# CHAPTER 1
# EXECUTIVE SUMMARY

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# CHAPTER 1

# EXECUTIVE SUMMARY

## 1.0 Purpose and Background

The City of Bend (City) has two primary water supply sources. The historic water source is a diversion of surface water from Bridge Creek. This is an approved, unfiltered surface water supply of high quality which provides approximately half the annual water supply for the City. The second source, groundwater, has been developed by wells placed into a highly productive aquifer lying approximately 500 feet below the City. This well system provides the other half to the annual water used by the City, most of which is used during the peak summer water use season.

Changes in the federal regulations that govern water systems now require that additional treatment be added to the Bridge Creek water supply by October 2012. The new treatment will require a major capital project to implement. Much of the Bridge Creek system was constructed in the mid-1920s and is in need of significant repair or replacement to bring the water system up to a reliability level sufficient for a water system serving a major population center. In addition, nearly 40 percent of the trees in the natural watershed for Bridge Creek, owned by the U.S. Forest Service (USFS), have been killed by insects. The large number of dead trees creates a severe fire hazard. Recently published U.S. Environmental Protection Agency (USEPA) reports have identified severe fires as a major threat to drinking water quality. To protect against this potential damage, a filtration water treatment plant (WTP) may be necessary. Because of the high cost to build facilities required to keep the Bridge Creek Water System as a major water source for Bend, the City initiated this study to help determine its the best alternative to provide current and future water supply.

To accomplish all the goals of the study, the project was undertaken in a series of steps. Each major step or phase of the project was completed by the creation of a summarizing technical memo. A total of twelve technical memoranda (TM) were produced for the study. They have been edited into chapters of this final report and are included herein with included appendices.

This Executive Summary is intended to provide a brief background for the study, a listing of the major recommendations and findings developed during the study, and a very brief summary of the work conducted for each of the chapters.

## 1.1 Recommendations

This Water Supply Alternatives Study has spanned a large breadth of material and topics. The chapters included here follow in close order to how the elements of the study were addressed. Each of the original TMs contained findings and recommendations which were often built upon by the work that followed. Results are presented in detail in the chapters of this report and summarized herein, again. The summation of the findings and recommendations from this study can be condensed into the following:

- **Finding No. 1.** The existing Bridge Creek supply system infrastructure is not in good condition and is not reliable as it exists today. The system needs to be repaired, replaced or abandoned in the reasonably near future.
- **Finding No. 2.** The risk to the water quality of the Bridge Creek supply from fire in the Bridge Creek watershed is significant and poses both short- and long-term risks to the usefulness of that water source, if the system remains unfiltered.

- **Finding No. 3.** A reconstructed Bridge Creek system offers the option to install a hydropower facility at the Outback Facility. Federal and State of Oregon incentive programs for green and renewable power, added to the basic sale of power, allow a hydropower unit at Outback to generate significant revenue above its capital and operating costs.

- **Recommendation No. 1.** The Bridge Creek supply system should be reconstructed. The project should include a new intake, hydropower-compatible penstock in Skyliners Road, hydropower facility at the Outback Facility, and a membrane filtration plant. This option, when compared to the others studied, provided a lower total cost to the City over the 50-year life of the project. The recommended option also provides a very reliable water supply and will enable the City to optimize the existing surface water rights held by the City.

    1. The existing pipelines from Bridge Creek Intake to the Outback Facility should be replaced with a new water transmission main located in Skyliners Road. A new penstock line is more cost-effective because it allows power to be produced, surface water use to be maximized, and reduces use and power use by City wells. A new penstock line will be much more reliable, an essential element for this critical water utility component.

    2. The treatment system for the Bridge Creek supply that provides the most value to the City is membrane filtration. Filtration will be the lowest cost in the long term due to a reduction in well use and an increase in power produced at the Outback Facility and other sites within the City water system. Membrane filtration, specifically, provides the significant added benefit of reducing the water quality impact to the water system from fire in the Bridge Creek watershed.

    3. A hydropower facility should be added to any reconstruction of the Bridge Creek supply system. With or without incentive funding and with or without added use of the City's existing water rights, a hydropower system will provide a positive financial return to the City.

- **Recommendation No. 2.** The federal and state incentive funding for the project should be pursued as soon as possible. These incentive programs are currently very favorable to the recommended project. However, they are subject to change and funding options should be secured rapidly.

## 1.2 Summary of Individual Chapters

Following is a brief summary of the chapters of this report. Some work reported in the chapters was done concurrently, but, much of the work was performed in a more linear fashion. The chapters are much in the order that they were produced.

### 1.2.1 Chapter 2 (TM 1) - Alternative Options Selection

The information in Chapter 2 was developed to determine which of seven supply options represented the lowest risk and most cost effective choice for future water supplies for the City. In the near future, the Bridge Creek supply system may not be able to continue to meet the City's potable water demand reliably. Its aging infrastructure, risk of fires in its watershed, and new regulations will require the existing system to be upgraded. To address these issues, the City retained the services of a consultant team led by Brown and Caldwell to identify and develop the best alternative that will satisfy these impending demands.

Chapter 2 documents the alternative identification and screening process that led to the selection of a preferred alternative.

#### 1.2.1.1 Alternative Selection and Evaluation

City staff and the consultant team met to determine the level of service (LOS) for the city water system required by the City. The panel collected data on the current situation and identified alternatives based on meeting the City's desired LOS.

- Meet USEPA's October 2012 date for providing treatment of surface water sources to reduce the risk of *Cryptosporidium*
- Address the aging supply and transmission system infrastructure
- Mitigate the water quality impacts from a large wildfire in the Bridge Creek watershed

The following alternatives were identified and developed sufficiently to do a preliminary evaluation:

- Do Nothing
- Add Ultraviolet (UV) disinfection to the Outback Facility and otherwise do nothing
- Renew the intake on the City's existing source at Bridge Creek and add water treatment
- Build a new intake on Tumalo Creek, pump the water to the Outback Facility, and add filtration water treatment
- Build an intake on the Deschutes River, add filtration water treatment, and pump the water to the Outback Facility
- Increase well capacity to replace the Bridge Creek supply
- Provide a new supply from a Deschutes River irrigation canal with existing fish screens and pump the water to the system storage reservoirs

The alternatives were screened, first eliminating those that did not meet the City's desired level of service goals. After the initial screening the following five alternatives remained:

- Renew the intake on the City's existing source at Bridge Creek and add water treatment
- Build a new intake on Tumalo Creek, pump the water to the Outback Facility, and add filtration water treatment
- Build an intake on the Deschutes River, add filtration water treatment, and pump the water to the Outback Facility
- Increase well capacity to replace the Bridge Creek supply
- Provide a new supply from a Deschutes River irrigation canal with existing fish screens and pump the water to the water system storage reservoirs

A risk and cost evaluation was then undertaken. As a result, one alternative was clearly best at meeting the criteria—to renew the Bridge Creek facilities and add water treatment. It not only paid for itself in the long-term but also had a very low risk factor. None of the other alternatives had a positive cash flow.

#### 1.2.1.2 Conclusion

The conclusion resulting from the analysis in Chapter 2 is that the alternative that includes the construction of a WTP and a hydropower facility at the Outback Facility, replacement of the existing Bridge Creek Intake, and replacement of the existing raw water mains with a penstock provides a low risk and lowest cost alternative for meeting the City's water needs. This alternative became the preferred alternative for the remainder of the study.

### 1.2.2 Chapter 3 (TM 2) - Bridge Creek Intake Evaluation

The purpose of Chapter 3 was to describe the investigation and evaluation of the Bridge Creek Intake Facility, which is a key component of the Bridge Creek water supply system. The existing facility is currently functional, but is very old and does not comply with many current standards. This chapter provides a preliminary review of the diversion dam, intake screens, and intake facility structure to assess its risk of failure without improvement and to evaluate the options and costs to improve or replace the existing intake structure and its appurtenances.

#### 1.2.2.1 Evaluation of the Existing Bridge Creek Facilities

A review of existing structural information for the diversion dam, intake screens, and intake building was undertaken. A preliminary evaluation was made regarding the condition of these facilities, potential risks of future damage to them, and any improvements to the structures required for compliance with current Oregon standards for lifeline facilities (facilities that are critical to the wellbeing of the community) and accessibility.

An element of this task was to identify any factors that pose a significant risk to the existing intake facilities and to make recommendations for actions that would help to minimize the risk of failures related to system vulnerabilities during the completion of this project. The project also identified defined improvements needed for short- and long-term reliable operation of the water system.

As a part of this task, a detailed review of the diversion dam, intake screens and intake building was undertaken.

#### 1.2.2.2 Evaluation of Bridge Creek Replacement/Upgrade Alternatives

The following four alternatives were examined:

- Upgrade Existing Facilities (using three variations of screening mechanisms)
- Raze Existing Facility and Construct New (using two variations of screening mechanisms)
- Replace Existing Facility with an Infiltration Gallery
- Do Nothing

#### 1.2.2.3 Recommendations

Based on the evaluations, installation of T-screens in conjunction with a new intake facility is the recommended alternative. Should continued development of the project determine that preserving the existing intake structure is important or required, T-screen installation combined with rehabilitation of the existing structure is possible and can be provided at a similar initial cost.

Upgrading or replacing the existing intake facility with T-screens can provide the maximum flow rate allowed under the City's water rights, even with a safety factor of 50 percent. They can reasonably be expected to provide effective debris removal, if adequate sweeping flow in the area of the screens is provided. The proposed concepts for both upgrading with T-screens or construction of new facilities with T-screens are in alignment with Oregon Department of Fish and Wildlife (ODFW) diversion siting and screen design criteria. Either upgrading existing facilities with T-screens or constructing new facilities with T-screens can be

expected to provide a long-term effective intake design with a low initial cost and low maintenance cost relative to other alternatives examined.

### 1.2.3 Chapter 4 (TM 3) – Skyliners Road Penstock

This chapter describes a study to define the cost of providing a new water transmission main from the Bridge Creek Intake to the Outback Facility. As the pipeline feeding the proposed hydropower facility, the new transmission main is identified in this and the succeeding chapters as a "penstock".

The two existing pipelines that convey water from the Bridge Creek Intake to the Outback Facility have neither the required size or sufficient strength to supply a hydropower unit as described in the criteria listed below.

#### 1.2.3.1 Design Criteria for the Penstock

The following design criteria were developed to guide the conceptual design of the proposed penstock:

- Maximize use of the City's existing water rights.
- Locate the penstock out of sensitive areas, such as on USFS land.
- Provide a penstock that will fully support a hydropower facility at the Outback Facility so that the power produced can help pay the cost of the USEPA-required water treatment facilities and provide revenue to the City.
- The diameter of the penstock was chosen to both maximize possible revenue generated through hydropower per dollar spent on construction and to allow future flexibility in operation of the water system. As a result of the life-cycle cost analysis, a 36-inch-diameter steel penstock was chosen. Steel is superior to other materials given the high pressure (433 pounds per square inch [psi]) in the penstock. The cost-effective penstock coating and lining material over the life of the project is polyurethane. This assumed penstock material and sizing was then used to develop the cost estimates for this study.
- The penstock will be protected against corrosion by an impressed current cathodic protection system.

#### 1.2.3.2 Geotechnical Information

A geological reconnaissance was conducted by Siemens and Associates along the proposed penstock alignment. The geotechnical report found the proposed alignment which follows the right-of-way (ROW) to be feasible in terms of excavation and geotechnical principles. The site investigation determined that approximately 1.7 miles of the 10-mile penstock route was likely to encounter rock in the trench depth. While more difficult to excavate, rock excavation is normal in the Bend area and contractors are well equipped to perform the work.

#### 1.2.3.3 ROW Issues

ROW issues associated with the penstock project can be divided into two general categories. The first category is for those areas where the new penstock will be located on property under the jurisdiction of the USFS. For these areas, the City will submit a permit application to install the new penstock on federally-regulated property. The second category is for those areas where the new penstock will be installed on dedicated county street ROW. For these areas, the City will submit a street occupancy permit to the county. The alignment of the new penstock will be set to avoid private property, if possible.

#### 1.2.3.4 Penstock Cost Estimate

The cost estimate for the 36-inch-diameter penstock is $28 million. The cost of the penstock material is estimated at $14 million, the cost of installation and appurtenances is estimated at $9.7 million, and the cost of engineering, legal and administration is estimated at $4.3 million for a total of $28 million.

#### 1.2.3.5 Permits

This chapter also made an identification of the required permits from federal, state and local agencies. While a more thorough analysis of the permit requirements is in Chapter 10, this chapter has a concise discussion of the permits that are likely to be required. This chapter, like Chapter 10, did not identify any permits that were ultimately unlikely to be issued to the City.

#### 1.2.3.6 Reservoir Use at the Outback Facility

The City currently has four reservoirs at the Outback Facility and has identified locations for several more. Use of the storage is currently limited by their use as chlorine contact chambers. Chlorine is added to the water before it enters the storage tanks. Because the system is currently without UV treatment and not filtered, USEPA drinking water regulations require an extended chlorine contact time with the water. To obtain sufficient contact time, three of the storage reservoirs (total volume of 6.5 million gallons [MG]) are connected in series to allow for sufficient time to develop the required chlorine contact time. Since the tanks are used for chlorine contact, they cannot be used for normal water storage. The result is that Bend's water system does not benefit from the ability to use the volume of the three tanks at the Outback Facility to meet peak system or fire flow demands. The addition of new treatment on the Bridge Creek supply will greatly reduce the required chlorine contact time and allow better use of the available storage. With storage costing approximately $1 per gallon to construct, putting the 6.5 MG back to normal use is a major secondary benefit realized by adding a new treatment system.

#### 1.2.3.7 Conclusions and Recommendations

As a result of the work in Chapter 4, it was determined that there are no fatal flaws to the construction of a 36-inch diameter steel penstock. The pressure of the penstock, while high (433 psi), is still within the range of thicknesses for steel penstock that can be made in Oregon. The lining and coatings recommended are appropriate for the pressures and materials recommended. A cathodic protection system will prevent metal loss from the penstock for many decades. The alignment of the penstock avoids many of the pitfalls of the existing pipelines. The environmental issues such as the two stream crossings all have reasonable solutions. The geotechnical report found some areas along the new proposed alignment that will require special construction methods.

### 1.2.4 Chapter 5 (TM 4) – Water Treatment Evaluation Bridge Creek Supply

The purpose of this technical evaluation was to provide guidance for the City of Bend in selecting the appropriate treatment process for their existing Bridge Creek surface supply. The evaluation focused on treatment for two water quality scenarios:

- Existing normal range of water quality
- Water quality following a significant fire in the watershed

The alternatives for both water quality scenarios are designed to meet the requirements of USEPA's Long Term 2 Enhanced Surface Water Treatment (LT2) Rule and all current and anticipated drinking water regulations. The capacity of the initial plant is anticipated to be 13 mgd with an allowance for future expansions. This chapter presents an evaluation of four treatment alternatives that will provide the desired inactivation or removal of *Cryptosporidium* to meet the requirements of the LT2 Rule.

#### 1.2.4.1 Alternatives Evaluated

The following four treatment alternatives were evaluated:

- Alternative 1 – UV disinfection
- Alternative 2 – UV disinfection with pretreatment for turbidity reduction
- Alternative 3 – Conventional treatment (defined as coagulation, flocculation, and sedimentation followed by granular media filtration)
- Alternative 4 – Membrane filtration (microfiltration or ultrafiltration) with pretreatment

#### 1.2.4.2 Evaluation Criteria

Each treatment alternative was ranked by the following seven evaluation criteria:

- Capital Cost
- Operation and Maintenance (O&M) Costs
- Water Quality
- Staffing, Operability, and Automation
- Expandability
- Operational Flexibility
- Site Compatibility

#### 1.2.4.3 Alternative Evaluation and Recommendation

According to our analysis, the total 20-year present worth of the four alternative treatment systems for 13 mgd capacity is listed in Table 1-1.

Table 1-1. Waste Treatment Alternative 20-year Present Worth Cost

| Treatment alternative | Cost, million dollars |
|---|---|
| Alternative 1 – UV Disinfection | 10.6 |
| Alternative 2 – UV Disinfection with Pretreatment | 19.8 |
| Alternative 3 – Conventional Treatment | 28.0 |
| Alternative 4 – Membrane Filtration | 28.7 |

Membrane filtration has the most favorable overall ranking, followed by UV disinfection without pretreatment, conventional filtration, and UV disinfection with pretreatment. Although ranked second with respect to total points, UV disinfection without pretreatment is ranked the lowest in the two most important areas—water quality risks and operational flexibility. Conventional treatment is ranked third but does have the ability to mitigate water quality risks and provides flexibility to treat varying raw water quality conditions. Membrane filtration is ranked first in the most categories including the key criteria of water quality risks and operational flexibility, primarily due to their robustness and ability to produce high quality water regardless or raw water quality conditions. UV disinfection with pretreatment is ranked lowest. Although UV disinfection

with pretreatment will provide more operational flexibility than UV disinfection without pretreatment, this alternative will not mitigate against forest fires. In addition, the additional capital costs of the pretreatment process and additional pumping requirements make this alternative significantly more expensive than UV disinfection alone.

### 1.2.5 Chapter 6 (TM 5) – Hydropower Generation Options Evaluation

The purpose of the chapter was to determine the economic and engineering viability of the construction of hydroelectric facilities at the following locations:

- Bridge Creek Intake
- Outback Facility
- Aquifer Storage and Recovery (ASR) injection wells
- Distribution system sites within the City of Bend

#### 1.2.5.1 Feasibility Determination

To determine the feasibility of the sites, evaluation was made of the following factors:

- Water Demand and Projections
- Generation Site
- Energy Generation
- Site Layout
- Power Distribution
- Powerhouse Permitting
- Cost Estimate
- Project Schedule

#### 1.2.5.2 Results of the Evaluations

- **Bridge Creek Intake** – It was determined that the environmental impacts that would be caused by the construction of hydroelectric facilities at Bridge Creek made the site unfavorable for further evaluation.
- **Outback Facility** – It was determined that the Outback Facility was not only feasible from a technical standpoint, but it offered a large financial return to the City. The flows through the plant are based on the existing water rights. Either two 2-megawatt (MW) turbines or one 3-MW turbine could be installed.
- **ASR injection wells** – It was determined that using water for ASR was technically and financially possible although the amount of water available for recharge diminishes as Bend's winter demand increases.
- **Distribution System sites:**
  - Aubrey Butte Feed (PRV-004) has the engineering and financial potential to cost-effectively produce about 800,000 kilowatt hours (kWh) of power annually.
  - Overturf Feed (PRV-003) may have the engineering and financial potential to cost-effectively produce about 57,000 kWh of power annually.
  - Athletic Club (PRV-064) may have the engineering and financial potential to cost-effectively produce about 180,000 kWh of power annually.

- Wild Rye and Wild Rye (PRV-038) does not offer sufficient power generation potential to produce power in a cost-effective manner.
- Summerhill (PRV-031) does not offer sufficient power generation potential to produce power in a cost effective manner.
- Wichita (PRV-088) may have the engineering and financial potential to cost-effectively produce about 170,000 kWh of power annually.

### 1.2.6 Chapter 7 (TM 6) – Hydropower Economic Evaluation

The purpose of this chapter was to present a more in-depth economic analysis of the hydropower facilities. For this chapter, construction cost estimates were made as well as estimates of the cost of O&M.

The facilities evaluated include the Outback Facility, ASR Injection Wells Hydropower Facility, and the Distribution Hydropower Facilities. The evaluation in this chapter along with the material in Chapters 8, and 9, Financial Analysis show that the Outback Facility is economically viable.

There are a number of federal and state incentives, and other public and private sector partners and institutions that can provide incentives for the construction and operation of renewable energy facilities. These incentives are explained in more detail in Chapter 8. The incentives were incorporated in the economic evaluation contained in Chapters 7 and 9.

#### 1.2.6.1 Economic Evaluations

- Using the most likely scenario for the amount of available water, the Outback Facility hydropower project is expected to generate from 9,260,000 kWh in 2013 rising to 11,750,000 kWh by 2029. For years beyond 2029 to the end of the evaluation period in 2063, the Outback Facility hydropower project is expected to generate about 11,790,000 kWh annually.
- The Outback Facility project will provide significant revenue over costs during its lifetime. Based on a set of fairly conservative projections, in terms of 2009 dollars, the Outback Facility hydropower project will provide revenue of $63 million and expenses of $25.3 million for a difference of income in excess of expenses of about $37.7 million over the 50-year examination period.

#### 1.2.6.2 Summary of Economic Evaluation and Recommendations

- All of the project alternatives and scenarios for the Outback Facility appear to be very attractive from a financial perspective. The ASR Injection Wells hydropower facility was incorporated into the Outback Facility for Scenarios I and III since both scenarios require the beneficial use of the water being injected into the wells. Outback Alternative 2 with one Pelton wheel provides the most gain and quicker payback period than the two-turbine option.
- When comparing the results of the Outback Facility for Scenarios II and III, it is evident that inclusion of ASR hydropower reduces the payback period by 2 years. That is, the additional flow through the Outback Facility turbine combined with well generation revenue justifies the cost of well installation.
- Based on the economic evaluation, the Aubrey Butte, Athletic Club, and Wichita sites are feasible. Aubrey Butte is the most attractive distribution hydropower site by far with a short payback period of 6 years. The Aubrey Butte site is recommended to be carried forward into predesign.
- We recommend that the project proceed using a single 3 MW Pelton Turbine/Generator at the Outback Facility site.

### 1.2.7 Chapter 8 (TM 7) – Hydroelectric Incentives

The development and use of renewable energy sources, such as a hydropower system, has been encouraged by both the federal and state governments. They have provided several sources of financial incentives to those developing new projects. A task of this study was to investigate potential financial sources and estimate their benefit to the project such that they could be included in the financial analysis for the potential return from the project and its initial capital funding.

#### 1.2.7.1 Need for Private Partners to take advantage of Many Incentives

Many federal, state, and quasi-governmental financial incentives both for construction and operation of hydroelectric facilities are in the form of tax credits. For a tax credit to assist in financing a hydroelectric project, the City will need to partner with a private sector entity or entities that have a federal and/or state tax liability. Since the potential savings of partnering could exceed 50 percent of the cost of the project, our recommendation is that the City find a partner or partners for the construction of the power plant, penstock, and well generation systems.

#### 1.2.7.2 Construction Incentives

- **Federal Business Energy Investment Tax Credit (ITC)**

  Under the ITC, the project may be eligible for a tax credit of 30 percent of the construction cost including all project (engineering, financing, etc.) costs. We expect that the City will be eligible for 30 percent of the cost of the hydroelectric portion of the projects. We have included $12.42 million from this source for the Outback hydroelectric and penstock project.

- **Federal Renewable Energy Grants**

  Federal Renewable Energy Grants are authorized by the American Recovery and Reinvestment Act of 2009 and are administered by the U.S. Treasury. The Outback hydroelectric and penstock project would receive about $400,000 for this tax credit or grant.

- **Clean Renewable Energy Bonds (CREBs)**

  CREBs may be used by governmental and tribal entities to finance renewable energy projects, and are essentially loans with a zero percent interest rate. The borrower pays back only the principal of the bond, and the bondholder receives federal tax credits in lieu of the traditional bond interest. The City applied for CREBs in early August 2009. They were successful in their endeavor and have a CREBs bond authorization for more than $1,000,000

- **Qualified Energy Conservation Bonds (QECBs)**

  QECBs are similar to CREBs in that they may be used by government and tribal entities, and are essentially loans with a zero percent interest rate. Funds are allocated to each state on the basis of its population relative to the total U.S. population.

- **U.S. Department of Energy (USDOE) Loan Guarantee Program**

  The USDOE Loan Guarantee Program paves the way for federal support of clean energy projects that use innovative technologies, and spurs further investment in these advanced technologies. It was designed to avoid the production of greenhouse gases. We expect that the loan guarantee program will be reauthorized in 2010 and 2011.

- **Oregon Business Energy Tax Credit (OBETC)**

  OBETC is a corporate tax credit. It is equal to 50 percent of the cost of construction for partnered projects and 35 percent of the cost of construction for non-partnered projects, up to $10 million per project. We expect that the City will be eligible for the 50 percent tax credit up to the $10 million cap for the hydroelectric portion of the project.

- **Energy Trust of Oregon (ETO) Open Solicitation Program**

  The ETO Open Solicitation Program is a grant program. The program issues grants, including those for the construction of facilities to generate renewable energy. The program is funded through a public purpose charge added to the bills of regulated utilities such as Pacific Power & Light (PP&L). ETO has wide discretion in both the amount of money granted and conditions of the program. ETO can provide payment of a rate of return on investment. The program also allows ETO to provide funds that would take an above-market cost project to a market cost project. ETO will provide guidance on what we can expect when the project is further along. A formal agreement on the amount must wait until after the Federal Energy Regulatory Commission (FERC) license is issued.

- **Oregon Small Scale Loan Program**

  The Oregon Small Scale Loan Program offers loans from $20,000 to $20 million for projects for terms of 5 to 15 years. The term of the loan cannot exceed the expected project life. The loans are typically used in conjunction with OBETC.

#### 1.2.7.3 Operations Incentives

- **Green Tags**

  Green tags, also referred to as renewable energy certificates and carbon credits, are tradeable commodities that represent proof that energy is generated from renewable energy sources. The value of green tags is based on market forces and is subject to fluctuation. We have taken a conservative approach by assuming an initial green tag value of $0.022 per kWh in 2012. In 2013 (the first full year of operation), the green tags for the Outback hydroelectric project are expected to be worth $215,332 rising to $888,570 ten years later and over $7 million per year in 2062..

- **Federal Hydroelectric Production Incentives**

  The Energy Policy Act provides for a Hydroelectric Production Incentive. This is a financial incentive for hydroelectric production for the first 10 years of operation that escalates with inflation and we expect that in 2012 it will be valued at approximately $0.022 per kWh. We have included this incentive in our economic evaluation of the projects. In 2013 (the first full year of operation, the Hydroelectric Production Incentive for the Outback hydroelectric project is expected to be worth $215,332 rising to $386,962 in 2021.

- **Federal Renewable Electric Production Tax Credits (PTCs)**

  PTCs are corporate tax credits for the production of renewable energy. Not to be confused with the Federal Hydroelectric Projection Incentives above, this program allows for a private sector partner to obtain a tax credit of $0.022 per kWh in 2012 for the first 10 years of operation. In 2013 (the first full year of operation, the PTCs for the Outback hydroelectric project are expected to be worth $215,332 rising to $234,960 in 2021.

#### 1.2.7.4 Conclusions

The use of federal and state incentives will greatly reduce the cost of construction of the facilities planned for the City. It is expected that just the two largest of the construction incentives will likely reduce the cost of the facilities to the City by about 54 percent for the powerhouse and penstock project. With a private sector partner, the City can expect 30 percent of the cost of the powerhouse and penstock from the Federal Business Energy ITC ($12.42 million), $10 million from the OBET, and a $400,000 renewable energy grant for a total of $22.82 million of the $41.4 million cost of the hydroelectric and penstock portions of the project. In addition, bond guarantee and other bonding programs of the federal government could effectively reduce the bond interest rate to zero, saving the City tens of millions of dollars over the life of the project. The bond guarantee program could eliminate the necessity of establishing a costly debt service reserve fund.

There are also programs that enhance the value of each kilowatt (kW) of renewable energy produced. The Federal Hydroelectric Production Incentive increases the value of power by an average of $300,000 for the first 10 years of the project. The Federal Renewable Electric PTC increases the value of each kW of power produced by an average of $225,000 for the first 10 years of the project. Finally, green tags or renewable energy certificates increase the value of the energy starting at $215,332 during the first full year of operation and ending with an annual payment project to be $7,810,000 in the year 2062.

The $22.8 million in construction incentives reduce the cost of the powerhouse and penstock from $41.4 million to $18.6 million. The operational incentives and green tags raise the value of power over that which PP&L will pay by $634,000 the first full year of operation, raising to more than $7.8 million in 2062. Total payments for power during the first full year of operation for the Outback Facility project should be in excess of $1.3 million. Over the 50-year life of the project, the Outback Facility project should be highly cost-effective.

### 1.2.8 Chapter 9 (TM 8) – Financial Analysis

This chapter summarizes the financial analysis that was conducted of the study options, both capital projects and funding options.

#### 1.2.8.1 Summary of Study

The scope of the financial analysis included the following tasks:

- Update the previous financial plan model developed for the City by Galardi Consulting in 2008 to reflect current operating and capital budget data.
- Evaluate potential financing options for capital improvements, incorporating data provided by the project consultant team, City staff, and the City's consulting financial advisor.
- Determine rate impacts of different capital project alternatives using the updated financial plan model and the relevant package of construction and financing assumptions.
- Develop documentation and presentation material, including a memorandum and matrix of construction/financing alternatives and corresponding rate impacts.

Over the course of the study, 22 primary scenarios were developed representing different options related to hydropower, treatment technology, timeline (2012 water treatment deadline versus a 2014 treatment deadline), and penstock construction. Additional scenarios were developed to analyze the impact of alternative debt assumptions (e.g., subordination of debt) and modified O&M and hydropower revenue assumptions.

#### 1.2.8.2 Conclusions

The City has a long-standing practice of adjusting water rates annually based on a long-term financial plan to avoid large single-year rate adjustments. The City last adopted a water system financial plan in 2008, and projected the need for an annual rate increase of 8.25 percent through fiscal year (FY)2012–13. The City implemented the first two rate increases from that plan in FY2008–09 and FY2009–10. The updated financial plan projects rate increases of 4.0 to 10.8 percent for FY2010–11 through FY2013–14 to fund the various options for the Bridge Creek Water Supply Improvements plus the City's current adopted 5-year, projected baseline O&M costs. The rate increase projected for the study's preferred option is 7.6 percent.

The hydropower options significantly mitigate projected rate increases, due to the additional revenue projected from the sale of hydroelectric power, as well as significant construction cost incentives. All of the Bridge Creek alternatives will greatly increase the City's debt service costs, and therefore will require a long-term commitment from the City to maintain sufficient rates and charges to meet bond covenants.

The rate increases projected in Chapter 9 are based on available information on costs and revenues as of May 2009, and include a number of assumptions related to future financing eligibility and market conditions. Changes in these assumptions may warrant modifications to the rate increases. Furthermore, continued economic challenges will require close monitoring of revenues and expenses, and possible future revisions to rate increases, if customer growth and consumption drop below projected levels.

### 1.2.9 Chapter 10 (TM 9) – Environmental and Regulatory Permit Impacts to Alternatives Summary

This chapter describes a preliminary permit requirement assessment for the City's water system alternative(s) as developed by the project team. The project is described in detail in other chapters. For the purposes of this chapter, the project is considered to be in the following three sections: intake structure improvements, penstock construction along Forest Road 4603 (Tumalo Falls Road) and Skyliners Road, and new development at the Outback Facility reservoir site (e.g. treatment facility, hydroelectric plant, ASR wells, and storage).

#### 1.2.9.1 Permitting Agencies

The following provides a description of the various permitting agencies.

- Federal:
  - USFS
  - Federal Highway Administration (FHWA)
  - U.S. Army Corps of Engineers (USACE)
  - U.S. Fish and Wildlife Service (USFWS)
- State:
  - Oregon Department of State Lands (ODSL)
  - ODFW
  - State Historical Preservation Organization (SHPO)
  - Oregon Department of Environmental Quality (DEQ)
  - Oregon Water Resources Department (OWRD)
- Local:
  - Deschutes County
  - City of Bend

FERC permit issues were discussed in Chapter 6.

#### 1.2.9.2 Analysis of Permitting Issues

For each permit, an analysis was made of the following issues:

- Description of the Permit—who issues it, what it covers, likely issues, etc.
- Timing—how long it is likely to take to obtain the permit
- Identification of the portion of the project impacted—what part of the project requires the permit
- Cost—development of the likely cost of the permit

Table 1-2 contains a summary of permit findings.

Table 1-2. Summary of Permit Findings

| Permit/Action | Timing | Portion of project impacted | Estimated cost |
|---|---|---|---|
| Environmental assessment (EA) – FHWA or USFS lead | 6 to 18 months | Intake; penstock | $75,000 to $200,000, depending on special technical reports needed |
| USACE fill permit (individual) | 3 months | Intake; stream and wetland crossings | $100 (permit only, not including delineation or mitigation design) |
| USFWS – threatened and endangered species impacts | Reviews parallel with action | USFS lands | Unknown–possible special studies |
| ODSL fill and removal | 3 months | Intake; stream and wetland crossings | $644 to $1,300 (permit only, not including delineation or mitigation design) |
| ODFW | Reviews parallel with action | All portions | Unknown–possible special studies |
| SHPO | Part of EA | Intake | None |
| DEQ<br>• Water quality certification | • With Federal Permits | • Hydroelectric plant | • Depends on complexity |
| • National Pollutant Discharge Elimination System (NPDES) general stormwater construction permit | • 2 months or less | • Any disturbance totaling more than 1 acre | • $1,510 + $765 per year |
| • NPDES wastewater permit | • Unknown | • Treatment facility | • General: $192 + $435 per year<br>• Industrial: $9,000 to $47,000 +$1,500 to $16,000 per year |
| • OWRD – Feasibility study/ASR limited license process | 6 to 15 months | ASR injection and down hole power generation | Limited license<br>Permit fee: up to $300<br>Permit support cost: $95,000 to $165,000 |
| Deschutes County | Max 150 days | All portions outside of urban growth boundary | Up to several thousand |
| USFS special use permit | Variable – 3 months estimate | Majority of project | Individually set - $10,000 estimate |

Note: The Federal Energy Regulatory Commission permits are discussed in Chapter 6.

### 1.2.10 Chapter 11 (TM 10) – Water Rights Considerations

The City holds a number of surface water rights that impact the Bridge Creek water supply system. To fully evaluate long-term use, their status and usefulness needed to be included in this study. Therefore, GSI Water Solutions, Inc. was employed to help define surface water rights as they may impact the options being considered, and specifically the use into the future of the Bridge Creek supply system. Chapter 11 provides foundational information about the City's water rights, and in particular, the opportunities, impediments, regulatory requirements, and basin-wide context of the City's current water rights.

Chapter 11 describes the City's historic use of surface water and groundwater, and surface water variability. The chapter considers how the amount of surface water use could vary under different scenarios, based on the likely availability of water under a particular water right due to its relative priority date within the system. Since this work is forward-looking, we have developed the analysis of the City's ability to use surface water under its existing water rights without regard to its current system capacities.

The City's water rights are complex and stretch back to the turn of the last century. The City holds surface water and groundwater rights that it uses to meet its municipal water demands. Many of the City's surface water rights have season of use and annual water use limitations because they were obtained in the early 1900s from irrigation rights which are limited traditionally to the growing season. In addition, several of the surface water rights are subject to regulation at some time during the irrigation season under the Oregon Watermaster's distribution schedule. Tumalo Irrigation District (TID) has significant rights to water from Tumalo Creek and during the summer period the water available to be withdrawn is equitably distributed between the water users, including the City and TID. As a result, when considering potential changes to its use of surface water, the City must be mindful of these considerations and the basin-wide context of changing how it uses surface water currently.

The City has sufficient proven water rights to water diverted from Bridge Creek to continue its current use as a water source for Bend into the future. Significant additional surface water rights or that or other locations will be difficult and/or expensive to obtain. Water rights in the Deschutes Basin are very complex.
Chapter 12 (TM 11) – Middle Deschutes River Temperature Evaluation

This chapter presents the results of an evaluation of river temperatures for the Middle Deschutes River. Temperature profiles were calculated for three flow scenarios for Tumalo Creek and were compared to two existing scenarios previously generated by DEQ in 2008.

#### 1.2.10.1 Background

The middle reach of the Deschutes River generally has lower flows and higher temperatures than the upper reach, which raises both recreational and environmental concerns. Many users withdraw water directly or indirectly from the upper reaches of the Deschutes River. In 2008, DEQ completed a temperature study for the subject river and stream reaches. DEQ is currently developing a total maximum daily load requirement for temperature in Tumalo Creek, Whychus Creek, Middle Deschutes River, and Upper Deschutes River. The computer model used and calibrated by DEQ in this work was employed to provide the analysis for this study.

#### 1.2.10.2 Conclusions and Recommendations

Comparing the five scenarios that were developed, it can be shown that increasing flow in Tumalo Creek's discharge to the Deschutes River decreases temperatures in the Middle Deschutes River. In the same manner, increases in flow passing North Canal Dam decreases temperatures in the Middle Deschutes River. The relative impacts between Tumalo Creek inflows and water passing North Canal Dam were not explicitly evaluated. However, temperature data for the streams show that Tumalo Creek inflows generally have lower temperatures than Deschutes River water passing through North Canal Dam.

## 1.2.11 Chapter 12 (TM 11) – Middle Deschutes River Temperature Evaluation

This chapter presents the results of an evaluation of river temperatures for the Middle Deschutes River. Temperature profiles were calculated for three flow scenarios for Tumalo Creek and were compared to two existing scenarios previously generated by the Oregon Department of Environmental Quality (DEQ) in 2008.

### 1.2.11.1 Background

The middle reach of the Deschutes River generally has lower flows and higher temperatures than the upper reach, which raises both recreational and environmental concerns. Many users withdraw water directly or indirectly from the upper reaches of the Deschutes River. DEQ completed in 2008 a temperature study for the subject river and stream reaches. DEQ is currently developing a total maximum daily load requirement for temperature in Tumalo Creek, Whychus Creek, Middle Deschutes River and Upper Deschutes River. The computer model used and calibrated by DEQ in this work was employed to provide the analysis for this study.

### 1.2.11.2 Conclusions and Recommendations

Comparing the five scenarios that were developed, it can be shown that increasing flow in Tumalo Creek's discharge to the Deschutes River decreases temperatures in the Middle Deschutes River. In the same manner, increases in flow passing North Canal Dam decreases temperatures in the Middle Deschutes River. The relative impacts between Tumalo Creek inflows and water passing North Canal Dam were not explicitly evaluated. However, temperature data for the streams show that Tumalo Creek inflows generally have lower temperatures than Deschutes River water passing North Canal Dam.

## 1.2.12 Chapter 13 (TM 12) – Alternatives Evaluation to the Bridge Creek Penstock

The Bridge Creek water supply system includes two pipelines that connect the water intake on Bridge Creek with the City's primary water control, storage, and treatment facility at the Outback Facility. This chapter provides a detailed evaluation of the two pipelines and provides options and costs to bring them into a more reliable condition. To accomplish this, a site inspection of the entire length of the two pipelines was made, interviews with City maintenance staff were conducted, a hydraulic analysis of the pipelines was conducted that evaluated the impact of some repair options, and a cost estimate of repairs and financial impact to the City was prepared. This chapter documents the results of the efforts, provides recommendations concerning whether to replace the existing pipelines, and if they are not replaced, how they can be upgraded to provide reliable service into the future.

### 1.2.12.1 Condition of the Existing Pipelines

As described in more detail in Chapter 4, the two pipelines were constructed in 1926 and from 1954 through 1957. There are a number of issues with the condition of the two existing pipes.

If taken foot-by-foot along their route, a very large number of specific problems with the existing pipelines can be identified. The chapter details these and provides photos of many examples. The problems with the pipeline include the following:

- **Pipe wall integrity** – The old pipes are beginning to rust through where they have lost their interior or exterior lines. They have also been damaged by exterior objects and trees. Evidence of leaks are apparent along the upper reaches of the two pipelines.

- **Slope instability** – Upper reaches of the pipes are in or under unstable slopes. They have been damaged in the past by slope movement and continue to be at risk.
- **Trees** – The pipelines are overlain by trees along much of their upper reaches. Trees can damage the pipelines by crushing their walls or causing penetrating leaks. Trees also encapsulate the pipelines with their roots, risking rupture of the pipelines if the tree blows over.
- **Easements** – The pipelines are in private easements on which the land owners have placed buildings and other structures over or near enough to the pipelines to threaten their water-tightness. Rupture of a large water main in an urban area is a danger to property and life safety.
- **Hydraulic issues** – The pipelines were designed to be small and consume the energy in the water by friction, thereby reducing the pressure within. However, the pipelines are not controlled well hydraulically and can no longer convey fully the City's water supply under its existing water rights from Bridge Creek.

#### 1.2.12.2 Options for Maintaining the Existing Pipe

There are options to rejuvenate the existing pipelines and place them into a reasonable, reliable condition again. The options evaluated included the following:

- **Cured-in-Place Pipe (CIPP) Relining Systems** – This process places a plastic pipe inside the existing pipeline at least in the areas where relining is beneficial. The evaluation of this option showed that it was not practical for this situation and had not been employed in this size pipeline in any great extent in North America.
- **Cement Mortar Relining** – This process places a new cement coating on the inside of the pipeline. This is the traditional method of water main relining and would serve here where relining is necessary.
- **Replacement of Select Pipe Section** – Several reaches of the upper sections of the two pipelines should simply be replaced with new ductile iron pipelines, or if the replacement can be done in Skyliners Road, they should be replaced with a new pipe of a size to serve a hydropower unit at the Outback Facility. The areas recommended for replacement are those sections immediately east of the Bridge Creek Intake.
- **Hydraulic Control Improvements** – Each pipeline should be equipped with intermediate standpipes and hydraulic control values to better ensure that the pressures in the pipelines remain in the range that they can withstand and that air is not trapped in the lines that would reduce their capacity.

The estimated cost to place the existing pipelines back into a reliable condition was $9.56 million.

#### 1.2.12.3 Recommendations

The economic advantage to installing the hydropower facility on a larger-capacity penstock is so great that we continue to recommend this alternative. The option to repair the existing pipelines will provide a lower initial capital cost. However, the long-term financial impact of pumping more well water and not receiving the revenue from the power is significant. In addition, after spending more than $9.5 million on the old pipelines, the City will still have a system that has two old pipelines at its heart.