Council Study Session

April 2, 2018

Title:	Water Treatment Plant Status Update	
Item Type:	Informational	
Requested by Council?	Yes	
From:	Paula C. Brown, PE	Public Works Director
	paula.brown@ashland.or.us	

Summary:
Before the Council is an update on the results of the comprehensive cost comparison for the water treatment plant (WTP). Council will recall staff's update at the November 6, 2017 study session in which staff proposed suspending the current direction of building a new 2.5 million gallon per day (mgd) WTP and concurrently running the existing plant, to allow staff to financially assess and compare the costs to **either** build a new 7.5 mgd water treatment plant or continue to upgrade and utilize the existing water treatment plant (WTP). The costs to operate two separate WTPs are not in the best interest of the City.

Discussion Questions:
The issue has not changed from last November: ensure the City has the ability to provide clean water reliably to our community, today and for the next 20-50^{+} years, and further ensure that the City is capable of meeting not only today's water quality standards, but to also anticipate meeting future regulation changes. The City has an outstanding water quality staff that operates the existing WTP and distribution system exceptionally and with pride for our community. The existing plant is in a less than optimal site, but has performed well in all but the most extreme circumstances.

Staff has moved forward on obtaining a competitive cost comparison from RH2 Engineering and their partner, Black and Veatch, at a fee not to exceed $34,900. That analysis is to evaluate:

1. Costs for a new 7.5 mgd WTP with a comparable treatment process to the existing plant.
2. Costs of facility and operational improvements to the existing treatment plant along with a risk assessment for seismic, flooding and operational expandability at the current site.

As such, based on the results of the cost comparison;

- Is council willing to overlook significant seismic, potential flooding and other risks at the existing plant site and continue to operate the WTP in its current location?
- Is council ready to fully invest in its future and build a 7.5 mgd WTP at the lower granite pit location?

Resource Requirements:
The current adopted biennium budget (BN 2018-19) appropriates a total of $22,674,000 dollars for the engineering and construction of two projects: a new 2.5 mgd supplemental water

CITY OF ASHLAND

treatment plant (Project # 2015-31) and proposed 2.6 million gallon (mg) Crowson II water storage reservoir. To date expenditures for the water treatment plant and reservoir siting study total $525,140. The preliminary engineering associated with these expenditures remain effective and will inform staff through the remainder of the water treatment plant design and construction as well as completion of the water master plan work.

Suggested Next Steps:
Staff recommends moving forward with a single project to build a new 7.5 mgd plant with potential for future capacity and stay within the same BN 2018-19 budget appropriation. Unless there are objections voiced tonight, staff will proceed with developing a formal request for qualifications to complete design of a 7.5 mgd water plant.

Staff will bring a formal decision for design consultant selection, final design approvals, construction award and any required additional funding options to Council at relevant points, as well as periodic updates through the Capital Improvements Plan reviews, budget reviews or water program updates as desired.

Policies, Plans and Goals Supported:
The original projects represent priorities within the Council approved 2012 Comprehensive Water Master Plan Update. Staff is currently in the process of completing a new Water Master Plan Update that evaluates the 2020-2030 time period with RH2 Engineers.

Council Goals:
4. *Evaluate real property and facility assets to strategically support city mission and goals.*
22. *Prepare for the impact of climate change on the community.*

Department Goals:
- Maintain existing infrastructure to meet regulatory requirements and minimize life-cycle costs
- Deliver timely life cycle capital improvement projects
- Maintain and improve infrastructure that enhances the economic vitality of the community
- Evaluate all city infrastructure regarding planning management and financial resources

Background: Cost Comparison and Evaluation Report:

> *"... it was determined that it is not possible to develop comparable alternatives due to the inability to rehabilitate the existing plant that mitigates three major risks..."*

In short, the engineering team of RH2 and Black & Veatch determined the existing plant could not fully overcome the risks associated with seismic stability, flooding and ensuring capacity for potential future regulatory requirements without rebuilding the WTP. Yes, the existing plant could be modified and updated one element at a time, but in the end, short of a full rebuild, the overall risks remain – and the City would still be operating in a less than desirable location which is also prone to wildfire and localized landslides.

Staff reviewed the details of the assessment and is confident in the approach taken. Although as suspected, the short term costs to provide upgrades to the existing plant are less than the cost to build a new plant, the risk, not only to plant personnel, but the City as a whole is not acceptable.

In addition, deferring construction of a new plant only imposes greater overall cost to the City. The existing plant has a finite life and the City's needs continue beyond that life span.

Background: Additional Information:

The 2012 Water Master Plan (Carollo) developed the recommendation for a supplemental 2.5 mgd WTP and 2.6 million gallon (mg) Crowson II storage reservoir as part of the final capital improvement plan. The 2.5 mgd plant was initially identified and sized to assist the City in meeting peak projected water usage in the summer seasons. It was meant to operate year round with the existing plant operating "as required" to meet system capacity requirements past 2.5 mgd. It was expected the 2.5 mgd plant would be expanded to a full 10 mgd sometime in the future, and the existing WTP phased out of operation. Based upon the prior water master plan, the Crowson II reservoir was initially assumed to be sized for 2.6 mg of potable water storage. Further analysis by RH2 has shown that the "Crowson II" storage reservoir may be unnecessary as the new Park Estates Pump Station is designed to maximize utilization of water in the existing Crowson Reservoir at full capacity. The need for future reservoir capacity and operational improvements will be assessed with the current Water Master Plan evaluation.

The City obtained low interest financing from the Infrastructure Finance Authority (IFA) for Engineering and construction of the water treatment plant. The loan was in the amount of $14,811,865 with a 1.79% interest rate and $1,030,000 in principal forgiveness. The Council authorized the IFA loan at the June 7, 2016, Business Meeting. Staff has not yet secured financing for the storage reservoir and will revise project costs and evaluate the need once Council makes a final recommendation on the WTP. The Council approved a financing resolution at the December 6, 2016, Business Meeting that allows for the reimbursement of funds towards the reservoir project to be "reimbursed" once financing is obtained. This financing resolution allowed the original project to proceed through preliminary engineering.

Through a formal selection process the City awarded Keller Associates stage 1, preliminary Engineering of the new treatment plant and reservoir (March 21, 2017, Business Meeting). This project had three phases; 1) determine the treatment process for the new WTP, 2) conceptual site selection, 3) the evaluation of repurposing the TID line, and 4) through addendum, support the evaluation of membrane filtration pilot analysis. Keller has completed their preliminary engineering work.

Subsequently, and as identified in the original request for qualifications, RH2 Engineering was hired to perform peer review on the preliminary engineering work of Keller Associates. RH2 Engineering also competed and was selected through a separate request for proposals process to complete the City's comprehensive Water Master Plan Update. RH2 Engineering finished peer review of the first phase of Keller Associates' work and is in the process of completing the Water Master Plan. The Water Master Plan is on schedule for completion this summer (2018).

AWAC:

The Ashland Water Advisory Committee (AWAC) continues to be appraised of the status of both projects. On September 26, 2017, AWAC unanimously supported staff's request to suspend the current decision to construct a supplemental 2.5 mgd WTP and a 2.6 mg reservoir with the intent to run both the new supplemental plant while also maintaining the existing plant. The City has a reliable alternative water source with the connection of the Talent Ashland Phoenix (TAP) water line and should not be running two separate water plants. AWAC supported staff's recommendation to develop a comprehensive cost comparison for **either** a single new 7.5 mgd WTP or improvements to the existing WTP for a 20-year life to include upgrades to the treatment process, and necessary facility improvements to sustain potential earthquake and flooding damage. On March 27, 2018, AWAC will be advised of staff's current recommendation to build a new 7.5 mgd plant.

Next Steps:

Staff will develop an RFQ for the final design of the 7.5 mgd WTP and bring the recommended award to Council once proposals are received and a recommended consultant selected. The design contract would come to council for approval (June or July 2018), as well as periodic updates on the design progress and final cost estimates. If necessary, staff will also seek approval for an increase in the IFA loan to accommodate any cost difference and those agreements will also come to Council for approval. Staff anticipates a 9-12 month design likely starting in July 2018 depending upon the selected treatment process and would build upon the work completed by Keller Associates. It is expected that construction could begin in the fall of 2019 (pushing this into next biennium), and will likely take three years to complete.

Attachments:

Water Treatment Plant Evaluation Report

RH2 ENGINEERING
40 YEARS SINCE 1978

RH2 ENGINEERING, INC.
www.rh2.com
mailbox@rh2.com
1.800.720.8052

WASHINGTON LOCATIONS

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BELLINGHAM

EAST WENATCHEE

ISSAQUAH

RICHLAND

TACOMA

OREGON LOCATIONS

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MAIN OFFICE
6500 SW Macadam Ave. Suite 125
Portland, OR 97239

MEDFORD

March 28, 2018

Paula Brown, P.E.
Public Works Director
City of Ashland
20 E Main St
Ashland, Oregon 97520

Sent via: *Email*

Subject: Plant Evaluation Report Cover Letter

Dear Paula:

The City of Ashland Contracted with RH2 Engineering, Inc.(RH2) and Black and Veatch (B&V) to complete an evaluation of the existing surface water treatment plant condition versus building similar treatment technology in a different location. The goal of the evaluation was to evaluate the economic feasibility of continuing to operate the existing water treatment plant versus building a new water treatment plant.

RH2 has reviewed the information provided by B&V and is agreement with the findings of the evaluation. The report acknowledges that it is feasible to continue the operation of the exiting plant for the 20-year planning horizon. The report also acknowledges that the risks associated with continuing to operate the plant in the existing location are not risks that can be reasonably mitigated. Due to the findings in the report it is not recommended to utilize the existing plant for the duration of the planning period, it is recommended that the City move towards a replacement facility to mitigate the established risks associated with the exiting location.

Sincerely,

RH2 ENGINEERING, INC.

Jeff Ballard, P.E.
Project Manager

Reviewer/Typist/Proofer/Admin

Enclosures or Attachments:

REGISTERED PROFESSIONAL ENGINEER
79543
OREGON
JULY 10, 2007
JEFFREY ALLEN BALLARD
EXPIRES: 12/31/2017

FINAL

PLANT EVALUATION REPORT

City of Ashland Water Treatment Plant

B&V PROJECT NO. 197823

City of Ashland

MARCH 29, 2018

City of Ashland Water Treatment Plant
PLANT EVALUATION REPORT

This Report has been prepared by or under the direct supervision of
David John Carlson, P.E., Black & Veatch Corporation.

REGISTERED PROFESSIONAL ENGINEER
88548
OREGON
JAN. 14, 2014
DAVID JOHN CARLSON
EXPIRES: DEC. 31, 2019

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1.0 Executive Summary

The City of Ashland is evaluating the rehabilitation costs associated with continued operation of the existing surface water plant as compared to the costs associated with construction of a new treatment plant. Black & Veatch reviewed available facility information and performed a site walk of the facility to determine the rehabilitation needed at the existing plant to maintain its operation for a 20-year planning horizon. Costs for rehabilitation were compared to a non-site specific cost to build a new water treatment plant similar to the existing plant.

1.1 BACKGROUND

The City's primary source of raw water comes from the Ashland Creek watershed. Raw water is supplied to the existing plant from Reeder Reservoir on Ashland Creek, located approximately two miles southwest of the city. The existing Ashland WTP site is approximately 0.6 acres in size, and is constrained by the Ashland Creek roughly to the east and south, and by a cliff to the north. Water is conveyed from the reservoir through a penstock from Hosler Dam to supply water to the Reeder Gulch hydroelectric power plant. The powerhouse is located immediately upstream of the existing WTP. After flow passes through the powerhouse, it discharges into a tailrace structure where a portion of the water is diverted to feed the existing WTP.

1.2 EXISTING WTP RISKS AND LIMITATIONS

In its current location, the plant faces several challenges/risks to its safe operation. These include; the risk of flooding due to rain or Dam failure, risk of a seismic event/damage due to landslide and inability to meet future treatment requirements. Based on the evaluation, it was determined that mitigating these risks in a cost-effective and practical manner is not possible. Consequently, it is not possible to develop comparable alternatives due to the inability to rehabilitate the existing plant in a manner that mitigates these three major risks; the risk of flooding, risk of a seismic event and the inability to meet future treatment requirements. The limitations associated with mitigating these risks are summarized below:

- ***Flood Risk.*** The existing WTP is susceptible to flooding due to rain or dam failure. It has experienced flooding three times in its last 60 years of operation. The flood risk could potentially be mitigated by constructing a flood wall; however, its ability to withstand a major flood event is questionable. Constructing a flood wall next to existing basins and structures along the creek is risky because it could potentially damage the existing facilities due to vibration related to construction activities. As such, the cost to mitigate the flood risk cannot be determined with reasonable certainty and therefore not included in the cost comparison.
- ***Seismic Risk and Landslide Risk.*** Regarding the seismic risk, a detailed structural assessment of the existing structures is outside the scope of this document; however, a cursory review indicates that the existing structures do not meet the current seismic code requirements. Assuming that the current loading on the existing structures remains the same, it is not required to upgrade the existing structures to meet the current seismic codes. However, in a seismic event, these structures could suffer significant damage and impair the ability of the plant to produce potable water. Due to the age and condition of the facilities it is not feasible to upgrade the existing structures to current seismic standards in a cost effective manner. Depending on the severity of a seismic event, the time to repair and make the plant functional could range from days to months. In its current location in the canyon, the existing plant is susceptible to damage from landslides. Similar to the seismic risk, the extent of damage that the plant could suffer will depend on the severity of a landslide event.

- ***Treatment Limitations.*** The existing plant is able to produce high quality drinking water using the current microfloc/filtration treatment process. It is currently unknown if additional treatment would be required by EPA as the regulations evolve in the future. However, due to lack of space, it is not possible to construct additional treatment processes or modify existing facilities to accommodate new treatment while keeping the plant in operation. Additionally, exposure of any new facilities to other risks (flooding, seismic, landslide) cannot be practically mitigated. As such, the existing plant does not have the ability to meet any additional treatment requirements such as treatment of algal toxins, if required by future regulations. Any additional treatment would need to be located offsite and would require associated infrastructure investment for pumps, piping, and storage to convey to the distribution system. Since this additional offsite treatment would be needed for both alternatives (existing and new plant configuration), it has not been included in the cost comparison.

1.3 CAPITAL COST COMPARISON

The cost comparison presented below does not take into account the risks outlined above since these cannot be mitigated cost-effectively. The cost purely focuses on the rehabilitation of the existing plant in its current condition. The capital cost comparison of the two alternatives shows the rehabilitation cost of the existing plant to be approximately 25% of the construction costs of a new plant. The base cost comparisons are demonstrated in Table 1-1 below. It assumes that the new plant will have the same capacity of 7.5 mgd and identical treatment processes as the existing water treatment plant.

A cost escalation is applied for both alternatives assuming that these costs will be incurred roughly 5 years from today's date. The cost escalation for both alternatives is determined to be the same as further explained in Section 4.1.3.

Table 1-1 Capital Cost Comparisons (Level 5 AACE Cost Estimate)

ITEM	NEW PLANT[2]	EXISTING PLANT
Facility Construction Cost	**$12,148,000**	**$3,047,500**
Contractor Markups	*$2,915,000*	*$731,400*
Subtotal Total Construction Cost	**$15,063,000**	**$3,778,900**
Total Non-Construction Costs	*$5,475,000*	*$1,284,826*
Escalation (2%/yr. @ 5 yrs. = 10%)	$2,053,000	$506,373
Total Project Cost	**$22,591,000**	**$5,570,099**
Total Project Cost (Rounded to nearest $1000)[1]	**$22,591,000**	**$5,570,000**

1 Level of Accuracy corresponds to AACE Level 5. The major risk factors (Flooding, Seismic, Landslide, and Treatment) are not addressed in the cost.
2 Non-site specific estimate.

1.4 CONCLUSION

While it is feasible to continue operating the existing facility over the 20-year planning horizon at a lower initial investment, the existing plant has some negative considerations that present a risk to continued operation. The City has the opportunity to accept or mitigate these risks in the decision process. Ultimately, the existing facility has a definitive life span and will reach a point where continual investment is no longer financially prudent or will not achieve the desired level of service for the City. Deferring construction of a new plant beyond the 20-year planning horizon will impose a greater overall cost to the City.

2.0 Introduction

The City of Ashland is evaluating future improvements needed at the current surface water treatment plant (WTP) (Figure 2-1) to provide reliable service over a planning horizon of the next 20 years. The purpose of the assessment is to evaluate the costs associated with continued operation of the existing plant as compared against the costs associated with construction of a new treatment plant. In addition to condition related inputs, the study considers adherence to future regulations, treatment capabilities, capacity, and external/environmental risks with continued operation of the existing plant.

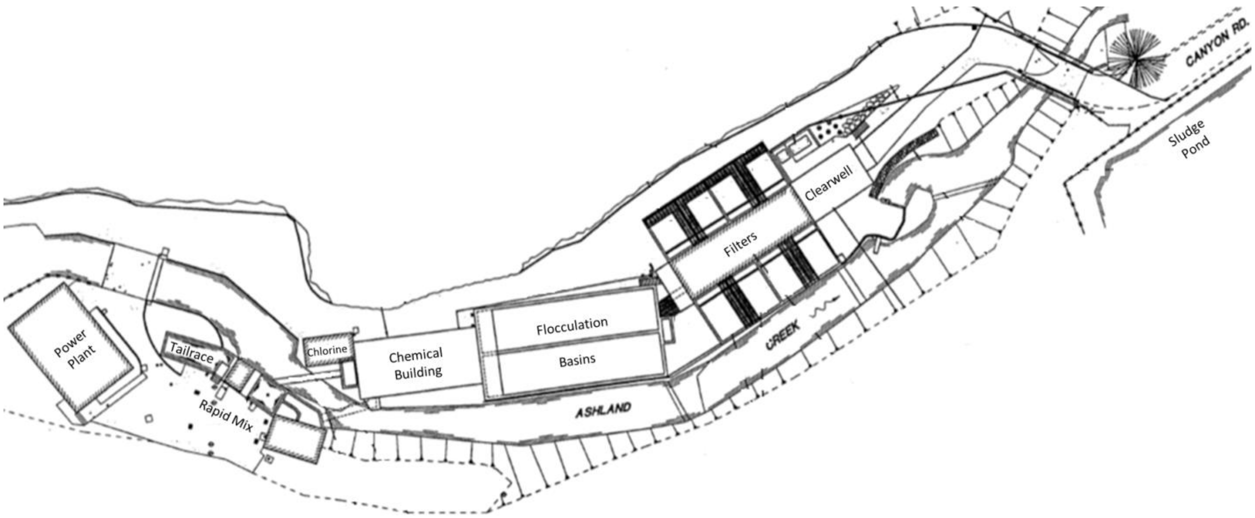

Figure 2-1 Existing Water Treatment Plant Site

2.1 EXISTING INFORMATION

Data request forms were developed with a basic questionnaire for WTP staff to complete with any additional information and past reports. The City staff responded with relevant information for each plant system. A hierarchy of evaluated systems was developed from the drawings provided by the City. Information provided by the City on the various systems was incorporated as a reference during the site evaluation.

2.2 PROJECT APPROACH

This report summarizes the key points of the evaluation with recommendations for improvements needed at the existing plant to maintain its operation, cost opinions for a new plant construction with features duplicating the existing plant, and further evaluation recommendations as necessary. The findings from the existing plant evaluation are compared against a typical generic cost (national cost) to build a new 7.5 Million Gallon/Day (mgd) water treatment plant employing similar treatment technologies.

2.2.1 Treatment Plant Process Areas

As part of the evaluation, Black & Veatch reviewed available facility information and performed a site walk of the facility to determine the existing condition of the major process structures and equipment. To facilitate the assessment, the WTP was subdivided into the following areas:

- Administration
- Pretreatment
- Plant Influent
- Dual Media Filters
- Chemical Feed
- Clearwell/Product Water

Assessments were categorized by discipline as followings:

- Process Mechanical
- Instrumentation and Controls
- Electrical
- Civil/Structural

Black & Veatch performed a walk-through condition assessment of the facilities on February 7, 2018 to document materials of construction and evaluate potential concerns and systems performance. Visual inspections of the facilities were performed to document conditions. Documentation of conformance with current design standards and codes were noted. The following hierarchy represents the major facilities at the plant that were included in the assessment:

Table 2-1 Asset Hierarchy

AREA	ASSET
Administration	Operations Building, building mechanical systems
	Plant roadways
	Fire Protection Systems
Plant Influent	Intake/Headworks Piping and feed from the dam
	Talent Irrigation District Piping
Chemical Feed	Alum, Soda Ash, Carbon, Potassium Permanganate & Cationic Polymer Feed Pumps
	Filter Polymer Aid Feed Pumps
	Building Structure
	Sodium Hypochlorite Tanks
	Old Chemical Storage Building
Pretreatment	East & West Flocculation Basin (incl. gates/valves)
	Flow Control Box (incl. gates/valves)
Dual Media Filters	Filter Basin Structures 1 through 8
	Backwash Pumps 1-3 (incl. associated valves, meters and instrumentation)
	Blower Motor
	Potable Detention Tank
	Hydro-pneumatic Tank
Clearwell	Clearwell Basin Structure
	Potable Pumps
	Finished Water Flow Meter

2.2.2 External Considerations

With the existing plant, there are several external considerations that have the potential to disrupt or impact the WTP operation. Although out of scope for this project, it is recommended that the City perform an in-depth evaluation of these potential risks to quantify their impacts to maintaining operation of the existing WTP. The intent of this section is to describe the external factors for further consideration and action by the City to mitigate risk.

A new plant would obviously provide provisions for increased capacity, redundancy, and improved effluent water quality. Furthermore, an alternate location would be sited in an area that is less susceptible to damage from periodic flooding, landslides, and wildfire. The two primary considerations for addressing existing facility treatment constraints and addressing natural hazards are presented below.

2.2.2.1 Treatment Constraints

A new plant could be designed to improve finished water quality by reducing taste and odor concerns, and treating any future regulated contaminants. Although generally a seasonal issue, the raw water occasionally contains a high concentration of algae. In previous years, the City cleaned the upstream reservoir to remove sediment which can contribute to algae growth. City also routinely sends algae samples to the lab for toxicity analysis.

Although historically non-toxic, the reservoir can contain algae that can produce cyanotoxins. This potential water quality concern is something that a new plant could be designed to be able to address through additional treatment. The existing site lacks the area to expand treatment capabilities to mitigate algal toxins to address EPAs anticipated Algae Guidance that is currently being developed.

The algae are also the source for the seasonal taste and odor issues that the City currently experiences. The existing plant uses powdered activated carbon (PAC) on a seasonal basis to attempt to remove tastes and odors. The past performance of PAC has not been adequate in removing Geosmin low enough to avoid customer taste and odor complaints. Furthermore, PAC can be difficult to manage; it is messy to handle and feed and PAC dust can create an explosive atmosphere around the feed equipment. PAC feed facilities are typically classified as explosive hazard areas. A new plant could be designed to be able to address these taste and odor issues. Furthermore, the following additional treatment considerations could be incorporated into the new plant design:

- Improved ability to remove iron and manganese
- Corrosion control by supplementing alkalinity and controlling pH
- Removal of color / control of disinfection byproduct formation

Other factors that should be considered include expanding the existing site to meet future capacity requirements. The existing 7.5 mgd plant is located on a constrained site with limited ability to expand. A new plant can be designed for an ultimate production capacity of 10 million gallons per day (mgd), which would provide the water needed to meet the City’s demands for the next 20 years, and beyond.

Automation is an important consideration in the evaluation to maintain the existing plant as compared to constructing a new plant. A new plant would likely be automated which would benefit the City by being less labor-intensive (potentially increasing over time with facility age) to operate and maintain the existing plant over the 20-year planning horizon. Through the use of automation, it is anticipated that a new plant would require less operator attention than the existing plant.

2.2.2.2 Natural Hazards

The location of the existing plant places the facility at risk of flooding. Based on information from the City, high flows in Ashland Creek during 1997 caused significant damage to the plant and disrupted water supply to the City. The existing plant was also damaged in the flood events in 1964 and 1974. Because of its remote location within the steep walls of Reeder Gulch, it may not be practical to completely protect the plant from periodic flooding. However, a flood wall at the existing water treatment plant would improve reliability of the existing plant.

Construction of a flood wall at the existing water treatment plant was evaluated by Carollo Engineers in the Water Conservation & Reuse Study (WCRS) & Comprehensive Water Master Plan (CWMP) prepared in October 2010. The flood wall proposed by Carollo (Figure 2-2) would tie into the slope north of the existing plant then extend between the water treatment plant and Ashland Creek for a length of approximately 1,000 feet. The wall would have a height of 10 feet with a thickness of 2 feet and the construction assumes that the wall would tie into existing structures at the plant, rather than be free standing.

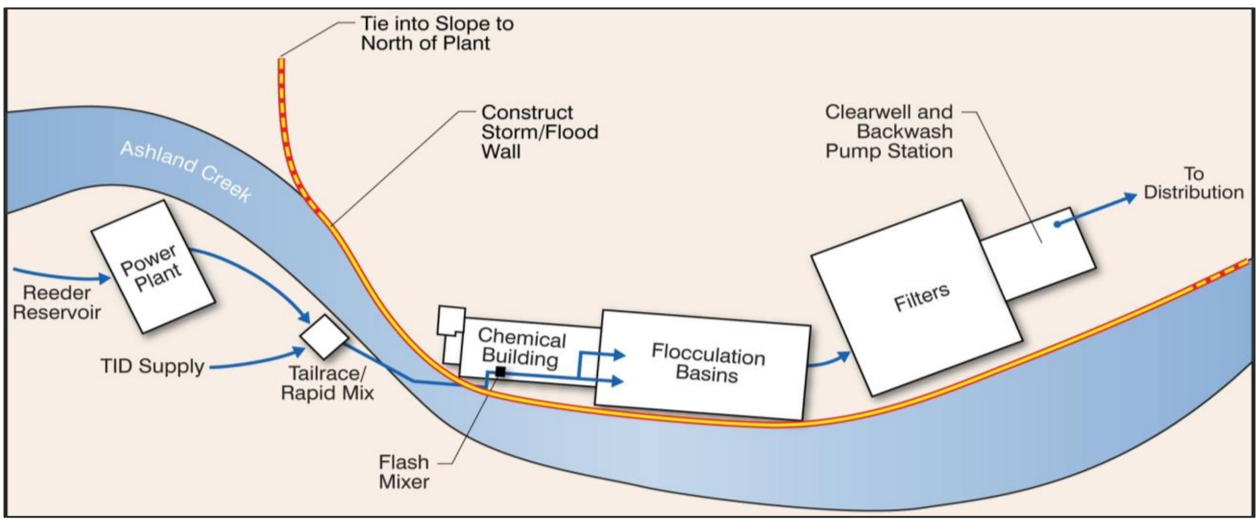

Figure 2-2 Proposed Water Treatment Plant Flood Wall (Carollo, 2010)

The existing plant is also susceptible to failure from a seismic event. The original plant was built in 1949 and has had one major renovation conducted in 1995. Considering the age of these facilities it is uncertain if the original design approach considered both static and dynamic loads. Since the original construction date, seismic loading design considerations have changed. Most water-retaining structures today are designed using ACI 350, which provides increased levels of reinforcing, closer rebar spacing, and limitations on crack width to prevent leakage. It is unlikely that ACI 350 or any of its principles were used to design the existing plant. The existing structures are likely unable to resist modern day seismic loads. These changes, coupled with a facility with concrete condition that has deteriorated due to normal use, makes the existing structures susceptible to failure from seismic activity. The plant basins and structural elements (such as walls) should be evaluated to determine if they can resist the current seismic acceleration and hydrodynamic forces per ACI 350. The City should consider whether existing facility should be upgraded to meet the requirements of the current seismic code.

2.2.2.3 Redundancy/Reliability

The City has some provisions for redundancy for up to 2.1 mgd treated water supplied from the Talent, Ashland and Phoenix (TAP) Pipeline. The TAP Pipeline benefits the City to provide supply during a treatment plant outage. The City has water rights for TAP through Lost Creek Lake up to 2.1 mgd only, but the TAP pumps can supply up to 3.0 MGD. Currently the TAP system has the ability to supply roughly one half of the population in the City. Additional improvements need to be made to the pumps and piping system to convert this into a full redundant supply. Although the City has provisions for an alternate source of finished water, the overall supply is not under the City's control.

3.0 Plant Evaluation

The following sections discuss the evaluation between the existing water treatment plant and a new water treatment plant. This includes the condition assessment and capital improvements to the existing plant, as well as new facility treatment assumptions and process description.

3.1 EXISTING WATER TREATMENT FACILITY

The City's primary source of raw water comes from the Ashland Creek watershed. Raw water is supplied to the existing plant from Reeder Reservoir on Ashland Creek, located approximately two miles southwest of the city. Water is conveyed from reservoir through a penstock from Hosler Dam to supply water to the Reeder Gulch hydroelectric power plant. The powerhouse is located immediately upstream of the existing WTP. After flow passes through the powerhouse, it discharges into a tailrace structure where a portion of the water is diverted to feed the existing WTP. Average water production is 2.9 mgd with peak summertime demands approaching 6.5 mgd. The WTP can also be fed using raw water supplied from the Talent Irrigation District's (TID) pipeline. TID water is used to supplement the WTP during low watershed conditions in reservoir.

The Ashland WTP site is approximately 0.6 acres in size, and is constrained by the Ashland Creek roughly to the east and south, and by a cliff to the north. The entire plant is gravity flow. Water is pulled from the Ashland Creek via a 36-inch raw water tailrace structure.

The treatment process consists of rapid mix, mechanical flocculation, granular media filtration, and chlorination. The water flows through a flash mixing process, then to the flocculation basins. The high rate filtration plant continues utilizing alum as a coagulant to aid particle agglomeration and soda ash for alkalinity adjustment and pH control. A chlorine solution is fed immediately ahead of the flocculation tanks. The chlorine feed is adjusted in response to the water temperature. Following flocculation, the water flows through the filter beds and then into a 168,000-gallon clearwell where the water is chlorinated and distributed to the system.

Alum, sodium hypochlorite, soda ash, and activated carbon can be mixed with the raw water in the flash mixing tank as part of the treatment process to aid in the removal of solid particles and other contaminants. Alum, soda ash, cationic polymer, and potassium permanganate are added via a mixer and the flow is sent through flocculation basins. The powdered activated carbon is used only seasonally when TID water is included in the system to treat any taste and odor problems or if the color is high. Color may be the result of organic matter, manganese, copper, or iron in the water. The activated carbon absorbs the organic material in the raw TID water, to remove the color.

The original plant construction included a previous sedimentation basin that was repurposed into the current chemical building. A separate chlorine building is located next to the old sedimentation basin structure. A 12.5% sodium hypochlorite solution is fed via a peristaltic pump to the influent mixer and the clearwell. All chemical pumps are located in the building basement level near the raw water pipeline and the flash mixer. Existing parallel sedimentation basins were repurposed into flocculation basins where redwood baffles and mechanical vertical flocculators were installed to help to grow the microfloc. Sediment from the flocculation basin and the filter backwash waste is piped to a sludge lagoon. After flowing through a flow control box at the end of the flocculation zone, the water is sent through one of six dual media filters that consist of sand and anthracite coal layers. There are two additional filter basins that have been abandoned. Each filter is equipped with automatic rate of flow controller valves. These filters remove remaining particles in the water before it enters the clearwell. A filter backwash system of tanks and pumps is also included.

Backwash water for the filters is pumped from the clearwell. Beneath the filters, there is an air scour system and associated equipment. Above the filter gallery, there are administration offices and a SCADA workstation area.

Solids from the filters are routed to a pond, which is eventually sent to the sewer. After the filters, product water is flows to the clearwell. After the clearwell, the chlorinated effluent flows to the downstream Crowson Tank finished water reservoir located off site.

3.1.1 Summary of Existing Plant Evaluation by Discipline

From a broad perspective, the existing WTP is old with outdated facilities, is located in a hazardous flood and seismic zone, and does not have room to expand to meet future capacity requirements or the ability to provide additional treatment processes to address potential algal toxins or to fully remove taste and odor issues.

The current WTP was partially re-built in 1995. From an engineering discipline perspective, the existing plant contains electrical and control systems that will need replacement or are obsolete, as well as mechanical equipment that is nearing the end of its useful life. City input regarding condition, operations and maintenance issues, and recent improvements, was incorporated into defining the rehabilitation needs. Input from plant staff regarding functional needs was also evaluated. For example, if equipment requires replacement because it is no longer reliable or no longer meets functional needs, the rehabilitation needs reflect this input. Since the plant will need to continue to provide peak capacity into the foreseeable future, many components are slated for replacement in the 20-year planning horizon.

3.1.1.1 Structural

The concrete observed at the existing plant is performing as expected given its service, usage, surrounding environment, and age. Deteriorated and corroded concrete was observed. Minor defects observed included localized concrete spalling, scaling, and cracking.

The structural integrity of the tanks and floors has not yet been compromised due to the deterioration that has occurred to date. However, concrete degradation will continue to occur and spread if left unchecked. Potential repair and rehabilitation methods and mitigation strategies recommended for further evaluation include: performing localized, partial depth concrete crack repairs and protective coating systems.

3.1.1.2 Process Mechanical

To meet the criteria of extending the existing plant useful service life by approximately 20-years, it is recommended that the pumps, gearboxes, and motors be replaced. Based on their assessed condition and operability, it is recommended that process mechanical valves either be refurbished or replaced in the 20-year planning horizon.

In general, it is assumed that replacement would be based on equipment types and sizes to match existing. However, it may be appropriate to replace with a different type of pump, valve or other equipment to better meet plant requirements or City staff preference. In most cases, replacement rather than repair of pumps, valves and other equipment is recommended to achieve the objective of extending service life by 20 years. If an asset is in good condition, and replacement parts are readily available, refurbishment may be more cost effective than replacement. However, it is important to also consider the amount of time the equipment can be taken out of service if it is scheduled for refurbishment.

Process mechanical pipelines were assessed to be in varying condition states. Most piping systems require attention and improvements. Some extent of piping protective systems, coatings and linings will be required to extend piping system useful service life by 20-years.

3.1.1.3 Electrical

In general, it was observed that some electrical equipment is not expected to last another 20 years and is recommended for replacement. Some of the electrical equipment that provides power to pump motors, valves, instruments, and other process related electrical loads is considered obsolete and is due for eventual replacement. The equipment includes:

- Switchgear and motor control centers
- Panelboards
- Disconnects

Based on the evaluation, it was observed that the panelboards serving process-related loads had reached the end of their useful life, with parts becoming difficult, if not impossible, to find. Therefore, panelboards are assumed to be obsolete and are recommended for replacement.

3.1.1.4 Instrumentation and Controls

The existing equipment will not meet the targeted service life of an additional 20 years. Typical instrument service life is 15-25 years, which is within the planning timeframe used for instrumentation components of this assessment and subsequent improvements. Therefore, it is recommended that the equipment be replaced. Much of the existing I&C equipment is nearing the end of its service life or does not meet the desired level of service for I&C equipment.

3.1.2 Facility Evaluation

The inspection of the Ashland Water Treatment Plant relied primarily on visual inspection of the plant assets, with a particular focus on what it would take to maintain useful plant operation for the next 20 years. Digital photos of the plant were taken to document asset condition. Because the plant was in operation during the time of the inspection, the interiors of process structures were not able to be inspected.

Prior to the inspection, the City of Ashland had sent Black & Veatch information on known deficiencies, or desired improvements to the site. The following sections describe the observed condition of each of the process areas of the WTP, and incorporate a description of these known deficiencies.

3.1.2.1 Administration

The assets within Administration area were generally in good condition. This facility includes the control room, offices, lockers, and lab, as well as other miscellaneous site civil structures, such as facility roadways.

The offices were in good condition, with no visible defects, or known issues brought up by the WTP staff. Within the lab, the sample sink needs to be replaced. The metal shelf stands have begun to corrode, and the narrow sink might not effectively suit technicians' needs (Photo 3-1). It was brought up by the City that they would like the shower facilities to be updated in the locker room. Furthermore, the City voiced a desire to recoat the plant administration building.

Photo 3-1 – Lab in Administration Building

Photo 3-2 – Potable Water Storage Tank and Hydro-Pneumatic Tank

In terms of site civil assets, the plant roadways appeared in good condition, with no visible defects. However, the City would like for the roads to be improved to accept bulk chemical deliveries. The current chemical delivery truck is not able to provide reliable deliveries, and newer trucks might have trouble navigating the roads on site. With geological site constraints caused by the canyon walls, it is unlikely that the roads will be able to be enlarged enough to accommodate a larger truck. The potable detention tank is adequate and there were no observable defects. However, the hydro-pneumatic tank will require eventual replacement in the 20-year planning horizon. A photo of the potable water storage tank and the hydro-pneumatic tank are above (Photo 3-2). Lastly, there are several concerns with the safety equipment installed on site. The fire protection system has an alarm component only and it does not include any fire suppression measures. This system should be updated to meet NFPA code. There are two emergency eyewash/shower stations on site. They don't have freeze or scald protector valves installed, which would be recommended as a safety provision for the WTP staff. An emergency eyewash/shower should also be installed in the chlorine building (preferably inside the containment area). The WTP staff would currently have to exit the building and go to the adjacent chemical building to access an emergency eyewash/shower.

The City would like intercom and video feeds throughout the site to record video when the operators are not on site, as well as a remote controlled electric gate. This would be an optional improvement recommendation, and not viewed as essential for plant operation for the next 20 years.

3.1.2.2 Plant Influent

The WTP tailrace structure, influent weir, and influent line were all structurally in good condition. It was noted by the City that there is a desire to be able to actuate the influent weir electronically, instead of manually adjusting the weir height. Furthermore, the 36-inch butterfly valve on the plant influent line doesn't close completely or modulate effectively. This should be replaced. Lastly, the City would like the hydroelectric generator bypass to be redesigned to eliminate vibration issues and improve flows. They are currently limited to 5 mgd with this bypass pipe. Photos of the influent weir and 36-inch butterfly valve are below (Photo 3-3 and Photo 3-4).

Water from the Talent Irrigation District is used to supplement supply during periods of drought or low water years. A 24-inch steel water pipe feeds the WTP from the Terrace Street Pump Station. The pipe supports were not closely inspected; however, material under some of the supports appears to be washing away. Furthermore, when there are high-level flows, the pipe is submerged in the creek, subjecting it to damage from debris (Photo 3-5).

Photo 3-3 – Influent Weir

Photo 3-4 – Influent 36-inch Butterfly Valve

Photo 3-5 – Talent Irrigation District Influent Pipeline

3.1.2.3 Chemical Feed

The assets within the chemical feed process group were in fair condition. The individual chemical feed systems are discussed in the sections below. Some of the systems were in better condition than others, but, generally speaking, it is ultimately recommended to replace the entire Chemical Building and the equipment inside in the next 20 years.

Alum Feed

The alum feed system consists of one alum tank, two alum feed pumps, and two alum feed motors. The new chemical building was built around the existing alum tank, with little regard given to tank replacement or maintenance (Photo 3-6). It was reported to Black & Veatch that the transducer located in the tank isn't functioning. However, to replace this transducer, the tank top would need to be removed, and there is limited space within the chemical building to perform this work. Additionally, if the tank were ever needed to be replaced, the building and second floor would likely have to be modified to accommodate this work.

The older auto diaphragm feeder pump was replaced with a peristaltic pump 2 years ago, and the City is very satisfied with the performance (Photo 3-7). However, the older pump can only be manually operated and replacement should be considered.

Photo 3-6 – Top of Alum Tank

Photo 3-7 – Base and Pedestal of Alum Tank

Soda Ash

The solution tank, hopper, storage tanks, feed pumps, and feed motors are all part of the soda ash system. The soda ash is used to maintain or adjust pH for finished water, and the City has mentioned that they would like to develop an improved caustic soda feed system to replace the current one. The current system is functional, and there weren't any visible defects. However, the age and efficacy of the system should be taken into consideration, and B&V concurs with the City that the system should be replaced in the next 10 years. The current system will be unable to meet any future higher pH requirements. Furthermore, the lower level of the chemical building is susceptible to flooding. Photos of the soda ash system are below (Photo 3-8 and Photo 3-9).

Photo 3-8 – Soda Ash Hopper

Photo 3-9 – Soda Ash Hopper, Dissolving Tank, and Metering Pumps

<u>Powdered Activated Carbon (PAC)</u>

The PAC hopper, auger feed and motor, and an educator make up the PAC feed system (Photo 3-10). Similar to the Soda Ash system, the PAC system is susceptible to flooding since part of the hopper is located on the lower level of the chemical building. There were no significant observable defects with the PAC system. However, the PAC system does not meet the desired level of service, and has not been effectively treating taste and odor during high Geosmin events. Furthermore, handling PAC can pose a health risk. The MSDS lists that the primary concerns for occupational exposure are skin contact and inhalation in the form of dust. The dust may cause eye irritation, slight skin irritation, and possible respiratory tract irritation. In confined spaces, it can adsorb oxygen, and asphyxiation may result. The dust from loading PAC can also lead to an explosive environment. It is recommended that this system be replaced in the 10- to 15-year timeframe.

Photo 3-10 – Powdered Activated Carbon Hopper

Potassium Permanganate (KMnO4)

The potassium permanganate system is comprised of the hopper, auger feeder and motor and an educator feed system. It is located on the lower level of the new chemical building, which is prone to flooding. It has been noted by the City that the KMnO4 system does not meet the desired level of service, and has not been effective at treating taste and odor during high geosmin events. It is recommended to replace the potassium permanganate system altogether, either with a newer feed system, or with a better oxidation system.

Polymer

The polymer system is comprised of two tanks, filter polymer aid (Superfloc N-300) feed pumps and motors, and cationic polymer (Superfloc C-573) feed pumps. Overall there were no significant visible defects detected with the polymer feed system. There are no visible defects with the LMI Polymax feed system. However, the City is hoping to upgrade the current cationic polymer diaphragm feed pump with a peristaltic pump. At this time, they would also like to reevaluate alternate injection points other than mixer M015. Due to lifespan expectancy, it is recommended to replace this system in the next 10 years. The filter polymer aid system is functional, but obsolete. The City has also reported that it delivers polymer aid unevenly to the filter surfaces. It is recommended to replace this system in the next 10 years. The tanks for the polymer feed and mixing are functional and should be used until the end of their useful life. However, the City has stated that functionally only a third (approximately 33 gallons) of the working capacity of each tank are able to be used. In the 10- to 15-year timeframe, the current tanks should be replaced with smaller, more adequately sized tanks. The City currently has planned replacements for both polymer systems budgeted. Photos of the polymer system are below.

Photo 3-11 – Filter Polymer Aid Hopper and Mixing Tank

Photo 3-12 – Filter Polymer Aid Feed Tanks

Photo 3-13 – Cationic Polymer Feeder

<u>Hypochlorite</u>

One 3,000-gallon tank and three feed pumps make up the hypochlorite system. The current tank was installed in 2008 and is nearing the end of its life (Photo 3-14). It is recommended to replace the tank in the next 10 years. As seen in the photo below, there is corrosion near the floor on some of the concrete masonry unit (CMU) bracing angles, mostly likely due to sodium hypochlorite contact (Photo 3-15). If the CMU blocks are not internally reinforced, this corrosion could ultimately weaken the structure. For this reason, when the tank is replaced, this will trigger removal of the containment basin and a major building demolition and renovation due to structural and safety considerations. The City has also voiced that they would like bulk chemical delivery if possible. This is not feasible at the existing facility. Bulk deliveries would require construction of a transfer station on the plant access road downhill from the existing plant with pumps and piping installed to supply the tanks at the plant.

The City has reported that there are signal issues with some of the sodium hypochlorite feed pumps. Pump #2 has frequent operational issues, and Pump #3 has communication issues with the SCADA. It is recommended to replace these pumps in the next 10 years.

The hoist in the Chlorine Building appeared in good condition with no observable defects. Due to its useful life estimate, the hoist will likely require replacement in 10-15 years.

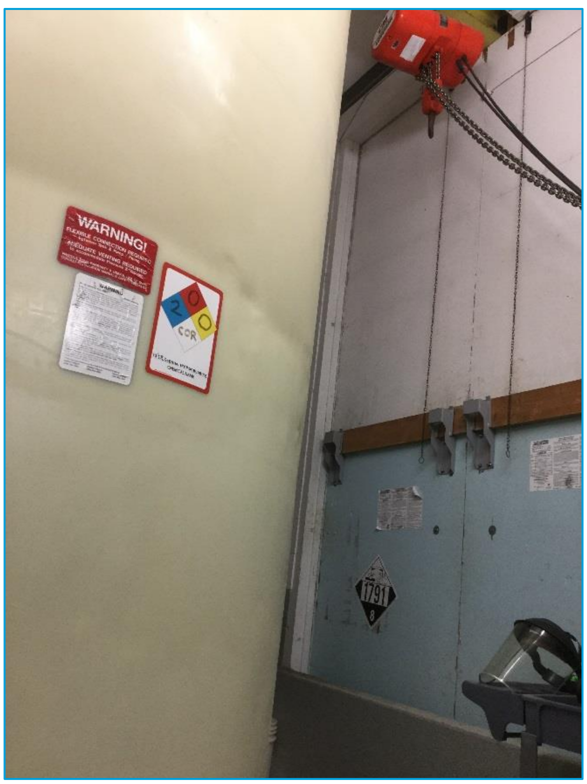

Photo 3-14 – Sodium Hypochlorite Tank and Hoist

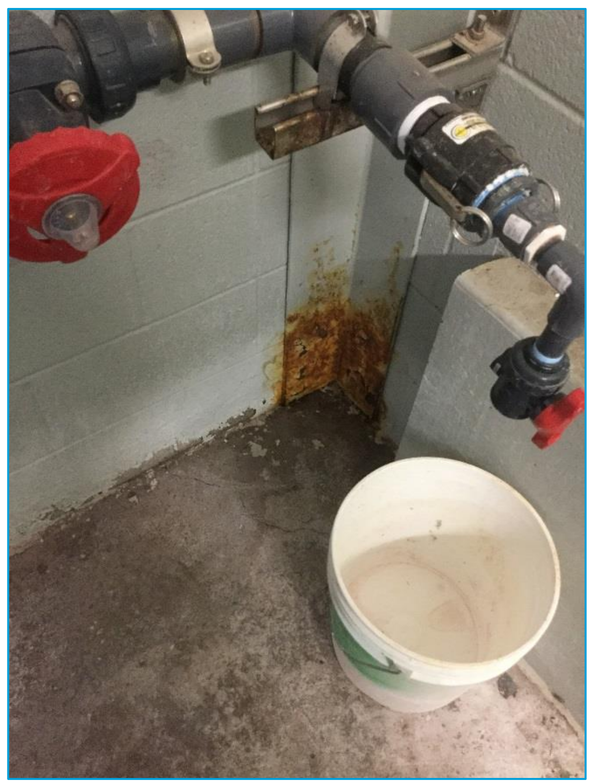

Photo 3-15 – Corrosion in Chlorine Building

Miscellaneous

There are several miscellaneous components to the chemical feed process that are discussed in the list below. All replacements are suggested to occur in the next 10 years.

- Due to flooding concerns, and seismic events, the existing Chemical Building is a liability, and is recommended to be replaced in the next 10 years.
- The chemical feed piping is in good physical condition. However, reconfiguring the piping is recommended to add more injection points.
- The chemical feed flow indicators are not functioning correctly and require replacement.
- It is recommended to upgrade all pumps to peristaltic pumps. This upgrade will render many of the valves unnecessary, ultimately creating fewer assets for the City to manage.
- Motor actuators for valves are recommended to be replaced.
- The mixer appears in good physical condition. However, it is in a corrosive, continuous-duty environment, and it is also recommended to be replaced.

Lastly, the sump pumps are currently adequate, and appear in good physical condition. However, they will near the end of their useful life in the 10- to 15-year range, and are recommended to be replace in that window.

3.1.2.4 Pretreatment

The Pretreatment process is made up primarily of the Flocculation Basins. During the inspection, it was observed that the Flocculation Basin structures were in good condition. However, it is recommended that they be recoated within the next 10 years to preserve concrete integrity. The City has mentioned that they would like to upsize and relocate the drain, as it is currently not at the bottom of the basin. Upsizing and relocating the flocculation basin drain would trigger major structural modifications, and this recommendation should be considered optional. It was also reported by the City that there has been hydraulic short-circuiting in the Flocculation Basins. Black & Veatch would recommend rewiring the flocculation motors to spin in the opposite direction and disassembling and reversing the vertical paddle mixers to improve settlement (Photo 3-16). This should be done in the next 10 years.

The Flow Control Box Structure is in good condition structurally, but it is undersized, and it is doubtful that it would be able to handle peak flows of 7.5 mgd (Photo 3-17). Structural modifications to enlarge the overflow drainage box are recommended, including upsizing the drain piping and fixing the slide gate. This is recommended to be constructed in the next 10 years. Lastly, as an optional improvement, underwater lights could be installed in the basin for enhancing visualization of floc flow patterns.

Photo 3-16 – Flocculation Basin and Paddle Mixer

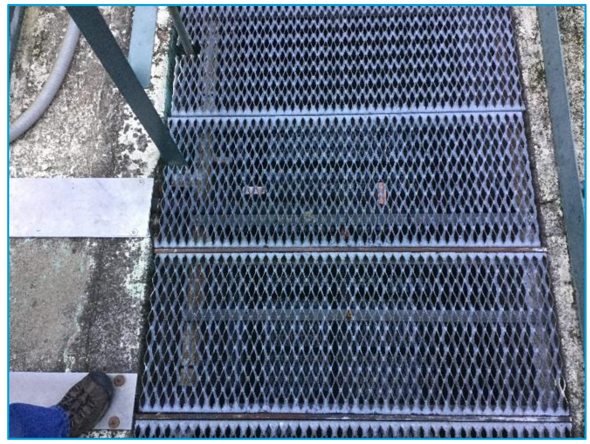

Photo 3-17 – Grating Above Overflow Box

3.1.2.5 Dual Media Filters

The Dual Media Filters were in fair condition (Photo 3-18). There is evidence of cracking within the filter structures, and possible leakage, visible from the efflorescence on the exterior of the filter concrete wall and from the leakage pattern staining around the air supply line on the exterior wall (Photo 3-20 and Photo 3-21). The coating is also failing in some areas. Concrete cracks should be repaired, and the filter basins should be recoated in the next 10 years. The City has mentioned that excessive debris falls into the basins during normal operation, affecting filter performance. Recent removal of overhanging trees has improved this situation. While not necessary for proper operation of the plant, a canopy structure over the Dual Media Filters would be considered an optional improvement to the plant to prevent the debris entering the filters. Filters 7 and 8 are currently not operational, and it is recommended to rehabilitate these filters in the 10- to 15-year timeframe to meet future treatment process demand (Photo 3-19). Rehabilitation would require concrete crack repair and surface restoration in addition to replacement of process mechanical equipment, launders and piping penetrations. In the same time frame, it is expected that existing filter media will reach the end of its useful life, and should be replaced. The filter influent pipe showed some signs of surface corrosion, and it should be recoated in the 10- to 15-year timeframe as well. When this effort is undertaken, it is recommended to perform a detailed condition assessment of the pipe.

The backwash pumps were in good condition, with no major observable defects detected. However, they are near the end of their useful life, and will require a major overhaul or should be replaced in the next 10 years. The backwash pump flow meters and instrumentation should also be replaced in the next 10 years. The backwash piping should be recoated and inspected for integrity during this same time. The backwash lagoon is expected to need cleaning in the next 20 years, and the backwash water samplers will also likely need to be replaced during this time. The City would like to remove the original steel backwash tanks on the slope above the WTP, which are no longer in use. These tanks present a dangerous risk to the facility if they were to fall. Although not critical to continued plant operation, removal of the steel backwash tanks should be considered.

There were no notable defects with the blower motor. However, it is subject to major overhaul or replacement due to reaching asset life expectancy during the 20-year planning horizon. This would occur in the 10- to 15-year timeframe. Similarly, the process air valves would need to be replaced in this same time frame.

Photo 3-18 – Dual Media Filters

Photo 3-19 – Abandoned Dual Media Filter #7

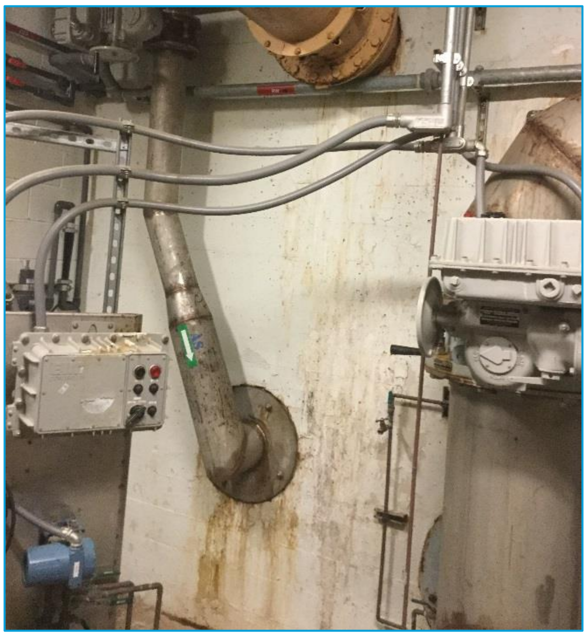

Photo 3-20 – Air Scour Air Supply (Evident Leakage)

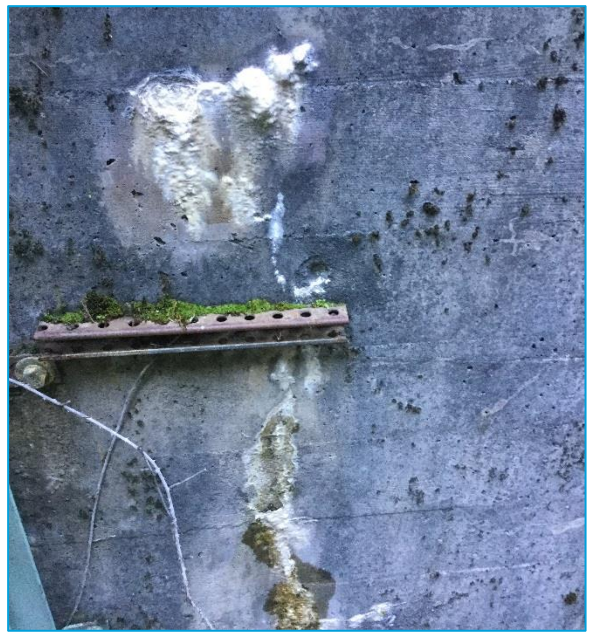

Photo 3-21 – Efflorescence on Exterior Dual Media Filter Wall

3.1.2.6 Clearwell / Product Water

The Clearwell is a concrete tank located beneath the Backwash Pump Station. It was not physically able to be inspected, but the City informed Black & Veatch of operational issues related to the tank. The sealing material on the cold joints within the Clearwell are deteriorating, and should be re-caulked in the next 10 years. There are currently dead zones within the Clearwell resulting from poor dispersion of the sodium hypochlorite. It is recommended to improve delivery piping to improve dispersion within the Clearwell in the next 10 years. The City would like to add a drain pipe from the Clearwell to the sludge pond or plant sewer drain. However, Black & Veatch considers this an optional recommendation and not necessary for continued plant operation. The Clearwell sample pump should also be changed to a peristaltic type in the next 10 years to prevent loss of prime. It is recommended that the contact basin drain valves and slide gate be replaced, as the City reports that they currently leak.

The plant has a potable water system to serve the plant water needs (drinking water, restrooms, chemical feed systems etc.). Currently, the potable water pump suction line isn't accessible without entering the Clearwell, and it is recommended to reroute the piping to be able to replace the foot valve at some point. Furthermore, the potable water pumps will most likely have to be replaced in the 20-year planning horizon.

3.1.2.7 Electrical

Electrical equipment was visually inspected while the plant was in operation; because of safety considerations, none of the cabinets were opened. Black & Veatch relied on information from the plant operators to make plant improvement recommendations. The plant generators are currently adequate, and no observable defects were detected. However, it is expected that the generators will require a major overhaul or need to be replaced during the next 20 years. Similarly, transformers, MCCs, breakers, cabling, and power lines were all in good condition, but will likely need to be replaced in the next 20 years. The building and yard lighting should also be replaced with LEDs as the existing lighting fixtures are considered to be economically obsolete. The photos of the electrical equipment shows arc-flash related labels/stickers which would indicate that at some point, an arc-flash analysis or study was conducted. NFPA 70-E guidelines stipulate that an arc-flash analysis be conducted every five years. Representative photos of electrical equipment are below.

Photo 3-22 – Motor Control Center

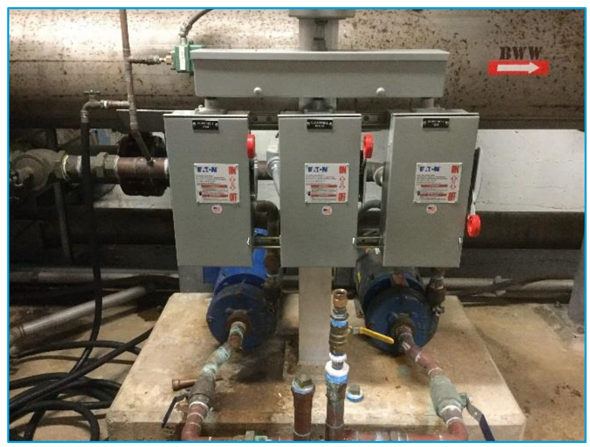

Photo 3-23 – Potable Water Pump Disconnects

3.1.2.8 Instrumentation & Control

Similar to the electrical assets, Black & Veatch relied on the plant operators to make improvement recommendations for I&C equipment. Instruments typically have a 10- to 20-year lifespan, so there are many instruments that will need to be replaced in the next 20 years. Specifically, the Flocculation Basin level sensor should be replaced in the 10- to 15-year timeframe. The following recommendations should all be addressed in the next 10 years:

- Plant-wide, the City would like to update the SCADA system and PLC telemetry to provide pressure and flow indication for plant water supply. The telemetry unit should also be relocated.
- In-line pH probes were in good condition, but will need replacement at the end of their useful life.
- Recommended to move the streaming current detector to the lower chemical room for faster response time. The instrument will also need to be replaced near the end of its life expectancy.
- Flowmeters were in good condition, but will need replacement at the end of their useful life.
- Turbidity meters were in good condition, but will need replacement at the end of their useful life.

- It is recommended to add a TOC in-line analyzer.
- Inflow meters should be replaced as they are nearing the end of their life expectancy.
- The WTP finished water effluent pipe empties as it flows to Crowson Tank during filter backwashes, resulting from inaccurate measurements. It is recommended to relocate the plant effluent flowmeter 1000-yards farther downstream to provide more accurate information.
- Upgrade Wonderware software on plant computers.

Representative photos of instruments are below.

Photo 3-24 – Dual Media Filter #1 Turbidity Meter

Photo 3-25 – PLC Telemetry Unit

3.1.3 Asset Life Expectancies

The age of an asset, together with its typical useful life, is an important characteristic used to assess an asset's condition. Because the actual installation date of most of the existing facility assets is unknown, the assumption of asset age was based on available drawings, field observations or staff input. Where assets appeared near or beyond their expected life, this factored into developing the rehabilitation needs. Assets that have exceeded their useful life are generally recommended for overhaul or replacement. Table 3-1 provides guidelines on typical life expectancies for plant assets.

Table 3-1 Asset Effective Life Expectancies

ASSET TYPE	EFFECTIVE LIFE (YRS.)
Civil structures	50-75
Pressure piping	60
Gravity pipelines	100
Pumps	40
Valves	30
Mechanical Systems / Motors	25-35
Electrical Systems / Components	30
Instrumentation and Controls	15-25
Building assets	30

3.1.4 Planning Horizon

This study needs to address reliable operation of the plant into the future based on a criterion set by the City for extending the remaining useful service life of the existing facilities by an estimated 20 years. The assumption is the existing plant would be required to remain operational for the next 20 years with no significant changes in its current treatment configuration. After this time, the existing plant may be decommissioned and replaced by a new plant. The assessment identified not only improvements required in the near term based on current condition, but also those improvements needed to maintain reliable operation over the 20-year planning horizon. Therefore, forward forecasts on replacement needs were developed for those assets that may not currently need work. For example, a motor that was very recently overhauled does not currently need work. However, the next improvement cycle, which may be in 15 years, has been included in the cost forecast.

3.2 NEW WATER TREATMENT FACILITY

This section presents the basis for developing a conceptual cost for constructing a 7.5 mgd new water treatment plant. The cost presented is an AACE Level 5 construction cost (with an accuracy range of -50% to +100%). The assumptions used to develop the conceptual cost are presented below.

3.2.1 Site and Hydraulics Considerations

The site identified to construct a new plant is located a couple of miles downstream of the existing plant site. The elevation of this site is lower than the existing plant site. This elevation difference would allow gravity flow of raw water into the new plant. However, because the new site is at a lower elevation, gravity flow of treated water into the existing downstream reservoir may not be possible. Additional analysis is warranted to confirm that gravity flow from the plant to the distribution system is not possible. It is envisioned that a part of the existing treated water pipeline from the existing plant could potentially be converted to convey raw water to the new treatment plant. Additional piping would be required to convey raw water to the plant site and treated water from the plant site to connect to the existing pipeline feeding the downstream reservoir.

The site is relatively flat with sufficient area to house the treatment facilities and auxiliary structures. Moderate site work would be needed construct the new treatment plant facilities.

3.2.2 Treatment Process Considerations

To provide a direct cost comparison with the existing plant, it is assumed that the new plant will employ the same treatment processes and chemical feed systems as the existing plant. These will include:

- A microfloc filtration plant that will employ in-line rapid mixing, flocculation followed by media filtration consisting of dual media filters
- Chemical systems will include PAC, Alum, KMnO4, soda ash, coagulant aid polymer, filter aid polymer and chlorine (12.5% sodium hypochlorite).It is assumed that the chemical systems (storage and feed systems) will be located indoors
- Administration building will be included to house offices/laboratory, electrical switchgear, as well as SCADA workstations

3.2.3 Cost Considerations

The conceptual costs for a new 7.5 mgd capacity plant that employs the same treatment processes as the existing plant are presented under Section 4. It should be noted that the costs associated with raw and finished water piping and a small filter effluent wetwell with associated high service pumps should be considered because these components will likely be required with the operation of the new plant. For planning purposes, it is assumed that approximately 0.25 mile of raw water piping and 0.25 mile of treated water piping would need to be constructed.

4.0 Cost Comparisons

Total life-cycle cost is evaluated based on the addition of the life-cycle O&M to the total project cost. The total life-cycle costs were developed for an equivalent 7.5 MGD WTP. This cost represents the total cost of ownership of the plant at the end of 20 years normalized to today's dollars.

The estimates presented in this report are order-of-magnitude estimates as defined by the Association for the Advancement of Cost Estimating (AACE). Typically, an order-of-magnitude estimate is expected be accurate within plus 100% to minus 50% of the estimated cost. Cost estimates are considered AACE Level Class 5 prepared with 0% to 2% project definition to be used as a general guideline for more specific and detailed studies.

The developed estimates have been prepared for guidance in evaluating the cost of maintaining the existing plant versus constructing a new plant. These cost estimates are derived from the information available at the time of the estimate. Detailed project costs will certainly depend on actual labor and material costs, competitive market conditions, final project costs, implementation schedule, and other variable factors. As a result, the actual costs can be expected to vary from the estimates presented herein.

There is a substantial amount of uncertainty in the opinions of probable construction cost, particularly with site development. Thus, the site considerations have been removed from this evaluation.

4.1 COST CATEGORIES

Order-of-magnitude estimates of costs (in 2018 dollars) were developed for plant rehabilitation. The cost estimates are comprised of several components described in this section:

- Equipment-specific improvement construction costs
- Rehabilitation costs based on site visit, industry knowledge and previous reports
- Cost allowances and contingencies

4.1.1 Equipment-Specific Construction Costs

To the extent possible, construction costs for equipment repairs, overhauls and replacements were developed. These costs represent installed costs, including purchase of equipment and labor to install. This methodology was implemented for expediency, as the project budget and schedule did not allow for development of construction cost estimates for each individual asset.

Asset replacement costs from equipment inventories from other projects were used as a starting point for determining the cost data. Typically, general equipment specifications (e.g. motor hp, valve size, etc.) would be used to assign replacement costs to individual assets. As this information was not readily available, replacement costs were assigned based on comparable equipment application and assumed size ranges. This approach represents a rapid means of compiling cost estimates. A more detailed approach, such as assigning replacement costs based on nameplate data for individual assets may be recommended for the future.

4.1.2 Rehabilitation Costs

Rehabilitation costs for the existing facility were based on results from site visit as well as Black & Veatch's knowledge and experience with similar projects across the United States. The rehabilitation recommendations and associated cost estimates are tabulated for reference in Attachment A.

4.1.3 Cost Factors and Contingencies

A number of cost factors, allowances and contingencies were applied to the construction costs to estimate an opinion for the total probable plant rehabilitation cost. These factors account for the conceptual nature of the base construction costs, project costs such as engineering, and escalation. The cost factors were applied consistent with industry assumptions. Table 4-1 describes the cost factors applied.

Table 4-1 Cost Factors to Develop Total Project Costs

COST FACTOR ITEM	FACTOR SUB ITEMS	PERCENT ALLOWANCE	NOTES	CUMULATIVE COST FACTOR
Site Work (misc. costs)		8%	On Constr. Cost	1.08
Yard Piping		9%		1.17
Electrical		10%		1.27
Instrumentation and Controls		2.5%		1.30
Estimating Contingency		15%	On Total Const.	1.49
Contractor Mark Up Costs (Cumulative)		24%	On Total Const. + Contingency	1.85
▪ Overhead	7%			
▪ Profit	10%			
▪ Mobilization/Bonds/Insurance	3%			
▪ Contingency	4%			
Planning, engineering, and const. management		48%		2.74
▪ Permitting	1%			
▪ Environmental Review	1%			
▪ Public Outreach	1%			
▪ Engineering design	8%			
▪ Engineering costs during construction	2%			
▪ Const. management services	7%			
▪ Commissioning/Startup	3%			
▪ City costs	5%			
▪ Construction change order allowance	5%			
▪ Contingency	15%			
Escalation	2%	10%		2.84
			Final Factor	**2.84**

Costs presented in this table include contingencies (30% for estimating and non-construction related costs) and other soft costs (33% for planning, engineering, and const. management). The final project cost factor represents the cumulative cost percentages and is useful in comparing construction costs and overall project costs.

A cost escalation of 2% per year over year has been assumed. It is anticipated that the escalation would be applied to represent the costs at the time of construction. It is conceivable that a new treatment plant would be constructed within the next 10 years. Thus, a mid-point in construction escalation of 5 years is assumed to arrive at the escalation allowance of 10%. By comparison to the existing plant rehabilitation needs, it is estimated that many of the recommended actions are also grouped in the 0- to10-year time frame for implementation. This is further described in the next section (Section 4.2). Thus, the same cost escalation factor would be applied for the existing plant rehabilitation needs.

4.2 PRIORITIZATION OF IMPROVEMENTS

Rehabilitation recommendations were organized with both short-term (immediate repair and replacement activities) and long-term replacement needs. The City may continue to replace or rehabilitate existing plant assets aligned with real time conditions at the plant. Refinements were made to the rehabilitation recommendation time frames to maximize the remaining useful life of the existing facilities.

Rehabilitation recommendations for each subsystem are assigned a timeframe for implementation to ensure continuous and reliable operation. The timeframe considers the typical useful life of a given asset, its current condition, the service date, and City staff input.

Rehabilitation needs were developed at the asset level and summarized at the subsystem level. The recommendations and timeframe for improvements are presented at the subsystem level with the anticipation that improvements for all assets within a subsystem would occur within the same timeframe for cost efficiencies and to reduce impacts to plant operations.

Recommendations are presented with a proposed timeframe for implementation such that budget plans can be developed. Each recommendation is placed into one of three timing phases: short-term (0 to 10 years), mid-term (10 to 15 years), and long-term (15 to 20 years). The overall summary of the rehabilitation recommendations show that the majority of the work needs to be performed in the short-term as demonstrated in Figure 4-1.

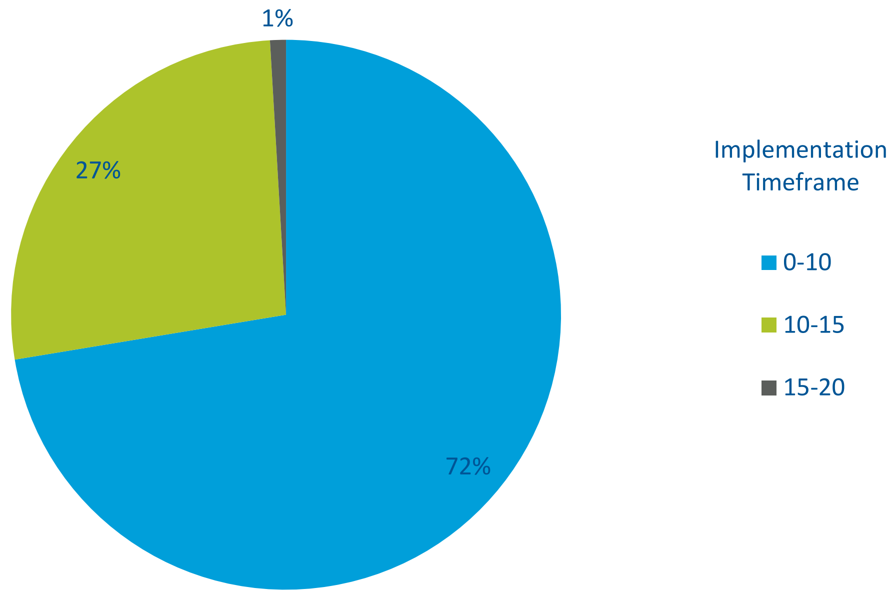

Figure 4-1 Itemization of Rehabilitation Cost Allocations Over Time

Figure 4-1 shows that approximately 72% of the rehabilitation needs are recommended to be performed in the short-term time frame. The graphic also shows that only a very small percentage of rehabilitation work (1%) could be performed at the end of the 20-year planning horizon. Some realignment of the timing intervals can be considered if asset run-to-failure strategies are employed. Although this strategy would only be viable if a new plant was ultimately decided as the City's future direction.

4.3 SUMMARY

The cost comparisons are provided for construction of a new plant versus the rehabilitation recommendations for the existing plant. The costs are organized in the following categories:

- Administration
- Plant Influent
- Chemical Feed
- Flocculation Basins
- Dual Media Filters
- Clearwell / Product Water
- Electrical
- Instrumentation & Controls

Costs were developed for the necessary rehabilitation required for the existing plant. The rehabilitation recommendations and associated cost estimates are provided in Attachment A. These costs were then grouped in the respective categories outlined above. Table 4-2 shows the comparative capital costs for the existing plant and a new 7.5 mgd capacity plant. Note the sub total amounts have been rounded to the nearest $1,000 dollars.

Table 4-2 Capital Cost Comparisons

ITEM	NEW PLANT	EXISTING PLANT
Flocculation Basins	$1,330,000	$472,000
Dual Media Filters	$3,637,000	$702,000
Chemical Feed	$923,000	$878,000
Administration	$1,000,000	$181,000
Plant Influent (Existing WTP) & Offsite Inf/Eff. Piping (New WTP)[1]	$550,000	$20,000
Clearwell/Product Water	$347,000	$83,000
High Service Pumps[2]	$400,000	
Site Work	$645,000	
Yard Piping	$725,000	
Electrical	$806,000	$186,000
Instrumentation & Controls	$201,000	$128,000
Estimating Contingency (15%)	$1,584,000	$397,500
Total Facility Cost	**$12,148,000**	**$3,047,500**
Contractor Mark Up Costs (Cumulative)		
Overhead (7%)	$850,000	$213,325
Profit (10%)	$1,214,000	$304,750
Mobilization/Bonds/Insurance (3%)	$365,000	$91,425
Contingency (4%)	$486,000	$121,900
Total Contractor Markups	*$2,915,000*	*$731,400*
Subtotal Construction Cost	**$15,063,000**	**$3,778,900**
Non-Construction Costs (Additive)		
Permitting (1%)	$150,000	$37,789
Environmental Review (1%)	$150,000	N/A
Public Outreach (1%)	$150,000	N/A
Engineering (8%)	$1,200,000	$302,312
Legal/Administration (0.5%)	$75,000	N/A
Construction Services (7%)	$1,050,000	$264,523
Commissioning/Startup (3%)	$450,000	$113,367
Contingency (15%)	$2,250,000	$566,835
Total Non-Construction Costs	*$5,475,000*	*$1,284,826*
Escalation (2%/yr. @ 5 yrs. = 10%)	$2,053,000	$506,373
Total Project Cost	**$22,591,000**	**$5,570,099**
Total Project Cost (Rounded to nearest $1000)	**$22,591,000**	**$5,570,000**

[1] Refer to Section 3.2.3. The length of influent and effluent piping used for cost estimating is 0.25 mile each.
[2] A finished water pumping station for the new plant site is expected to send flow to the downstream reservoir.

It should be noted in the above table that some costs are not applicable to rehabilitation of the existing plant. Non-construction related costs associated with environmental review, public outreach and legal/administrative functions are not expected to be incurred on the existing plant. As such these cost assumptions for non-construction are provided for reference as they apply to the new plant for comparison purposes but have not been included in the total project cost for a new plant.

Based on the comparison table the following trends are evident. Overall rehabilitation costs for the existing facility are approximately 25% of the construction costs of a new plant. Within the individual facility areas, the improvement cost for the existing chemical feed is nearly equivalent to the construction costs of a chemical feed area in a new facility. This intuitively reinforces the results of the existing plant evaluation as the chemical feed area was noted to require the most extensive amount of rehabilitation. Additionally, the rehabilitation costs associated with Instrumentation & Controls are also 64% of the new I&C plant construction cost. The City has kept up with upgrades of I&C equipment over time and these ongoing costs are expected going forward with the 20-year planning horizon of the existing facility as the life expectancy of these systems is shorter than other asset types.

From a broad perspective, it is feasible to continue to utilize the existing facility over the 20-year planning horizon at a lower initial investment than constructing a new treatment plant. For the purposes of this analysis, all efforts have been made to provide an equivalent cost comparison between the existing facility rehabilitation requirements to the construction costs associated with an equivalent new facility.

4.3.1 Additional Considerations

The capital cost comparison has worked toward providing an equivalent comparison between the two primary alternatives of rehabilitating the existing plant and constructing a new plant. However, it is prudent to provide discussion on the additional factors that should be included for the City's consideration. Follow up studies to further vet these considerations, including performing business case evaluations that factor in the importance of economic and non-economic factors should be performed. For brevity, the following table (Table 4-3) provides some of the additional considerations that may have either positive or negative impacts associated with either alternative. General discussions of these considerations are provided following the table. The potential impacts of these issues can be rated by the City according to their importance in a triple bottom line analysis that considers social, environmental and financial factors.

Table 4-3 Considerations with Positive/Negative Impacts

ISSUE	POSITIVE OR NEGATIVE CONTRIBUTION	
	Existing Plant	New Plant
Additional Rehabilitation Needs	-	+
Flood Risks	-	+
Seismic Risk	-	+
Operation Costs	+	-
Maintenance Costs	-	+
Treatment Requirements	-	+
Capacity	-	+

4.3.1.1 Additional Rehabilitation Needs

It should be noted that the rehabilitation needs were based on a cursory site assessment and that the actual extent of rehabilitation could be greater than what was identified based on visual inspection and input from operations staff. Based on the limited extent of inspection information available, this consideration could negatively impact the existing plant alternative as actual rehabilitation costs could be higher than anticipated.

4.3.1.2 Flood Risks

The existing plant is subject to flooding from the adjacent Ashland Creek. The existing plant has flooded on multiple occasions. Flooding presents a risk to the reliable operation of the existing facility. The impacts of flooding damage to the existing plant and the cost to mitigate flooding cannot be well quantified. It is recommended the City evaluate the acceptable risk tolerance for flooding impacts in the decision for rehabilitating the existing facility or construction of a new plant. A new plant would be located in an area less prone to flooding and thus has a positive contribution as compared to that of rehabilitating the existing facility.

Costs to construct a flood wall to mitigate flooding are provided in the City's WCRS & CWMP report prepared by Carollo. The report indicates the direct costs for construction of the flood wall are estimated at $1 Million dollars in 2010. The present cost of the flood wall in 2018 is $1.21 Million dollars using Engineering News Record average construction cost indices for present day adjustments. When applying the 2.84 cost factor developed in Section 4.1.2, the total present day project costs for the flood wall are estimated at $3.44 Million dollars.

The flood risk could potentially be mitigated by constructing a flood wall; however, its ability to withstand a major flood event is questionable. Constructing a flood wall next to existing basins and structures along the creek is risky because it could potentially damage the existing facilities due to vibration related to construction activities. As such, the cost to mitigate the flood risk cannot be determined with reasonable certainty and therefore not included in the cost comparison.

4.3.1.3 Seismic and Landslide Risks

The existing plant is vulnerable to failure from a seismic event. Rehabilitation recommendations presented in Table 4.2 do not reflect the costs to upgrade the existing facilities to current seismic standards. The original existing structures built in 1948 are lightly reinforced compared to the current ACI 350 requirements. Upgrades to the WTP structures have been performed since original construction. In general, an increase in the gravity loads by more than 5 percent from the original design would typically require a seismic upgrade to the current code standards. It is unclear if the previous upgrades resulted in the seismic resiliency improvements. Furthermore, any vibration or construction activity around these structures (e.g. construction of a flood wall next to the flocculation tanks and filter cells) could potentially result in concrete cracking and leakage. A detailed structural assessment of the existing structures is outside the scope of this document; however, a cursory review indicates that the existing structures do not meet the current seismic code requirements. Assuming that the current loading on the existing structures remains the same, it is not required to upgrade the existing structures to meet the current seismic codes. However, in a seismic event, these structures could suffer significant damage and impair the ability of the plant to produce potable water. Due to the age and condition of the facilities it is not feasible to upgrade the existing structures to current seismic standards in a cost effective manner. Depending on the severity of a seismic event, the time to repair and make the plant functional could range from days to months.

In its current location in the canyon, the existing plant is susceptible to damage from landslides. Similar to the seismic risk, the extent of damage that the plant could suffer will depend on the severity of a landslide event.

4.3.1.4 Operational Costs

Currently the existing plant benefits from gravity flow conditions which reduce operational costs associated with influent or effluent pumping. Proposed locations downstream may result in a new plant requiring some final effluent pumping to send treated water to the distribution system. Capital costs for a final effluent high-service pumping station have been estimated at $400,000 as presented in Table 4-2. The City would need to consider the additional operating costs of this facility as part of the new treatment plant design.

Furthermore, increased pumping costs and operational costs can be expected with enhanced treatment technologies (such as microfiltration, ozone or ultraviolet disinfection), should the City decide to employ these technologies in order to fully address the current taste and odor issues, future algal toxin treatment or other regulatory requirements. These costs are expected to be similar for both alternatives (existing plant vs new plant). Due to lack of space, it is envisioned that these facilities would need to be located offsite.

With new treatment technologies, it can be expected that some labor costs could increase. These may be partially offset through enhanced automation of the new facility which would require less staff oversight and control. The lower operational costs would seem to be a benefit for continued use of the existing plant. The possible opportunities for reducing operational costs at a new plant may make this consideration neutral between the two alternatives. Regardless of the result, additional financial analysis for operational costs should be undertaken as part of the pre-design effort for a new plant and included in the decision making process for alternatives.

4.3.1.5 Maintenance Costs

As opposed to the operational costs, the reduced maintenance costs would favor the new plant. Currently the City spends a greater extent of time and resources in maintaining the existing plant. A new facility would diminish the maintenance costs. Initially the new plant would incur low maintenance costs. Over time with any facility, routine maintenance is expected. The benefit for reduced maintenance of the new facility may only extend during the initial start-up, commissioning and warranty period of the new plant. Thus after this time, it can be expected that maintenance on the new facility would be somewhat comparable to the existing facility. However, the existing plant continues to age and will certainly require an increasing amount of maintenance over the 20-year planning horizon.

Situations can occur, such as at the existing facility, where maintenance activities are deferred. This can create a backlog of maintenance to restore the facility to suitable operating conditions. It should be noted that if a new plant is ultimately on the horizon for the City, the City may elect to defer maintenance in a strategy to run assets to failure. This strategy is not necessarily advisable for any assets critical to plant operation but could potentially reduce the City's cumulative investment in the existing plant.

4.3.1.6 Treatment Requirements

The existing plant is able to produce high quality drinking water using the current microfloc/filtration treatment process. It is currently unknown if additional treatment would be required by EPA as the regulations evolve in the future. However, due to lack of space, it is not possible to construct additional treatment processes or modify existing facilities to accommodate new treatment while keeping the plant in operation. Additionally, exposure of new facilities to other risks (flooding, seismic, landslide) cannot be practically mitigated. As such, the existing plant does not have the ability to meet any additional treatment requirements such as treatment of algal toxins, if required by future regulations. Any additional treatment would need to be located offsite and would require associated infrastructure investment for pumps, piping, and storage to convey to the distribution system.

4.3.1.7 Capacity Requirements

Projections for water treatment capacity needs for the City of Ashland have been prepared under previous master planning efforts. It is beyond the scope of this study to consider future capacity requirements. Hence, the comparison between the existing plant and the new plant only considers the current fixed water treatment capacity of 7.5 mgd. When considering the future capacity requirements, the existing plant may be able to be marginally expanded by rehabilitating the two abandoned filter basins (Filters #7 and #8) and returning these to service. Additionally, the City has redundant provisions for treated water supply from the TAP pipeline for up to 2.1 mgd (City's current water rights). However, the current understanding is that this pipeline is for emergency use and not intended to provide drinking water supply for an extended period of time to the City. The benefit when considering future capacity requirements clearly favors the construction of a new facility that by design could be made expandable to accommodate future capacity requirements.

4.4 CONCLUSIONS

A summary of cost comparisons show that rehabilitation costs for the existing facility are approximately 25% of the construction costs of a new plant. While it is feasible to continue operating the existing facility over the 20-year planning horizon at a lower initial investment, the existing plant has some negative considerations that present a risk to continued operation. The City has the opportunity to accept or mitigate these risks in the decision process. Ultimately, the existing facility has a definitive life span and will reach a point where continual investment is no longer financially prudent or will not achieve the desired level of service for the City. Deferring construction of a new plant beyond the 20-year planning horizon will impose a greater overall cost to the City.