MEMORANDUM

EUGENE WATER & ELECTRIC BOARD

Rely on us.

TO: Commissioners Simpson, Helgeson, Manning, Mital and Brown

FROM: Mel Damewood, Chief Engineering & Operations Officer,
Wally McCullough, Water Engineering Supervisor

DATE: September 24, 2016

SUBJECT: New Water Filtration Plant – Update on Preliminary Design

OBJECTIVE: Information Only

Issue
Preliminary design efforts have begun on the Water Utility's proposed New Water Filtration Plant. This memo provides an update on the work to date of this effort.

Background
Staff have been working towards a redundant water source for years and in 2014 a point of diversion was solidified on the Upper Willamette River below the confluence of the Middle Fork and Coast Fork. Since then efforts have ramped up with property acquisition and due diligence activities. The goal is to have a redundant filtration plant operational by the end of 2021.

In the spring of 2016, staff initiated the most significant effort to date for the new Plant – Preliminary Design. With Board contract approval in May, Carollo Engineers was retained to prepare the preliminary design for the new water treatment plant. A key part of the preliminary design effort is a series of workshops to consider options and build towards resolution on a series of technical issues. Four workshops have been completed to date and summaries of the first two workshops have previously been provided to the Board. This memo provides a summary of all work to date including that which occurred during the two most recent workshops. Also included is an update on property acquisition and budget.

Work accomplished prior to the preliminary design effort was summarized in two previous Board Memos presented on March 3, 2015 and February 2, 2016.

Discussion
<u>Preliminary Design Work Completed to Date</u>

Analysis of Raw Water Quality
Raw water quality samples have been taken at the proposed intake site since 2013. Initially these were grab samples taken quarterly and during storm events. In early 2016 a sonde (a submersible instrument for collecting continuous readings) was deployed and is currently providing data. The data collected at the site has been supplemented by data from other utilities including Springfield Utility Board and Creswell.

The raw water data collected was compared to the maximum contaminant level (MCL) for regulated compounds for drinking water. Almost all concentrations of regulated compounds in the raw water (prior to any treatment) from the Willamette River were found to be below the finished water MCL requirement. This helped confirm the high quality of the water source.

As the data was analyzed, a comparison between the Willamette River and McKenzie River was performed. From this comparison the following general observations were documented:

- Water in the Willamette River is slightly warmer than the McKenzie River
- Both sources have a similar pH
- The Willamette River is expected to have higher turbidity than the McKenzie River
- Higher microbial (bacteriological) counts are present in the Willamette River
- Water in the Willamette River typically has higher total organic carbon (TOC) than the McKenzie River. TOC is important because, when chlorinated, it can form disinfection by-products (DBPs)
- Concentrations of dissolved metals were slightly higher in the Willamette than in the Mckenzie.

During the course of the sampling there were a few unregulated contaminants detected at low levels that influenced the treatment process recommended below. These were:

- Geosmin and MIB. These two naturally occurring compounds which cause taste and odor issues were detected. The presence of these compounds is common in water systems (often associated with algae) and they are easily removed with the appropriate treatment process.
- Algae/Algal Toxins. The algae and associated toxins produced by algae in the source water are of a concern for most utilities in the Pacific Northwest that rely on surface waters. Sampling has twice detected algal toxin at the intake site at low levels. Additional sampling is continuing for this compound on both the McKenzie and Willamette Rivers.

Development of Level of Service Goals

Level of service goals for the new plant were defined early in the preliminary design process. These included goals related to both finished water quality and the occurrence of a major seismic event. The level of service goals are summarized below:

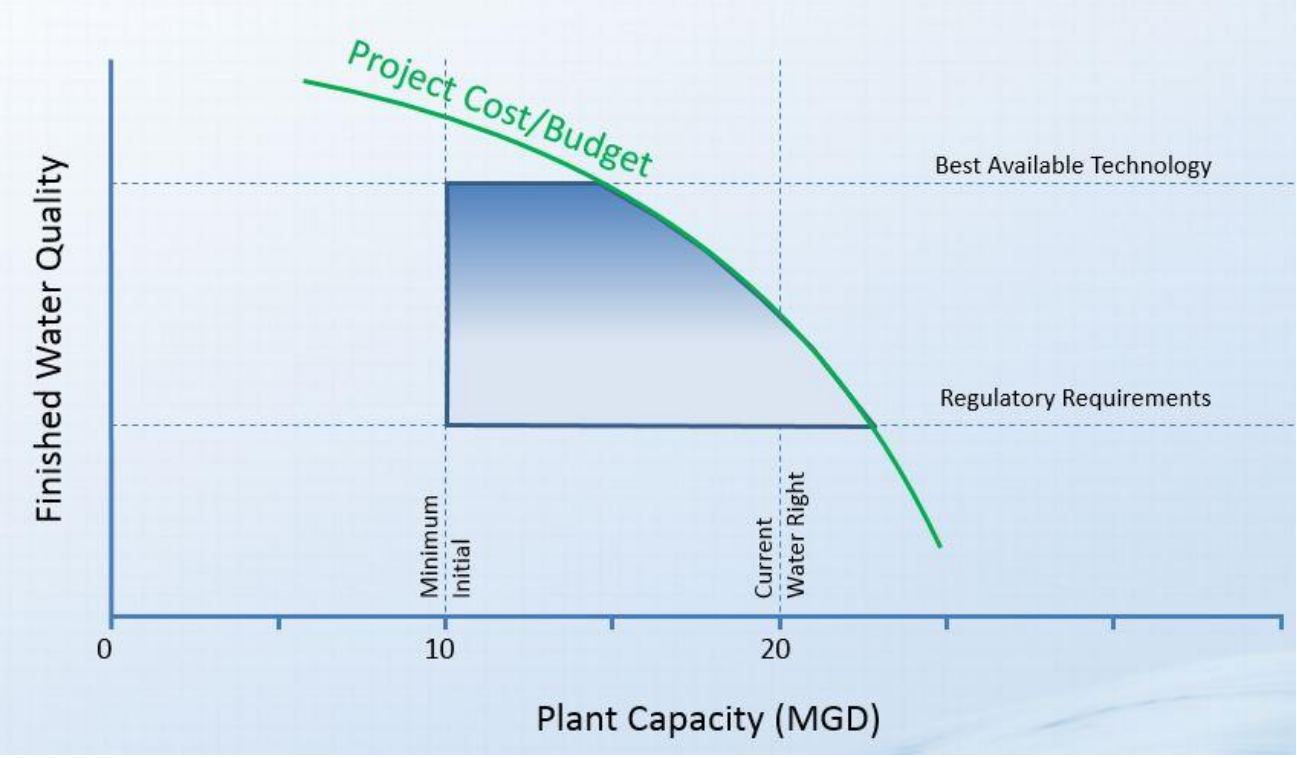
- Finished Water Quality:
    - Routine plant operation must achieve water quality better than or equal to Hayden Bridge. Under emergency operation plant must meet regulatory requirements at all times. A plant with higher capacity and lower water quality goals (still above regulatory requirements) would be acceptable under emergency conditions.
    - Turbidity – Will match the Hayden Bridge goal of 0.07 NTU (a unit of measurement associated with the ability for light to pass through a water sample; lower levels indicate fewer suspended solids and therefore a higher water quality).
    - TOC-Disinfection Byproducts: Maintain DBPs at less than 50% of regulatory limits.
- Occurrence of a major seismic event:

- Design criteria for plant - 2,500 year seismic event.
- Recovery from a seismic event should be within 24 hours.
- Capacity following a seismic event should be 100% of minimum winter demand.

Identification of the Water Quality and Capacity Constraints
Concurrent with the development of the level of service goals, the team defined the boundaries for viable treatment plant alternatives. This are illustrated in Figure 1 below. As shown the minimum capacity to be provided will be 10 million gallons per day (MGD). This is based on previous discussions with the Board during the initiation of this project. The capacity will be limited by our water right which is a bit above 19 MGD or, most likely, the funding available.

With respect to finished water quality, the minimum would be the regulatory requirements. As stated previously, the team defined a level of service goal that would place water quality well above regulatory requirements under normal operation but under emergency operation the water quality could drop but not lower than regulatory requirements. The maximum water quality has two upper limits, what is possible using the best available technology and what can be afforded. Costs will likely be the limiting factor here as well.

Figure 1. Range of Potential Solutions

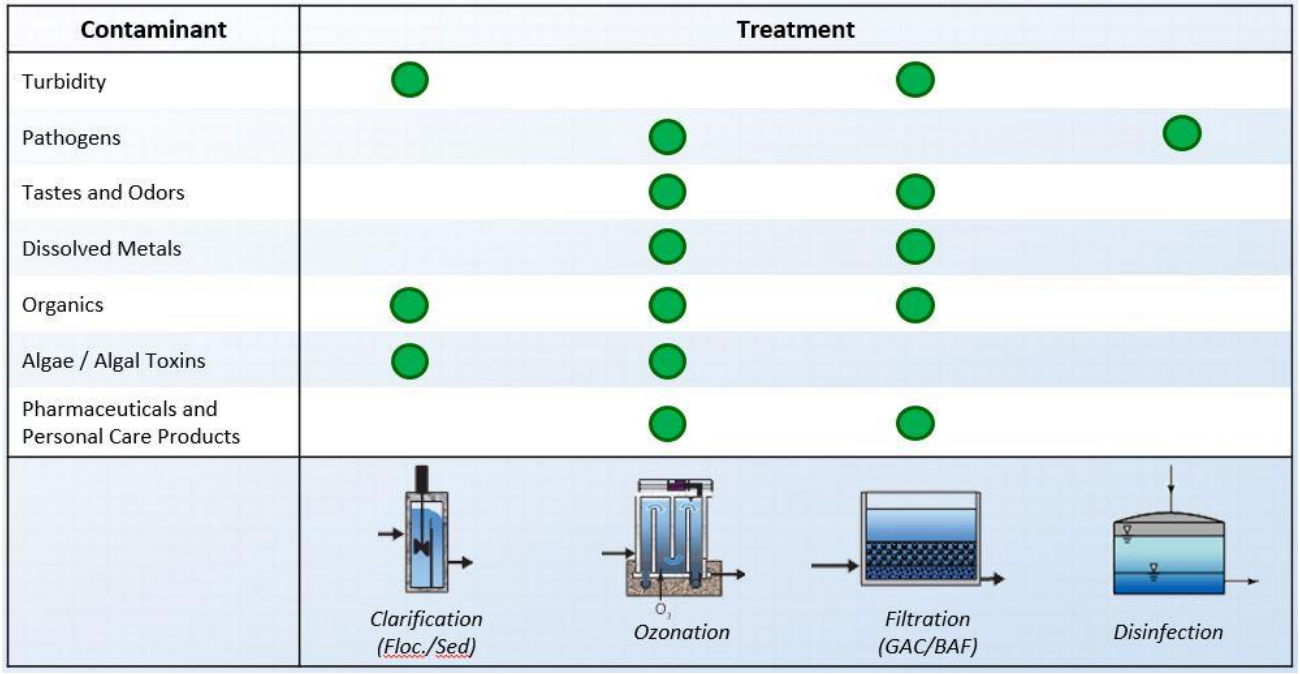


Identification of a Recommended Treatment Process
Following analysis of the raw water quality and development of the level of service goals, work began to identify a recommended treatment process. Criteria used to identify the process include:

- Ability to treat the contaminants detected in the raw water as well as future contaminants that could be anticipated at the intake location.
- Multi-barrier treatment of the contaminants of concern i.e. if one process were to fail, there is redundancy.
- Process similarity to Hayden Bridge to facilitate staff cross training.
- Treatment technologies proven and accepted on similar raw waters in the Pacific Northwest.
- Ability to start and stop the treatment process on a regular basis.

Using the above criteria, the team developed the process shown in Figure 2 as the minimum recommended process for the new water treatment plant. The green circles show what contaminant each process targets.

Figure 2. Recommended Treatment Process



In summary the recommended treatment process includes the following steps:

1) Clarification. A process where particles in the water are mixed with coagulant chemicals, agglomerated, and settled out. The process proposed would be similar to but much more robust and efficient than what occurs in the large open basins at Hayden Bridge.

2) Ozonation. This is a new process for EWEB but one commonly used in water treatment. Ozone (O_3) is a highly reactive gas that is formed by applying an electric charge to gaseous oxygen. This gas is commonly just injected into the water stream for a certain length of "contact time". Many of the newer plants being built utilize ozone in their process as it is one of the most effective "tools in the water treatment tool box" for operators and offers multiple benefits to the treatment process. These benefits include the effective control of color, taste, and odors; its ability to serve as a primary or secondary disinfectant; and the

enhancement of other treatment processes designed to remove particles and decrease turbidity.

3) Filtration. Similar to Hayden Bridge, dual media filters are recommended for the new plant. The principal difference between the filters at Hayden Bridge and those proposed at the new plant is the type of media. Hayden Bridge uses anthracite coal while the filters at the new plant are recommended to have granular activated carbon media. The activated carbon provides the multi-barrier treatment, along with ozone, for many contaminants.
4) Disinfection. With the exception of ozone providing some of the disinfection, this step would be similar to Hayden Bridge where chlorine is added to the water for disinfection and to provide a residual disinfectant in the distribution system.

Note that there are many technical details and alternatives associated with each of these processes that are being discussed during the preliminary design effort.

Identification of a Recommended Operational Strategy
Multiple operational strategies have been reviewed to date during Preliminary Design. These ranged from 24-7 continuous operation to operation only during emergency events. During these discussions, two important criteria were agreed upon:

1) The plant should operate on a daily basis. Staff has a strong recommendation that if the new plant is to be relied upon to be operational after an emergency, it will be important to operate it on a regular basis. Regular operation ensures the process is working and that staff have knowledge of all the idiosyncrasies that come with a treatment process. This is especially important for a plant that could be required to increase capacity to the limits of its treatment process at any time following a catastrophic event.
2) Regardless of how the finished water enters the distribution system, it should do so at a relatively constant rate in relation to the supply from Hayden Bridge. This is necessary to minimize customer-detected water quality "change" and provide consistent aesthetics in the system.

With these two criteria, the questions became how long each day the plant should run, at what capacity, and how much should be delivered into the system at a constant rate.

In attempting to answer the above, plant staffing was discussed. It was acknowledged that Hayden Bridge would always be the primary plant and will continue to be staffed 24-7 as it is today. This is due to both its capacity and with it being an older treatment plant, it is not easy to start and stop it as would be with a new plant. It was also acknowledged that the new plant would be highly automated and at times, could be operated remotely from Hayden Bridge. Many new treatment plants operate 'unmanned' at times. To minimize staffing additions, it was proposed that the plant would be operated daily for one shift i.e. 8 hours.

Given the above, the following operational strategy was developed:

- Daily operation for approximately one shift or 8 hours.

- Plant capacity at normal daily operation would be approximately 5 MGD. This is half its required initial capacity of 10 MGD and serves as an acceptable long term "turn-down" for a plant.
- Approximately 1-2 MGD would be delivered into the distribution system 24-7. Under this scenario, the plant would operate at a rate of approximately 5 MGD for a shift or 8 hours. During this time, excess water above the 1-2 MGD rate provided to the system would be stored on site for delivery into the system when the plant is not operating. Additional storage capacity will be provided on-site to allow for this operating scenario.

Note that the above is for normal operation. In an emergency if Hayden Bridge was out of service, the new plant capacity would be increased to the maximum permissible and operation would be continuous.

Identification of Alternatives for Delivering Water into the System
Given the anticipated vicinity of the new water treatment plant, two options are being considered for delivering finished water into the distribution system. Both alternatives are discussed below and are shown on Figure 3.

1) Alternative 1: Delivery at the Knickerbocker Bridge. For this alternative, finished water from the new water treatment plant could be delivered into the distribution system at this location. Based on the operational strategy discussed previously, it would be delivered into the system at a relatively low rate. Customers downstream of the injection point, primarily those in South Eugene, would receive a blend of water estimated to vary from 10% to 25%, new water treatment plant to Hayden Bridge.

2) Alternative 2: Delivery at the Intertie Location. With improvements and modifications to the transmission system, finished water could be delivered to the existing "Intertie" location. Delivering the water at this point would ensure that all customers receive approximately the same blend of water, estimated to vary from approximately 4% to 10%, new water treatment plant to Hayden Bridge.

   This alternative requires the following modifications and improvements to the transmission system:

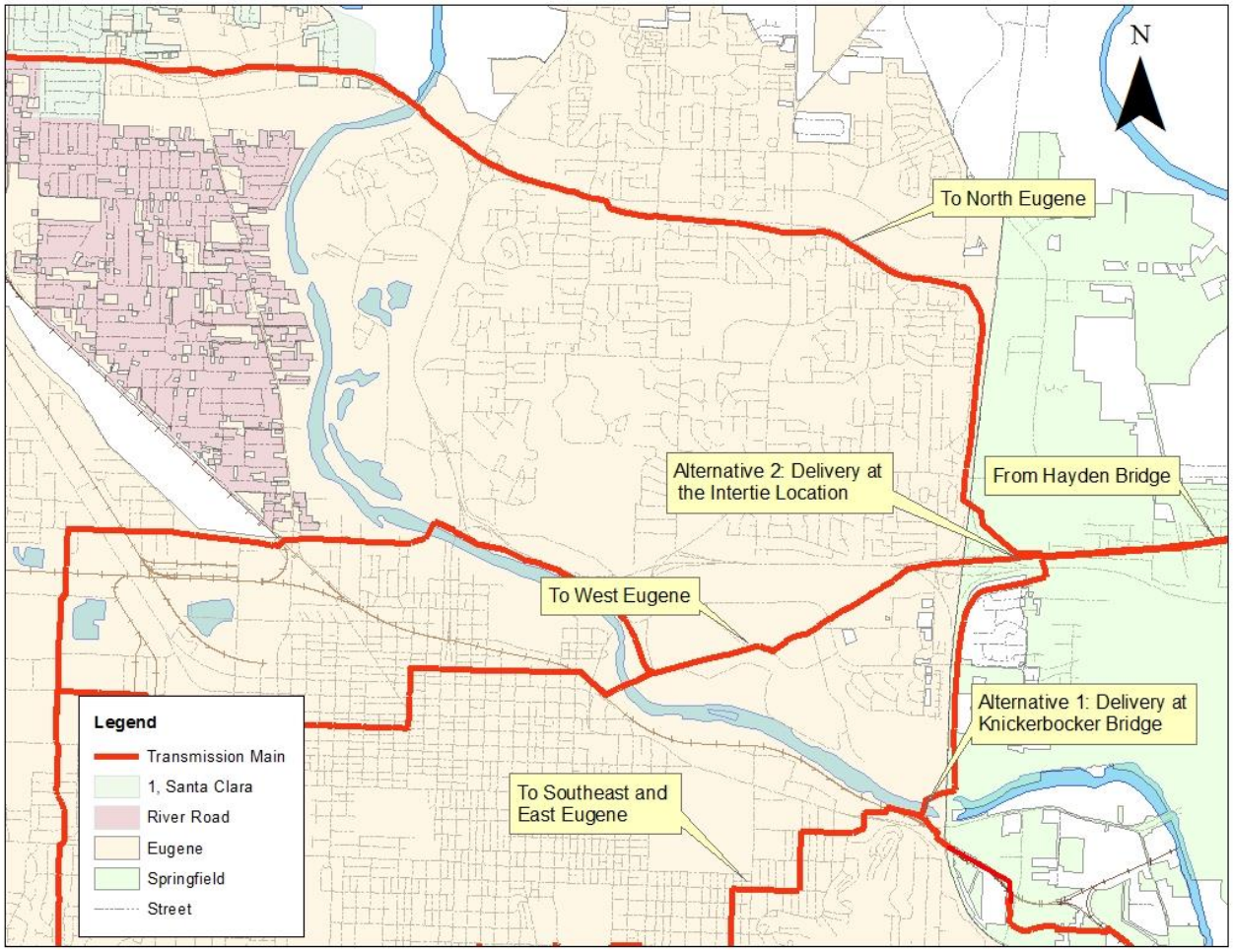
   - Reversal of flow across the Knickerbocker Bridge. Instead of carrying water from Hayden Bridge, the pipe from the Intertie to the Knickerbocker Bridge would carry finished water from the new water treatment plant to the Intertie.

   - Construction of a new transmission pipeline from the Headquarters site to South Eugene. This pipeline is needed to replace the transmission pipeline across Knickerbocker Bridge. Note that this pipe is a recommended project in the Water Master Plan. It is not in the current ten year CIP but will be in the CIP soon regardless of this project.

   The transmission improvements and modifications required for delivery of the finished water from the new water treatment plant to the Intertie and the pipeline to

South Eugene are estimated to cost from $7 to $9 Million. This cost is not included in the preliminary estimate provided below.

Figure 3. Alternative Delivery Locations



Development of Preliminary Cost Estimates
Preliminary estimates have been completed for the new water treatment plant and related infrastructure. These are summarized in Table 1.

Table 1. Preliminary Estimated Costs for New Water Source

Water Treatment Plant	$58M
River Intake	$8M
Pipelines	$5M
Total	$71M

The costs shown in Table 1 are based on the following:

- Water Treatment Plant. Costs for a 10MGD plant with the treatment process noted above designed to meet the stated level of service goals. Five MG of storage would be provided at the site as well.
- River Intake. Costs for the river intake and pump station are based on conceptual designs developed early in the project. The intake design has not been advanced as far as the treatment plant as we are waiting for confirmation on treatment plant location. Costs assume a submerged river intake with a tunnel to a deep shaft/pump station located away from the river.
- Pipelines. Depending on the final location and site configuration of the treatment plant the pipeline length could vary. Where new pipelines were required they were sized for the capacity of the water right on the Willamette – 20MGD. Where existing pipelines are of sufficient size for the initial capacity of 10 MGD but not for future, they were not replaced. Allowances have been added to account for the many unknowns at this time in this area. Costs for the transmission pipeline improvement to South Eugene, discussed previously under the Water Delivery Alternatives, are not included.

It should be noted that the current amount allocated for this project in the CIP is approximately $66 Million. Costs in previous CIPs for a second source on the Willamette have ranged from $50 Million to $120 Million. The estimate shown in Table 1 is preliminary. We will continue to refine the costs and value engineer the project to reduce the estimate where appropriate. We anticipate further discussions with the Board on where costs could be reduced in the future.

<u>Property Acquisition</u>
Multiple properties are required for the project. Specifically property is required for the river intake and raw water pump station and for the water treatment plant. Each are discussed separately below.

River Intake and Pump Station
Two properties were acquired in 2015 and 2016 for the river intake and pump station. The river intake property acquisition was completed via a trade with Wildish for EWEB property near one of their gravel pits. The river intake property, as shown to the Board on a tour on September 16th, is located just below the confluence of the Middle and Coast Forks of the Willamette River.

In addition, a second property was purchased west of the intake property to allow placement of the intake pump station on a site above the maximum flood levels and with better access.

Both of the properties acquired for the river intake and pump station were completed after a favorable Development Issues Meeting with the City of Springfield where development of the sites was discussed.

Treatment Plant Property
Numerous properties were considered for the treatment plant property. Criteria used in the selection of property included:

- Close proximity to the raw water intake location.
- Location above the flood plain and with suitable geological conditions for a critical facility.
- A minimum of 5 usable acres.

- Close proximity to EWEB's existing 24" water transmission main easement/corridor which runs through Glenwood towards the Knickerbocker Bike Bridge.
- Sufficient access for deliveries and daily operations

Properties immediately west of Interstate 5 and the intake location were evaluated, however, topography, potential geotechnical issues, cost, multiple freeway crossings, and distance from the intake and transmission main easement precluded these properties.

Vacant properties east of Interstate 5 from the proposed property northwest to Henderson Ave were also evaluated. In this location, three potential properties were identified. One of the properties was recently purchased by the Springfield Utility Board for a new substation and the other property did not have adequate access. This left one property as the preferred site for the treatment plant. This property is optimally located immediately west of the river intake property on the west side of Franklin Blvd.

A second Development Issues Meeting was held with the City of Springfield to discuss development of the proposed treatment plant site. The various land use actions for development of the site were discussed along with the processes required to resolve them.

After this meeting, numerous attempts were made to purchase the preferred site. These efforts were unsuccessful and EWEB decided to use the power of eminent domain to acquire the property. This is the current status of this property purchase – it is in condemnation awaiting a trial date.

Concurrent with the eminent domain process, EWEB began working on the land use actions required for development of the site. The first step in this process was the initiation of amendments to the Eugene Springfield Metropolitan Area Public Facilities and Services Plan (PFSP) to show the proposed intake and treatment plant. These improvements need to be included in the PFSP prior to subsequent land use approvals.

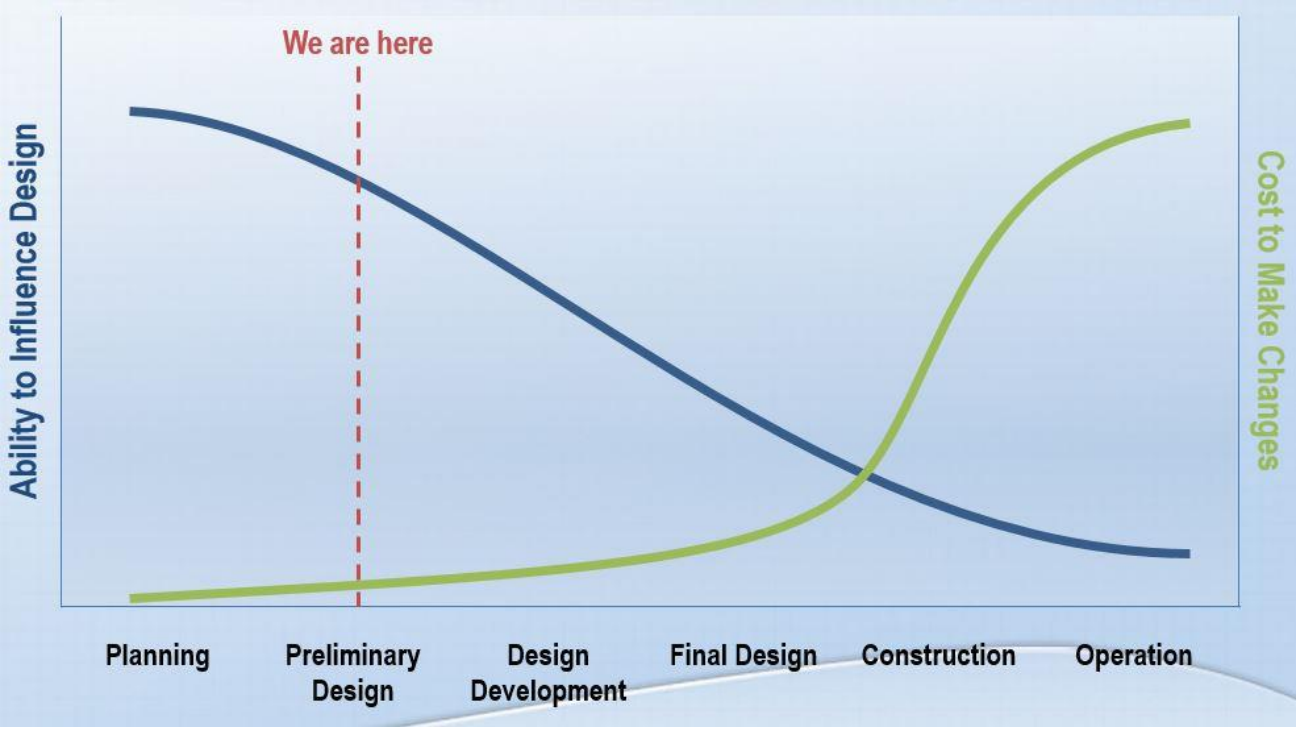
Amendments to the PFSP can be initiated by Eugene, Springfield or Land County, and after initiation, all three entities are required to approve changes to the Metro Plan. EWEB approached the City of Springfield to initiate the land use process, but after two discussions, Springfield City Council preferred that the City of Eugene take the lead. The timeline for the City of Eugene to take up initiation is under discussion now.

<u>Project Cost and Decision Status</u>
To date since the start of active work on the new water treatment plant/river intake a total of approximately $900,000 has been spent. This represents a little over 1% of the total amount included in the CIP for this project. This has been for a combination of: planning work, water quality sampling, property acquisition and due diligence activities, legal fees, and preliminary design.

Also it is important to note where we are in the project with respect to the cost and ability to make changes. Thus far, most everything completed to date is preliminary, only existing on paper. This makes it relatively easy and cost effective for EWEB to make changes.

As we go forward into the subsequent phases of design and construction it gets increasingly more difficult and costly to make changes. This concept, shown in Figure 4 illustrates why it is important to receive and incorporate comments from the Board and stakeholders early in the project.

Figure 4. Decision/Cost Impact Status



Next Steps

Our next steps in several different areas are discussed below.

Preliminary Design

We will probably slow down a bit on the preliminary design effort until some more certainty is available on the treatment plant property and while we vet our current recommendations through additional public engagement.

There are several areas however where we are exploring alternatives regarding where focus should be placed at the plant – water quality or emergency capacity. We will further develop these alternatives and anticipate presenting them to the Board in February.

Property Acquisition

Alternatives will need to be discussed on how best to proceed on the treatment plant property. Meetings are scheduled with City of Eugene staff to discuss the PFSP initiation and alternatives. The outcome of those meetings will dictate our path forward.

Public Engagement
There are several items on the public engagement front anticipated in the near future:

- Panel of Experts. It is proposed that a panel of subject matter experts be assembled to review and confirm the treatment process, operational strategies, and other relevant topics arising from the preliminary design work. It is anticipated that this panel will be assembled in late 2016 and will be able to provide input to the Board in early 2017.
- Additional Site Visits. Site visits for EWEB and City staff as well as invited elected officials to the river intake location are planned in late October and early November.
- Customer Panel. The new source on the Willamette will be the topic at the Fall meeting. This will be the third time this topic was discussed with this group.
- EWEB Lunch and Learns. Two are planned for late October.
- Intro to Willamette Video. This is nearing completion and hopefully will be available at the October Board Meeting.

Recommendation
None. This is an information item only.

Requested Board Action
Input is sought from the Board on the items presented herein. This is an update on a long-term strategic project. Board feedback to help ensure we are moving in the right direction on predesign is requested.
Staff will be available to answer questions at the October 4, 2016 Board meeting.

If you have any questions please contact Wally McCullough, Water Engineering Supervisor at 541-685-7435 or email wally.mccullough@eweb.org.