# CHAPTER 7

# CHAPTER 7
# EXISTING WATER TREATMENT PLANT ALTERNATIVES

## Introduction

This chapter presents alternatives which can expand capacity and address the existing deficiencies at the existing WTP site. Planning level project cost estimates are also presented which are used for comparison with other alternatives.

The ultimate capacity at the existing WTP site is limited to 30 mgd. This is due to space limitations at the site and raw water intake capacity. Therefore, in order to meet long-term water demands, a new treatment facility with a new intake would still be required in approximately 2065 according to Chapter 6 findings. The capacity of the new facility could vary depending on the degree of investment initially made in new facilities at the existing site. Two alternatives for expanding the existing plant were developed for this facility plan; the alternatives were intended to bracket the spectrum of options with regard to cost.

### *Alternative 1 Overview*

Alternative 1 retains as many existing process facilities at the existing WTP site as practicable at a lower granular media filtration rate. For this alternative, the existing filter building, clearwells, and high service pumping facilities are retained and upgraded. A new clarification process facility uses ballasted flocculation to reduce the treatment process footprint and a mechanical dewatering process is added. Three additional filters and new clearwell systems are constructed to provide 30 mgd capacity. Alternative 1's approach attempts to use as much of the older existing structure as possible. A significant capital investment would be required for this alternative once 30 mgd is exceeded in year 2065. A new 45-mgd treatment facility would then need to be constructed and the existing 30 mgd plant would be abandoned. This alternative involves a higher level of risk associated with extending the life of existing deteriorated facilities, some of which have reached the end of their useful design life.

### *Alternative 2 Overview*

Alternative 2 replaces most of the facilities at the existing WTP using phased demolition and reconstruction. This alternative adds new ballasted flocculation and dewatering facilities and demolishes the existing filter building. As part of this alternative, deep bed, high rate filters would be constructed. A new clearwell and high service pump station would also be constructed. Because all critical facilities under this alternative are newly constructed, the life expectancy of the resulting 30 mgd WTP would be approximately 75 years, through the end of the planning period evaluation. In 2065, when system MDD reaches 30 mgd, a new WTP and intake will be needed to supplement the existing WTP and achieve a total capacity of 45 mgd between the two plants. The City would operate two plants through the end of the planning period resulting in higher operating costs than operating a single WTP.

### *Site and Construction Constraints*

Implementing either alternative requires consideration of the risks and challenges related to construction activities around the existing plant and within the limited available space. Since this is the City's only water supply, construction activities at the existing plant site must not interfere with on-going operations and the production of safe drinking water. These alternatives are subject to the following additional planning criteria:

- To implement the required improvements, the maximum plant production rate will likely be reduced for extended periods of time, as basins or filters are taken out of service for repairs or demolition. Based on recent historical water system demands which show a peak week demand and peak month demand of approximately 11.5 and 10.5 mgd, respectively, a maximum plant production rate of 10 to 12 mgd may be tolerable as construction activities occur. The City may need to implement water use restrictions or rationing during hot weather conditions to limit demands based on plant production limitations with facilities out of service.
- The WTP cannot be shut down for more than two to three consecutive days during the low-demand period from November to April. Shutdowns which last for one day may be tolerable during October and May. No plant shutdowns are acceptable from June to September.
- The most pressing short-term concern is structural and seismic rehabilitation of the east and west clearwells. The 1980s clearwell, which also serves as a wet well for the high service pumps, also requires structural and seismic upgrades. All of these clearwell upgrades will take longer than three consecutive days to complete. Therefore, other plant additions must be completed, such as another clearwell and a new high service pump station (HSPS), before upgrades can be completed on the 1980s clearwell.
- Existing high-voltage power lines run north-to-south over the western part of the site, limiting construction activities which can be performed directly beneath. Locating permanent facilities directly beneath the power lines would present significant construction and permitting challenges.
- There is a 50-foot set-back between the edge of the property and above-grade structures.
- Construction activities cannot hinder vehicular traffic around the plant perimeter, including chemical delivery traffic.
- The space required for construction staging and storage exceeds the available space at the existing plant site. This limitation could result in added construction costs for both alternatives.
- A phased construction program may be considered to spread out capital investments, but extended construction duration will have an impact on plant operations and project costs.

- While there is no immediate need to expand production capacity in order to meet near term water demands, there is an immediate need for seismic and structural upgrades.

## Process Alternatives and Selection

This section presents the basis for developing the two alternatives introduced in this chapter. Each of the primary processes and main support facilities are briefly discussed below.

### *Intake and Raw Water Pump Station*

The existing intake was retrofitted with a fish screen system in 2008 and has a hydraulic capacity of 30 mgd. The four existing raw water pumps are a vertical turbine configuration which withdraws water from a wetwell downstream of the screens. The raw water pump station (RWPS) has space provisions for two additional pumps to expand from 20 mgd to 30 mgd. The intake and adjacent riverbank requires structural upgrades and stabilization to protect against failure resulting from a seismic event. Beyond 2065, an adjacent second intake structure and associated pumping and transmission facilities will be required to bring intake capacity to 45 mgd. The proposed improvements to the intake and RWPS are similar for both alternatives.

### *Rapid Mixing*

A new rapid mixing system that provides for optimum chemical dispersion will be required to expand the plant capacity to 30 mgd. The new system will need to be located in the new raw water pipeline to be constructed between the existing RWPS and the new ballasted flocculation system. There are a number of rapid mixing systems considered as part of this assessment, including:

- In-line static mixer, similar to the existing system
- In-line mechanical mixer
- Pumped diffusion system

For planning purposes, a new pumped diffusion system is recommended since it provides optimum mixing over a wide range of flows, reduces chemical use and head loss, and uses less energy than the other options.

### *Clarification*

The combined area occupied by basins 1, 2, and 3 is approximately 21,000 square feet. Basins 1 and 2 have an approximate combined hydraulic capacity of 12 mgd and basin 3 has an approximate hydraulic capacity of 8 mgd. As discussed in Chapter 2, basin 3 does not perform as well as basins 1 and 2 due to its square configuration and radial flow design.

*Basin 1, 2, and 3 Improvements*

Without significant structural and seismic improvements, basins 1 and 2 are approaching the end of their useful lives. Even with these improvements, their hydraulic capacity cannot be increased enough to provide an additional 10 mgd of clarification capacity. As part of earlier studies completed in 2009 concerning installation of a settled solids collection system, it was estimated that the project cost of the recommended improvements for basins 1 and 2 would be approximately $3 million and would not result in additional capacity. Additional costs are required for basin 3 to make structural and seismic upgrades and to improve its performance. In order to increase its clarification capacity to 30 mgd using similar technology, an additional large basin would be necessary. In total, all of these improvements would likely cost in excess of $7 million to achieve a capacity of 30 mgd and to extend the useful life of the older basins by approximately 45 years.

*New High-Rate Clarification*

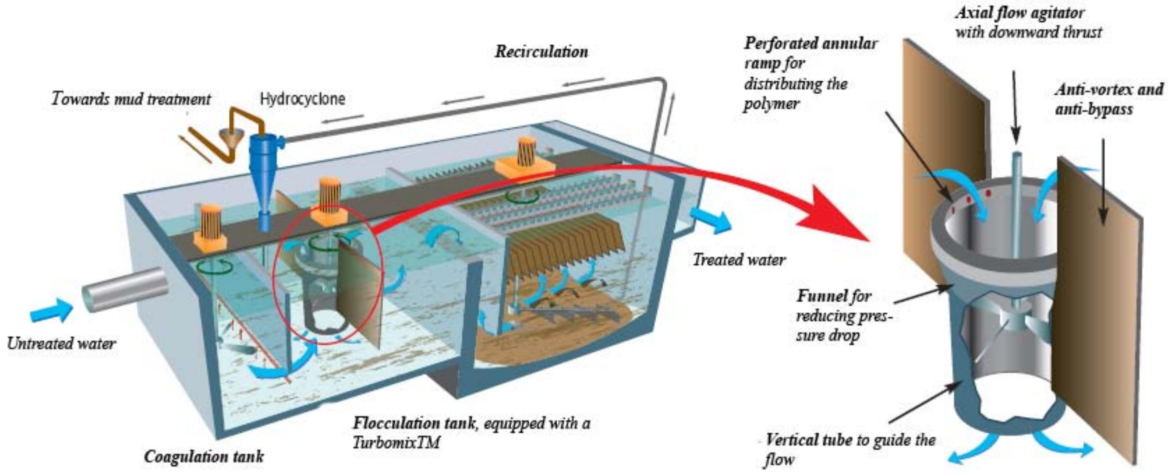
An alternative to improving the existing clarification structures is the construction of a higher-rate clarification system which will reduce surface area requirements. As discussed in Chapter 6, potential high-rate processes include:

- Tube settlers or plate settlers preceded by mechanical flocculation
- Upflow sludge blanket clarifiers
- Dissolved air flotation
- Ballasted flocculation

Based on the consultant team's experience elsewhere in the region, a new high-rate ballasted flocculation process could be constructed to replace the three existing basins and provide an optimized clarification system. This technology has gained considerable acceptance in Oregon and throughout the country over the past decade, and it is believed to be appropriate for treatment of the Rogue River raw water. The process uses settling rates of 20 to 30 gpm/ft$^2$, compared to settling rates of 1 to 6 gpm/ft$^2$ for other clarification processes, and can be constructed on a very small footprint. Figure 7-1 presents a schematic overview of this process.

The required footprint for ballasted flocculation at 30 mgd capacity is approximately 2,100 square feet which is smaller than any one of the existing basins. Basin 1 or 3 could be taken off-line for a season and demolished. Then, ballasted flocculation could be constructed in that space. The two remaining basins could then be re-purposed or demolished to create space at the site for other improvements. Ballasted flocculation and its associated costs are not expected to be any higher than the costs of improving the existing basins and building and constructing an additional basin to get to 30 mgd capacity. The new ballasted flocculation structures will have a 75-year expected useful design life.

**Figure 7-1**
**Schematic of the Actiflo™ Turbo Ballasted Flocculation Process**




(Courtesy of Kruger, Inc.)

Ballasted flocculation to provide 30 mgd capacity would consist of two 15-mgd process trains. This would provide operational flexibility and redundancy and would be less expensive than installing three process trains with individual capacities of 10 mgd. It would also require that a solids thickener be constructed to handle the recycle flows and the solids produced, as well as a sand feed system and a polymer feed system. Improvements to the settled water conveyance system would be required to properly distribute flows to the filters.

Based on recent manufacturer quotes and construction costs elsewhere, it will cost less than $5 million to install a 30-mgd ballasted flocculation system, including thickening, at the existing WTP site. For all of these reasons, ballasted flocculation is recommended as the clarification process for both Alternatives 1 and 2 to expand and upgrade the existing WTP.

### *Ozone*

Space for future ozone equipment is reserved under Alternatives 1 and 2 in case the City decides to implement ozone for taste and odor control, or for any other unforeseen circumstance in the future. Multiple ozone contact basins sized to provide adequate contact time at full capacity could be installed between the clarification and filtration processes with liquid oxygen storage and ozone generators located nearby. Approximately 2 feet of hydraulic head would be needed if ozonation facilities were added in the future, which results in a clarification water surface level that is higher than the current level.

### *Filtration*

As discussed in Chapter 6, it is recommended to continue use of granular media filtration for the Rogue River supply. Low-pressure membrane filtration, the other common alternative, is more expensive to construct and operate than granular filters. Therefore, both upgrade and expansion alternatives for the existing Grants Pass WTP include granular media filtration.

The eight existing filters at the WTP were upgraded in 2007 and are deemed to have useful life for the next 40 years with a production capacity of 20 mgd with one filter out of service. Some structural and seismic upgrades are required, particularly in the oldest three filters. The filter design is not ideal to meet current filtration standards due in part to a relatively shallow media depth. It is believed, however, that these filters can continue to operate efficiently in the future in conjunction with an optimized clarification system such as ballasted flocculation.

*Alternative 1 Filtration*

Alternative 1 proposes the continued use of the eight existing filters. To achieve 30 mgd of filtration capacity, the construction of three new filters with a media area similar in size to filters 4 and 5 is recommended. The depth of media can be slightly deeper than the existing filter media to enhance performance. The new filters would be backwashed using the existing backwash pumps inside the HSPS. The location of the new filters should be determined based on available space and proximity to the clearwells and HSPS.

*Alternative 2 Filtration*

For Alternative 2, it is proposed to demolish all of the existing filters, including the associated buildings and clearwells, and replace them with six new high-rate, deep-bed granular media filters. A maximum filtration rate of 8 gpm/ft$^2$ with one filter out of service using 48 to 60 inches of dual media is recommended, based on successful experiences elsewhere with similar raw water and clarification systems. This higher filtration rate will reduce footprint and reduce construction costs. The new filters would initially be built and put in service before the existing filters are demolished, so they need to be located in an area that is currently open or available after demolition of the existing sedimentation basins. The new deep-bed filters would be backwashed using new pumps inside the proposed new HSPS and would also be cleaned using an air scour system. It is also possible to consider the use of granular activated carbon as a filter media in lieu of anthracite as an added taste and odor control feature.

### *Disinfection and Finished Water Storage*

The WTP existing finished water storage structures include three separate clearwells built at different times. They have a combined total volume of approximately 433,000 gallons with an operating volume of 362,000 to 400,000 gallons, which is just enough to meet current disinfection requirements using free chlorine under most conditions. Ultraviolet irradiation (UV) disinfection is an alternative to free chlorination for future primary disinfection at the Grants Pass WTP. Implementing UV allows for a reduction in required finished water storage volume required for disinfection, but does result in increased power cost. Because a large finished water storage basin is needed for proper operation of the HSPS, it is believed that free chlorine will continue to be the most cost-effective alternative for future primary and secondary disinfection. It is also anticipated that disinfection byproduct concentrations will be reduced after improvements are complete, due mainly to the planned discontinuation of pre-chlorination. Future disinfection with free chlorine will need to be achieved downstream of filtration.

If free chlorine remains the primary disinfectant at the Grants Pass WTP, additional clearwell volume will be required. Based on seasonal demands and temperature profiles, at least 650,000 gallons of baffled storage will be required to meet the 0.5-log *Giardia* inactivation requirements at 30 mgd.

As documented in the June 2012, "Structural and Seismic Evaluation Report" presented in Appendix D, the existing clearwell is in immediate need of structural upgrades to minimize the risk of damage during a seismic event. Unfortunately, the estimated duration of implementing these improvements exceeds the maximum allowable plant shut-down duration of three days. Though a temporary UV disinfection system could potentially allow for upgrades to the 1930s and 1960s portions of the clearwell, additional clearwell and distribution pumping capacity will be needed prior to upgrades to the 1980s portion of the clearwell because this is where the existing HSPS is located. Therefore, for Alternative 1, construction of a new 375,000-gallon clearwell and a new HSPS is recommended. The recommended volume is adequate to meet current CT requirements with free chlorine during the clearwell upgrade construction period when operating at flows under 15 mgd. Once the new clearwell and HSPS are put into service, the existing clearwell can be taken out of service and repaired, either all at once or sequentially. Temporary and permanent yard piping improvements will also be required to connect the old and new clearwells.

For Alternative 2, a new 650,000-gallon clearwell is recommended for construction in conjunction with a new 30-mgd HSPS prior to abandoning and demolishing the existing three clearwells.

For both Alternatives 1 and 2, it is recommended that the new clearwell be located directly beneath the new filters and HSPS to minimize footprint and piping.

### *High Service Pumping*

The existing HSPS has approximately 30 mgd of available capacity, assuming that the distribution system is upgraded to receive this additional flow. However, the clearwell below the HSPS requires structural and seismic upgrades, requiring construction of a new clearwell and a 10 to 12 mgd HSPS for Alternative 1 as previously discussed. The discharge piping of this new, smaller HSPS would be connected to the existing plant finished water pipeline. Following the structural and seismic upgrades, this new HSPS would operate in parallel with the existing HSPS, increasing operational flexibility and overall plant reliability.

For Alternative 2, a new 30-mgd HSPS should be constructed along with a new 650,000-gallon clearwell. The proposed location for the new HSPS and clearwell is in the area currently occupied by basins 1 and 2. Hence, these older basins would need to be demolished following construction and startup of the proposed new ballasted flocculation system so that the new HSPS and clearwell can be constructed. When these new facilities have been completed, the existing HSPS and associated buildings can be demolished. The new HSPS would discharge into a new finished water pipeline that would connect to the existing pipeline. The new HSPS would also be equipped with backwash pumps to support the new filters proposed under Alternative 2.

### *Chemical Storage and Injection*

The existing chemical storage area and sodium hypochlorite room has enough capacity to treat more than 20 mgd. It is not anticipated that additional space on the site would need to be dedicated to treat 30 mgd, even when considering the additional polymer system required for the proposed ballasted flocculation system. Chemical metering pumps could be added or replaced to meet the increased chemical feed rate.

#### *Alternative 1 Chemical Storage and Injection*

Rather than increasing the number or size of the existing chemical storage tanks, the Alternative 1 approach would be to schedule more frequent chemical deliveries. As such, Alternative 1 will use the existing chemical storage and feed areas, following structural and seismic upgrades, to achieve a remaining useful life of 45 years. The existing maintenance area for the WTP is currently co-located in the chemical storage area. This maintenance area will be moved to a new dedicated space elsewhere on the site for Alternative 1. Space is also available to add a carbon dioxide tank and feed system for raw water coagulation and pH control if it becomes necessary in the future.

#### *Alternative 2 Chemical Storage and Injection*

For Alternative 2, the existing chemical storage areas will be replaced with a new chemical building. This new building would be built and put into service before demolition of the existing chemical building. The proposed location for the new chemical building is adjacent to the new filters.

### *Residuals and Solids Handling*

The backwash water from the existing filters is currently equalized in a basin located on the west end of the plant, then pumped to the old mill pond across the street. The suspended solids concentration in this water is relatively low and the pond acts as a settling basin to ensure that the overflow from the pond, which discharges to Skunk Creek, meets NPDES requirements. The pond also provides time for the chlorine residual to dissipate. Because the pond is partially filled with solids deposited prior to the development of the geobag dewatering program, the City employs a dredging program in the pond every summer to remove and dewater settled solids.

The solids which collect in the three contact basins are removed two to three times per year on a batch basis since the basins do not have continuous solids removal systems. These solids are equalized in an on-site tank and then treated with polymer before being pumped into geobags. The geobags are located to the west of basin 3 and to the north of the equalization basin.

*Mechanical Dewatering*

Due to limited available space, a mechanical dewatering system is recommended which can remove solids on a continuous basis and produce higher dewatered solids concentrations than the current method. A mechanical dewatering system includes three key components: thickening, storage and equalization, and mechanical dewatering equipment. Dewatering equipment options include belt presses, centrifuges, and screw presses.

The mechanical dewatering equipment and ancillary features should be installed in a building, preferably with the dewatering equipment on the second story to facilitate truck loading for off-site disposal. For both Alternatives 1 and 2, the mechanical dewatering building is located to the west of the main plant facilities and is capable of accommodating any of the mechanical dewatering variations.

*Liquid Residuals*

As long as disposal of liquid decant from the old mill pond to Skunk Creek remains acceptable, it is recommended to continue handling backwash water using the current practice. Decant from the new gravity thickener would also be pumped to the old mill pond. If Skunk Creek becomes unavailable in the future, then improvements to clarify and recycle the backwash water and thickener decant to the raw water stream upstream of flash mix would likely be necessary. For Alternatives 1 and 2, the existing equalization basin is retained. The pumps would be replaced due to age, and conveyance capacity to the pond would be increased.

### *Operations and Maintenance Support Facilities*

The existing plant provides insufficient space for efficiency and effective operations and maintenance activities. Under Alternative 1, the existing administrative building and facilities will remain and a new maintenance/shop/storage building is recommended for construction. It should be located in available space created by demolition of the existing buildings. In Alternative 2, the existing administrative building will be demolished and a new operations and maintenance building will be built where the existing administrative building and filters 1 to 5 are currently located. Based on preliminary discussions with the City's planning department, the new operations building must be similar in appearance to the existing buildings to match the historical nature of the older plant buildings.

### *Summary of Alternatives*

Both Alternative 1 and 2 site plans for expanding and upgrading the existing WTP include the following primary treatment processes:

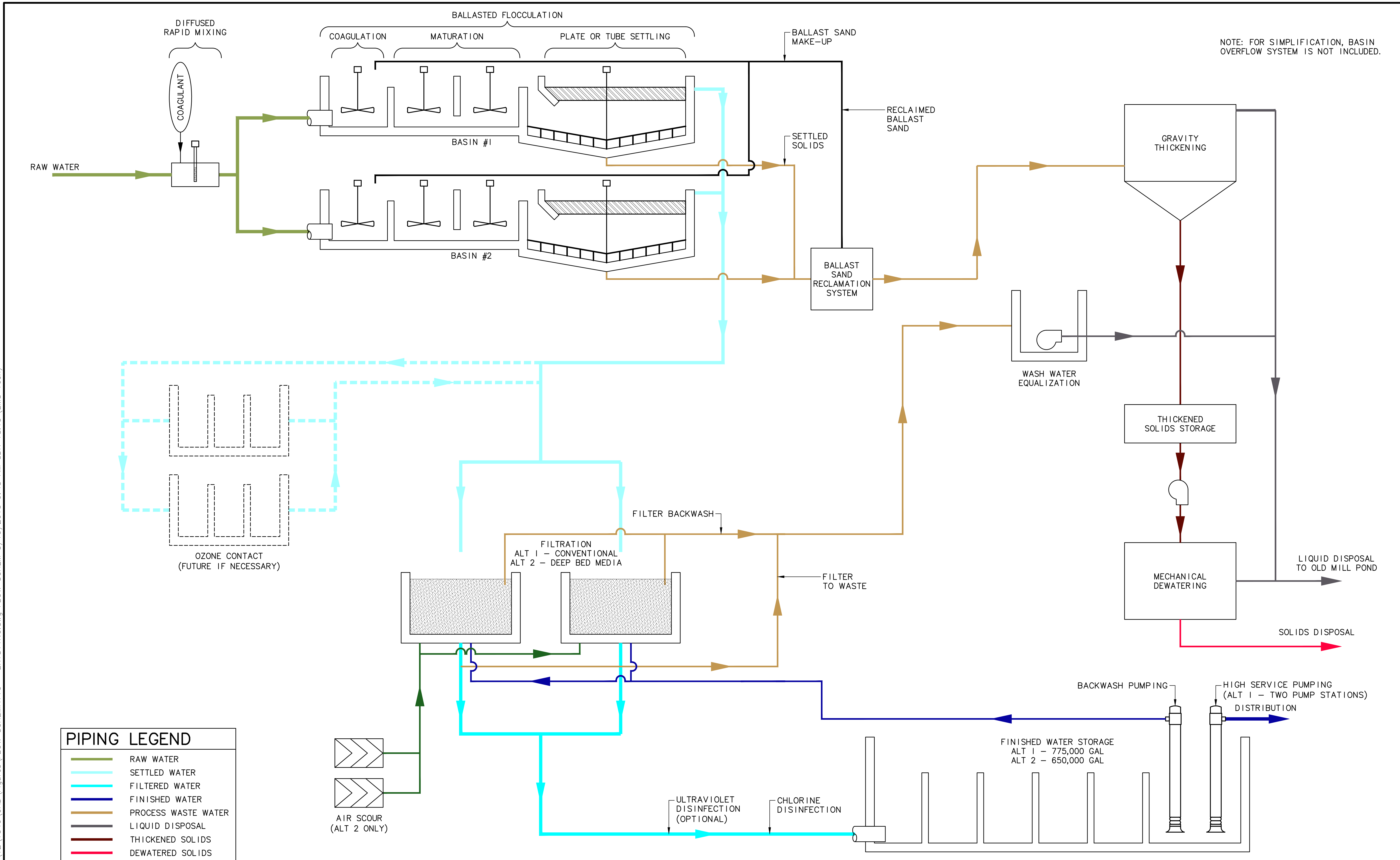
- Pumped diffusion rapid mixing
- Ballasted flocculation
- Potential future intermediate ozonation
- Granular media filtration
- Chlorine disinfection

The solids treatment train includes gravity thickening, solids homogenization, and mechanical dewatering facilities. New high service pumping facilities are also required for both alternatives. In both alternatives, the layout attempts to minimize building footprints and costs where possible. Both alternatives would result in a 30-mgd WTP with a remaining useful life of approximately 45 years. Alternative 2 has a longer useful life as it includes construction of multiple new facilities. Figure 7-2 shows process flow schematics for Alternatives 1 and 2.

Table 7-1 presents a comparison of the advantages and disadvantages for the two alternatives. Either alternative will require the construction of new intake facilities and a new WTP at a different site in approximately 2065 when the water system MDD reaches 30 mgd. The capacity of the future new WTP would be 45 mgd for Alternative 1 and 15 mgd for Alternative 2.

**Table 7-1**
**Existing Water Treatment Plant Expansion and Upgrade Alternative Summary**

| Alternative | Advantages | Disadvantages |
|---|---|---|
| 1 | • Lowest initial capital cost<br>• Increased HSPS reliability and operational flexibility<br>• Preserves architectural look of historical buildings | • Increased risk of water rationing during construction<br>• Multiple smaller filters with shallow media depth<br>• Requires construction of a new 45-mgd plant in 2065 |
| 2 | • New facilities offer useful life of more than 45 years<br>• More efficient equipment and support systems<br>• Deeper filter media helps with taste and odor control<br>• Newer facilities provide opportunity to comply with current OSHA and ESA codes | • Longest construction duration and water rationing<br>• Highest initial capital cost<br>• Requires construction of a new 15-mgd WTP in 2065<br>• Results in operation of two plants beyond 2065 |

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WATER TREATMENT PLANT FACILITY PLAN UPDATE
FIGURE 7-2
PROCESS FLOW SCHEMATIC - ALTERNATIVES 1 AND 2

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## Facility Layouts and Construction Sequencing

Figures 7-3 and 7-4 illustrate the proposed facilities layouts for Alternatives 1 and 2, respectively. The size, placement, and timing of facilities shown in the figures reflect the discussion of treatment processes in this chapter.

A phased approach to construction is required for both alternatives in order to sequentially complete key elements of the work, assure adequate plant production capacity, and to spread out the costs. In order for plant staff to become familiar with the operation of new facilities associated with progressive phases of work, each construction phase will be followed by a break from construction.

For each alternative, three suggested phases of work with separate construction contracts are summarized in the figure legends. The itemized scope of work for each phase included in the legends is intended to balance the risk of prolonged operational obstructions with addressing the most critical upgrades as early as possible. This staged approach is necessary to maintain plant production and will result in a longer construction duration compared to completing the work under a single construction contract, which will increase costs. Both alternatives will require that the plant operate at a maximum production of 10 to 12 mgd for a period of 12 to 18 months, including at least one summer with potential water rationing, until key facilities can be constructed and brought on-line. For purposes of estimating comparative contractor overhead and profit between alternatives, Alternative 1 is estimated to have three phases. The first phase would have a duration of 12 months and the second and third phases would each last18 months. Alternative 2 is estimated to have three equal phases with a duration of 18 month each.

### *Construction Constraints*

Both alternatives require careful planning and design to implement the proposed improvements and a pre-qualified, experienced contractor with a proven ability to work within the significant site constraints. Discussion of work sequencing, permissible work areas and work hours, and coordination with City operational staff for activities impacting normal plant operations will all need to be included in the construction contract and bidding documents. Construction storage and staging areas need to be established and additional off-site staging may be required. Access to and around the plant site for chemical deliveries and plant activities must be maintained throughout the course of construction activities.

## Project Cost Estimates

Table 7-2 and Table 7-3 present planning-level project cost estimates for Alternative 1 and Alternative 2, respectively. The estimated project costs are expressed in 2013 dollars. Due to the phased nature of both alternatives, it is anticipated that these project costs would be incurred in several expenditures over the course of several years. As such, net present value is a more meaningful way to compare the costs associated with these alternatives and the additional alternatives presented in Chapter 8.

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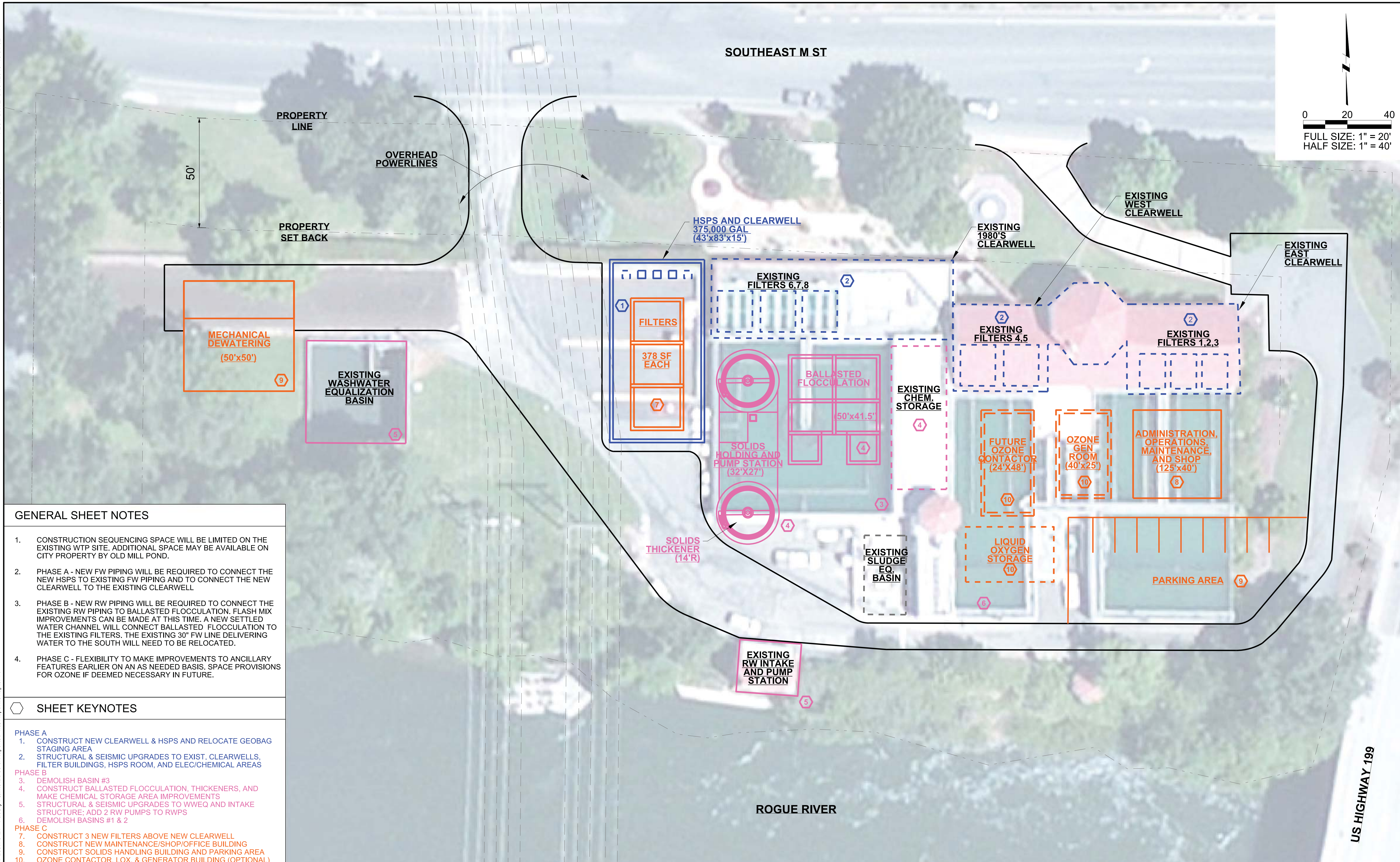


## GENERAL SHEET NOTES

1. CONSTRUCTION SEQUENCING SPACE WILL BE LIMITED ON THE EXISTING WTP SITE. ADDITIONAL SPACE MAY BE AVAILABLE ON CITY PROPERTY BY OLD MILL POND.
2. PHASE A - NEW FW PIPING WILL BE REQUIRED TO CONNECT THE NEW HSPS TO EXISTING FW PIPING AND TO CONNECT THE NEW CLEARWELL TO THE EXISTING CLEARWELL
3. PHASE B - NEW RW PIPING WILL BE REQUIRED TO CONNECT THE EXISTING RW PIPING TO BALLASTED FLOCCULATION. FLASH MIX IMPROVEMENTS CAN BE MADE AT THIS TIME. A NEW SETTLED WATER CHANNEL WILL CONNECT BALLASTED FLOCCULATION TO THE EXISTING FILTERS. THE EXISTING 30" FW LINE DELIVERING WATER TO THE SOUTH WILL NEED TO BE RELOCATED.
4. PHASE C - FLEXIBILITY TO MAKE IMPROVEMENTS TO ANCILLARY FEATURES EARLIER ON AN AS NEEDED BASIS. SPACE PROVISIONS FOR OZONE IF DEEMED NECESSARY IN FUTURE.

## SHEET KEYNOTES

PHASE A
1. CONSTRUCT NEW CLEARWELL & HSPS AND RELOCATE GEOBAG STAGING AREA
2. STRUCTURAL & SEISMIC UPGRADES TO EXIST. CLEARWELLS, FILTER BUILDINGS, HSPS ROOM, AND ELEC/CHEMICAL AREAS

PHASE B
3. DEMOLISH BASIN #3
4. CONSTRUCT BALLASTED FLOCCULATION, THICKENERS, AND MAKE CHEMICAL STORAGE AREA IMPROVEMENTS
5. STRUCTURAL & SEISMIC UPGRADES TO WWEQ AND INTAKE STRUCTURE; ADD 2 RW PUMPS TO RWPS
6. DEMOLISH BASINS #1 & 2

PHASE C
7. CONSTRUCT 3 NEW FILTERS ABOVE NEW CLEARWELL
8. CONSTRUCT NEW MAINTENANCE/SHOP/OFFICE BUILDING
9. CONSTRUCT SOLIDS HANDLING BUILDING AND PARKING AREA
10. OZONE CONTACTOR, LOX, & GENERATOR BUILDING (OPTIONAL)

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WATER TREATMENT PLANT FACILITY PLAN UPDATE
FIGURE 7-3
SITE LAYOUT - ALTERNATIVE 1

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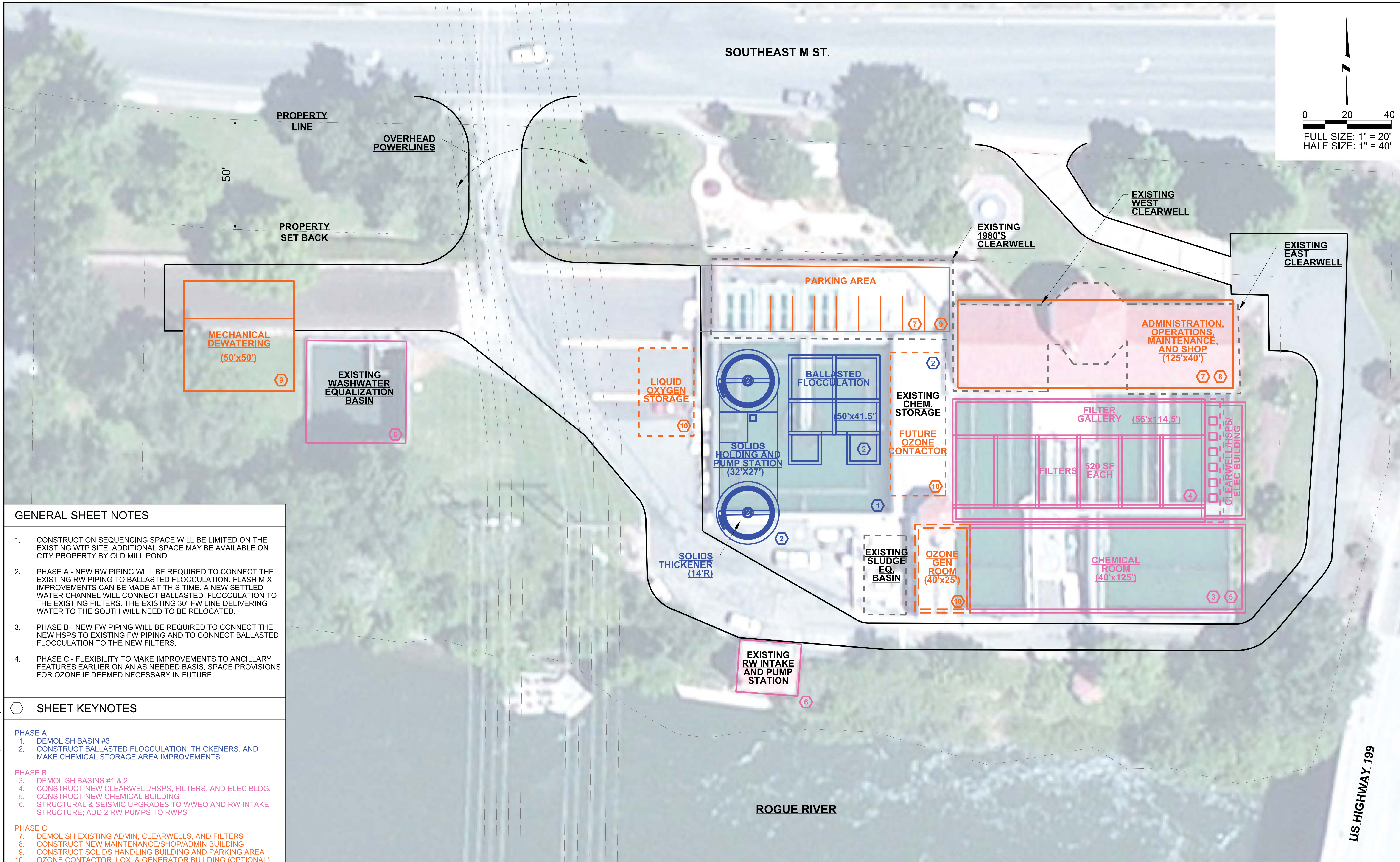


## GENERAL SHEET NOTES

1. CONSTRUCTION SEQUENCING SPACE WILL BE LIMITED ON THE EXISTING WTP SITE. ADDITIONAL SPACE MAY BE AVAILABLE ON CITY PROPERTY BY OLD MILL POND.
2. PHASE A - NEW RW PIPING WILL BE REQUIRED TO CONNECT THE EXISTING RW PIPING TO BALLASTED FLOCCULATION. FLASH MIX IMPROVEMENTS CAN BE MADE AT THIS TIME. A NEW SETTLED WATER CHANNEL WILL CONNECT BALLASTED FLOCCULATION TO THE EXISTING FILTERS. THE EXISTING 30" FW LINE DELIVERING WATER TO THE SOUTH WILL NEED TO BE RELOCATED.
3. PHASE B - NEW FW PIPING WILL BE REQUIRED TO CONNECT THE NEW HSPS TO EXISTING FW PIPING AND TO CONNECT BALLASTED FLOCCULATION TO THE NEW FILTERS.
4. PHASE C - FLEXIBILITY TO MAKE IMPROVEMENTS TO ANCILLARY FEATURES EARLIER ON AN AS NEEDED BASIS. SPACE PROVISIONS FOR OZONE IF DEEMED NECESSARY IN FUTURE.

## SHEET KEYNOTES

PHASE A
1. DEMOLISH BASIN #3
2. CONSTRUCT BALLASTED FLOCCULATION, THICKENERS, AND MAKE CHEMICAL STORAGE AREA IMPROVEMENTS

PHASE B
3. DEMOLISH BASINS #1 & 2
4. CONSTRUCT NEW CLEARWELL/HSPS, FILTERS, AND ELEC BLDG.
5. CONSTRUCT NEW CHEMICAL BUILDING
6. STRUCTURAL & SEISMIC UPGRADES TO WWEQ AND RW INTAKE STRUCTURE; ADD 2 RW PUMPS TO RWPS

PHASE C
7. DEMOLISH EXISTING ADMIN, CLEARWELLS, AND FILTERS
8. CONSTRUCT NEW MAINTENANCE/SHOP/ADMIN BUILDING
9. CONSTRUCT SOLIDS HANDLING BUILDING AND PARKING AREA
10. OZONE CONTACTOR, LOX, & GENERATOR BUILDING (OPTIONAL)

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WATER TREATMENT PLANT FACILITY PLAN UPDATE
FIGURE 7-4
SITE LAYOUT - ALTERNATIVE 2

**Table 7-2**
**Alternative 1 Project Cost Estimate**

| Facility | Estimated Cost (2013 USD) |
|---|---|
| Mobilization and General Conditions (12 percent) | $2,500,000 |
| Intake and Raw Water Pump Station Improvements | $1,450,000 |
| 375,000 gallons of New Treated Water Storage | $1,000,000 |
| New 7.5 MGD Capacity High Service Pumping Equipment | $1,000,000 |
| New Finished Water Piping | $250,000 |
| Relocate Geobag Staging Area | $100,000 |
| Structural/Seismic Upgrades to Existing 3 Clearwells | $750,000 |
| Structural/Seismic Upgrades to HSPS Room | $100,000 |
| Structural/Seismic Upgrades to Existing Filter Buildings | $500,000 |
| Structural/Seismic Upgrades to Chemical and Electrical Rooms | $400,000 |
| Tank, Electrical Equipment, and Pipe Anchorages | $250,000 |
| Demolish Existing Basin 3 | $300,000 |
| Relocate 30-inch diameter Finished Water Pipe | $200,000 |
| New Ballasted Flocculation and Sedimentation | $3,200,000 |
| New Gravity Thickeners and Associated Piping | $900,000 |
| Thickened Solids Storage | $450,000 |
| New Chemical Systems for Ballasted Flocculation and Thickeners | $150,000 |
| 36-inch diameter Raw Water Pipe to Ballasted Floc Basins and Flow Splitter | $150,000 |
| Add New Settled Water Channel | $200,000 |
| Demolish Basins 1 and 2 | $300,000 |
| Influent Flow Metering and Flash Mix Facilities | $300,000 |
| Build Three New Filters, Retain Filters 1 through 8 | $2,600,000 |
| Upgrades to Existing Wastewater Equalization Basin, Pumps, and Piping | $300,000 |
| Mechanical Dewatering Building | $1,350,000 |
| New Maintenance/Shop/Office Building | $2,000,000 |
| Electrical and Instrumentation | $1,500,000 |
| Site Civil and Miscellaneous Yard Piping | $500,000 |
| Landscaping | $50,000 |
| **Subtotal: Construction without Contingency** | **$22,800,000** |
| *Contingency (25 percent)* | $5,700,000 |
| *Additional Contractor Overhead and Profit for Three Phases* | $2,052,000 |
| **Subtotal: Construction with Contingency** | **$30,600,000** |
| **Engineering, Permitting, Construction Management Services, Legal, Administration (30 percent)** | **$6,840,000** |
| **Total Estimated Project Cost with Contingencies** | **$37,400,000** |

**Table 7-3**
**Alternative 2 Project Cost Estimate**

| Facility | Estimated Cost (2013 USD) |
|---|---|
| Mobilization and General Conditions (12 percent) | $3,700,000 |
| Intake and Raw Water Pump Station Improvements | $1,450,000 |
| Demolish Existing Basin 3 | $300,000 |
| Relocate 30-inch diameter Finished Water Pipe | $200,000 |
| New Ballasted Flocculation and Sedimentation | $3,200,000 |
| New Gravity Thickeners and Associated Piping | $900,000 |
| Thickened Solids Storage Tank | $450,000 |
| New Chemical Systems for Ballasted Flocculation and Thickening | $150,000 |
| 36-inch diameter Raw Water Pipe to Ballasted Floc Basins and Flow Splitter | $150,000 |
| New Settled Water Channel | $200,000 |
| Influent Flow Metering and Flash Mix Facilities | $300,000 |
| Demolish Existing Basins 1 and 2 | $300,000 |
| 650,000 gallons of New Treated Water Storage | $1,500,000 |
| New 30 MGD High Service Pump Station | $3,750,000 |
| New Finished Water Piping | $500,000 |
| Build Six New Filters | $5,200,000 |
| Demolish Filters 6, 7, 8, Existing HSPS, and 1980s Clearwell | $500,000 |
| Demolish Filters 1, 2, 3, and East Clearwell | $500,000 |
| Upgrades to Existing Wastewater Equalization Basin, Pumps, and Piping | $300,000 |
| New Administration and Maintenance Building | $2,500,000 |
| Demolish Filters 4, 5, Existing Ops Building, and West Clearwell | $500,000 |
| New Chemical Building | $2,500,000 |
| Mechanical Dewatering Building | $1,750,000 |
| Electrical and Instrumentation | $2,000,000 |
| Site Civil and Miscellaneous Yard Piping | $1,000,000 |
| Landscaping | $100,000 |
| **Subtotal: Construction without Contingency** | **$33,900,000** |
| *Contingency (25 percent)* | $8,500,000 |
| *Additional Contractor Overhead and Profit for Three Phases* | $3,850,000 |
| **Subtotal: Construction with Contingency** | **$46,300,000** |
| **Engineering, Permitting, Construction Management Services, Legal, Administration (30 percent)** | **$10,200,000** |
| **Total Estimated Project Cost with Contingencies** | **$56,500,000** |

Project cost estimates were developed using recent local industry information from estimates, bid tabs, vendor quotations, and other material unit costs for similar treatment facilities. Line item estimates represent installed costs that include materials, labor, equipment, and contractor overhead and profit. Building costs for Alternative 2 are higher to account for more expensive architectural finishes that match the look of the existing buildings.

The project cost estimates are Class 5 estimates as defined by the American Association of Cost Engineering. These opinions of probable cost are based on planning-level analysis and a low level of project definition. Accuracy typically ranges from –30 percent to +50 percent.

In developing the project costs for Alternatives 1 and 2, it was necessary to add premiums associated with the risk and difficulty associated with construction at the existing site. Assumptions that were used to develop these costs, which are different from those used to develop costs for the construction of a new WTP, include the following:

- A mobilization cost at a higher percentage than used for construction of a new WTP to account for the potential need by the contractor to secure additional off-site staging areas, and the likely necessity for more heavy equipment transport and storage to minimize on-site contractor presence and impact on ongoing plant operations.
- A higher planning-level construction cost contingency allowance than used for construction of a new WTP, recognizing the increased potential for changed conditions and contractor claims on a confined site with various existing utilities and working constraints.
- Additional contractor overhead and profit assessed when compared to construction of a new WTP intended to account for the cost of on-site equipment and labor proportional to the increased total construction time of all three phases. This is relative to an estimated 30-month construction duration for a new WTP. Contractor overhead and profit was taken as 15 percent of construction cost in this analysis.
- A higher markup used between construction and project costs than used for the new WTP alternatives, accounting for the increased engineering, permitting, construction management, legal, and administrative cost allowances required to administering three separate construction contracts instead of a single contract.

**Summary**

The two alternatives for expanding and upgrading the existing WTP on the existing WTP site have a wide range of capital costs and have different implications for long-term operation of the City's water supply system over the next century. New WTP Alternatives 3, 4 and 5, presented in Chapter 8, evaluate the construction of new treatment facilities on new sites. A comparative evaluation of all five alternatives, which includes social and environmental considerations as well as costs, is presented in Chapter 9. Chapter 9 includes a final recommendation for the preferred capital improvement program.