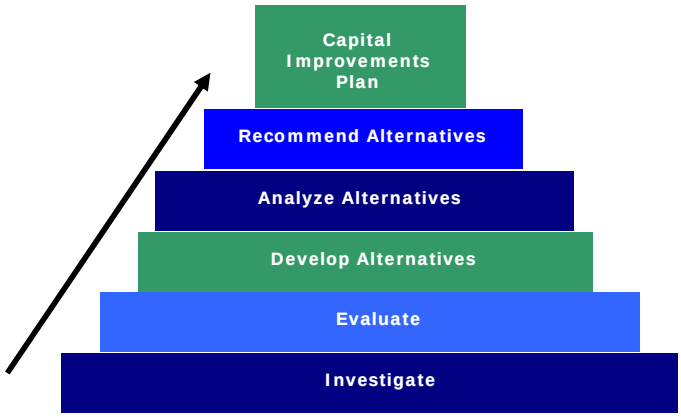
The study area for the evaluation of the City's water facilities encompasses the entire 1.8 square miles (U.S. Census 2000) of the City limits in Inyo County, CA. Areas outside the current City limits were also considered in determining the capacities of facilities servicing areas within the City limits. The

physical boundaries of the study are North Sierra Highway/Highway 395 on the north, Shepard Lane to the west, Sunland Res Road to the south, and Airport Road along Poleta Road to the east.

2.2 Methodology

The Master Plan was developed through a systematic, proven process. The investigation of the existing facilities provided the foundation upon which the Master Plan was designed. Following the investigation a comprehensive evaluation of the facilities and City's needs was performed to develop improvement alternatives for the City's infrastructure. Each improvement alternative was analyzed using a selection matrix to help determine the recommended improvement alternatives for the City. Finally, the recommended improvement alternatives were incorporated into a Capital Improvements Plan outlining and prioritizing future infrastructure projects for the City. The development of the Master Plan is characterized by the flow chart pictured in Figure 2.1.

Figure 2.1: Methodology Flow Chart



Investigation of Existing Facilities and Conditions

A comprehensive investigation of the City's facilities was completed through site visits with City staff. System Design and Performance Criteria were developed and used to compare to existing facility capacity and conditions of the water systems. These were utilized in the evaluation of facilities and development of improvement alternatives.

The investigation of facilities included Well 1, Well 2, Well 4, water disinfection system, storage tank, distribution system, and the City's Department of Public Works office and maintenance areas. Input was gained from the operators during site visits on how well these systems meet the needs of the City, what difficulties they have, and how specific modifications could facilitate system maintenance and operations. Through the site visits an inventory of the system and possible steps the City can take to improve operational efficiency, effectiveness, and reliability were identified. This information provided the foundation for determining system deficiencies and potential solutions to those deficiencies.

Documentation provided by the City, including system atlas maps, and California Department of Public Health (CDPH) documentation (permits and violations), well production rates, water operations and capital budgets, and anticipated customer growth within the City's service area was reviewed (although growth in Bishop is anticipated to be sporadic and on a small scale). The City's GIS system was used extensively for system information as well. The age of the information, such as the system atlas maps being 50 years old, was also taken into account during the investigation.

Adjacent water agencies were also investigated to identify the potential of cooperating more to address shared needs and services.

Evaluation of Existing Facilities

Following the information obtained from document review, and discussions and field visits with the City, an evaluation of how well the existing water facilities meet the existing and future needs of the City was completed. This evaluation was performed in graphical, tabular, and text forms. It included the City well sites, storage tank, and distribution system.

A computer model was created for the water collection system in H2OMap. The hydrant testing data from the City Fire Department was used to calibrate the water model. The model assisted Nolte to identify shortcomings in the pipeline systems and to identify the improvement options. The demands in the water distribution system model were based on peak hour demands, and maximum day plus fire flow demands. The model helped to determine whether the system was capable of meeting pressure and flow requirements during these scenarios. Fire flow scenarios were performed at up to five different hydrant locations. The performance of the modeled system was then compared to the System Design and Performance Criteria outlined in Section 3.0 Investigation of Existing Facilities and Conditions.

The existing facilities were compared to the current and future needs of the City on a facility-by-facility basis, to identify specific improvement areas. The capacities of individual facilities were compared to the existing, seasonal, and future needs.

The Residential Land Use Districts were evaluated to estimate the future build out water demands. Water demands were assumed based on industry standards for residential, commercial and industrial areas. For maximum build-out conditions it is anticipated that additional water sources and storage capacity is required.

The projected average water demand for full build out is 5.7 million gallons per day. Residential demands account for approximately 1.7 million gallons of that demand, commercial for 3.9 and industrial/schools for the remaining 140,000 gallons per day. The existing wells can produce up to 5.7 million gallons a day. The full build out average demand can be met by the existing wells but additional sources of water will be necessary to supply water during peak hours of summer demands.

Development of Improvement Alternatives
Improvement alternatives were developed to address the identified water deficiencies. For each alternative, the proposed improvement, how the deficiency will be rectified, the capital cost, the impact to operational expenses, facility footprint, useful life and annual reserve requirements for future replacement, and benefits and drawbacks to the improvement alternative. Multiple improvement alternatives were developed for most deficiencies.

Recommendation of Improvement Alternatives
The improvement alternatives were prioritized and recommendations of alternatives were made based on the criteria developed with the City. A draft Capital Improvements Plan (CIP) for the water system was developed and included a provision for inflation for each project, depending on the timeline for the improvement.

Capital Improvements Plan
A detailed analysis of the first four capital projects was prepared to provide more accurate capital cost opinions; identify impacts from existing facilities, rights of way, groundwater and soils conditions (excluding geotechnical investigations), and land features (rivers, wetlands, structures and pavement); map regulatory and funding agency approval procedures; and a more detailed project schedule. The first four capital projects were selected based on a prioritization matrix, discussion with city, and project complexity. The City has expressed particular interest in the following projects:

- New Well 3 Site
- SCADA System
- Emergency Interconnection with Indian Creek Community Services District
- Refurbishing of Well 2 and Well 4/Tank Valves

The Capital Improvements Plan was finalized and the impact it may have on existing user rates and capacity fees was evaluated. The Capital Improvements Plan will be the primary springboard from which the City can proceed with implementation of projects to address system deficiencies.

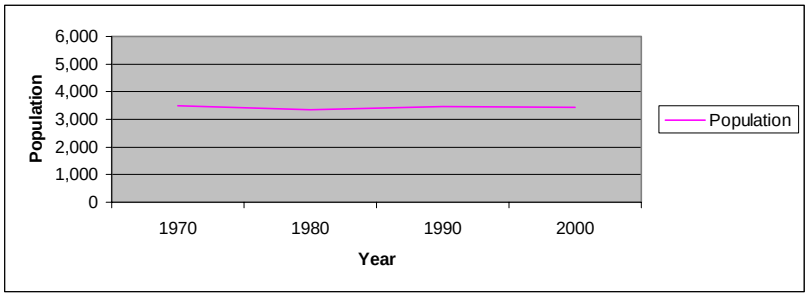
2.3 Climate, Economy, and Demographics

The City was incorporated in 1903 and has a population of 3,575 (U.S. Census 2000). As pictured in Figure 2.2, the City's population has remained steady over the last 10 years. The City is largely confined by adjacent landowners: Bishop Paiute Tribe and the Los Angeles Department of Water and Power (DWP). The Bureau of Land Management owns property around the City, sometimes described as a bathtub ring around the valley above the DWP property on the valley floor where the water is and below the Forest Service. This has contributed to the minimal population growth in recent decades.

It is difficult for the City to anticipate the size of future developments, as this is largely dependent upon the release of DWP property. The City foresees the possibility of individual small lots or larger parcels of land being developed in upcoming decades.

The City's recreation-based economy encourages large numbers of visitors and lodgers in comparison to the permanent resident population.

Figure 2.2: City of Bishop Population



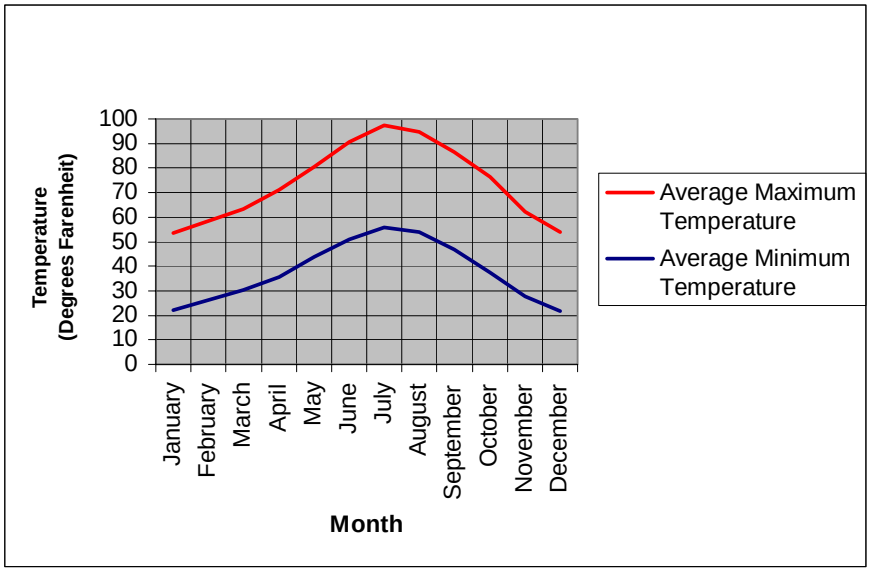
Source: State of California City/County Population and Housing Estimates (January 1, 2000)

Based on the Demographic Research Unit of the California Department of Finance, the population in Bishop has remained consistent throughout the last three decades. The population in 1970 was 3,498, and in 1980 the population was 3,333.

Climate

Bishop experiences a wide range of temperatures. The summer temperatures can reach 100°F, while the winter minimum temperatures are near 0°F. Figure 2.3 portrays the average maximum and minimum temperatures over 29 years (from 1961 to 1990).

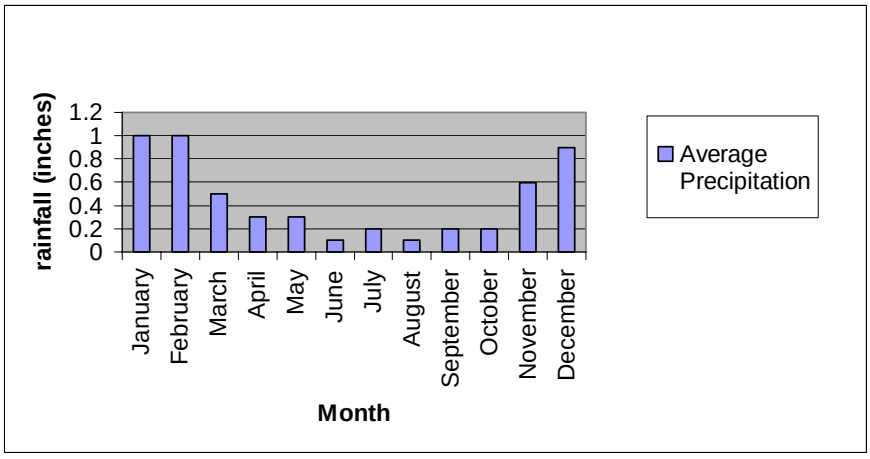
Figure 2.3: Average Temperature in Bishop



Source: World Climate (www.worldclimate.com). Data is derived from NCDC TD 9641 Clim 81 1961-1990 Normals. The average was determined based on data from 1961 through 1990.

The greatest precipitation months are November through April. January is the wettest month during which the City receives 1.0 inches out of a 5.72 inch annual average. The City experiences occasional thunderstorms from May to September. Some of the greatest influxes on monsoon moisture occur in September and early October. Bishop also receives snowfall every year; occasionally the amount can be significant.

Figure 2.4: Average Precipitation in Bishop



Source: World Climate (www.worldclimate.com). Precipitation data is derived from NCDC Cooperative Stations. The average was determined based on data from 1948 through 1995.

Economy and Demographics

The biggest segment of the economy is government (federal, state, county, and cities – DWP and Bishop) with tourism being the second biggest. Bishop is a prime attraction for fishermen, skiers, hunters, and campers. It is also a popular retirement location.

Education/health/social services, public administration, and retail trade are the next largest industries. Manufacturing and industrial enterprise are not large components of Bishop's economy.

Figure 2.5: Industries in Bishop as a Percentage of Total Economy

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Source: U.S. U.S. Census 2000

The per capita income for the city was $17,660. The median income for a household in the City was $27,338 and the median income for a family was $34,423. About 16% of the population was below the poverty line (US Census 2000).

3.0 Investigation of Existing Water Facilities

The first step in determining the necessary improvements is to inventory the existing water facilities. The City of Bishop currently provides water to all of the residents and businesses (customers) inside the city limits and to four customers outside the city limits, and will probably serve more in the future. The City owns, operates, and maintains three wells, one steel water storage tank, 21.3 miles of pipelines, fire hydrants, and a disinfection facility.

Nolte obtained information from various sources principally GIS water maps, well production records, water quality information, and regulatory violations. This information was examined and is presented in this study. Figure 3.1 was prepared to better illustrate the locations of the wells, sampling stations and the storage tanks. Figure 3.2 illustrates the layout of the existing water distribution system, pipelines and fire hydrants.

3.1 Existing Water Sources

The City owns and operates three wells. Figure 3.1 depicts the location of each of these water sources.

Well 1

The new depth of Well 1 is 380 feet deep (after a 225 feet of sealing) and is equipped with a combination drive, 1800 revolutions per minute (rpm), 125-horsepower (HP) electric motor. The design point for the well pump is 2,000 gallons per minute (gpm) at 189 total dynamic head (TDH). It is located on North Warren Street, behind the Bishop Police Department. An auxiliary diesel motor is kept on site. Well 1 currently serves as a "stand-by" well. In October of 2006, the Well 1 Rehabilitation project was completed. The project included electrical panel updates including a variable speed drive, sealing out the lower 225 feet of the well with concrete, and replacement of 110 feet of column pipe. The controls to the well are working properly including the variable speed drive and the ability to control the well based on system pressure.

The well pump discharges through a 10-inch pipe into a 100-pound per square inch (psi), 1,750 gpm rated pressure desander. After flowing through the desander, the water travels through a 12-inch line into a 100-psi rated, 9500-gallon tank. The water is discharged into the City's distribution system through a 14-inch line.

Well 2

Well 2 is the City's second source of water. Well 2 is located on the northwest corner of the intersection between Sierra and Main Streets, 300 to 500 feet from each. In 2005, it produced 87 million gallons (MG) of water. The City runs Well 2 when Well 4 is unable to keep up with higher water demands, which occurs primarily in the summer months. In 2005, the City upgraded the controls to increase the well's efficiency.

Well 2 is 493 feet deep. It is equipped with an 1800 rpm, 125-HP electric motor manufactured by U.S. Electrical Motors. The design point for the well pump is 2,000 gpm at 189 TDH. The well has connection for a portable generator. The well used to use a pressure reducing valve (PRV), however in 2005 the controls of the well were improved to remove the valve and installed a variable speed drive and related controls.

The well is equipped with an alarm system that dials programmed emergency phone numbers to report an alarm condition. Currently, the alarm is non operational.

Well 3
Well 3 is planned for construction of the two acre property the City owns for the purpose on Sunland Drive near Mandich Street. The City has plans to incorporate it into its water system.

Well 4
The City's primary source of water is Well 4. The well is located on West Line Street approximately three miles west of Main Street. In 2005, the well produced 452 MG of water. Well 4 is able to accommodate the City's water needs most of the year. During the summer months, when there is an increased demand, the City also runs Well 2.

The well is 400 feet deep. It is powered by a 100-HP, 1800-rpm electric motor. The well is equipped with an alarm system that dials programmed emergency phone numbers to report an alarm condition.

Total Well Production
Southern California Edison recently performed pump tests to determine the volume of water the City of Bishop's wells are able to produce. Based on those pump tests, Well 2 can produce 1880 gpm at a discharge pressure of 60 psi. Well 4 discharges at 1880 gpm and does not discharge into the system; it discharges directly into the tank. Although it can produce 1800 gpm, Well 1 is not currently being used because of the high fluoride levels found in the water. A summary of well production data is listed in Table 3.1.

Table 3.1: Total Well Production

Well	Well Pump Production Capacity (GPM)	Discharge Pressure (psi)	Production in 2005 (MG)
Well 1	1800	–	Stand-by
Well 2	1880	65	87
Well 4	1880	<4	452

Well 2 is the variable speed drive so it discharges what pressure the system needs to maintain 65 psi. Well 4 has a very low discharge pressure because once it reaches the surface that line simply flows by gravity to the 1 million gallon storage tank.

3.2 Water Disinfection System

Water from Well 4 is chlorinated as it exits the well, with a ClorTec™ On-Site Sodium Hypochlorite Generation System. The ClorTec™ system generates a 0.8% sodium hypochlorite solution using three common consumables: salt, water, and electricity (NaCI + H2O +2e = NaOCI +H2). Solution is injected into the discharge pipe that fills the 1 MG steel tank fill line as it exits the site. From discussions with the operators, the chlorine concentration in town is maintained at approximately 0.1 parts per million (ppm).

The City has recently learned from DPH that they are not required to chlorinate their system. They are considering stopping chlorination. The well discharges into the 1 million gallon tank on West Line Street.

FIGURE 3.1. CITY OF BISHOP EXISTING WATER FACILITIES

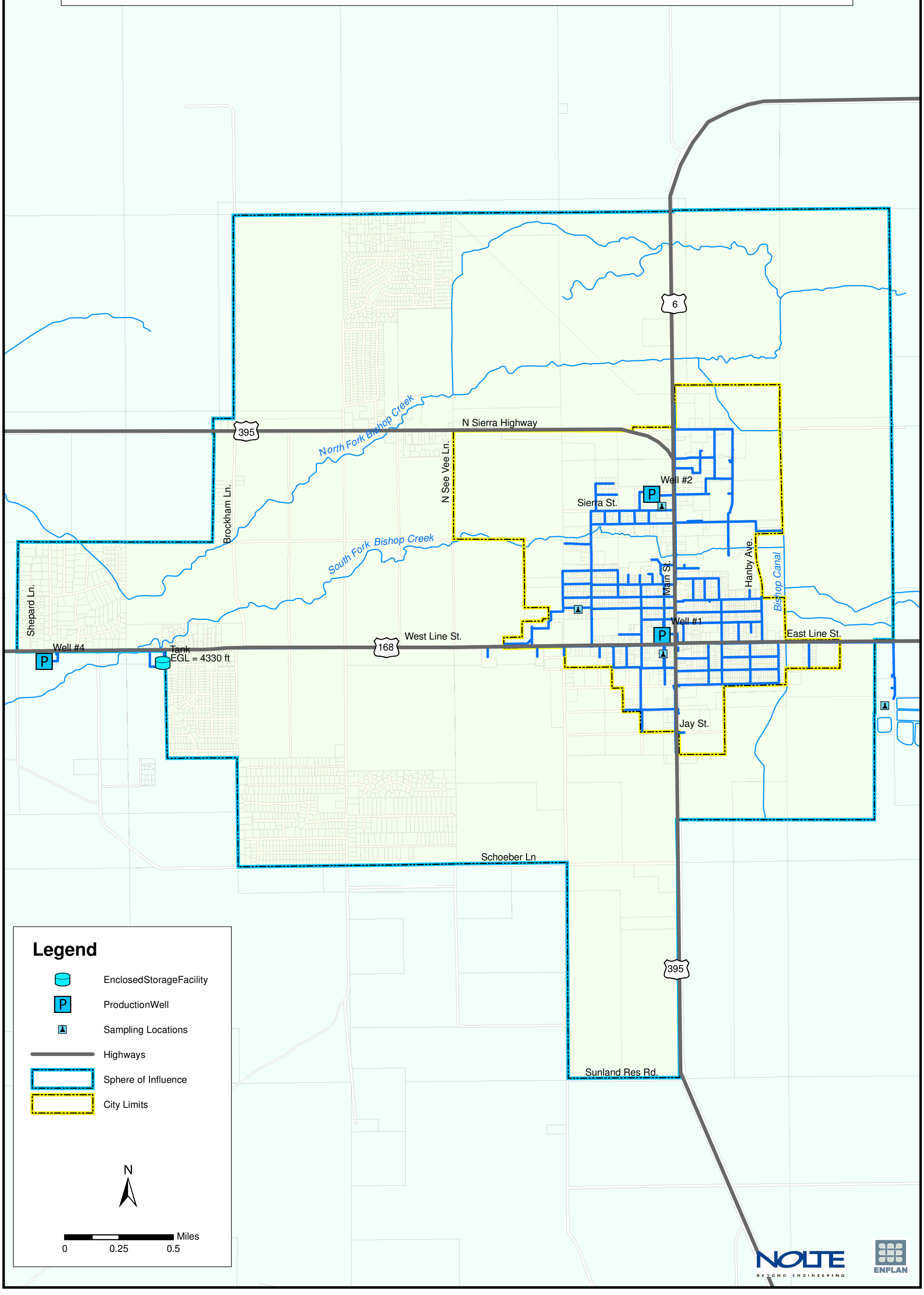


Figure 3.2: Clor-Tec onsite Sodium Hypochlorite Generation System

3.3 Existing Storage Facility

1 Million Gallon Storage Tank

The City stores all of its water in a one million gallon (MG) steel water storage tank. The steel tank was constructed in 1991 and is 23 feet high, 93 feet in diameter, maintains a water level of 18 to 22 feet, and has a footprint of 6,789 square (sq.) feet. The tank is located on West Line Street approximately two-thirds of a mile east of Well 4.

The tank was inspected and cleaned by Liquivision Technology Diving Services (LTDS) on September 27, 2005. In October of 2005, following the inspection, LTDS performed repairs to the inside of the tank. They removed rust stains and patched the exposed surfaces with epoxy. The City is mandated by the State to clean and inspect the tank every two years.

3.4 Existing Distribution System

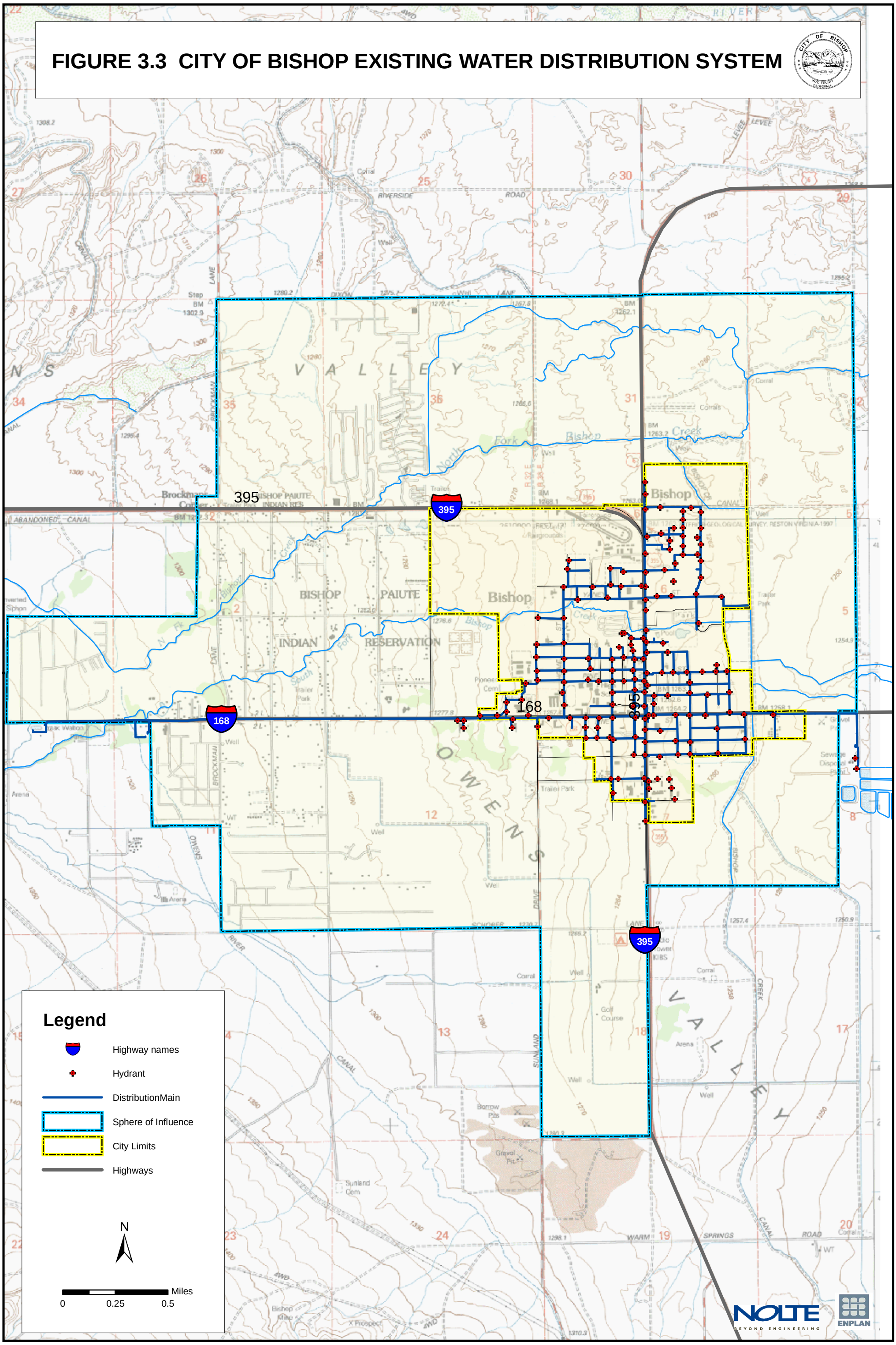
The City of Bishop has approximately 112,700 feet (21.3 miles) of water distribution pipe, which is shown on Figure 3.2. The system consists of 2-inch to 20-inch diameter pipe. The pipelines are of different sizes, material, ages, and configurations.

A 12-inch pipeline extends from Well 4 along West Line Street (Highway 168) to Home Street. There is a short stretch of 20-inch pipe coming out of the storage tank. Another 12-inch pipe extends from Well 1 south along Warren Street to Lagoon Street.

A 14-inch diameter pipe extends from Well 1 along Warren Street north to Elm Street. Another 14-inch pipe extends from Well 2 to Main Street where it connects to a 12-inch pipe that runs in the south-north direction along Main Street.

The City of Bishop water distribution system supplies water through 2-inch to 14-inch pipelines. The City of Bishop Wastewater Treatment Plant receives water via a 10-inch pipe that connects to a 6-inch x 6-inch x 10-inch reducing tee at the intersection of First Street and West Line Street

FIGURE 3.3 CITY OF BISHOP EXISTING WATER DISTRIBUTION SYSTEM



3.5 Fire Suppression System

All new hydrants are installed per the City's specifications. All hydrants have the same size port and the City has been upgrading them systematically to Mueller Super Centurion 250 hydrants. The City installed 156 hydrants throughout the City and two at the wastewater treatment facility (WWTF). The locations of the hydrants are depicted in Figure 3.2.

3.6 Sampling Locations

Currently the City samples water at four different dedicated sampling stations located throughout the City. Each dedicated sample station has an upstream (U/S) and a downstream (D/S) repeat sample location which is used in case there is a positive sample. The repeat sample sites are typically hose bibs and residences. The U/S repeat sample site for the WWTF is on East Line Street. The sample locations are shown in Figure 3.1.

Sampling Station location:

1. **151 South Warren Street (Public Works compound)**
   U/S repeat location: 206 West Line St
   D/S repeat location: 251 South Warren St

2. **800 West Pine Street**
   U/S repeat location: 786 West Elm St.
   D/S repeat location: 786 Grove St.

3. **Well 2 Compound**
   U/S repeat location: 273 Sierra St.
   D/S repeat location: 1005 North Main St.

4. **City of Bishop Wastewater Treatment Plant**
   U/S repeat location: 606 East Line St.
   D/S repeat location: Eastern Sierra Community Services District

The California Department of Public Health (CDPH) requires that sampling be performed on a monthly basis (4 samples per month).

3.7 Water Quality

The United States Environmental Protection Agency (USEPA) and the CDPH set limits on the amounts of certain contaminants in the water provided by public water systems. The CDPH requires the City to monitor for certain contaminants on a quarterly and yearly basis. Water quality parameters have consistently met regulatory requirements, and many customers believe that the City's water taste is superb.

3.8 Water Demands

Bishop's water demands vary considerably during the year. The following demands have been estimated for municipal water use: Average Day demand, Maximum Day demand, Peak Hour Demand, and Fire Flow.

Table 3.2: Water Demand Formulas

1. Average Day Demand (ADD):

$$Avg = \frac{total\ gallons \,/\, year}{365\ days}$$

2. Maximum Day Demand (MDD):

$$Max = 2.5 * Avg$$

3. Peak Hour Demand (PHD):

$$Peak = 3.5 * Avg$$

Based on these formulas and the information obtained from the City of Bishop Water Quality Report, Bishop's average daily water usage in 2004 was 1.6 million gallons per day (MGD). The Maximum Day demand was 4.0 MGD and the Peak Hour demand was 5.6 MGD.

Approximately 50% of the year's total water use occurs between the months of June through September; July being the highest usage of water (13.9% of yearly amount) and January the lowest (4.9%).

Table 3.3: Average Daily Water Use, Maximum Day Demand, and Peak Hour Demand

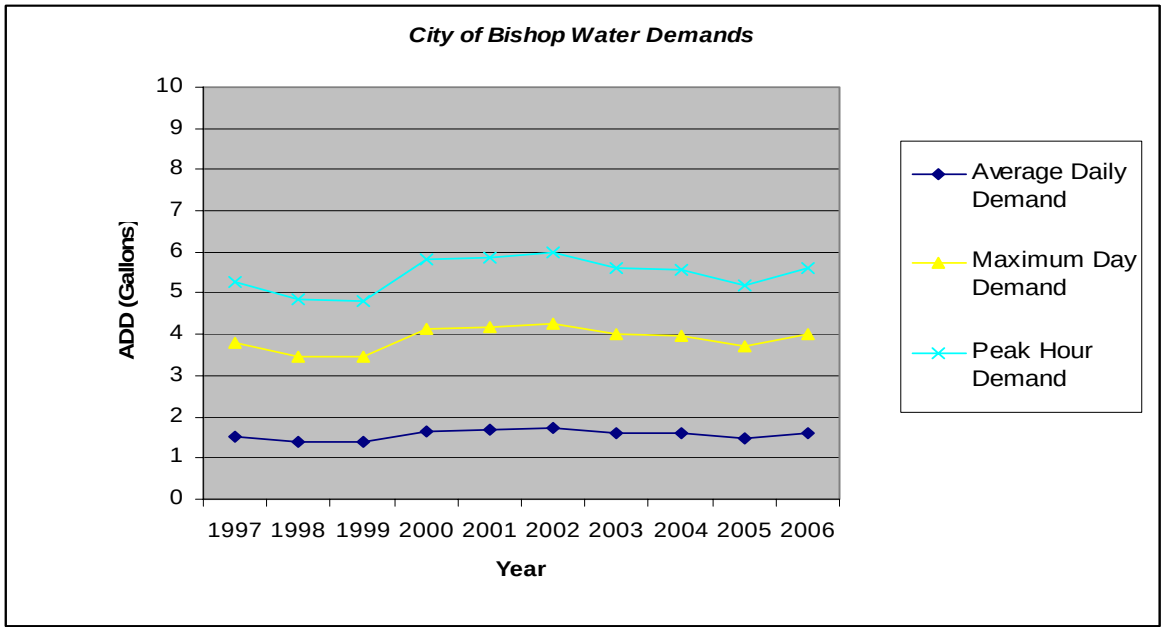
Year	ADD (mgd)	MDD (mgd)	PHD (mgd)	ADD/Capita*day (gallons)
1997	1.51	3.78	5.29	431
1998	1.39	3.48	4.87	397
1999	1.38	3.45	4.83	394
2000	1.66	4.15	5.81	474
2001	1.67	4.18	5.85	477
2002	1.71	4.28	5.99	489
2003	1.6	4.00	5.60	457
2004	1.59	3.98	5.57	454
2005	1.48	3.70	5.18	423
2006	1.6	4.00	5.60	449

3.9 Fire Flows

The design criteria for fire flows are divided into two main categories: residential areas and non-residential areas. In residential areas, pipeline sizing should be based on the maximum day demand plus a fire flow demand of 1,500 GPM at a minimum residual main pressure of 20 psi for a 2-hour minimum duration.

Based on conversation with the City's Fire Chief, Ray Seguine, the fire flow requirement for the existing buildings is obtained from the 2001 California Fire Code, Appendix III-A and Appendix III-AA. The fire flow requirements are based on the square footage of each building and the type of construction.

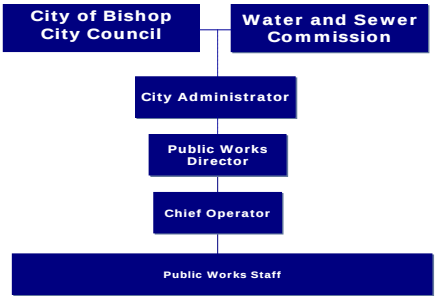
Figure 3.4: Average Daily Water Use, Maximum Day Demand, and Peak Hour Demand



3.10 Existing Facility Operation

The Publics Works' personnel operate the water facilities. Figure 3.3 displays the organization of the City's Public Works Department is organized for the purposes of water supply.

Figure 3.5: Organization Chart



3.11 Design Criteria

The City has established criteria upon which all new water facilities should be designed. The criteria were developed to assess the capabilities of the water infrastructure to meet current and future service demands. It is also used to determine the recommended facilities/infrastructure for resolving identified deficiencies.

Nolte complemented the City's design requirements with additional design requirements. The requirements are listed in Table 3.4. All of the requirements are in accordance with industry standards.

Table 3.4: Water System Design Criteria

System Element/Condition	Design Requirement
Pipe Material	Poly Vinyl Chloride (PVC) for all new pipe
Pipe Material	Class 350 ductile iron cement lined pipe
Hazen-Williams Coefficient (C)	130 for PVC
Peak Factor	3.5 and approved by the City
Minimum Pipe Diameter	8 inch

Table 3.4: Water System Design Criteria (cont.)

System Element/Condition	Design Requirement
Maximum Intermediate Valve Spacing	Are required so that no more than 600 feet of line will have to be shut off at any one time.
Isolation Valves	There should be three valves on tees and four valves on crosses
Isolation Valves	Valves should be flanged to fittings
Isolation Valves	When water mains are in easements outside traveled streets, a valve shall be located at each end of easement
Air release-valves	Shall be installed at all high points in line as directed by the City.
Blow-offs	Blow-offs shall be installed at ends of mains and low points where sediment may settle in the line
Water pipelines in streets are normally located 15 feet from and parallel to centerline.	
There should be a minimum of 10.0 feet separation from sanitary sewers (edge of pipe to edge of pipe)	
Minimum Water Storage Capacity	1 day of Maximum Day Demand flow plus fire flow
Maximum Day plus Fire Flow velocity	10 feet per second
Peak Hour Maximum Velocity	8 feet per second
Minimum pressure w/ Maximum Day plus fire flow	20 psi @ active fire hydrant
Minimum pressure w/Peak hour flow	35 psi
Minimum pipe cover	3 feet

3.12 Budget Information

The City of Bishop provided Nolte Associates with its preliminary budget for the fiscal year 2007-08. On July 1st of 2006, the water fund had a beginning balance of $746, 067, and the ending balance as of July 1st, 2007 was $935,174. Revenues from the water fund for 2006-07 totaled $1,161,432, and came primarily form the water service collection. Other sources of revenues are interest on bank deposits, water service penalties, and water permits.

The major expenditures of the water fund include: salaries and benefits, supplies and services, and capital improvements. These expenditures added up to $972,325. The City's debt service ($43,000) is approximately 5% of their annual expenditures.

The approved budget by the Council for the fiscal year 2007-08 for the water fund was $1,087,410. The proposed capital improvement, equipment, and replacement budget for fiscal year 2007-08 is $347,000.

3.13 Water Rates and Billing Structure

The City of Bishop collects fees for the water services provided to its residents. The water rates are based on the Single Family Residential User Equivalency (SFRUE), which is $32.00 per month as of July 1, 2007. Water connections are put into categories and are billed on a monthly basis in accordance with their water rate category, as listed in Table 3.5 below. The billing rate is a flat fee, regardless of the amount of water used.

Table 3.5: Water Rate Categories and Monthly Rates

Water Rate Category	SFRUE	PER
Single Family Residence	1 SFRUE	unit
Multiple Family Residence	0.80 SFRUE	unit
Church	1 SFRUE	plus 1 SFRUE each recreation hall
Hospital	1/3 SFRUE	maximum licensed patient bed capacity
Lodge and Meeting Hall	1 SFRUE	plus 1 SFRUE each bar with alcoholic beverage license
Elementary School	0.04 SFRUE	ADA
High School	0.04 SFRUE	ADA
Other School	0.32 SFRUE	ADA
Fairgrounds	7 SFRUE	
Service Station	0.40 SFRUE	island
Car Wash	3 SFRUE	rack
Beauty or Barber Shop	1 SFRUE	shop
Bar	0.08 SFRUE	unit of seating capacity
Hotel or motel	1 SFRUE	Manager's quarters plus 0.25 SFRUE per rental unit
Laundries, Commercial	3 SFRUE	washing unit
Laundromat with automatic washers	0.80 SFRUE	automatic washer
Restaurant	0.10 SFRUE	unit of seating capacity
Trailer Dump Station	2 SFRUE	
All Others	1 SFRUE	per water closet or per equivalent fixture unit

Revenues from these charges are used to pay for Operation and Maintenance (O&M) and capital expenses. Capital improvements on the water system are necessary to provide satisfactory service to the citizens of Bishop and to meet regulatory agency requirements.

The City ordinance that sets water service charges was last amended in 2004. In 2004, the joint efforts of a Citizen's Advisory Committee (CAC) appointed by the City Council, the City Engineer and a consultant produced new water service charges to fund the increasing O&M and capital improvements costs. These new monthly rates that became effective in 2004 were established based on historical income information gathered by the City. The rates that went into effect in July 2004 included four annual increases through July 2007.

The new monthly rate was divided by the Single Family Residential Unit Equivalent (SFRUE) rate (set by the City) in order to obtain the City's current number of SFRUEs. The average monthly rate per SFRUE was $30.00 effective as of July 1st, 2006. Proposition 218 activities lead to the last rate increase effective July 1, 2007. The rate was increased to $32.00 per SFRUE. Beyond the last rate

increase in July of 2007, rates will need to increase to offset inflation for the following years. An additional review of rates is planned after the July 2007 increase.

Based on the new rates and the formula below, the City of Bishop's approximate annual operating revenue is estimated to be $1.2 million (M). The City offers discounts to low income seniors, collects penalties in others and receives revenue from investments of water funds on hand. The City's 2004 Rate Study projected operating and maintenance expenses to remain constant from 2006 through 2025 ($1.2M). It will be important to adjust the rates on a yearly basis to account for inflation.

Approx. Annual Operating Revenue = Monthly Service Rate x Number of Equivalent Units x 12

4.0 Evaluation of Existing Water Facilities

The evaluation section of the Water Master Plan phase intends to identify the deficiencies in the existing water system regarding water sources and water quality, distribution facilities, fire suppression system, potable storage facilities, operations and regulatory requirements.

For purposes of the evaluation, Nolte divided the water system into the main components and assigned each component a letter code. Every deficiency that was identified in the evaluation phase was numbered following the letter code. A solution or comment for every item listed in this chapter is cross referenced in the following chapter (Chapter 5, Development of Alternatives).

Table 4.1: Water Distribution System Components

Component	Letter Code
Water Supply and Quality	WSQ
Water Distribution	WD
Fire Suppression System	FR
Water Storage	WT
General	G
Water Regulatory Requirements	RR

4.1 Water Sources and Water Quality

WSQ-1: The City of Bishop currently draws water from Well 4 and Well 2 to supply to its customers. Chlorination takes place at Well 4 and only when Well 4 is operating. There is no chlorination capacity at Well 2 or at the tank site. If Well 4 is not operating, chlorination does not occur.

The City is considering ceasing chlorination of the potable water system following notification from DPH that chlorination is no longer required.

WSQ-2: Water quality (Cl_2) is not automatically monitored at any location throughout the system or at the tank. Sampling is performed manually at four different stations, on a quarterly and monthly basis.

By automatically monitoring chlorine in the system, operators can be notified more rapidly if chlorine levels drop in different parts of the City and address the situation much faster.

Should the City cease chlorination, the installation of such facilities will no longer be required.

WSQ-3: Fluoride levels at Well 1 exceed its respective MCL. The Arsenic concentration in Well 1 is considerable higher than in the other wells. For this reason Well 1 has historically been operated as a stand-by well by California Department of Public Health (CDPH). The bottom 220 feet of the well was recently capped with

concrete to plug zones suspected of supplying water containing significant Fluoride and Arsenic. The capping was not successful at bringing the well's water quality into compliance. This condition leaves the City's productive wells to Well 2 and Well 4. If either one of the producing wells fails (2 or 4), the remaining well will not be able to supply the required maximum day demand by itself. Well 1 cannot be used for more than 5 consecutive days and/or more than 15 days in a year per CDPH.

WSQ-4: Southern California Edison (SCE), the electric utility, performed Hydraulic test results on Well 4 in March of 2000, April of 2003, June of 2004, and November of 2006. The results of these tests show that the well system has been operating inefficiently for the last six years (< 60%). This inefficiency is most likely caused by pump wear, the failure of the pump design to meet existing conditions or a combination of both.

Table 4.2: SCE Hydraulic Test Results

Parameter	2000	2003	2004	2006
Discharge Pressure (psi)	2	2	2.2	3.7
Standing Water Level, (ft)	75	86.6	100.4	87.9
Discharge Head, (ft)	4.6	4.6	5.1	8.5
Pumping Water Level, (ft)	112.1	117.9	127.6	119.1
Total Head, (ft)	116.7	122.5	132.7	127.6
Capacity, (gpm)	1762	1838	1662	1670
kW Input to Motor	70.8	69.3	69.7	68
HP Input to Motor	94.9	92.9	93.5	91.2
Motor Load (%)	89.3	87.4	88	85.8
Measured Speed of Pump, (rpm)	1787	1785	NA	1784
Overall Eff. (%)	54.7	61.2	59.6	59

The following analysis is an estimate based on the conditions present during the SCE pump test performed in November 7, 2006, billing history of the last 12 months, and the current rate schedule of PA-1 (Agricultural and Pumping Rate with a flat energy charge, based on connected load).

Table 4.3: SCE Estimated Annual Savings

Plant Efficiency			
	Existing	**Improved**	**Annual Savings**
Total kWh	333,324	273,192	60,132
kW Input	68	55.7	12.3
kWh per Acre Ft	221	181	40
Acre Ft. per Year	1507		
Avg. Cost per kWh	$0.15		
Avg. Cost per Acre Ft.	$33.36	$27.34	$6.02
Overall Plant Eff. (%)	59	72	
Total Annual Cost	**$50,285.26**	**$41,213.78**	**$9,071.48**

4.2 Water Distribution System

WD-1: Not used.

WD-2: A hydraulic test was performed on Well 2 on November of 2006. The results of this test were inconclusive due to the inability to perform the test in the appropriate location. The test location did not meet industry standards (8-10 diameters of uninterrupted pipe lengths for the ideal test location per SCE).

WD-3: The existing 12 inch transmission main that runs east from the 1 MG storage tank along Highway 168 into the City is undersized. Friction losses through this line are high and significantly reduce system pressure prior to reaching distribution branches in the network during high demand periods. This pressure drop is exacerbated by the small diameter pipes and insufficient number of pipelines within in the City. This deficiency is further described in WD-5 and WD-6.

Pressure drops can be diminished by feeding the water system from existing and/or proposed wells. Alternatives to address distribution system limitations are described in Section 5.

Table 4.4 shows the results of the fire hydrant tests performed in October of 2003 by the City of Bishop Fire Department:

Table 4.4: Fire Hydrant Test Results (2003)

Hydrant ID	Location	Static Pressure (psi)	GPM 20 psi
I FAC 2	1180 N Main/HW 395 Southeast of Smart and Final	55	862
I SPR 15	Spruce Street east of Mac Iver Street	65	1056
I SPR 16	Spruce Street/South East of Caltrans Yard	65	957
I SPR 17	Spruce Street and Wye Road	65	957
I WYE 4	Wye Road north of K-mart	60	1007

*Required fire flow for sprinklered buildings is 1,500 gpm

The model demonstrated that significant pressure drop occur during high demands between the tank and the City.

WD-4: The fill line to the 1 MG storage tank from Well 4 empties when Well 4 is not running and operates at low and possibly negative pressures when the pump is running. These conditions leave the system more susceptible to groundwater contamination.

WD-5: There are several dead end pipelines within the water system which cause water to stagnate at different locations. Looping of these pipelines would eliminate stagnant water and improve conveyance capacity. The multiple pipe sizes include 2-inch, 4-inch, and 6-inch diameters which reduce fire suppression capacity, require storage of additional material and sizes in the event of pipe failure, and contains materials that area more susceptible to corrosion and leaks.

WD-6: Pressure drops within the system are considerable between the location of the tank (Highway 168) and Well 2. Localized drops cannot be detected. The main reasons for these pressure drops to occur can be attributed to the differences in elevation between the tank and Well 2, long runs of small diameter pipes (2, 4 and 6 inches), and the long run of the 12 inch pipe between the tank and the town.

Many existing water mains in the City of Bishop are too small to provide adequate fire flows. Many water mains are in poor condition, are old, and of out-of-date materials. Many of these lines require frequent repair and could cause water quality concerns. It can be difficult to stock the variety of materials necessary to repair older and small diameter parts of the system.

In and of itself, multiple pipe sizes and materials do not constitute a need for replacement. Uniformity of sizes and materials should be a goal that is achieved through pipe replacement brought on by hydraulic, structural, or water quality deficiencies.

WD-7: System valves need to be replaced on a regular program. This will help ensure that valves will be operational when required. Given the amount of 2-inch, 4-inch, and 6-inch lines to be replaced, the valve replacement program can concentrate in these areas for the next several years.

WD-8: Not used.

WD-9: Distances between sewer laterals and water services are often small and could allow contamination.

4.3 Fire Suppression System

FR-1: Pressures and flows at Vons and K-mart do not meet fire suppression requirements during simulated fire demands. Required fire flows are derived from the *California Fire Code*, based on the square footage of the building/structure in which the fire event is taking place. The Bishop Fire Department tested the fire hydrants at Vons and K-mart in October of 2003. The minimum fire flow requirement is 1,500 gpm if the structure is sprinklered. However, the shopping center area where the K-mart and Vons are located can only achieve low flows below 1,000 gpm at 20 psi..

Based on conversations with the City of Bishop Fire Chief, Ray Seguine, some hydrants are connected to small branches which cannot convey the required flows to combat a fire. As a result, pressures drop below required minimum levels, even at flows less than the minimum requirements. A specific concern of the Fire is Willow Street east of Whitney Alley. There are 1,910 LF of 4-in pipe along Willow Street and there are two fire hydrants connected to this line. This creates a localized and significant pressure drop when these hydrants are activated. This situation also happens at other locations within the City.

FR-2: Existing fire hydrants are of multiple types. They should be of one standard configuration to standardize hose fittings, facilitate hook up, increase system uniformity, and reduce reserve inventory requirements. The City is replacing non-uniform hydrants on a planned basis and when they break.

4.4 Water Storage Facilities

WT-1: An inspection of the tank was performed in September of 2005 by Liquivison Technology Diving Services. It was determined that the components of the tank were in good condition. Problems were mostly cosmetic and repairs were optional.

Rust and corrosion was evident in random and isolated locations on the interior floor and on the interior inlet and outlet pipe.
Some paint peeling was evident adjacent to the wall to ceiling weld seam near the upper interior ladder and entry hatch.

WT-2: Currently the City of Bishop owns and operates only one storage tank. This tank set the static pressure for the entire City (one pressure zone). There is no back up or secondary storage facility.

A secondary storage tank can help mitigate unforeseen events that might sever the 12-inch pipe between the tank and the City (earthquake, accident along Highway 168, etc).

If new connections were to be established to the water system (population growth, new businesses, etc), the additional number of connections will require that the City install a second storage facility. The City currently has 1,170 connections. If the Indian Creek service area is added, 211 new connections will be incorporated, bringing the total to 1,381. The existing tank has just enough capacity to supply water for the existing and future Indian Creek CSD users. Adding the new customers to the system will increase the maximum day demand. A secondary storage tank will be required.

The volume deficiency could be significantly lowered if usage were brought down to a more typical level for a community of this make up.

Based on current production records, the maximum day demand for the City of Bishop is (MDD) is 4 million gallons. The required water storage can be estimated using San Diego Water Agencies' Standards, or CDPH' procedures for determining needed storage volume. Table 4.5 shows the recommended storage volume for each methodology.

Table 4.5: Recommended Storage Volume

San Diego Water Agencies' Standards

Existing Storage (gallons)	Operational Storage (gallons)	Fire Storage (gallons)	Emergency Storage (gallons)	Deficit (gallons)
	0.3xMDD	4000 gpm x 2 hours	0.2xMDD	(OS+FS+ES)-ExS
1,000,000	1,200,000	480,000	800,000	1,480,000

California Department of Public Health

Existing Storage (gallons)	Needed Storage (gallons)	Deficit (gallons)
	1170 Connections	(NS-ExS)
1,000,000	1,850,000	850,000

WT-3: The City operates the water distribution system utilizing legacy telemetry hardware. The storage tank and Well 4 use dedicated lease lines for communications. All other facilities are stand alone systems. There are no provisions for the automatic gathering and reporting of system data or operator access to operate the entire system from one location.

A communications system between water system facilities (tanks, wells, flow meters, sensors, etc.) needs to be installed to in order to track the behavior of the system and the operating conditions (i.e. water level at tank, pumping demands, etc.) and to allow operators to remotely control the system. This improvement will increase the systems reliability, reduce labor costs and reduce response time to system alarms.

4.5 General Water System Evaluation

G-1: **Billing System:** The City does not have an automated payment system to bill its water customers. Bills are sent by mail and payment is received in the mail. This process is inefficient and time consuming: cashing checks, sending out bills, postage, etc. Several automated paying options are described below. Some of the financial benefits of automating payments are: obtain deposits faster, improve cash flow, accrue interest sooner and reduce labor costs.

G-2: **Public Works Yard:** This property could be better utilized by another City facility or by a private entity. This could increase the City's revenue by selling the property, increased sales tax and increased property tax. The Department of Public Works yard is located in downtown Bishop next to City Hall. It is utilized for the storage of pipes, valves, backhoes & other equipment, and used to accommodate employee parking, offices, and the maintenance shop.

G-3: **Energy Efficiency:** Currently, well pumps and motors do not operate under an energy savings schedule; hence energy costs for well operations are not optimized. Operations costs could be reduced if operations were modified. SCE performs periodical rate schedule analyses based on the billing of the last 12 months.

G-4: **Emergency Interconnections:** There is a potential for impact to service if the power goes out or there is a major water system shut down. The City has the 1 MG storage tank but no emergency interconnections have been established with nearby agencies. An emergency interconnection should be established to ensure a more reliable system.

The Indian Creek Community Services District water system has 770 customers (people) and 210 service connections. The Indian Creek CSD has the excess capacity that the City of Bishop could perhaps benefit from.

The Bishop Paiute Tribe has shown interest in establishing and emergency interconnection with the City of Bishop.

G-5: **Water Conservations and Time of Use Plan:** Based on the Consumer Confidence Report of 2005 and the City of Bishop's water consumption records, the average per capita water demand has exceeded 400 gallons per capita per day for the last seven years. These amounts are almost doubled during hot summer months.

Keeping in mind that the City receives many tourists all year round, especially during summer, this number does not represent the real per capita water demand of Bishop's residents. Nevertheless, this average is considerably high for a population of less than 4,000.

Reducing water consumption and decreasing peak consumption will improve system performances and reduce operating costs.

Estimating the amount of water that is consumed by restaurants and lodging establishments is complex due to the fact that no meters are utilized to record water consumption. An approximation can be obtained by calculating the number of Single Family Residential Unit Equivalents (SFRUE) that these establishments make up for. Based on the water and sewer accounts provided by the City, lodging and food establishments are the equivalent of 15% of the average daily demand in the City. This corresponds to 240,000 gallons per day.

G-6: The current City of Bishop *Water and Sewer Standard Specifications* were prepared in 1991 and have not been revised or amended since then to include up to date construction and materials provisions.

4.6 Regulatory Requirements

Nolte contacted Eric Zuñiga from CDPH and discussed foreseeable regulations that the City of Bishop should consider when implementing improvements to the existing water distribution system. Also, Nolte obtained recent tests results from the COB's wells from SCE. This information facilitated the assessment and adequacy of COB existing drinking water supply.

RR-1: **Required Storage Capacity:** Based on SCE's Hydraulic Test Results performed in November of 2007 on Bishop's water system, it was determined that two of their operating wells were *active* (Well 2 and Well 4). The combined capacity of these two wells is 4.45 MGD (3,092 gpm). Based on the number of service connections (1170) for a flat rate water system, the required storage capacity is 1,850,000 gallons (per Title 22 California Code of Regulations).

RR-2: The status of Well 1 was set as *stand-by*; due to the concentrations of Fluoride this well is inactive. It is only used for emergency/fire suppression purposes by the City of Bishop. It cannot be used for more than 5 consecutive days and/or more than 15 days in a year per CDPH. The production capacity of Well 1 is not included in the calculation of the total capacity of the wells. There are no backup sources of water; if either Well 4 or Well 2 goes down, the maximum day demand cannot be met by only one of the active wells.

RR-3: **Federal Stage 2 Disinfectants and Disinfection Byproducts Rule (D/DBPR):** The federal disinfection/disinfection by-products rule became effective June 17, 2006 for groundwater systems and all systems serving fewer than 10,000 people. The Stage 2 DBP rule builds upon earlier rules that addressed disinfection byproducts to improve drinking water quality and provide additional public health protection from disinfection byproducts. This rule strengthens public health protection for customers by tightening compliance monitoring requirements for two groups of DBPs, trihalomethanes (TTHM) and five halo acetic acids (HAA5). These halogenated compounds form when chlorine is used in drinking waters for disinfection and chlorine oxidizes organic material. According to the EPA, these are

believed to be carcinogenic compounds. The rule targets systems water systems that add and /or deliver water that is treated with a primary or residual disinfectant other than UV light.

Because of the low concentration of organic material in the City's water, the potential for Disinfection by Products formation is consistently low. Therefore, the City should comply with the testing requirements of the Federal Stage 2 DBP Rule.

5.0 Development of Alternatives

Alternatives were developed to address the deficiencies that were identified in the evaluation phase of the water distribution system (Chapter 4.0). The solution alternatives described at the end of this chapter compile and group the deficiencies outlined in the previous section and offer costs for addressing these. Cost estimates were prepared for the proposed improvements to the existing water infrastructure and are presented in Appendix A. Each solution alternative applies to one or more of the main objectives that Nolte considers encompass the fundamental concerns of the evaluation phase.

The proposed alternatives to address individual and combined deficiencies were based on the following main objectives of this master plan:

1. Provide Adequate Fire Protection
2. Reduce Operation Costs
3. Comply with Regulatory Requirements
4. Improve System Reliability and Redundancy
5. Increase Utilization of Capacity/Increase Revenue
6. Improve Customer Service
7. Improve Water Quality
8. Improve System Operations

At the end of each set of alternatives, the main objectives addressed are listed. For example, a listing of (1, 6), means that the alternatives listed address "Improve System Reliability and Redundancy" and "Improve Water Quality", as referenced above.

The preparation of the cost opinions for the different water system improvements (estimates presented in appendix A) assumed prevailing wages applied. Utility improvement projects funded with state or federal moneys require that prevailing wages be required. Capital costs are presented in $2007.

5.1 Water Sources and Water Quality

WSQ-1: A second chlorination mechanism should be installed at a different location to complement the chlorination capacity of the system located at Well 4, since this is the only place in the entire system where water receives treatment. There is no redundant chlorination mechanism at Well 4. If existing chlorination system needs to be maintained or serviced, a secondary system should be available on-site, especially since it is the primary water source.

A. Eventually, a mandate will call for some sort of disinfection system to be in place at every well. A new disinfection system should be installed at Well 2 since currently water at this well is not treated before entering the distribution system;
B. An alternate location for a back-up chlorination system is northwest outside City limits, north of Highway 395, where a second storage tank could be built.
C. New chlorination system east of K-mart and Vons, behind Caltrans yard, where a second storage tank could be built.
D. New **c**hlorination system at 2 acre parcel owned by City, where a second storage tank could be built. (4, 6)

There is a risk inherent to the customers in the vicinity of Well 2 regarding chlorination. If Well 4 were to be shut down and Well 2 had to be turned on, customers in the immediate vicinity of Well 2 would receive un-chlorinated water. This risk is offset by the fact that the demand for chlorine in the system is very low. It is not an ideal situation that there is no way to provide contact time for the water pumped from Well 2, but it is recommended. This operating scenario will be temporary and will only take place during the shut down of Well 4. The City recently received notification from the State stating that chlorination is no longer required. Should the City cease to chlorinate its system there is no need to install a secondary chlorination system.

WSQ-2: Water quality (Cl_2 residuals) should be monitored continuously. Chlorine sensors should be installed at the existing sampling locations with connections to SCADA for automatic monitoring and remote access. Based on the City's population (3,500) and the number of connections (1,170), it is required that the City have 4 sampling locations where to collect samples for chlorine residuals. The City recently received notification from the State stating that chlorination is no longer required. Should the City cease to chlorinate its system there is no need to install a chlorine monitoring system. (3, 7, 8)

WSQ-3: Since Well 1 cannot be used as a source of drinking water due to its high levels Fluoride, new well locations should be explored. Well 1also has high levels of Arsenic, although it does not exceed the MCL for Arsenic. Possible well locations are:

- **A.** Outside City limits, west and north of the Paiute Indian Reservation, north of Highway 395;
- **B.** Northeast portion of City next to the Caltrans yard;
- **C.** Two acre parcel owned by City on Sunland Drive north of Mandich Street. (4)
- **D.** Annexation of Indian Creek CSD water system.

WSQ-4: The pump should be replaced at Well 4 due to the wear and age of the equipment, and system inefficiency. A cost estimate for the new equipment is presented in Appendix A. Incentives are available to help offset the capital cost of energy efficient installations. SCE offers rebates to reduce energy consumption. If existing equipment is replaced with qualifying energy efficient pumps (premium efficiency) SCE reimburses non-residential customers a discount on monthly energy costs. The City of Bishop believes that the pump contributes significantly to the lack of efficiency at Well 4. Replacement of the pump should be included in the solution alternatives to this deficiency.

The motor at Well 4 is a premium efficiency motor which was installed 8 years ago. The inspection of the motor should be coordnated with the inspection of Well 4. This project has been combined with WD-10.

- **A.** SCE will reimburse the City ff the existing standard efficient equipment is replaced with the proposed pump.
- **B.** If non-qualifying equipment is installed, money will be reimbursed by SCE based on the energy savings of installing the new equipment. (2, 8)

5.2 Water Distribution System

WD-1: Not used

WD-2: Since Well 2 cannot be tested by industry standards, it could be tested at whatever can be drawn out of two adjacent hydrants fully open. A test with the well and two hydrants isolated from the system would provide valuable information.

As the main source of water for the City, Well 4 is run continuously throughout the year. At 1900 gpm, the pump can operate at an efficiency level near its design point (85.5%). The last hydraulic test performed on Well 4 by SCE, revealed that the Well 4 efficiency is only 59% at 1670 gpm, when it should be near 82% for this flow. This means that the efficiency curve of the pump has shifted and is operating inefficiently. SCE suggested on their report that the inefficiency can be caused by pump wear.

Based on the pump curves provided by the City of Bishop, the best operating point for the pump at Well 2 is between 1900 and 200 gpm at a total dynamic head of 189 feet. Well 2 does not operate near its highest efficiency (85%). Since it is a variable frequency drive (VFD), it operates at a flow much less than 1900 gpm lowering its efficiency to less than 75%. Unless this pump is operated for higher flows and lower durations, an acceptable efficiency level will not be obtained.

To increase the efficiency in Well 2, the production rate at Well 2 needs to increase. This would require the production at Well 4 to diminish. This could be accomplished by installing a pump at Well 4 that operates at a high efficiency at a lower flow rate. To realize real operational cost savings, these pumps should operate for longer periods of time at a more efficient flow rate.

WD-3: Replacing the existing 12 inch transmission line that runs along Highway 168 to a 16 inch can increase fire protection capabilities to the northern portion of the City (K-mart, Vons). Pressures are low in the vicinity of this commercial area due to line restrictions or closed valves in the system. Increasing the pipe size to a 16-in can help reduce the average velocity of the flow and decrease friction losses.

Low pressures are observed when Well 2 is not in operation. The installation and operation of the future Well 3 shall mitigate these pressure drops around the Vons and K-mart area.

Since the existing 12-in transmission line was laid in Caltrans right-of-way, an encroachment permit and coordination efforts are foreseen. See Appendix C for Rating Curve. (1, 4, 8)

WD-4: A new valve configuration can be constructed at the tank site to alleviate this problem. The new valve configuration consists of a new altitude valve to regulate the reservoir level. When water in the tank reaches a high level, the altitude valve (hydraulically operated) will close. A signal will be emitted from the valve that will shut off the pump at Well 4. When the tank level drops to the low level, the altitude valve will open and a second signal will be emitted to reinitiate the pump at Well 4. The well will be controlled indirectly by the level of the tank through the altitude valve. Isolation valves and a bypass line should be installed in order to perform maintenance on the valve when required. (7)

WD-5: City of Bishop Domestic Water and Sewer Specifications indicate that the minimum pipe size shall be 8 inches in diameter based on maximum day demand plus fire flow (minimum flow rate shall be 2,000 gpm).

The City of Bishop should continue its pipeline replacement program to eliminate stagnation, improve water quality, improve fire suppression capacity, provide uniformity in distribution materials and sizes, and remove corrosion susceptible materials. In many places and for the next five years, these improvements can be done concurrently with the street improvements projetc.

Based on the water distribution layout and GIS database provided by ENPLAN, there are approximately 42,700 linear feet of pipe 6 inches in diameter or smaller.

Table 5.1: Small Diameter Pipe Lengths

Size	2-in	4-in	6-in
Length	2,275	22,600	17,832

City of Bishop prefers PVC pipe and has been replacing old ductile iron, cast iron and steel lines with PVC pipe. PVC pipe reduces the need of replacement parts, reduces the head losses due to friction, and is corrosion resistant.

The replacement of the small diameter pipe (less than 8 inches) should be prioritized based on the smallest diameter size and linear feet of pipe in the ground. The approximate length of transmission lines size 2-in is 2,300 linear feet. The advantages of replacing these lines first include the fact that there is a significant improvement on the hydraulic behavior of the system and that it is the shortest length of small diameter pipe to replace. The outcome of replacing these lines first, in conjunction with closing dead ends (looping circuits), were evaluated in the *H_2OMap* water model.

A. Replace all lines smaller than 8 inch. (1, 4, 8)

WD-6: **A.** Additional pressure sensing locations should be installed in critical locations throughout the distribution system to detect localized pressure drops and trigger Well 2 to turn on;
B. A secondary source to feed the town can help attenuate pressure drops between the storage tank and Well 2. A second 12-in pipeline will be extended from the existing tank into the City along Highway 168/West Line Street;
C. Pressure fluctuation will attenuate when the small diameter pipes, ranging in size from 2 to 6 inch, are replaced with 8 inch diameter pipe and dead ends are looped. (4, 8)

WD-7: Capitalize budget for ongoing annual valve replacement program assuming that valves have a service life of approximately 30 years. The valve replacement program should be prioritized based on the coordination with the pipe replacement program, the year of installation and condition of the valve.

Recent valve replacements have been completed on ductile iron lines 8 inches in diameter or larger (new valves are less than 15 years old). The City performs an annual valve inspection exercise and valves are replaced as deemed necessary. This program should be coordinated with alternative with WD-5.

New valves need to be installed in small pipelines that are replaced with 8 inch diameter pipes. (4)

WD-8: Not used.

WD-9: The City of Bishop installs water and sewer lines and laterals according to DPH and RWQCB and standards of separation of water and sewer mains for all new replacements. The existing configuration has not lead to any water quality issues to be reported. The relocation of some of the water lines is concurrent with a portion of the street improvements project. This is an opportune time to address the relocation of some of the utilities. (3, 6, 7)

WD-10: The City of Bishop wants to conduct well examinations to assess the condition of their two existing production wells and review the design of both pumps to ensure they are appropriate for their planned operations. Also, the existing 12-inch fill line from Well 4 to the reservoir empties during times of low demands, exposing the fill line to infiltration problems. There is no evidence that infiltration has occurred. Nolte recommends that a new valve configuration be constructed at the tank site to alleviate this problem.

The new valve configuration consists of a new altitude valve to regulate the reservoir level. When water in the tank reaches a high level, the altitude valve (hydraulically operated) will close. A signal will be emitted from the valve that will shot off the pump at Well 4. When the tank level drops to the low level, the altitude valve will open and a second signal will be emitted to reinitiate the pump at Well 4. The well will be controlled indirectly by the level of the tank through the altitude valve (non-throttling valve). Isolation valves and a bypass line should be installed in order to perform maintenance on the valve when required.

WD-12: The City is interested in moving from a flat rate system to a metered system of water charges. Under the current flat rate system, customers can consume unlimited water for a flat monthly fee. The use of a metered system could foster better water conservation in the City. A rate structure for a metered system could be tiered based on water usage.

5.3 Fire Suppression System

FR-1: The two fire hydrants on Willow Street need to be replaced because they do not have steamer ports. The cost estimate of replacing the 4-in line water line in Willow Road is presented in Appendix A. The Cory hydrant is slated for replacement when the water line is replaced. (1)

FR-2: Replace hydrants per modified City of Bishop Standard Specifications. The City should continue its hydrant replacement plan; there are currently 171 hydrants installed throughout the City. Five of these hydrants are privately owned and are located in the Fairgrounds. Caltrans has three privately owned hydrants.

The City has been replacing the old hydrants with Mueller hydrants. The City started the hydrant replacement program 10 years ago replacing three hydrants per year. There are 39 remaining hydrants (manufactured by Pacific States, Greenberg and Cory). A capitalization budget should be created in order to replace 3 hydrants annually and the 39 remaining non-Mueller hydrants. Some privately owned

hydrants such as those owned by Caltrans are not included in this hydrant replacement program.

The City currently and has been for some years been replacing at least three hydrants a year. (1)

5.4 Water Storage Facilities

WT-1: Repairs were performed to coating failure on internal fixtures, floors and wall at the storage tank. Repairs below the water line were accomplished using divers, the proper tools and especially formulated two-part epoxy.

Liquivison Technologies recommended performing a regular cleaning, inspection and repair cycle every 2-3 years in order to ensure superior water quality and performing the proper maintenance of coating conditions and appurtenances. The next scheduled tank cleaning is planned for the Fall of 2007. The City is mandated by the State to clean and inspect the tank every two years.

The cost to clean and inspect the tank is approximately $4,500, including minor repairs. (4)

WT-2: A second storage tank can be installed at four potential locations:

A. Northwest of town with a new transmission line connecting pipe;
B. Install a second tank east of the Caltrans yard;
C. Install a second tank at the 2 acre parcel in the southern portion of City.
D. Install a second tank at Well 4. (4)

WT-3: The City of retained the services of ScadaTech to asses the current conditions of the water system data gathering and communications system. Based on ScadaTech's assessment of the City's communication system, the following was recommended:

The City should install a SCADA system that will fully integrate all water facilities with Programmable Logic Controllers (PLC).

1. Well 2: Integrate and monitor well status, alarms, and distribution pressure. The automatic tracking and reporting of well flow, daily production and run hours.
2. Well 4: Integrate and monitor well status and alarms, Sodium Hypochlorite (NaOCl) levels and alarms. The automatic tracking and reporting of chemical use and well flow, daily production and run hours.
3. Reservoir: Integrate and monitor reservoir level. Provide new Smart type pressure transmitter to measure level using tank head pressure.

Implement radio connection by utilizing the tower that the City uses for emergency services/dispatches. Costs for portions of this project maybe shared with the wastewater system. (8)

5.5 General Water System Evaluation

G-1: A Pay Pal type system can be developed so that customers can pay their water bill electronically on-line through a stand alone gateway service. An automated

clearinghouse service can also be implemented so that payments can be automatically deducted from user's bank accounts.

Three alternatives are presented to implement an online or automatic payment system. These solutions are duplicated in the City of Bishop Sewer Master Plan.

A. Paypal: The Payflow Pro payment gateway service is a stand alone system that connects an online store to any major payment processor, bank, and card association. A payment gateway is a secure connection from your online store to an internet merchant account and a payment processing network.

The steps to follow are described below:

a. Water/sewer customer inputs credit/debit card information on City of Bishop's (COB) Online Store (COB's website).
b. The Payment Gateway encrypts data and securely sends it to COB's Internet Merchant Account.
c. The transaction is reviewed for authorization.
d. The result is encrypted and sent back through the payment gateway.
e. COB receives the results and decides whether or not to fulfill the order.

COB currently has 1,150 connections (accounts) for water and sewer. The Payflow Pro includes 1,000 monthly transactions. $0.10 will be charged for each additional transaction. The monthly cost for processing payments will be $75.00.

The set-up price is a one time fee. The Recurring Billing service offers COB customers a way to save time by automatically debiting their credit or bank accounts. The cost of setting up recurring billing is a one time fee of $39.99 and a monthly fee of $29.99. With the Recurring Billing service, the monthly fee for supporting this system will be $104.99.

Implementing the Paypal's Payflow Pro plus the recurring billing service reduces the hassles that come with manually processing recurring sales and can help COB better forecast revenue streams.

B. An alternate option for processing online payments is through Official Payments Inc. (OPI). This method is an alternative that the City of Bishop can offer to customers who do not have liquid funds by the due date, and reducing late payments.

Customers could access the OPI website through a hyperlink shown on the City of Bishop's website. OPI provides a secure payment site for the credit card holder to transfer funds to the City's account.

This service is offered at no cost to the City. OPI charges a convenience fee to the credit card holder for processing the transaction that is usually 3% of the flat rate charged for providing water and sewer services.

The use of this payment mechanism can help the City reduce costs by eliminating the time it takes to process these payments, particularly late payments. OPI updates accounts nightly and furnishes a flat file with an activity report to their clients.

C. Setting up recurring payments online can be completed through the Automated Clearing House system. Automated Clearing House (ACH) is a secure payment transfer system that connects all U.S. financial institutions. The ACH network acts as the central clearing facility for all Electronic Fund Transfer (EFT) transactions that occur nationwide.

Water and sewer customers can set up monthly payments from their financial institutions through the ACH network. A fixed amount can be debited from customer's accounts and be transferred to the receiving banking institution. This could be easily accomplished given the City's flat rate billing structure. This would reduce mailing, printing, cashing, and other costs that the City incurs in for producing paper statements.

G-2: Nolte recommends that the office, parking, storage, and shop be moved to another location, perhaps the WWTP or the City owned two acre site south of town. The other sites maybe significantly less valuable in terms of property value, location, and proximity to nearby commercial and civic entities.

This way, the City can use the existing Public Works Yard site for another City purpose or sell the property. Given the value and location of the property, the property could be better suited for another purpose. This is not an immediate project. The sale of the property could result in ongoing property tax, sales tax and transient occupancy revenue to the City.

G-3: City personnel met with SCE account manager Sandy Gabriel on November of 2006 and revised the current rate schedule PA-1. Sandy Gabriel verified and explained why the City of Bishop should change the current rate schedule for both wells, PA-1. The City has changed to Time of Use plus Flat Rate for Horse Power of pump motor: TOU-PA-5 for Well 4 and a TOU-PA-B for Well 2, as of December of 2006. Both of these rate schedules would relieve the City from the Horse Power flat rate charge.

<u>Potential Savings</u>

Well 4

PA-1= 54,929.21
TOU-PA-5= 34,413.58
Savings of $20515.63 / year or 37%

Well 2

PA-1= 32,842.47
TOU-PA-B= 17,631.07
Savings of $15,211.40 or 46%

Energy saving calculations were estimated in November of 2006 based on the previous rate schedule under which Well 4 (PA-1) is billed. In order to perform these calculations, 12 months of billings are required. Based on the energy consumption for the 12 month period (March 24, 2005-February 22, 2006), it was determined that Well 4 was eligible to submit a change of rate schedule. The new rate schedule effective November 2006 is TOU-PA-5. It was estimated that the savings in dollars was $20,515.63 (37.35%).

The rate schedule for Well 4 should be reassessed if the new pump and motor are installed and 12 months of operations have been billed in order to compare dollar savings.

G-4: **A.** Based on information provided by Eric Zuniga from the California Department of Public Health, Indian Creek CSD has about 1,400 gpm of source capacity including their two new wells (400 gpm each) and about 389 gpm of maximum day demand (2003). Such an interconnection could not be included as a permanent supplement to City of Bishop's active water supply unless a written contract from Indian Creek CSD is obtained for a certain amount or flow-rate of water per year. California Department of Public Health' concern is that Indian Creek CSD has to be able to guarantee that amount of water given the size of their water supply (it would not be able to meet a supply equivalent to one of the City's Wells).

B. Per California Department of Public Health**,** if what is desired is simply an emergency interconnection for fire-flows or other unplanned emergencies, this intertie would probably be beneficial. The intertie would be added to City of Bishop's source of supply as a standby source subject to a restricted use of 5 consecutive days and 15 days per year (similar to Well 1) per DPH, unless an on going agreement is established between the City of Bishop and Indian Creek CSD.

C. Another alternative is to consolidate water systems so that the City would own and operate the wells in both water systems, adding about 213 service connections and 1,400 gpm of source capacity (which would eliminate the need of finding a new source). However, in order to accomplish this, the City would probably need to annex Indian Creek's service area since it is outside the City limits.
If the Indian Creek service area is annexed to the City, the higher number of connections and the increase in population will call for a new sampling station to be installed per CDPH requirements. The City provides numerous services beyond water and sewer services, including police, fire, drainage, streets, etc. Annexation of Indian Creek CSD would be a much more involved process than the purchase of water between City of Bishop and Indian Creek CSD. It would require a legal, electoral, and political process.

If annexation of Indian Creek CSD is not a viable option, the City could possibly provide the service of running their water system.

D. The Bishop Paiute Tribe has 615 connections and a population of approximately 2,000. The Tribe currently owns and operates three wells. Both the City and the Tribe have shown an interest in establishing an interconnection. The proposed location of the connection is along West Line Street.

G-5: Developing and implementing a *Water Conservation and Time of Use Plan* in Bishop brings both financial profit and environmental benefit to the City.

If the residents of the community are encouraged to decrease their water consumption habits, the City will observe large savings in their energy bill. By reducing the amount of water that needs to be drawn from the wells, pumping and related costs will be lowered, and pressure fluctuations will be reduced. Capital improvements like a new well, a new storage facility, the installation of new pipelines, and the improvements to the wastewater treatment plant, can be postponed due to the reduced demand for water.

In addition to educating the public about water conservation practices that can spread out water consumption over a longer period during the day (i.e. setting sprinklers on timers with rain sensors to water lawns, running washer and dryers at night, etc.), the City can pass new construction ordinances that will provide incentives for builders to install water and energy saving domestic devices. These ordinances can extend to existing homeowners who decide to replace their old appliances with new ones (i.e. low flush toilettes). An incentive program can be put into action to propagate the installation of such devices.

The impact of moving to a metered system include the reduction of excess consumption and /or waste of water, creation of a more equitable billing system for customers, can help postpone infrastructure improvements, can help estimates looses in the system and can contribute to the creation of a more accurate hydraulic model of the system by ascertaining consumption patterns. A metered system may also be a requirement by funding agencies prior to project development.

G-6: A revision of this document in approximately five years should be included in the list of capital projects.

5.6 Regulatory Requirements

RR-1: Based on the California Code of Regulations (CCR) (Title 22) storage requirement recommendations, the City of Bishop has a deficit of 850,000 gallons. This volume does not take into account emergency storage or fire flow storage. A secondary storage tank is required in order to meet the storage recommendations outlined by Title 22.

Three different sources were used to determine the storage volume requirements: California Code of regulations (Title 22), San Diego Water Agencies' Standards (WAS) and Nolte's storage volume recommendation.

Nolte's recommendation (one day of maximum day demand which is equivalent to 4 million gallons) is the most conservative of the three. CCR's requirements don't account for fire or emergency storage (1.85 million gallons). For this reason, Nolte recommends WAS storage volume requirements (2,480,000).

RR-2: Based on conversations with Eric Zuniga from CDPH's, exploring and drilling an extra groundwater source to increase the systems capacity is recommended since Well 1 cannot be considered a source of drinking water for the customers of the City of Bishop. If either Well 4 or Well 2 fails, the maximum day demand cannot be met by either active well. Well 1 cannot be used for more than 5 consecutive days and/or more than 15 days in a year per CDPH.

RR-3: The City water system is subject to the *Initial Distribution System Evaluation* provision of the Federal Stage 2 DBP Rule because it uses a primary disinfectant other than Ultraviolet (UV) light. The goal of the Initial Distribution System Evaluation is to characterize the distribution system and identify monitoring sites where customers may be exposed to high levels of trihalomethanes or haloacetic acids.

The City's water system can comply with the Stage 2 DBPR IDSE provision through one of the following options: 40/30 Certification (40/30) or the Standard Monitoring.

A. The 40/30 allows a system to comply with the IDSE requirement without having to conduct additional system monitoring. To be eligible for a 40/30, the system must meet the following requirements for eight consecutive quarters by April 1, 2008:

1. Collected all required Stage 1 DBPR samples
2. No individual TTHM samples exceeded 0.040 mg/l and no individual HAA5 samples exceed 0.03 mg/l.
3. The system has not had any TTHM or HAA5 monitoring violations.

The required elements of the Stage 2 DBPR compliance monitoring plan are the compliance monitoring locations, dates, and compliance calculation procedures. Stage 2 DBPR compliance monitoring requirements for a groundwater type system that serves less than 10,000 are:

Monitoring Frequency: Annual
Total per monitoring period: 2
Highest TTHM locations: 1
Highest HAA5 locations: 1

B. Standard Monitoring (SM): collect 1 year of TTHM and HAA5 data at a specified frequency and locations to characterize TTHM and HAA5 levels in distribution system. If COB opts to conduct SM it has to follow 3 steps:

- Prepare and submit a SM Plan by April 1, 2008
- Conduct one year of SM in distribution system
- Prepare IDSE report
- Prepare a Stage 2 DBP rule compliance monitoring plan

The SM must be completed by March 31, 2010. The ISDE report has to be submitted by July 1, 2010.

All systems must monitor during the month of highest DBP concentration (August).

The following alternative groups are a grouping of alternatives that address multiple deficiencies. Since many of the deficiencies and solutions are related and can be addressed through a larger project, four such groupings of alternatives have been developed. These groupings address many deficiencies and gather several alternatives together into one larger project. Some deficiencies and alternatives that need to be implemented are stand alone and/or are not included in these projects.

5.7 Water Alternative Group 1

Alternative Group 1 proposes that a new tank, a new well, a new pump station, a new booster pump, and a new chlorination system be constructed east of the K-mart and Vons shopping center, west of the Caltrans yard. The City could purchase the land necessary to install the new equipment. This location is advantageous because the distance between the discharge from the tank and the distribution system is very short compared to a different location, and the existing 12-in that runs along Highway 168. The discharge line will be comparatively shorter and will connect to the exiting 12-in line that runs in a north to south direction along Spruce Street (see Figure 5.1).

Land for these improvements should be purchased by the City of Bishop, along with the right to extract water from it. It is against the charter of the City of Los Angeles to sell its water rights which presents a major hurdle.

5.8 Water Alternative Group 2

In Alternative Group 2, a new tank, a new well, a new pump station and a new chlorination system will be located outside of the City limits, northwest of Bishop. The City will have to purchase the land in order to build the new facility just as in Alternative 1. In Alternative 2, the construction costs of the well and storage tank, and a 12-in distribution line were evaluated separately (see Figure 5.1).

Land for these improvements should be purchased by the City of Bishop, along with the right to extract water from it. It is against the charter of the City of Los Angeles to sell its water rights which presents a major hurdle.

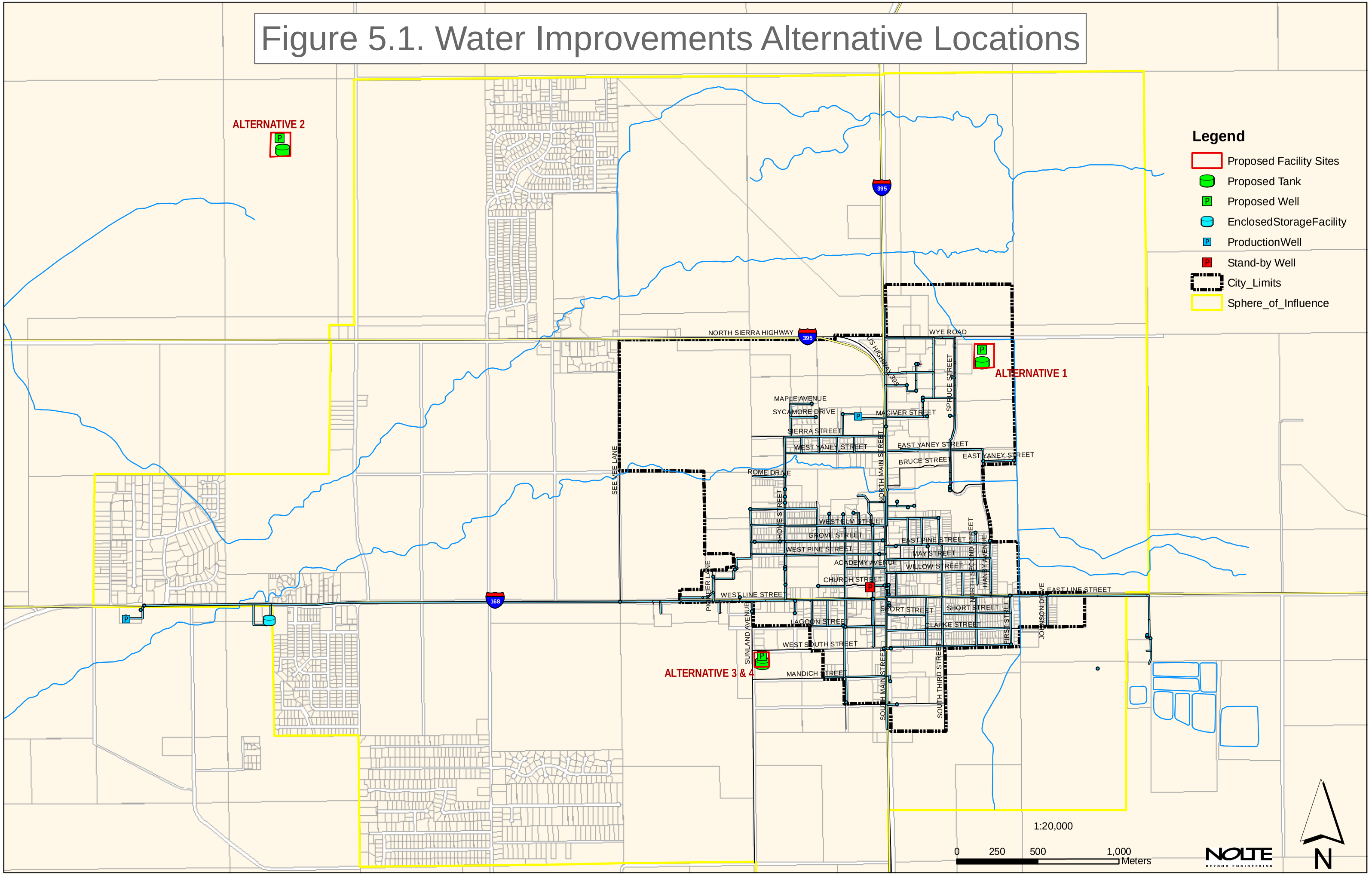
5.9 Water Alternative Group 3

Alternative Group 3 proposes the same improvements described in Alternative 1 and Alternative 2. The new facilities will be located in the southwestern portion of the City in a 2 acre site that the City owns on Sunland street north of Mandich Street (see Figure 5.1). The City will not have to direct additional funds towards purchasing the land where the proposed water facilities will be installed. The distribution line from the tank to the distribution system is directed northbound and will connect into the proposed 16-in transmission line that will run along Highway 168 from the existing storage tank.

5.10 Water Alternative Group 4

Alternative Group 4 proposes a new well, a new pump station, and a new booster pump be constructed and located in the 2 acre parcel that the City owns south of Highway 168 on Sunland Avenue, the same location defined for Alternative 3. In this alternative, the existing 12-in distribution line that runs along Highway 168 will be used as a fill line from the proposed new well location for the existing storage tank (reverse direction of flow). A new 16 inch distribution line will be placed along Highway 168 parallel to the existing 12-in line.

Figure 5.1. Water Improvements Alternative Locations



6.0 Recommended Water Improvements

The process that was put into practice to select and prioritize the project alternatives described previously is discussed in this chapter. Nolte staff has held meetings with the Director of Public Works and the Public Works Superintendent and discussed which projects are considered a priority and should be implemented in the short term.

Selections were based on discussions with City staff and a screening process based on several criteria. The criteria were used to determine the best suite alternative for each deficiency.

6.1 Project Selection

There are several projects that have more than one solution alternative to them. These projects were listed by the name given to them in Chapter 4 in which the system deficiencies were identified. The selection matrix is presented in Appendix E. Appendix E outlines all of the alternatives, their scores for each criteria, the weighing factor for each criteria, and their overall ranking. Judgment was based on a compiled score using a scale of one to five for easy criterion. A score of "5" represents a most favorable result while a score of "1" signifies the least favorable result. A weighing factor was applied to two criteria to amplify their importance. This methodology was used for deficiencies that have more than one alternative. Deficiencies with only one alternative were not included in this alternative evaluation. The preferred alternatives are those that resulted in the highest total score. The alternatives were evaluated based on the following criteria:

- Capital costs (1)
- Operation and maintenance costs (2)
- Land requirement/environmental impacts (1)
- Funding agency assistance (1)
- Operational complexity (1)
- Correspondence with other City projects (3)
- Legal/water rights (1)
- Reliability (2)
- Time for implementation (1)

The weighing factor is shown in parenthesis after each selection criteria listed above. Based on this methodology, the selected projects are the following:

WSQ-1D: Chlorination at Well 3 site
Project description: When future Well 3 is constructed it should be equipped with a new chlorination system with the purpose of providing redundancy to the existing chlorination system located at Well 4. Initially, Well 3 will serve as a stand-by well, but can replace Well 4 when it needs to undergo maintenance or an unexpected shut down is required.

WSQ-3C: New Well 3
Project description: The City wants to install of a small diameter test well to 1000 feet below the ground surface on the Well 3 site. The purpose of the test well is to test the suitability of the site for a municipal water supply well and to develop information on which to base the detailed design of a production well for the site; construction of a well for municipal water supply including casing, pump, and motor; improvement of well site suitable for a municipal production well including water treatment facilities, grading, construction of perimeter fencing and gates, paving, well building, site drainage, well controls, telemetry, and security; provide electricity and communication service to well

site; construction of two 12-inch water lines along Sunland Drive from existing water line under West Line Street (Highway 168) south onto well site and of a 12-inch water line probably along the right of way for West South Street from well site east to the existing water line under South Fowler Street.

WSQ-4A: Replacement of pump at Well 4
Project description: Recent hydraulic tests performed by Southern California Edison at Well 4 showed that the well system has been operating inefficiently for the last six years. The pump and should be replaced at Well 4 due to the wear of the equipment and system inefficiency. This project should be coordinated with project WD-10: Refurbishment of Well 2 and Well 4.

WD-6C: Loop dead end lines
Project description: Looping existing dead end lines with new 8-inch PVC pipe will reduce stagnant water and improve water circulation within the system. By looping the system, more ways for water to be conveyed will be provided while improving system reliability. Looping these lines also helps improve fire protection capabilities by increasing the flow that can be obtained out of different hydrants.

WT-2C: New water storage facility at Well 3
Project description: Based on the current water consumption pattern of the City, a new tank for emergency storage of potable water is required. The existing tank is located 1.5 miles west from the limits of the City and there is only one distribution line into the City form the tank. For this reason, a second storage facility that feeds the City from a different location is necessary to mitigate any unforeseen severance to the existing 12-inch distribution line in case of a fire event or an emergency.

G-1A: Set up Paypal's Pay Flow gateway
Project description: A Pay Pal type system can be developed so that customers can pay their water bill electronically on-line through a stand alone gateway service.

The Payflow Pro payment gateway service is a stand alone system that connects an online store to any major payment processor, bank, and card association. A payment gateway is a secure connection from your online store to an internet merchant account and a payment processing network.

G-1C: Set up automated clearing house (ACH)
Project description: Setting up recurring payments online can be completed through the Automated Clearing House system. Automated Clearing House (ACH) is a secure payment transfer system that connects all U.S. financial institutions. The ACH network acts as the central clearing facility for all Electronic Fund Transfer (EFT) transactions that occur nationwide. Water and sewer customers can set up monthly payments from their financial institutions through the ACH network.

G-4B: Emergency Intertie with Indian Creek Community Services District
Project description: Since Well 1 cannot be used as a source of drinking water for an extended period of time due to its high levels of Fluoride, an emergency interconnection for fire-flows or other unplanned emergencies (major water system shut down), would be beneficial. The City's 1 million gallon tank can contribute to increase ICCSD's water system reliability by providing some emergency storage that ICCSD currently lacks.

6.2 Project Prioritization

The prioritization process was implemented among the selected projects described above, and the projects that only have one alternative solution. Their priority was established based on a scoring system similar to the one in the selection process. A score between one and five was given to each project and its alternative based on the following criteria:

- System Reliability (1)
- Capital Cost (1)
- Employee Health and Safety (1)
- Correspondence with Other projects (2)
- Revenue and Operational Cost (1)
- Funding Agency Assistance (2)
- Regulatory Requirements (2)

The prioritization matrix is presented in Appendix F. The number in parenthesis represents the weight of each criterion on the final score. The projects were classified by tiers based on their final scores.

1. **First Tier (high priority):**

WSQ-4A: Replacement of pump and motor at Well 4. This project was combined with project alternative WD-10. WD-10 is a high priority project that will be completed in the first two years of the Capital Improvements Plan.

WD-4A: 1 MG tank valves
Project Description: To prevent the existing 12-inch fill line from Well 4 to the reservoir from emptying during times of low demands, and exposing the fill line to infiltration problems, Nolte recommends that a new valve configuration be constructed at the tank site to alleviate this problem. The new valve configuration consists of a new altitude valve to regulate the reservoir level, working in conjunction with a pressure reducing valve that will maintain back pressure in the 12-inch pipe.

WD-5A: Replacement of small diameter pipelines
Project Description: There are approximately 42,700 linear feet of water pipe throughout the City that are between 2-inch and 6-inch in diameter. Per the City of Bishop Domestic Water and Sewer Specifications, the minimum pipe size should be 8 inches. These old and small pipes should be replaced with 8-inch pipe to improve system hydraulics and reliability.

WD-6C: Looping of dead end pipelines

2. Second Tier:

WSQ-3C: New Well 3

WT-3A: SCADA System

G-4B: Intertie with Indian Creek Community Services District

G-4D: Emergency interconnection with Bishop Paiute Tribe

G-5A: Water Conservation and time of use plan
Project Description: Development and implementation of a Water Conservation and Time of Use Plan in Bishop brings both financial profit and environmental benefit to the City.

3. Third tier:

WD-7A: Valve replacement program

Project Description: The valve replacement program should be prioritized based on the coordination with the pipe replacement program, the year of installation and condition of the valve. Recent valve replacements have been completed on ductile iron lines 8 inches in diameter or larger (new valves are less than 15 years old). The City performs an annual valve inspection exercise and valves are replaced as deemed necessary.

FR-2C: Hydrant replacement Program
Project Description: Development of a hydrant replacement plan should be coordinated with the pipe replacement program. The City has been replacing the old hydrants with Mueller hydrants. The City started the hydrant replacement program 10 years ago replacing three hydrants per year.

WT-2C: New water storage facility at Well 3

G-1A: Set up Paypal's Pay Flow gateway

G-1C: Set up automated clearing house (ACH)

G-3A: Revise SCE Schedule

G-7A: Cell phone tower

4. Fourth tier:

WSQ-1D: Chlorination at Well 3 site. Should the City decide to cease chlorination, this alternative is no longer applicable.

WSQ-2A: Chlorine sensors
Project Description: Water quality (Cl_2 residuals) should be monitored continuously. Chlorine sensors should be installed at the existing sampling locations with connections to SCADA for automatic monitoring and remote access. Should the City decide to cease chlorination, this alternative is no longer applicable.

WD-3A: Replacement of 12-inch transmission line along West Line Street (Highway 168)
Project Description: Replacement of the existing 12-inch line along Highway 168 can help increase fire protection capabilities in the northern portion of the City. Increasing this line to a 16-inch considerable reduces the average velocity of the flow and decreases friction losses.

WD-9A: Relocation of water services
Project Description: Relocation of existing water lines and sewer laterals should be performed according to DPH and RWQCB and standards of separation of water and sewer main. This project should be completed in conjunction with the WD-5A. Full implementation of this alternative may take decades to complete.

G-6A: Update Standard Specifications
Project Description: The current City of Bishop Water and Sewer Standard Specifications were prepared in 1991 and have not been revised or amended since then to include up to date construction and materials provisions. A revision of this document should be included in the list of capital projects.

RR-3A: 40/30 Certification

RR-3B: DDBP Monitoring

5. Fifth tier:

WD-2A: Retest Well 2

WD-6A: Install pressure sensors
Project Description: Additional pressure sensing locations should be installed throughout the distribution system to detect localized pressure drops and trigger Well 2 to turn on.

WD-10A: Refurbishing Wells 2 and 4

FR-1A: Replacement of 4-inch line on Willow Road
Project Description: Some hydrants are connected to small branches which cannot convey the required flows to combat a fire. Specifically, at Willow Street east of Whitney Alley, there are 1,911 LF of 4-in pipe along Willow Street and there are two fire hydrants connected to this line, which need to be replaced because they do not have steamer ports.

G-2A: Relocation of Public Works yard
Project Description: Nolte recommends that the office, parking, storage, and shop be moved to another location, perhaps the WWTP or the City owned two acre site south of town. The other sites maybe significantly less valuable in terms of property value, location, and proximity to nearby commercial and civic entities.

6.3 Detailed Project Descriptions

The City has expressed interest in four particular projects it considers necessary to enhance the reliability of the system, facilitate operations, and improve monitoring and communication between the different elements of the water system. A more detailed description of these projects is presented below:

1. **Project Title:** New Well 3 Site

   Improvement Number: WSQ-3C

   Improvement Summary: The City of Bishop wants to build a new test well, and a new production well on City owned property. The new well will be in production regularly on a rotational basis with the other two operating wells (Well 2 and Well 4). If water demands increases, Well 3 can be used as a primary well. A Request for Proposals for the environmental documentation Impact Report was released March, 2007, and should be complete by the end of 2007. Nolte recommends that a new 1 million gallon storage tank be constructed to increase the operational and fire flow storage capacity based on the City's current potable water daily demands (MDD for 2002 4.28 MGD), and to provide flexibility in repairing the existing tank in the future.

   Project Capital Cost: $2,280,000 (Phase 1)

   Detailed Description of Work: Installation of a small diameter test well to 1000 feet below the ground surface on the Well 3 site. The purpose of the test well is to test the suitability of the site for a municipal water supply well and to develop information on which to base the detailed design of a production well for the site; construction of a well for municipal water supply including casing, pump, and motor; improvement of well site suitable for a municipal production well including water treatment facilities, grading, construction of perimeter fencing and gates, paving, well building, site drainage, well controls, telemetry, and security; provide electricity and

communication service to well site; construction of two 12-inch water lines along Sunland Drive from existing water line under West Line Street (Highway 168) south onto well site and of a 12-inch water line probably along the right of way for West South Street from well site east to the existing water line under South Fowler Street.

The project was divided into six phases as follows:

- Phase 1: Environmental Documentation (underway).
- Phase 2: Application for funding, preparation of Preliminary Engineering Report (underway).
- Phase 3: Design and surveying of Well 3 site and 1900 feet of 12-inch diameter pipe.
- Phase 4: Construction of new well, improvements to well site, and 1900 feet of 12-inch diameter pipeline.
- Phase 5: Design of 1 MG storage tank and 1005 feet of 12-inch diameter pipeline.
- Phase 6: Construction of new 1 MG storage tank and 1005 feet of 12-inch diameter pipeline.

Related Work: The completion of the New Well 3 project should be coordinated with the SCADA system integration of other water facilities (Well 4, Well 2, and Reservoir) (WT-3).

Identified Permitting and Right of Way Issues: Construction of the 12-inch line from the well site along Sunland Drive into the existing 12-inch line along West Line Drive (Highway 168) may encroach upon Caltrans Right of Way. Caltrans permitting issues are anticipated. A significant amount of the proposed water line construction is along Inyo County road right of ways. Permission form the County is likely required.

Outside Funding Opportunities: United States Department of Agriculture, Proposition 84.

2. **Project Title:** SCADA System

Improvement Number: WT-3

Improvement Summary: Integration of water facilities (Well 1, Well 4, Well 2, Reservoir, Public Works Yard) utilizing Programmable Logic Controllers (PLCs). The installation of a SCADA system will allow the City staff to remotely view water distribution system status and make control system changes safely and securely via the internet, and allow City staff to reduce response times to alarms.

Project Capital Cost: $155,500 (does not include wastewater cost).

Detailed Description of Work: The SCADA system will be based on PLC equipment readily available at electrical supply distributors to facilitate ease of maintenance. The new SCADA system will be expandable allowing for the addition of future facilities. Operator interaction will with the SCADA system will be via a computer workstation running a Human Machine Interface (HMI) application located at the City's Public Works Office. Costs for furnishing HMI and SCADA equipment in the Public Works Office are divided between WT-3, and WCS-8 and TP-7. The type of data that will be acquired is described below:

- Well 1 and Well 2:

Integrate and monitor well status, alarms, and distribution pressure. The automatic tracking and reporting of well flow, daily production and run hours.

- Well 4:

Integrate and monitor well status and alarms, sodium hypochlorite levels and alarms. The automatic tracking and reporting of chemical use and well flow, daily production and run hours.

- Reservoir:

Integrate and monitor reservoir level. Provide new Smart type pressure transmitter to measure level using tank head pressure.

Communication between the tank and the pump at Well 4 is through a leased line. The City believes that the existing communications system is unreliable and wants it replaced. SCADA would integrate all water facilities. This can be accomplished in conjunction with project WD-10.

Related Work: The implementation of the SCADA system can be coordinated with the following projects:
-Equipping and start up of the new Well 3 after its completion (WSQ-3C);
-Refurbishing of Wells 2 and 4 and improvements to Well 4 site (WD-10);
-Emergency intertie with the Bishop Paiute Tribe and/or the Indian Creek Water Company (G-4B).
-SCADA at City's wastewater facilities (WCS-8 and TP-7).

Other Participating Agencies: Bishop Piute Tribe, Indian Creek Water Company (for interconnections).

Outside funding Opportunities: Bishop Paiute Tribe or Indian Creek Water Company, USDA, Proposition 84 (New Well 3, Emergency Interconnections).

Identified Permitting Issues and Right of Way issues: Permitting issues between the City and the Jill Kinmont Boothe School are expected because the location of the proposed emergency interconnection with the Indian Creek Water Company facility is within School property.

3. **Project Title:** Emergency Interconnection with Indian Creek Community Services District

Improvement Number: G-4B

Improvement Summary: City of Bishop's Well 1 cannot be used as a source of drinking water due to its high levels Fluoride, which exceed its respective MCL. Well 1 also has high levels of Arsenic, although it does not exceed the MCL for Arsenic. For this reason, Well 1 is regarded as a stand-by well by California Department of Public Health (CDPH). This condition leaves the City's productive wells to Well 2 and Well 4. If either one of the producing wells fail (2 or 4), or require extensive maintenances or inspection, the remaining well will not be able to supply the required maximum day demand by itself. This interconnection provides a low cost redundancy for water supply.

Since Well 1 cannot be used as a source of drinking water for an extended period of time due to its high levels of Fluoride, an emergency interconnection for fire-flows or other unplanned emergencies (major water system shut down), would be beneficial. The City's 1 million gallon tank can contribute to increase ICCSD's water system reliability by providing some emergency storage that ICCSD currently lacks.

In July 2007, Nolte completed a preliminary study called "Indian Creek Community Services District Emergency Interconnection" for the City of Bishop. The emergency interconnection

project was discussed in more depth and two alternatives for the location of the proposed interconnection were described.

Project Capital Cost: $518,000-620,000

Detailed Description of Work: Water from ICCSD can flow by gravity into the City's network, whereas water from the City into ICCSD needs to be pumped. Two different pumps with different power requirements might be necessary. A small 15 HP pump for an estimated flow of 500 gpm can supply water on a consistent basis, where as a 75 HP pump can supply power for a fire emergency, assuming a 2,000 gpm fire flow. The proposed 10-inch diameter size can be revised when confirmation for fire flow demands is received from the Fire Marshal. The power supply for the pumps can be obtained from the existing power lines on State Highway 168.

Two alternatives were developed for the location of the interconnection. In Alternative A, the pipe heads north across the Jill Kinmont Boothe School playground into the City of Bishop 12-inch ductile iron pipe from the Indian Creek CSD Well 6 site. The second interconnection alternative assumes that the new pipeline connects the City's system and ICCSD system with connection points at the City's 1 million gallon storage tank and ICCSD 6-inch pipe along Tumbleweed Road.

The anticipated operation of the pipeline is to pump from the pressurized Indian Creek CSD distribution system into the City's main distribution line or 1 million gallon storage tank, and vice versa. Since the distribution systems operate in different pressure zones, the installation of a booster station is anticipated. The operational configuration should make it work for both directions of flow in the pipeline.

The pipeline would operate in the following way. Water from the City's system is pressurized by the elevation of the tank (4338.00 feet), and water from ICCSD is pressurized through an existing 8,000 gallon pneumatic tank at Well 5 and the system's well pumps. There will be a valve at both ends of the pipe connected to each water system.

The flow control valves and two meters should be installed at a common point to measure flow in either direction. They will be located inside the fence of either the School site or the Well 6 site, or the City's tank site in a new building. The meter and valves are enclosed with access for operators to manage and perform maintenance. This will protect the equipment from theft, vandalism and the elements. The City wants a portable 380 kVA generator to be located on-site to power the pumps in case of a power outage.

Related Work: This project can be coordinated with the SCADA integration of other water facilities (Well 1, Well 2, Well 4, and Reservoir) (WT-3).

Other Participating Agencies: Indian Creek Water Company, Caltrans.

Identified Permitting and Right of Way Issues:
Anticipated permits for Alternative A are:

- California Department of Heath Services (Revised ICCSD Water Permit)
- California Department of Heath Services (Revised City of Bishop Water Permit)
- Caltrans (State Highway 168)
- Inyo County Office of Education (Jill Kinmont Boothe School playground)

Anticipated permits for Alternative B are:
- Inyo County (Road Encroachment)
- Private owner, Dawson Trust (APN# 01125001, for pipeline)
- City of Los Angeles Department of Water and Power (Building and pipeline)
- California Department of Heath Services (Revised ICCSD Water Permit)

Outside funding Opportunities: Indian Creek Water Company, Proposition 84, USDA.

4. **Project Title:** Refurbishing of Well 2 and Well 4/Tank Valves

   Improvement Number: WD-10

   Improvement Summary: The City of Bishop wants to conduct well examinations to assess the condition of their two existing production wells and review the design of both pumps to ensure they are appropriate for their planned operations. Also, the existing 12-inch fill line from Well 4 to the reservoir empties during times of low demands, exposing the fill line to infiltration problems. There is no evidence that infiltration has occurred. Nolte recommends that a new valve configuration be constructed at the tank site to alleviate this problem.

   Project Capital Cost: $262,000

   Detailed Description of the Work: The existing well examination includes the following activities:
   -Pulling pumps out and transporting for inspection.
   -Video log well
   -Wire brush well
   -Swab well
   -Bail Well
   -Re-video log well

   The new valve configuration consists of a new altitude valve to regulate the reservoir level. When water in the tank reaches a high level, the altitude valve (hydraulically operated) will close. A signal will be emitted from the valve that will shot off the pump at Well 4. When the tank level drops to the low level, the altitude valve will open and a second signal will be emitted to reinitiate the pump at Well 4. The well will be controlled indirectly by the level of the tank through the altitude valve. Isolation valves and a bypass line should be installed in order to perform maintenance on the valve when required.

   Related Work: The examination of Well 4 and installation of the valves can be coordinated with the improvement to Well 4 pumping equipment (WD-1).

   The refurbishing of both wells should be conducted prior to the SCADA system implementation (WT-3). Additional work to improve wells 2 and 4 may arise from this investigation.

   Outside funding Opportunities: Proposition 84, United States Department of Agriculture.

7.0 Water System Capital Improvements Plan

This section outlines and schedules the capital improvements to Bishop's water system that were selected in Chapter 6. Improvements are included for the systems treatment, pumping, and storage elements. The schedule for capital improvements has been developed by identifying deficiencies that need to be addressed at the present and anticipating future infrastructure improvements to meet growing demands and changes in federal and state regulations and goals.

The capital improvement plan for the City of Bishop water system is presented in Appendix G. Appendix G shows the anticipated improvements, their year of implementation, and their costs. The solution alternatives for the proposed projects were listed and were broken up into phases depending on the type of project. Potential funding agencies were listed next to each proposed project. The project cost of each proposed improvement is shown for each project in $2007.

The time horizon for the Capital Improvement Plan is 20 years (2008-2027). An annual inflation rate of 8% was used based the recent rapid increase in construction materials and labor cost. Rates of inflation will likely vary throughout the capital improvement plan time horizon. The City should monitor factors that affect project costs and adjust project costs when necessary. The main criterion for spreading out the capital projects and their costs in the next 20 year period is the correspondence of any of the projects with a top priority project. The future value for the completion of each phase is shown on the estimated year of completion of the project phase.

For many of the 20 years in the CIP's time horizon, the projected capital expenditure exceeds the City's annual capital projects budget. To address this, the City has applied to outside agencies for financial assistance. The City has the option of financing projects in part through debt. In addition, many projects with a long term horizon (2014-2027) can be further phased or postponed. Reasonable increases in user rates will not permit the City to pay for these projects on a cash basis.

7.1 Immediate Projects (2008)

The timeline for completing the proposed improvement projects was chosen based on the top priority projects described in section 6.3. The first projects that should be completed in the coming year are the environmental and ensuing documentation for the New Well 3 site project (WSQ-3C). These are the preliminary phases for this project before proceeding with the design and construction phases. Request for proposals for the environmental impact study were received in April of 2007 and are being evaluated at the present moment. The application for funding from State of California Department of Public Health, Proposition 84, along with the preliminary engineering report for the new facility (PER), are to be completed by next year. The estimated value of these tasks in 2008$ is $124,200. The completion of Well 3 was spread out in five years. The main funding sources to be considered for this project are the United Sates Department of Agriculture (USDA) and State of California DPH Proposition 84.

The design phase of project WD-4A, Tank valves, is also scheduled to be initiated in 2008. It is probable that this project will be funded by the City of Bishop.

Based on the City's 2007 Road Projects Map, the small pipe replacement project WD-5A was schedule for 2008. To correspond with the road improvement projects the small pipes located along the street that would be rehabilitated were scheduled to be replaced simultaneously. Funding from Proposition 84 and USDA can be obtained for the completion of these improvements.

Other projects scheduled for 2008 are the examinations of Well 2 and Well 4, the set up of online automated payment methods for water and sewer customers, the development of a new rate study, a water conservation and time of use plan, and update of the City's Standard Specifications.

Recurring projects that will be completed in 2008 include the hydrant replacement program, which the City has been implementing for the last ten year, and the 1 million gallon tank inspection, which is performed every two years.

Lastly, the application for funding, the development of preliminary engineering report, and the environmental documentation for the emergency interconnections with the adjacent agencies (Bishop Paiute Tribe and Indian Creek Community Services District) were scheduled to be completed within a year from now.

7.2 Future Projects (2009-2013)

The projects scheduled for the years 2009 through 2013 include the construction of Phase II of Well 3. The second phase of this project includes the second 12-inch line that will tie into the system, a storage tank, and the chlorination system.

The construction phase of the tank valves was scheduled for 2009 along with the installation of 8-inch diameter pipes that can be replaced in coordination with the road improvement program. A portion of the relocation of the water services can be completed with these projects in the same year.

A few projects that will make the City incur in annual operating costs like the hydrant replacement program, and the maintenance fees for the automated payment options. There are other projects that take place every other year or every five years, like the tank inspection, and the rate studies and future master plans.

The SCADA system upgrade is scheduled for 2009 to coincide with the finalization of the improvements to Well 4, Well 2 and the construction of Well 3.

The legal, design, and construction phase of the emergency interconnection projects is scheduled for 2009.

7.3 Long Term Projects (2014-2027)

The second phase of the replacement of small diameter pipes was scheduled for 2014 to be coordinated with the valve replacement program and the relocation of additional water services.

It is anticipated that a light industrial area will be developed in the vicinity of the Bishop Airport by the year 2014. The application for funding from Proposition 84 and USDA phase for the intertie with the Bishop Airport was scheduled for 2014 and its subsequent phases, design and construction, are scheduled for the following two years. The installation of water meters was scheduled for the same year. This project should be completed once all water services are relocated to comply with DPH main separation requirements.

The replacement of the existing 12-inch transmission line on Highway 168 was scheduled ten years from now, in 2007. The total duration of the project is estimated to be three years. The application for funding phase is planned out for 2017, and the design and construction phases for 2018 and 2019 respectively. This project can be valuated later on to determine its viability. If the growing population's need for water is offset by reduced consumption habits, the replacement of the line may not be necessary.

The remaining portion for small pipe diameter replacements was scheduled for 2021. By then, all pipe diameters and materials should be standardized.

8.0 Appendices

Appendix A: Construction Cost Opinions

Replacement 4-in Water Line Willow Street (FR-1)				
Item	**Unit**	**Qty**	**Unit Cost**	**Cost**
Pipeline - 8" PVC	LF	1,911	$ 96	$ 183,427
Air Release/ Blow-off Valves	EA	1	$ 300	$ 300
Thrust Blocks	EA	3	$ 500	$ 1,500
Fittings,Valves, Crosses, Tees, Blind Flanges for Future Expansion	LS	1	$ 5,000	$ 5,000
Fire Hydrants (Dry Barrel)	EA	2	$ 2,000	$ 4,000
8" Isolation Valves (Butterfly)	EA	4	$ 600	$ 2,400
Subtotal				**$ 196,627**
Pothole Connections	EA	2	$ 1,000	$ 2,000
Design Survey	LS	1	$ 2,000	$ 2,000
Construction Staking	LS	1	$ 3,500	$ 3,500
Contractor Bonding and Insurance	%	2	$ 40,000	$ 3,933
Application for Funding	LS	1	$ 2,000	$ 2,000
Construction Management and Inspection	%	12		$ 23,595
Traffic Control	%	3		$ 5,899
Contractor Mobilization	%	6		$ 11,798
Soils Investigation	LS	1	$ 10,000	$ 10,000
Design	%	10		$ 19,663
As-builts	LS	1	$ 5,000	$ 5,000
Subtotal				$ 89,387
Contingency	%	15		$ 42,902
Total ($2007)				**$ 328,916**

Automated Billing System (G-1A)		
Item	**Payflow Pro**	**Recurring Billing Service**
Set-up Price	$249.00	$39.99
Monthly Price	$59.95	$29.99
Included Monthly Transactions	Up to 1,000	N/A
Additional Transactions	$0.10 USD per transaction	N/A
Advertising and Procurement Costs	$4,000 (one time)	N/A
Legal/Administrative Costs (IT Department)	$10,000 (one time)	N/A
Community Coordination & Education	$5,000 (one time)	N/A

Bishop Paiute Emergency Interconnection (G-4D)				
Item	**Unit**	**Qty**	**Unit Cost**	**Cost**
Building Foundation	LS	1	$ 7,500	$ 7,500
Site Grading	LS	1	$ 4,000	$ 4,000
Prefabricated Buildin	LS	1	$ 100,000	$ 100,000
Site Access	LS	1	$ 12,000	$ 12,000
Electrical Panel and Conduit	LS	1	$ 8,000	$ 8,000
Lighting	LS	1	$ 2,000	$ 2,000
Sampling Port	EA	3	$ 200	$ 600
SCADA Connection	LS	1	$ 6,000	$ 6,000
Alarms	LS	1	$ 1,000	$ 1,000
Pipe Improvements	LS	1	$ 25,000	$ 25,000
Flow Meter	EA	2	$ 2,000	$ 4,000
Valves	EA	4	$ 800	$ 3,200
Hydrant Assembly	EA	3	$ 2,000	$ 6,000
Pump System	LS	1	$ 18,000	$ 18,000
Start up and Testing	LS	1	$ 1,500	$ 1,500
Operator Training	LS	1	$ 2,000	$ 2,000
Subtotal				**$ 200,800**
Pothole Connections	EA	3	$ 1,000	$ 3,000
Design Survey	LS	1	$ 10,000	$ 10,000
Site Lease/Easement	LS	1	$ 15,000	$ 15,000
Construction Staking	LS	1	$ 7,000	$ 7,000
Contractor Bonding and Insurance	%	2		$ 4,016
Construction Management and Inspection	%	15		$ 30,120
Traffic Control	%	3		$ 6,024
Caltrans Permitting	LS	1	$ 5,000	$ 5,000
Prop. 84/USDA Applications	LS	1	$ 2,000	$ 2,000
PER	LS	1	$ 15,000	$ 15,000
Coordination with Bishop Paiute Tribe	LS	1	$ 5,000	$ 5,000
Environmental Documentation	LS	1	$ 10,000	$ 10,000
Legal/Operating Agreement	LS	1	$ 10,000	$ 10,000
Legal and Administrative	LS	1	$ 3,000	$ 3,000
Labor Compliance Plan (Prop 84 requirement)	LS	1	$ 1,500	$ 1,500
Bidding and Advertising	LS	1	$ 2,000	$ 2,000
Contractor Mobilization	%	10		$ 20,080
Soils Investigation	LS	1	$ 5,000	$ 5,000
Civil and Mechanical Design	LS	1	$ 25,000	$ 25,000
Electrical and Controls Design	LS	1	$ 10,000	$ 10,000
HVAC Design	LS	1	$ 2,500	$ 2,500
Facility Operations Manual	LS	1	$ 10,000	$ 10,000
As-built Preparation	LS	1	$ 5,000	$ 5,000
Subtotal				$ 206,240
Contingency	%	10		$ 40,704
Total ($2007)				**$ 447,744**

Replacement of Existing 12-in Transmission Line (WD-3)				
Item	**Unit**	**Qty**	**Unit Cost**	**Cost**
Pipeline - 16" PVC	LF	8,300	$ 192	$ 1,593,600
Air Release/ Blow-off Valves	EA	5	$ 300	$ 1,500
Thrust Blocks	EA	11	$ 500	$ 5,500
Fittings,Valves, Crosses, Tees, Blind Flanges for Future Expansion	LS	1	$ 10,000	$ 10,000
12" Isolation Valves (Butterfly)		14	$ 1,200	$ 16,800
Pavement Replacement	SF	45,500	$ 6	$ 273,000
Subtotal				**$ 1,900,400**
Pothole Connections and Utilities	EA	6	$ 1,000	$ 6,000
Design Survey	LS	1	$ 3,800	$ 3,800
Construction Staking	LS	1	$ 7,000	$ 7,000
Contractor Bonding and Insurance	%	2		$ 38,008
Construction Management and Inspection	%	12		$ 228,048
Traffic Control	%	3		$ 57,012
Contractor Mobilization	%	6		$ 114,024
Soils Investigation	EA	1	$ 10,000	$ 10,000
Advertising and Bidding	LS	1	$ 5,000	$ 5,000
Design	%	10		$ 190,040
Adminstration and Legal	%	3		$ 57,012
As-builts	LS	1	$ 5,000	$ 5,000
Subtotal				$ 720,944
Contingency	%	15		$ 393,202
Total ($2007)				**$ 3,014,546**

Installation of Tank Valves (WD-4)				
Item	**Unit**	**Qty**	**Unit Cost**	**Cost**
Altitude Valve	EA	1	$ 12,000	$ 12,000
Piping Modifications	LS	1	$ 10,000	$ 10,000
12-inch Pressure Reducing Valve	LS	1	$ 20,000	$ 20,000
Earthwork	CY	39	$ 250	$ 9,750
Concrete Vault	CY	39	$ 750	$ 29,056
12-inch Isolation Valves	EA	3	$ 1,200	$ 3,600
Miscellaneous Piping	LS	1	$ 4,000	$ 4,000
Subtotal				**$ 88,406**
Contractor Bonding and Insurance	%	2		$ 1,768
Construction Management and Inspection	%	12		$ 10,609
Contractor Mobilization	%	6		$ 5,304
Bidding and Advertising	LS	1	$ 4,000	$ 4,000
Legal/Administrative	LS	1	$ 2,000	$ 2,000
Civil and Mechanical Design	%	12		$ 10,609
As-builts	LS	1	$ 5,000	$ 5,000
Subtotal				$ 39,290
Contingency	%	10		$ 12,770
Total ($2007)				**$ 140,465**

Replacement Small Lines along New Roads (WD-5)				
Item	**Unit**	**Qty**	**Unit Cost**	**Cost**
Pipeline - 8" PVC	LF	73,657	$ 96	$ 7,071,072
Air Release/ Blow-off Valves	EA	36	$ 300	$ 10,800
Thrust Blocks	EA	93	$ 500	$ 46,500
Fittings,Valves, Crosses, Tees, Blind Flanges for Future Expansion	LS	1	$ 95,000	$ 95,000
8" Isolation Valves (Butterfly)	EA	125	$ 600	$ 75,000
Subtotal				**$ 7,298,372**
Pothole Connections	EA	72	$ 1,000	$ 72,000
Design Survey	LS	1	$ 30,000	$ 30,000
Construction Staking	LS	1	$ 55,000	$ 55,000
Contractor Bonding and Insurance	%	2		$ 145,967
Construction Management and Inspection	%	12		$ 875,805
Traffic Control	%	3		$ 218,951
Contractor Mobilization	%	6		$ 437,902
Soils Investigation	LS	1	$ 20,000	$ 20,000
Design	%	10		$ 729,837
As-builts	LS	1	$ 18,000	$ 18,000
Subtotal				$ 2,603,463
Contingency	%	15		$ 1,485,275
Total ($2007)				**$ 11,387,110**

12-in Branch from 12-in Water Line along Highway 168/W. Line Street (WD-6B)				
Item	**Unit**	**Qty**	**Unit Cost**	**Cost**
Pipeline - 12" PVC	LF	10,000	$ 150	$ 1,500,000
Air Release/ Blow-off Valves	EA	10	$ 300	$ 3,000
Thrust Blocks	EA	13	$ 500	$ 6,500
Fittings,Valves, Crosses, Tees, Blind Flanges for Future Expansion	LS	4	$ 10,000	$ 40,000
10" Isolation Valves (Butterfly)		10	$ 600	
8" Isolation Valves (Butterfly)	EA	7	$ 600	$ 4,200
Subtotal				**$ 1,553,700**
Pothole Connections	EA	2	$ 500	$ 1,000
Design Survey	LS	1	$ 4,500	$ 4,500
Construction Staking	LS	1	$ 8,000	$ 8,000
Contractor Bonding and Insurance	%	2		$ 31,074
Construction Management and Inspection	%	8		$ 124,296
Traffic Control	%	3		$ 46,611
Contractor Mobilization	%	6		$ 93,222
Soils Investigation	EA	1	$ 10,000	$ 10,000
Design	%	8		$ 124,296
As-builts	LS	1	$ 5,000	$ 5,000
Subtotal				$ 447,999
Contingency	%	15		$ 300,255
Total ($2007)				**$ 2,301,954**

New 8-in Loops (WD-6C)				
Item	**Unit**	**Qty**	**Unit Cost**	**Cost**
Pipeline - 10" PVC	LF	11,540	$ 120	$ 1,384,800
Air Release/ Blow-off Valves	EA	5	$ 300	$ 1,500
Thrust Blocks	EA	15	$ 500	$ 7,500
Fittings,Valves, Crosses, Tees, Blind Flanges for Future Expansion	LS	1	$ 10,000	$ 10,000
10" Isolation Valves (Butterfly)	EA	20	$ 1,000	$ 20,000
Subtotal				**$ 1,423,800**
Pothole Connections	EA	10	$ 1,000	$ 10,000
Design Survey	LS	1	$ 5,200	$ 5,200
Construction Staking	LS	1	$ 9,300	$ 9,300
Contractor Bonding and Insurance	%	2		$ 28,476
Construction Management and Inspection	%	12		$ 170,856
Traffic Control	%	3		$ 42,714
Contractor Mobilization	%	6		$ 85,428
Soils Investigation	LS	1	$ 10,000	$ 10,000
Design	%	10		$ 142,380
As-builts	LS	1	$ 5,000	$ 5,000
Subtotal				$ 509,354
Contingency	%	15		$ 289,973
Total ($2007)				**$ 2,223,127**

Examination of Wells 2 and 4 (WD-10)				
Item	**Unit**	**Qty**	**Unit Cost**	**Cost**
Well 2 and 4				
Remove Pump, video, clean well, revideo	LS	1	$ 35,000	$ 35,000
Remove Pump, video, clean well, revideo	LS	1	$ 35,000	$ 35,000
Subtotal				**$ 70,000**
Contractor Bonding and Insurance	%	2		$ 1,400
Review of Well condition	LS	1	$ 7,000	$ 7,000
Contractor Mobilization	%	6		$ 4,200
Bidding and Advertising	LS	1	$ 4,000	$ 4,000
Legal/Administrative	LS	1	$ 2,000	$ 2,000
Prepare Bid Package	%	7		$ 4,900
Subtotal				$ 23,500
Contingency	%	10		$ 9,350
Total ($2007)				**$ 102,850**
*Does not include well improvements				

Airport Interconnection (WD-11)				
Item	**Unit**	**Qty**	**Unit Cost**	**Cost**
Pipeline - 10" PVC pipe	LF	15,050	$ 120	$ 1,806,000
Sampling Port	EA	3	$ 200	$ 600
Fittings,Valves, Crosses, Tees, Blind Flanges for Future Expansion	LS	1	$ 20,000	$ 20,000
Meter	EA	1	$ 1,500	$ 1,500
Valves	EA	5	$ 800	$ 4,000
Hydrant Assembly	EA	3	$ 2,000	$ 6,000
Subtotal				**$ 1,838,100**
Pothole Connections	EA	3	$ 1,000	$ 3,000
Design Survey	LS	1	$ 8,000	$ 8,000
Construction Staking	LS	1	$ 10,000	$ 10,000
Contractor Bonding and Insurance	%	2		$ 36,762
Construction Management and Inspection	%	15		$ 275,715
Traffic Control	%	3		$ 55,143
USDA Application	LS	1	$ 3,000	$ 3,000
PER	LS	1	$ 15,000	$ 15,000
Environmental Documentation	LS	1	$ 6,000	$ 6,000
Legal and Administrative	LS	1	$ 3,000	$ 3,000
Labor Compliance Plan (Prop 84 requirement)	LS	1	$ 1,500	$ 1,500
Bidding and Advertising	LS	1	$ 5,000	$ 5,000
Contractor Mobilization	%	6		$ 110,286
Soils Investigation	LS	1	$ 5,000	$ 5,000
Agreement LAFCO	LS	1	$ 2,000	$ 2,000
Civil and Mechanical Design	%	10		$ 183,810
As-builts	LS	1	$ 5,000	$ 5,000
Subtotal				$ 728,216
Contingency	%	10		$ 256,632
Total ($2007)				**$ 2,822,948**

Installation of Water Meters (WD-12)				
Item	**Unit**	**Qty**	**Unit Cost**	**Cost**
1-inch Water Meter	EA	1,120	$ 400	$ 448,000
2-inch Water Meter	EA	50	$ 800	$ 40,000
Meter Software	LS	1	$ 50,000	$ 50,000
Billing Software	LS	1	$ 15,000	$ 15,000
Labor	EA	1,170	$ 200	$ 234,000
Operator Training	LS	1	$ 4,000	$ 4,000
Subtotal				**$ 791,000**
Contractor Bonding and Insurance	%	2		$ 15,820
Construction Management and Inspection	%	15		$ 118,650
Community Outreach	LS	1	$ 2,500	$ 2,500
Contractor Mobilization	%	6		$ 47,460
Rate Structure Analysis	LS	1	$ 25,000	$ 25,000
Bidding and Advertising	LS	1	$ 5,000	$ 5,000
Legal/Administrative	LS	1	$ 2,000	$ 2,000
Prop 218 Compliance	LS	1	$ 8,000	$ 8,000
Civil and Mechanical Design	%	10		$ 79,100
As-builts	LS	1	$ 5,000	$ 5,000
Subtotal				$ 308,530
Contingency	%	15		$ 164,930
Total ($2007)				**$ 1,264,460**

New 12-in Line East of Caltrans Yard (WSQ-3A, WT-2A)				
Item	**Unit**	**Qty**	**Unit Cost**	**Cost**
Pipeline - 12" PVC	LF	2,200	$ 150	$ 330,000
Air Release/ Blow-off Valves	EA	2	$ 300	$ 600
Thrust Blocks	EA	3	$ 500	$ 1,500
Fittings,Valves, Crosses, Tees, Blind Flanges for Future Expansion	LS	1	$ 10,000	$ 10,000
10" Isolation Valves (Butterfly)		4	$ 800	$ 3,200
Subtotal				**$ 345,300**
Pothole Connections	EA	2	$ 500	$ 1,000
Design Survey	LS	1	$ 2,000	$ 2,000
Construction Staking	LS	1	$ 3,000	$ 3,000
Contractor Bonding and Insurance	%	2		$ 6,906
Construction Management and Inspection	%	8		$ 27,624
Legal and Administrative	LS	1	$ 3,000	$ 3,000
Bidding and Advertising	LS	1	$ 3,000	$ 3,000
Traffic Control	%	3		$ 10,359
Contractor Mobilization	%	6		$ 20,718
Soils Investigation	EA	1	$ 10,000	$ 10,000
Design	%	10		$ 34,530
As-builts	LS	1	$ 5,000	$ 5,000
Subtotal				$ 127,137
Contingency	%	15		$ 70,866
Total ($2007)				**$ 543,303**

New 12-in Discharge Line NW of City (WSQ-3B, WT-2B)				
Item	**Unit**	**Qty**	**Unit Cost**	**Cost**
Pipeline - 12" PVC	LF	14,000	$ 144	$ 2,016,000
Jack and bore beneth Bishop Creek	LF	100	$ 300	$ 30,000
Air Release/ Blow-off Valves	EA	10	$ 300	$ 3,000
Thrust Blocks	EA	18	$ 500	$ 9,000
Fittings,Valves, Crosses, Tees, Blind Flanges for Future Expansion	LS	4	$ 20,000	$ 80,000
12" Isolation Valves (Butterfly)		24	$ 1,200	$ 28,800
Subtotal				**$ 2,166,800**
Pothole Connections	EA	2	$ 500	$ 1,000
Design Survey	LS	1	$ 6,500	$ 6,500
Construction Staking	LS	1	$ 11,250	$ 11,250
Contractor Bonding and Insurance	%	2		$ 43,336
Construction Management and Inspection	%	8		$ 173,344
Easement Property Acquisition	LS	1	$ 150,000	$ 150,000
Traffic Control	%	3		$ 65,004
Contractor Mobilization	%	6		$ 130,008
County Permitting	LS	1	$ 4,000	$ 4,000
County Plan Review	LS	1	$ 4,000	$ 4,000
Soils Investigation	EA	1	$ 10,000	$ 10,000
Design	%	8		$ 173,344
Bidding and Advertising	Ls	1	$ 3,000	$ 3,000
Legal/Adnministrative	LS	1	$ 3,000	$ 3,000
As-builts	LS	1	$ 5,000	$ 5,000
Subtotal				$ 782,786
Contingency	%	15		$ 442,438
Total ($2007)				**$ 3,392,024**

Indian Creek Emergency Interconnection (WSQ-3D)				
Item	**Unit**	**Qty**	**Unit Cost**	**Cost**
Building Foundation	LS	1	$ 4,500	$ 4,500
Site Grading	LS	1	$ 3,000	$ 3,000
Building Structure	LS	1	$ 20,000	$ 20,000
Site Access	LS	1	$ 12,000	$ 12,000
Electrical Panel and Conduit	LS	1	$ 8,000	$ 8,000
Lighting	LS	1	$ 2,000	$ 2,000
Sampling Port	EA	3	$ 200	$ 600
SCADA Connection	LS	1	$ 15,000	$ 15,000
Alarms	LS	1	$ 1,000	$ 1,000
Pipe Improvements	LS	1	$ 25,000	$ 25,000
Flow Meter	EA	2	$ 2,000	$ 4,000
Valves	EA	4	$ 800	$ 3,200
Hydrant Assembly	EA	3	$ 2,000	$ 6,000
Pump System	LS	1	$ 18,000	$ 18,000
Start up and Testing	LS	1	$ 1,500	$ 1,500
Operator Training	LS	1	$ 2,000	$ 2,000
Subtotal				**$ 125,800**
Pothole Connections	EA	3	$ 1,000	$ 3,000
Design Survey	LS	1	$ 10,000	$ 10,000
Site Lease/Easement	LS	1	$ 15,000	$ 15,000
Construction Staking	LS	1	$ 7,000	$ 7,000
Contractor Bonding and Insurance	%	2		$ 2,516
Construction Management and Inspection	%	15		$ 18,870
Traffic Control	%	3		$ 3,774
Caltrans Permitting	LS	1	$ 5,000	$ 5,000
Prop. 84/USDA Applications	LS	1	$ 2,000	$ 2,000
PER	LS	1	$ 15,000	$ 15,000
Coordination with School and Indian Creek WD	LS	1	$ 7,500	$ 7,500
Environmental Documentation	LS	1	$ 10,000	$ 10,000
Legal/Operating Agreement	LS	1	$ 10,000	$ 10,000
Legal and Administrative	LS	1	$ 3,000	$ 3,000
Labor Compliance Plan (Prop 84 requirement)	LS	1	$ 1,500	$ 1,500
Bidding and Advertising	LS	1	$ 2,000	$ 2,000
Contractor Mobilization	%	10		$ 12,580
Soils Investigation	LS	1	$ 5,000	$ 5,000
Civil and Mechanical Design	LS	1	$ 25,000	$ 25,000
Electrical and Controls Design	LS	1	$ 10,000	$ 10,000
HVAC Design	LS	1	$ 2,500	$ 2,500
Facility Operations Manual	LS	1	$ 10,000	$ 10,000
As-built Preparation	LS	1	$ 5,000	$ 5,000
Compensation to School (undefined)	LS	1	$ 15,000	$ 15,000
Subtotal				$ 201,240
Contingency	%	10		$ 32,704
Total ($2007)				**$ 359,744**

Well 4 Pump and Motor Replacement (WSQ-4A)

Item	Unit	Qty	Unit Cost	Cost
14 MD, 2 Stage Bowl, vertical turbine pump threaded column, suction bell, threaded discharge case Manufactured by Peerless pump 100 Hp 1780 rpm, 3 Ph, 60 Hz., 460 V, Frame 405 TP, TEFC Enclosure. Motor Model-No 6763. Manufactured by US Motors.	LS	1	$ 45,000	$ 45,000
Piping	LS	1	$ 4,000	$ 4,000
Electrical	LS	1	$ 3,200	$ 3,200
Instrumentation	LS	1	$ 2,000	$ 2,000
Site Preparation	LS	1	$ 2,000	$ 2,000
Subtotal				**$ 56,200**
Contractor Bonding and Insurance	%	2		$ 1,124
Construction Management and Inspection	%	12		$ 6,744
Contractor Mobilization	%	6		$ 3,372
Advertising and Bidding	LS	1	$ 4,000	$ 4,000
Design	%	10		$ 5,620
Administration/Legal	%	3		$ 1,686
As-builts	LS	1	$ 5,000	$ 5,000
Subtotal				$ 27,546
Contingency	%	15		$ 12,562
Total ($2007)				**$ 96,308**

SCADA System Project (WT-3)				
Item	**UNIT**	**QTY**	**Unit Cost**	**Total**
Well 4: SCADA System & Commissioning	LS	1	$ 25,000	$ 25,000
Reservoir: SCADA System & Commissioning	LS	1	$ 21,000	$ 21,000
Well 2: SCADA System & Commissioning	LS	1	$ 25,000	$ 25,000
Public Works Office: SCADA and Commissioning	LS	1	$ 25,000	$ 25,000
Sub-total				**$ 96,000**
Legal/Adminstrative	%	5		$ 4,800
Project Closeout	LS	1	$ 5,000	$ 5,000
Sub-total				**$ 9,800**
Contingency			15	$ 15,870
Total				**$ 121,670**

Appendix B: Alternative Matrix

Water Sources and Water Quality						
Deficiency No.	**Deficiency Description**	**Alternative**	**Alternative Description**	**Main Objectives***	**Capital Cost ($2007)**	**Comments**
WSQ-1	Chlorination only takes place at Well 4	A	New chlorination system at Well 2	1,6	$69,600	Cost of disinfection unit includes: engineering and documentation, installation inspection, start-up and training of City personnel.
		B	New chlorination system at new tank location, northwest of City		$69,600	
		C	New chlorination system east of K-mart and Vons, behind Caltrans yard		$69,600	
		D	New chlorination yard at 2 acre parcel owned by City of Bishop		$69,600	
WSQ-2	No automatic monitoring of Cl_2	A	Install chlorine sensors at sampling locations	5, 6, 7	$10,000	
WSQ-3	Need third water supply source to meet MDD if unexpected well failure occurs	A	New well east of K-mart and Vons, behind Caltrans	1	$3,300,000	Cost includes: new well and pump station, chlorination unit, 12- in discharge line. See Appendix A. Alternative C completed in conjunction with WD-3.
		B	New well northwest outside City limits		$5,940,600	
		C	New well at 2 acre parcel owned by City		$3,580,000	
		D	Connect with Indian Creek CSD		$670,000	Same as G-4C
Fire Suppression System						
Deficiency No.	**Deficiency Description**	**Alternative**	**Alternative Description**	**Main Objectives***	**Capital Cost ($2007)**	**Comments**
FR-1	Low pressures experienced along Willow Street	A	Replace 4-in water line along Willow Street with larger pipeline	8	$560,000	See Appendix A
FR-2	Heterogeneous hydrant types	A	Implement annual hydrant replacement program	8	$15,000	Replacement of three hydrants on first year
Water Storage Facilities						
Deficiency No.	**Deficiency Description**	**Alternative**	**Alternative Description**	**Main Objectives***	**Capital Cost ($2007)**	**Comments**
WT-2	No back-up or secondary storage facility	A	Install a second tank east of the Caltrans yard	1	$4,100,000	Installation of tank includes drilling of new well, new pump station, discharge line, etc. Completed in conjunction with WD-3. See Appendix A for cost break down.
		B	Northwest of town with a new transmission line connecting pipe		$6,670,000	
		C	Install a second tank at the 2 acre parcel in the southern portion of City		$3,988,000	
WT-3	No provisions for automatic gathering/reporting of data or operator access to operate system from one location	A	SCADA system to integrate facilities with PLCs	1,7	$135,000	

General Water System Evaluation						
Deficiency No.	**Deficiency Description**	**Alternative**	**Alternative Description**	**Main Objectives***	**Capital Cost ($2007)**	**Comments**
G-1	Inefficient billing system	A	Implement the Payflow Pro payment gateway	2, 3, 4, 7	$20,000	
		B	Process online payments through Official Payments Inc.			
		C	Set up recurring payments online through ACH			
G-2	Better use of existing Public Works yard space	A	Relocate Public Works yard	2	$514,000	Duplicate from Wastewater Master Plan, See TP-5
G-3	Revise current rate schedules for Well 2 and Well 4	A	Revise current SCE rate schedule when new motor and equipment is installed in Well 4	3	Included in SCE services	Review last 12 month billing when new motor is installed.
G-4	No emergency interconnnections with adjacent water agencies	A	Obtain contract with Indian Creek for water supply	1, 2	$325,000	Annexing Indian Creek CSD service area adds 1400 gpm to City's source capacity. Will need to install chlorination unit at well.
		B	Intertie as stand by source with restricted use		$300,000	
		C	Consolidate systems, annex Indian Creek service area to City		$670,000	
		D	Emergency connection with Bishop Paiute Tribe		$500,000	Emergency connection with tribe along W. Line Street
G-5	High demand of water per capita	A	Develop Water Conservation and Time of Use Plan	1, 2, 3, 8	$25,000	Duplicate from Wastewater Master Plan, See GI-2
G-6	Outdated Standard Specifications	A	Modify, update document	4, 7	$40,000	Duplicate from Wastewater Master Plan, See GI-3
G-7	Lack of cell phone tower at tanks or wells	A	Install cell phone tower	1, 2, 7	Revenue Generating	

Regulatory Requirements						
Deficiency No.	**Deficiency Description**	**Alternative**	**Alternative Description**	**Main Objectives***	**Capital Cost ($2007)**	**Comments**
RR-2	MDD cannot be met without Well 1 (stand-by)	A	Explore and operate third well	1, 5	See comments	New well locations and costs are given in WSQ-3 and WT-2. If Indian Creek CSD service area is annexed, no need for third well, new sampling station required per CDHS.
RR-3	New Federal DBPR to be implemented	A	40/30 Certification	5	$5,000	Cost for collecting and shipping samples, and laboratory analyses.
		B	Standard Monitoring		$5,000	

Water Distribution System						
Deficiency No.	**Deficiency Description**	**Alternative**	**Alternative Description**	**Main Objectives***	**Capital Cost ($2007)**	**Comments**
WD-1	Inefficient operation of Well 4	A	Install premium efficiency motor at Well 4	3, 7	$95,000	SCE reimburses City approximately $720. See Appendix A for cost break down. Add $15,00 for removal of old building and safety enhancement measures at Well 4.
		B	Install standard efficiency motor at Well 4		$95,000	
WD-2	Hydraulic test performed by SCE on Well 2 gave inconclusive results	A	Retest Well 2 during summer months for operational efficiency	7	Included in SCE services, performed yearly	Well 2 never runs near design parameters
WD-3	High friction losses in 12-in transmission line from 1 MG tank	A	Upsize 12-in transmission line to 16-in along Highway 168	1, 7, 8	$3,070,000	Caltrans Encroachment Permit required. Completed in conjunction with WSQ-3C or WT-2C.
WD-4	Fill line from Well 4 to tank does not run full at all times	A	Relocate existing tank from Well 1 to Well 4	1, 6	$15,000	Can be completed with improvements to Well 4, WD-1.
		B	Install new tank at Well 4		$25,000	
WD-5	Various materials and pipe sizes installed throughout system	A	Replace small diameter pipe with 8-in Class 350 ductile iron pipe or PVC	1, 7, 8	$10,500,000	Replace 2-in pipe first, shortest length and smallest diameter.
WD-6	Considerable pressure fluctuations between tank and Well 2	A	Install pressure sensors throughout City	1, 7	$20,000	Assume all new pipe is 8-in DI or PVC.
		B	Secondary feed into City from existing tank		$2,530,000	
		C	Replace small diameter lines and loop open circuits		$13,500,000	
WD-7	Replacement of valves	A	Capitalize budget for annual valve replacement program	1	$15,000	Replacement of eight valves annually
WD-9	Many water services are in same trench as sewer laterals	A	Relocate water services	4, 5, 6	$1,200/connection	Number of connections unknown

* Improvement Objectives are Defined as Follows:

1. Improve System Reliability and Redundancy
2. Increase Utilization of Capacity/Increase Revenue
3. Reduce Operation Costs
4. Improve Customer Service
5. Comply with Regulatory Requirements
6. Improve Water Quality
7. Improve System Operations
8. Provide Adequate Fire Protection

Appendix C: List of Abbreviations

Terms	Abbreviation
Geographic Information System	GIS
Capital Improvements Plan	CIP
Number	No.
Horsepower	HP
Gallons per minute	gpm
Total dynamic head	TDH
Million gallon	MG
Pounds per square inch	psi
Pressure Reducing Valve	PRV
Rotations Per Minute	rpm
Square	sq.
Wastewater Treatment Facility	WWTF
Upstream	U/S
Downstream	D/S
Maximum Contaminant Level Goal	MCL
Trihalomethane	TTHM
Chlorine	Cl_2
Maximum Residual Disinfectant Level	MRDL
Total Dissolved Solids	TDS
Average Day Demand	ADD
Maximum Day Demand	MDD
Peak Hour Demand	PHD
Million gallons per day	mgd
Insurance Services Office	I.S.O.
Operations and Maintenance	O&M
Single Family Residential Unit Equivalent	SFRUE
	ADA

Agency Names	Abbreviation
City of Bishop	City
Liquivision Technology Diving Services	LTDS
California Department of Public Health	CDPH
United States Environmental Protection Agency	USEPA
Citizen's Advisory Committee	CAC

Appendix D: Rating Curve for 12-in Transmission Line

Rating Curve for Pressure Pipe - 1

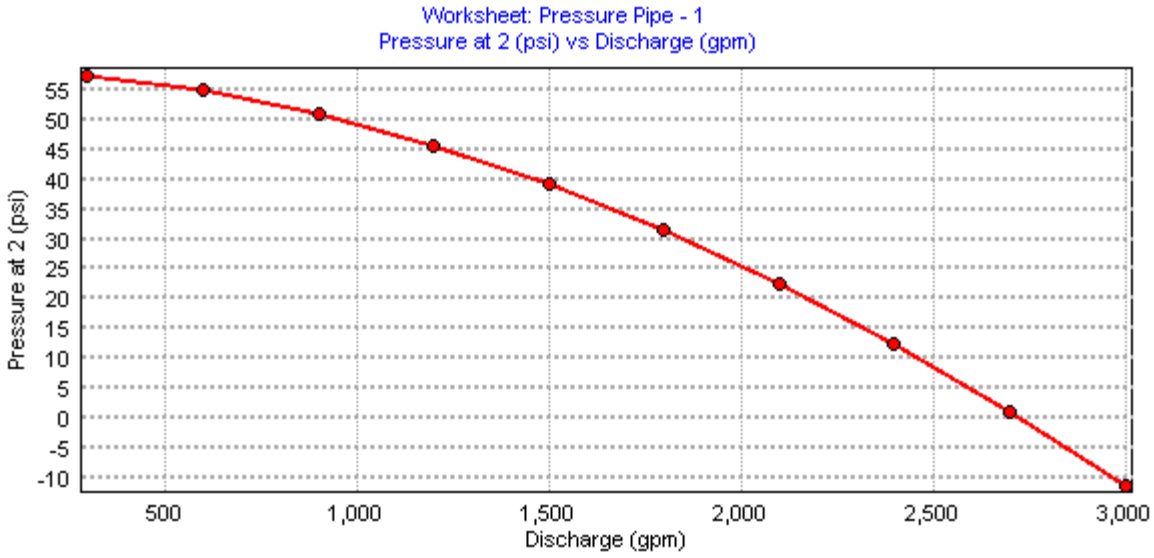
Project Description

Friction Method	Hazen-Williams Formula
Solve For	Pressure at 2

Input Data

Pressure 1	0.00	psi
Elevation 1	140.00	ft
Elevation 2	0.00	ft
Length	8300.00	ft
Roughness Coefficient	130.000	
Diameter	1.00	ft
Discharge	1.00	gpm

Rating Curve Plot



Appendix E: Project Selection Matrix

BISHOP WATER MASTER PLAN
SELECTION MATRIX

ALTERNATIVE SELECTION CRITERIA		Alternative Description		Capital Costs	O&M Costs	Land Requirement/ Environmental Impacts	Funding Agency Assistance	Operational Complexity	Correspondance With Other City Projects	Legal/ Water Rights	Reliability	Time For Implementation	TOTAL POINTS
Weighing Factor (1-3)				1	2	1	1	1	3	1	2	1	
Defic. No.	*Altern.*												
WSQ-1	A	New Chlorination Equipment at Well 2	$ 66,700	5	5	5	5	5	4	5	5	5	**62**
	B	New Chlorination Equipment at New Well Site NW of City Limits	$ 66,700	5	5	4	4	5	1	5	5	2	**48**
	C	New Chlorination System East of Kmart/Vons	$ 66,700	5	5	4	4	5	1	5	5	2	**48**
	D	New Chlorination System at Well 3 Site	$ 66,700	5	5	4	5	5	5	5	5	3	**62**
WSQ-3 [a]	A	3rd Water Supply Well - Kmart/Vons	$ 4,100,000	3	3	2	2	3	1	2	3	2	**29**
	B	3rd Water Supply Well - NW outside City Limits	$ 6,670,000	1	2	1	1	5	1	2	4	1	**26**
	C	3rd Water Supply Well - Well No. 3 Site	$ 3,833,000	3	3	3	3	3	3	4	3	3	**40**
WD-1	A	Install Prem. Eff. Pump Well 4	$ 96,000	5	5	5	5	5	5	5	5	5	**65**
	B	Install Standard Eff. Pump at Well 4	$ 95,000	5	4	5	4	5	5	5	5	5	**62**
WD-4	A	Tank Valves	$ 155,900	5	5	5	5	5	5	5	5	3	**63**
WD-6 [a]	A	Pressure Sensors	$ 20,000	5	3	5	3	3	3	5	3	4	**46**
	B	2nd Feed to City from Tank	$ 2,530,000	3	5	2	3	5	3	5	4	3	**48**
	C	Loop dead end pipelines	$ 2,170,000	2	5	3	5	5	5	5	5	4	**59**
WT-2	A	Install 2nd Tank	$ 1,423,000	3	3	3	3	3	4	4	3	3	**43**
	B	Install 2nd Tank NW of City	$ 1,423,000	3	5	2	2	5	4	4	5	2	**50**
	C	Install 2nd Tank at Well 3	$ 1,423,000	3	3	5	5	3	5	5	3	5	**53**
G-1 [a]	A	Payflow Pro Payment Gateway	$ 20,000	4	4	5	1	4	1	5	5	5	**45**
	B	Official Payments, Inc	$ 15,000	5	3	5	1	4	1	5	5	5	**44**
	C	Set Up ACH Payments	$ 15,000	5	3	5	1	5	1	5	5	5	**45**
G-4 [a]	A	Obtain Contract with Indian Creek for Water Supply	$ 325,000	5	5	5	4	5	5	5	5	5	**64**
	B	Intertie with Indian Creek CSD as Standby with Restricted Use	$ 618,000	5	4	5	4	5	5	5	4	5	**60**
	C	Consolidate Indian Creek to City Service Area	$ 670,000	3	3	2	4	5	5	4	5	2	**51**
	D	Emergency Connection with Bishop Paiute Tribe	$ 500,000	4	5	4	5	5	5	5	4	4	**60**
Scoring: Based on a scale of 1 to 5 with 1 being the "least favorable" and 5 the "most favorable"				Equipment, structures, installation	Operator labor, energy	Footprint, land availability, easements/ROW, expansion feasibility, layout, site topography, access roads	Availability of funds	Operator friendly	Other related City projects	Legal constraints	Resiliency against shock loading, variable water quality, parallel treatment lines	Urgency, project need	
Note: Projects with only 1 Alternative are not included													

[a] - Alternatives are not mutually exclusive

BEYOND ENGINEERING

Appendix F: Project Prioritization Matrix

Appendix G: Capital Improvement Plan