Gray & Osborne, Inc.
CONSULTING ENGINEERS

TECHNICAL MEMORANDUM 20434-8

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FROM:	KEITH STEWART, P.E. RUSSELL PORTER, P.E.
DATE:	FEBRUARY 15, 2022
SUBJECT:	SUDDEN VALLEY WTP STRUCTURAL AND ARCHITECTURAL SYSTEM ANALYSIS LAKE WHATCOM WATER & SEWER DISTRICT, WHATCOM COUNTY, WASHINGTON G&O #20434.00

INTRODUCTION

In 2019, the Lake Whatcom Water & Sewer District (District) contracted with Gray & Osborne to perform a condition assessment for their existing Sudden Valley Water Treatment Plant (WTP). This assessment is part of a larger effort to analyze the District's water treatment facilities in order to prioritize funds for rehabilitation, modification, and/or replacement projects. The goal of the assessment and subsequent analysis is to identify potential improvements for the existing structures and treatment processes in an attempt to maximize treatment efficiency and extend the operational life of these facilities. The reports and technical memoranda generated as part of this assessment project will be used to develop a strategy for prioritizing modifications to the WTP to ensure it can efficiently and cost-effectively provide clean potable water for its existing and projected customers.

This memorandum summarizes an assessment of the existing WTP Main Building and Finished Water Pump Buildings, and provides three basic options for expansion/modification. This memo then provides an analysis of factors to consider for each of these options.

Final recommendations for modifications to the WTP Main Building and/or layout will be presented in the final Alternatives Analysis Report, which is scheduled to be completed in spring 2021. This final report will consider all of the alternatives and recommendations compiled for each of the treatment systems and will provide a coordinated set of recommendations based on capital costs, District needs, operational costs, and other factors.

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BACKGROUND AND EXISTING FACILITIES

Background

The District operates three Group A water systems – South Shore (DOH 95910), Eagleridge (DOH 08118), and Agate Heights (DOH 52957) – all of which are in and around the shores of Lake Whatcom, which lies southeast of Bellingham in Whatcom County, Washington. The District serves approximately 3,900 residential and commercial water system connections with a residential population of approximately 10,000 people.

The South Shore system is the largest of the three systems and is supplied wholly by water treated at its Sudden Valley WTP. In addition to the WTP, the District also owns and maintains surface water source, storage, and distribution system facilities. The distribution system includes multiple pressure zones, four booster stations, and approximately 2.8 million gallons (MG) of storage in five reservoirs. The District also maintains a secondary intertie with the City of Bellingham Water System (DOH 50600) that is used only during emergency situations.

The existing WTP is a rapid-rate direct filtration plant with a rated capacity of 2.0 million gallons per day (MGD), which is equivalent to approximately 1,400 gallons per minute (gpm), but currently operates at a reduced flow of 1.0 MGD (700 gpm). The maximum allowable water right for this source is 1,526 gpm; however, the WTP and its components will be sized to accommodate the WTP's rated flow of 1,400 gpm. This design flow is suitable to serve the projected buildout water demand of 1.3 MGD as listed in the District's 2018 Water System Comprehensive Plan.

The WTP is located at 22 Morning Beach Drive in Bellingham, Washington, and is housed in a partially below-grade concrete building located adjacent to Morning Beach Park. The facility was constructed in 1972 and has undergone several minor improvements since that time but was most recently upgraded in 1992. Two centrifugal raw water pumps pump water from the Lake Whatcom intake to the WTP where alum coagulant is injected. After mixing with coagulant, water enters the flocculation basin before entering the filter distribution trough and the mixed-media filters. Water proceeds through the filters into the underdrain system then exits the filter through the filter discharge piping. The filter discharge piping includes injection points for both soda ash (pH adjustment) and chlorine. This piping then directs the filtered water to the below-grade clearwell. Two transfer pumps located in the WTP move water from the clearwell to the chlorine contact basin, which is a welded steel reservoir located adjacent to the WTP that provides additional chlorine contact time. From the chlorine contact

basin, four finished water pumps pump water to the District's storage reservoirs and distribution system for consumption.

Historical WTP Performance

Historically, the plant has performed well and provides high-quality finished water with turbidities of less than 0.1 nephelometric turbidity units (NTU).

The individual building structures have also performed well and are generally in good condition. Additional information on the construction of these buildings as well as the findings of a recently completed WTP assessment are provided in the next section.

BUILDING CONSTRUCTION

WTP Main Building

The WTP Main Building (Main Building) was constructed in 1972 and is a three-room one-story building consisting of cast-in-place concrete walls with a roof made from precast concrete tee beams overlain by a 4-inch concrete topping slab at the roof. The tee beams are supported at the perimeter of the building by the concrete walls. The building is built into a hillside so its walls are partially to fully below grade, except at the entrance on the north side of the building – which is fully exposed. The north wall with the entrance is a glass and metal framed "storefront" façade. According to record drawings, the roof structure has three-ply built-up roofing, overlain by 2 inches of sand, overlain by up to 18 inches of soil fill. Some photographs of the Main Building are shown as Figure A-1 in Exhibit A and a plan drawing of the building is shown as Figure A-2.

The Main Building contains a large treatment room that houses treatment equipment including raw water pumps, primary treatment equipment, filtration equipment, filtered water storage and pumping, laboratory, and storage space. Below grade, there is a concrete clearwell which provides equalization volume for filtered water prior to being pumped to the chlorine contact basin (CCB). The footprint of the clearwell is approximately 440 square feet (sf) with a total depth of approximately 9 feet. Within the treatment room is a small enclosed washup facility with a sink, toilet, and small storage closet. The washup facility is separated from the treatment room by wood framing, gypsum wallboard, and a hollow-core wood access door. The Main Building also includes an adjoining room that houses the chlorine gas disinfection equipment. Although there is a glass window that provides visibility to the chorine room from the treatment room, the chlorine room is only accessible via an external entrance with a single metal access door. Lastly, the Main Building contains a metal security cage on the

front façade to provide protection from vandalism and further restrict public access to the building.

In 2020, Gray & Osborne completed an assessment of the WTP and compiled the findings of the assessment into the *Sudden Valley Water Treatment Plant Assessment Report* (Assessment Report). The assessment included findings and recommendations from a mechanical, process, electrical, and structural/architectural perspective. The structural findings from this Assessment Report are summarized below while the mechanical, process, electrical, and coating assessment findings are addressed in other technical memoranda associated with this project.

- In general, the concrete structure is in good condition. No major cracks or spalling were found.

- According to record drawings, the topping slab over the tee beams is only 2 inches thick at the perimeter. It increases to 4 inches thick at the center of the roof to provide an external slope to promote drainage. The flanges of the tee beams are also relatively thin, tapering down to 1.5 inches thick at the ends of the flange. According to the record drawings, the roof was designed for 40 pounds per square foot (psf) live load and a maximum soil depth of 18 inches.

- The building is categorized as a Type C2 with concrete shear walls and stiff diaphragm and a preliminary Tier 1 seismic analysis did not find any major seismic deficiencies in the building.

- Miscellaneous structural steel supports such as pipe, conduit, and equipment supports are corroded. In some cases, the corrosion is severe enough that the strength of the support has been reduced.

- There are two coated steel tanks (flocculation and Filters 1 and 2) inside the building. The steel for these tanks is coated with paint and in some areas the paint has failed leading to corrosion of the steel. The corrosion does not appear to be advanced enough to affect the structural integrity of the tanks. The vessel for Filters 3 and 4 is made from aluminum and does not show signs of corrosion.

- Various segments of piping and associated fittings show minor signs of corrosion. This corrosion tends to be located at joints, fasteners, or edges, which is typical for piping within a moist environment. The corrosion does not appear to have affected the integrity of the piping and/or fittings.

- Many of the interior tanks and miscellaneous items supported from the building structure do not appear to have adequate seismic anchorage and/or bracing.

With regard to the layout of the Main Building, the Assessment Report had the following architectural observations:

- The building is extremely cramped due to the presence and location of large treatment equipment, most notably the flocculation tank, chemical tanks, and filter vessels. Furthermore, the existing footprint does not have adequate space or accommodations for additional equipment.

- Working clearances to all sides of each treatment component are limited due to the presence and location of stored materials used for maintenance and/or operation of the facility.

- Removal of any large treatment components (i.e., filters) will require removal of storefront windows as well as removal of the flocculation tank and/or chemical storage tanks.

- The laboratory space and computer monitoring equipment occupy the same space/counter, which places the electronic equipment at risk from damage due to spills/moisture. In addition to this, there is no dedicated office space where staff can complete water quality forms and/or monitor and control the treatment equipment.

- Storage space is limited. To ensure successful operation of the facility, a significant number of parts and tools are required. These parts and tools should be readily accessible; however, the available storage space is limited. Additionally, a tool cart and additional storage and workspace would make it easier for WTP staff to operate and maintain the facility. Furthermore, chemicals are stored in close proximity to electrical components, which promotes deterioration and degradation due to corrosion.

- The existing restroom facility and associated finishes show signs of deterioration.

- The existing safety shower and eyewash units installed at the WTP do not meet the requirements listed in ANSI Z358.1.

- Various areas throughout the WTP (concrete walls, storefront windows, etc.) show signs of current and/or previous moisture intrusion. Furthermore, moisture continually present on the floor is likely due to insufficient drainage slopes and presents a safety hazard.

- The existing structure contains significant plant (ivy) growth on its exterior. This growth provides some camouflaging effect, but also inhibits the ability to inspect the structure and could potentially damage waterproofing systems if left unmanaged.

- The building components associated with the chlorine gas disinfection system show signs of deterioration and the chlorine gas system itself does not meet current codes for use/storage of the chemicals.

- The structure does not utilize an effective smoke alarm or fire suppression system.

- Site security is limited for the facility and the general public currently has access to both treatment buildings as well as the chlorine contact basin.

Per the previously completed Assessment Report, no seismic deficiencies were found in the structure of the Main Building. However, some nonstructural items such as partition walls and seismic bracing for piping were found to be deficient and require retrofits to meet the desired seismic performance level. The structural items noted above can all be addressed with minimal effort and expense when compared to the cost of substantial building modifications and/or replacement. Also, per the Assessment Report, the safety systems such as showers/eyewashes and the fire/smoke alarm systems do not meet current codes. Repairs to these systems, to equipment showing fatigue, and repairs to address moisture issues can all be addressed through individual projects based on available funding. Issues with capacity for expansion and space allocation for the various WTP staff work requirements at the WTP are more complex and are discussed in subsequent sections of this memorandum.

Finished Water Pump Building

This one-story building was constructed in 1992 and consists of prefabricated wood trusses at the roof supported by concrete masonry unit (CMU) walls at the perimeter of the building. The building exterior is provided with wood plank siding and the roof is constructed with asphalt shingle materials. The portion of this building that is utilized by the District contains a single large room that houses the finished water pumps and piping,

the electrical components and starters associated with these pumps, various security and monitoring equipment, and the auxiliary generator that serves both the WTP and the Afternoon Beach Lift Station. The building also contains separate men's and women's restrooms at the west end of the building. The restroom facilities are each accessed via the building exterior by a single metal door, and these restrooms are only open to the public and Morning Beach Park users during the warmer summer months. Some photographs of the Finished Water Pump Building are provided as Figure A-3 in Exhibit A while a plan drawing of the building is shown as Figure A-4. Adjacent to the building is a freestanding 2,500-gallon diesel fuel tank that provides up to 96 hours of fuel for operation of the auxiliary generator.

The structural findings from the Assessment Report for this building are summarized below:

- In general, the prefabricated wood trusses and CMU walls are in good condition.
- Electrical conduit in the attic had only occasional bracing that did not appear to be adequate for the design-level earthquake.
- The building is categorized as a Type RM1 with reinforced masonry bearing walls and flexible diaphragm and a preliminary Tier 1 seismic analysis found two seismic deficiencies of concern:
    - The first deficiency concerns the transfer of horizontal shear forces from the roof diaphragm to the CMU wall at the south side of the building.
    - The second deficiency is insufficient out-of-plane anchorage of the tops of the CMU walls to the roof diaphragm.

The Assessment Report had no significant architectural observations for the Finished Water Pump Building and, in general, the building has sufficient space for access and maintenance on the equipment located within the building.

The items noted above can all be addressed with minimal effort and expense when compared to the cost of substantial building modifications and/or replacement. The next section describes options and analysis for potential modifications to the WTP structures.

BUILDING ANALYSIS

In this section, we will discuss the factors involved with modifying the existing WTP structures in order to accomplish the District's goals for their treatment operations which include:

1. Provide adequate space and accommodations for operation and maintenance of the equipment.

2. Provide suitable accommodations for expansion or replacement of treatment equipment including flows up to the maximum design flow of 1,400 gpm.

3. Provide treatment process redundancy so that the WTP can maintain operations if selected equipment must be removed from service for maintenance.

4. Provide components that will help preserve the function and condition of the electrical components used for treatment analysis.

5. Continue to provide exceptionally high-quality potable water to service area customers as efficiently and as cost-effectively as possible.

WTP Main Building

In its current orientation, space within the Main Building is very limited and the existing facility does not accomplish Goal 1, 2, 3, or 4 listed above. Additionally, the orientation and size of the treatment equipment will make it very difficult to meet these goals without some modifications to the Main Building. In order to meet these goals, additional facility space is required and can be provided in three main ways: expansion above the existing structure, expansion adjacent to the existing structure, and construction of a new separate building/structure. The sections below provide additional information and considerations for several key factors to consider when weighing these alternatives.

<u>Alternative 1 – Building Expansion Above the Existing Structure</u>

Alternative 1 includes expanding the existing structure vertically to create a second floor/story within the building. The new space would have an identical footprint to the existing structure and could be accessed from the Main Building ground floor, exterior stairs, and/or a separate access driveway.

Condition and Code Adherence

Per the previously completed Assessment Report, no seismic deficiencies were found in the structure of the Main Building. However, some nonstructural items such as partition walls and seismic bracing for piping were found to be deficient and require retrofits to meet the desired seismic performance level.

Expansion of the existing facility would be more difficult than construction of a new facility with regard to meeting current codes. If the existing facility is expanded, the entire building, including the chlorine gas room, must be brought into compliance with current building and safety codes. For the chlorine room, this would include additional security, chemical storage, ventilation, and fire alarm systems. Additionally, if this option is selected, there are several nonstructural recommendations in Technical Memorandum 20434-3 (Gray & Osborne, 2020), including bracing of equipment and addressing minor corrosion of equipment/materials that should be completed in order to provide a robust treatment system.

Constructability

Factors that affect the constructability include (but are not limited to) preparation of the space, materials of construction, joining of materials, construction sequencing, equipment needed, space needed for construction, and equipment staging.

The Main Building is located partially below grade, at the base of a steep hillside under cover of approximately 18 inches of soil, and utilizes a roof which is not designed to support heavy or point loading. All of these factors will reduce and complicate access by vehicles, materials, and workers during construction.

Any modifications to the existing structure should be preceded by a thorough geotechnical and hillside analysis to ensure that construction of the proposed expansion is appropriate given the terrain and to potentially identify any geotechnical requirements that should be included in the construction methods for facility expansion.

While technically feasible, expansion of the existing facility above the existing structure is not recommended because of the restricted access for construction vehicles and slope/location of the adjacent hillside. It is likely that construction of this alternative would require specific geotechnical construction considerations.

Property, Land Acquisition, and Land Use

The District does not own the parcel that contains the existing WTP and as such, would need to purchase or lease the land from its owner, the Sudden Valley Community Association (SVCA). The SVCA manages the operation of its property and works to ensure that the values of the community are maintained with regard to development and utility services. The land adjacent to the WTP is a public park and continuous availability to community members is a high priority for the SVCA. Impacts to the adjacent park are a significant factor when considering a plan of action for any WTP modification project.

Expansion of the existing facility above the existing structure is most desirable from a land acquisition/land use standpoint because the footprint of the WTP would not increase.

Access

Currently, the WTP is accessible via Morning Beach Drive and shares access with the adjacent Morning Beach Park parking lot. Morning Beach is a highly popular park in the summer months and adequate parking for visitors must be maintained. Additionally, the District must maintain access to the WTP for operations staff, for maintenance vehicles, and for chemical delivery vehicles. Currently, chemical delivery vehicles are small to medium size, but depending on whether or not the treatment process is modified, additional space may be necessary to accommodate larger delivery vehicles with larger turning radii.

Expansion of the existing facility above the existing structure would provide the lowest level of access to the facility. Expansion above the existing facility would necessitate the use of high slope roads and most likely a significant retaining wall for vehicular access to the upper level. It would also require stairs and/or elevators to access the upper floors from the building interior; however, the existing building footprint is not conducive to the space required to provide a stairway.

In addition to vehicular and pedestrian access to the WTP, there is also a question of conformance with the Americans with Disabilities Act (ADA). The current facility is not ADA compliant with regard to ingress/egress points, aisleway clearances, or restroom spacing. This is very common for water and wastewater treatment facilities given that these facilities are designed with heavy and moving equipment and often necessitate the use of large elevation changes or access to tight spaces; however, many entities have made their treatment facilities fully compliant with ADA requirements to corroborate with their status as an Equal Opportunity Employer, out of personal preference or company policy, or at the request/direction of building permit officials. Modifications to

either the existing building or for any new structures should consider whether these facilities will be compliant with ADA as the accommodations for clearances, parking, building access, and restroom facilities are a significant consideration in the design of any structure. Of the three options, expansion of the existing structure above the Main Building would provide the greatest number of challenges in complying with ADA requirements.

Capacity for Expansion and Rehabilitation

One of the District's primary goals for modifications to the existing WTP is to provide sufficient accommodations for facility expansion/rehabilitation. Although the existing operational flow of 700 gpm is suitable to serve the current demands and the WTP is rated for treatment up to 1,400 gpm which will meet the projected design flow for the service area, the District would like to provide treatment capacity of the design flow ***with redundancy.*** This will help ensure that the WTP can provide potable water if selected components are offline for maintenance. The orientation of the existing treatment equipment does not provide accommodations for replacement/expansion of the filter equipment, flocculation tank, or chemical storage tanks – all of which would require modifications to the existing storefront window façade and/or temporary relocation or removal of selected equipment. Furthermore, there are other treatment components, most notably the chlorine contact basin, that limit the treatment capacity of the WTP but are not specifically located within the Main Building.

Expansion of the existing facility above the existing structure would not improve the capacity for equipment expansion/replacement because the upper floors could only be used for laboratory/work space or light storage and not treatment equipment or chemical storage. The lower floor must continue to house all of the treatment equipment and accessing/replacing the treatment components would still require significant modifications to the facility.

Summary

Based on the factors and descriptions noted above, expansion of the existing facility above the existing Main Building footprint does not appear to help the District meet its treatment and/or building expansion goals.

<u>Alternative 2 – Expansion Adjacent to the Existing Structure</u>

Alternative 2 includes expanding the existing structure horizontally to expand the footprint. The new space would be accessed from the existing access driveway or through the existing Main Building ground floor.

Condition and Code Adherence

Similar to Alternative 1, expansion of the existing facility would be more difficult than construction of a new facility with regard to meeting current codes. Upgrades to comply with current chlorine gas codes would need to be completed, and nonstructural recommendations listed in Technical Memorandum 20434-3 for the Main Building should be completed.

Constructability

Expansion of the existing facility adjacent to the existing structure is more feasible than above the existing structure as discussed in Alternative 1. This is largely because the area to the north of the existing structure is open and available for construction equipment and/or staging and the expansion is not constrained by the footprint and construction type of the existing facility as in Alternative 1. Access to the existing facility would need to be maintained at all times, which would add significant complications to the construction schedule and sequencing. Furthermore, the new building expansion could be constructed with less-expensive construction materials such as wood framing or prefabricated metal buildings to limit cost. It should be noted, however, that these lower-cost materials may have a shorter lifespan.

Property, Land Acquisition, and Land Use

Expansion of the existing facility adjacent to the existing structure would require input and substantial coordination with the SVCA as well as other stakeholders. Special consideration would need to be given to maintaining access to Morning Beach Park and the District should consider how the expansion may affect use of the park by the public.

Access

Expansion of the existing facility adjacent to the existing structure would improve access to the facility but would also potentially decrease access to Morning Beach Park. Turnarounds and access by delivery vehicles would be maintained with this option.

Expansion of the existing facility adjacent to the Main Building structure would provide a better opportunity to comply with ADA requirements when compared to expansion above the existing structure; however, compliance would still be more difficult with this alternative when compared with construction of a new separate structure.

Capacity for Expansion and Rehabilitation

Expansion of the existing facility adjacent to the existing structure could provide accommodations for equipment expansion/rehabilitation depending on the building size, layout, and orientation. If specific equipment is relocated to the expanded structure, it should be oriented in a fashion that will provide for easy removal/rehabilitation. While this would allow for reorganization of the space within the existing Main Building, access to the existing building would still be through a single door via the expanded space. Expansion of the existing building would not accomplish the District's goals unless all of the treatment equipment is relocated to the expanded space. However, relocating the existing treatment equipment to an expanded space would require that the WTP be taken offline for a significant period of time and would require that water service be provided by another source during this period. This temporary service could be avoided if new treatment equipment were included with the building expansion project as this new equipment could be installed, connected, and tested, and the WTP would only be taken offline to make final connections and for testing/startup.

Alternative 3 – Construction of a New Separate Structure

Alternative 3 includes construction of a new separate building. The building would be located near the existing Main Building, but would allow access to each building through unique access doors. Access to both structures would be from the existing access driveway.

Condition and Code Adherence

Construction of a separate structure would be simpler than vertically or horizontally expanding the existing facility. For the existing Main Building, upgrades to comply with current chlorine gas codes would need to be completed, the safety shower and eyewash systems should be brought into conformance with ANSI Z385.1, the fire/alarm system should be upgraded, and nonstructural recommendations listed in Technical Memorandum 20434-3 for the Main Building should be completed.

Constructability

Construction of a new facility is the most feasible of the three options because design of a new building could be tailored and optimized for the facility's needs. It would also provide for an open construction area and could be designed to provide more room for District staff to access the existing Main Building. If the new building is separate from the existing building, it allows greater flexibility in choosing the construction type for the

new building. Less-expensive construction types such as wood-framed or prefabricated metal buildings could be considered to limit cost.

Property, Land Acquisition, and Land Use

Construction of a new separate structure would require input and substantial coordination with the SVCA as well as other stakeholders. Special consideration would need to be given to maintaining access to Morning Beach Park and the District should consider how construction would affect use of the park by the public.

Access

Construction of a new facility would provide the greatest improvement in access to the WTP but would also potentially decrease access to the adjacent beach park. Turnarounds and access by delivery vehicles could be optimized with this option.

Of the three alternatives, construction of a new building would provide the simplest and most cost-effective method for complying with ADA requirements if desired by the District.

Capacity for Expansion and Rehabilitation

Construction of a new facility would have the most significant benefit on improving accommodations for rehabilitation/expansion. A new facility could be designed and sized to accommodate current and future treatment equipment.

Building Costs

Capital cost is a significant consideration for any utility provider and is a critical factor in determining the option with the greatest value for the District's operations. Each of the options discussed herein has various possible construction techniques and each of these techniques has variable costs for design and construction.

Wood-framed structures are the least expensive and require the least design effort, but are more susceptible to damage from elements such as moisture. Wooden structures may sit on concrete foundations and can be constructed to a wide range of heights and dimensions. They are easily modified using standard construction practices and tools, and these materials are typically the most readily available from local sources. Wood-framed structures typically cost between $150 and $250 per square foot and have a design life of 30 to 50 years if properly maintained, but are less appropriate for damp environments such as water treatment facilities.

Prefabricated metal structures are slightly more expensive than wooden structures, but have a longer design life (40 to 60 years) if properly maintained and are usually more durable than wooden-framed buildings. These materials are typically provided by a fabricator specializing in the manufacturing of metal components and are often available as a built system that includes framing, siding, roofing, insulation, and supporting materials. This combined system can often result in lower construction costs when compared to other building materials. Metal buildings typically cost between $250 and $350 per square foot. Coatings and material grades should be carefully specified for metal structures to help ensure that they are appropriate for damp environments due to the potential for corrosion of the structural members and/or siding materials.

The structure could also be constructed from CMU block and metal roofing materials. This type of building is more durable than both the wood-framed or metal structures described above and more suitable for damp environments such as water treatment facilities. These materials are readily available and commonly used for utility buildings, but do cost more than the alternatives discussed above. CMU/metal roof buildings typically cost between $400 and $500 per square foot, but also have the longest design life (more than 50 years) if well maintained.

Other Building Improvements

The alternatives listed above highlight three options for generic building modifications that would accomplish the goals set forth by the District for water treatment. In addition to these treatment goals, the District would like to try and address as many of the architectural observations and recommendations made in the Assessment Report for the Main Building as practicable. The specifics on how to address these items largely depends on the alternative selected, but if a new building or building expansion is selected, it would be feasible and most cost effective to address these recommendations as part of the design for the new facility. A brief description of how some of these recommendations could be accomplished as well as a budgetary cost for these elements is provided below. All of the costs provided are for equipment only and additional costs would be incurred for design, construction, contingencies, and/or Washington State sales tax.

Laboratory/Office Space

The existing laboratory/office space is small, cramped, and does not provide adequate separation between electronic equipment and wet sampling/testing areas. This increases the risk to the electronic equipment, which is necessary for recordkeeping and tracking the WTP performance in accordance with DOH requirements. Providing separate areas

for wet sampling/analysis and office work would provide the highest value for the District; however, this separation is not possible given the current Main Building configuration. If the Main Building is modified or a new building is constructed, separate areas for sampling/analysis and treatment plant operation/monitoring could be provided. To provide the most efficient laboratory space for District staff, the following components are recommended:

- Additional upper and lower cabinetry for equipment, chemical, and laboratory storage.
- Separately plumbed sample stations for raw water, filtered water, and finished water.
- Additional storage for manuals, standard operating procedures, and other critical written documents.
- Additional counterspace for testing, analysis, and recordkeeping.

Additional office space would also provide additional value to WTP staff and would provide them with a space to efficiently complete their work and would also allow them to easily monitor the treatment process. Including additional separate office space is not feasible given the current Main Building configuration; however, if the building is modified or a new building is constructed, new treatment plant operation/monitoring could be provided. To provide the most efficient operation for District staff, the following components are recommended:

- Space separated from noisy treatment plant processes and equipment.
- Heated, well-ventilated space designed for human occupancy/work.
- Generous desk area for computers, phone(s), and other electronic equipment.
- File cabinets and storage for manuals, procedures, historical data, DOH forms, and other documents.
- General office equipment such as a printer and fax machine.
- Space for at least two WTP staff and guests/other District staff.

In addition to these basic office requirements, the District may wish to consider additional facilities designed to accommodate longer-term use. In the event of an emergency (earthquake, flooding, contamination of other sources, etc.), the WTP may be required to operate continuously, which would necessitate long-term use by District staff. Furthermore, the WTP may also be designated as an alternate Emergency Operations Center (EOC) from which District activities may be coordinated and dispatched. If either of these conditions are realized, then the following facilities would provide additional value to the District:

- Simple meal storage, preparation, and consumption area (refrigerator, microwave, toaster oven, coffeemaker, etc.).
- Small space for resting.
- Washup facility with sink.

The scope and modifications to the existing sampling/analysis and office spaces will be based on the District's desires and will be in conjunction with other modifications made to the WTP. If modifications to the existing Main Building or a new building is constructed, we recommend including the desired spaces and/or accommodations for these spaces in the future. Costs to construct and outfit new office/laboratory space range between $50 and $250 per square foot, and greatly depend on the size, finishes, and desired function of the space.

Storage and Workspace

While the existing Main Building does maintain some storage space, it is small and lacks organization for small parts and the capacity to store large heavy items. Storage could be provided via an organized unit for small parts/components but should also include heavy-duty shelf storage for heavier items such as pumps, pipe fittings, etc. It also may be beneficial to locate at least some of this storage space outside of the moist treatment plant environment so that electronic equipment could be safety stored. Approximately three to four standard industrial shelving units would be recommended in addition to the existing shelving.

While the Main Building does contain a single workbench for repairs or modifications to equipment, the space is small and has little room for expansion given the current layout of the building. Furthermore, access to tools is restricted by the existing storage space and additional space for tool storage, including mobile tool storage, is desired. Additional tool storage and providing easy access to these tools would provide additional value to the District and would allow the WTP staff to more efficiently complete required

maintenance tasks. Depending on the layout for any building modifications, additional storage could likely be provided for less than $5,000.

Lifting Equipment

Currently, there is no lifting equipment for the raw water pumps in the Main Building, which makes removing these pumps and associated piping very difficult and cumbersome for District staff. Lifting equipment could include a bridge/trolley hoist above the raw water pump pit or a jib/davit crane installed within the existing floor slab. Alternatively, space could be provided for a manual mobile hoist. While a bridge/trolley hoist is likely not cost effective for this facility, a small jib crane and some structural slab modifications could significantly improve the ability of the staff to remove/service this equipment. An appropriately sized jib crane and structural modifications would likely cost between $5,000 and $15,000 depending on the extent of modifications required to support the loads.

Site Security

Currently, there are no security measures to separate the treatment facilities from the public facilities associated with Morning Beach Park. This presents a safety, access, and potential public health hazard and could be addressed through installation of various access control and/or monitoring equipment. Fencing and gates could be added that would limit access to the treatment facilities to authorized staff. Additionally, security cameras and/or site lighting can improve monitoring capability and visibility for the site. Security fencing typically costs between $45 and $70 per linear foot, depending on the number of gates, terrain, materials and finishes, and overall length. To limit access to the general public, approximately 550 linear feet of fencing might be required, which results in an estimated cost of $25,000 to $38,000. Basic camera security equipment could be provided for an additional $20,000 to $50,000 depending on the level of coverage, quality, and amount of storage desired.

Access

Currently, the only point of access into the Main Building is a single pedestrian door. Removal of large equipment would require that it be demolished within the building then removed, piece by piece, or the existing storefront windows/door must be temporarily removed. A commercial-style coiling door could provide excellent site security, but also allow for the movement of large pieces of equipment. These types of doors are common at municipal treatment facilities, can be provided with a variety of finishes and features, and cost between $15,000 and $20,000 depending on the size, finish, and features provided.

Restrooms and Public Facilities

The existing restroom at the Main Building is in fair condition, but should be updated with new coatings and fixtures to ensure its continued trouble-free operation. In addition to this, depending on the construction or development of an EOC within the new/modified building, additional facilities such as showers or additional toilets may be warranted. A larger restroom facility would provide added value to the District if staff must remain at the EOC for long periods of time during an emergency. The Main Building does not have sufficient space to expand the existing restroom to include additional toilets or a shower; however, these facilities could be included into the design if a new building is constructed. Updating the existing restroom would cost between $5,000 and $10,000. New restroom facilities for a new building typically cost between $100 and $200 per square foot depending on the size and quality of fixtures, and type of finishes installed.

Additionally, because the WTP may be occasionally visited by selected members of the general public, the District may wish to consider accommodating these visits by providing wide spaces, convenient and open pathways, and clear access to the treatment process for viewing. Furthermore, it may also be desirable to allow for some level of educational space where placards, cutaways, or informational bulletins could be posted that explain the operation of selected pieces of equipment. These wide, clear pathways and additional space near critical pieces of equipment would provide additional value to District staff by improving their access to equipment for maintenance and service which makes completion of these tasks safer and more efficient.

Finished Water Pump Building

Because the Finished Water Pump Building does not contain any treatment equipment, it does not have the same considerations for expansion/modifications as the Main Building. The sections below discuss some of the considerations for expansion/modification of the existing Finished Water Pump Building. The impetus for modifications to this building are less significant than for the Main Building because space and access to the existing equipment is sufficient to maintain the components.

Condition and Code Adherence

The Finished Water Pump Building, as noted above, does not meet current seismic design parameters with regard to the roof and shear wall diaphragm connections. These issues are easily and inexpensively addressed and additional information on methods for addressing this issue are provided in Technical Memorandum 20434-3 (Gray & Osborne,

2020). Briefly, they include new roof sheathing nails, additional wall diaphragm blocking, and new roofing materials. The estimated cost to address these seismic issues is $100,000 to $110,000, not including tax, contingency, or project design and administration. Additional nonstructural considerations such as seismic bracing of equipment and piping should be completed in order to help the structure meet the desired seismic performance objective identified in the Assessment Report; however, these modifications could be completed over several years based on available funding.

If these structural and/or nonstructural modifications are completed, the building would meet current codes and should be suitable to provide for the District's needs for many years.

Building Expansion

The existing Finished Water Pump Building was constructed in 1992 and is generally in good condition. Given the differing functions of the Main Building and the Finished Water Pump Building, using or expanding the Finished Water Pump Building to improve the space issues at the Main Building, such as adding chemical storage to the Finished Water Pump Building, is not recommended. Consequently, only the adequacy of the existing building relative to the District's finished water pumping needs will be analyzed.

The Finished Water Pump Building houses two pumps that move water to the Division 7 Reservoir, each with a capacity of approximately 700 gpm, and two pumps that move water to the Division 22 Reservoir, each with a capacity of 700 gpm. The current building layout provides good access to the pumps, piping, and motor control centers. Typically, demand for the Division 7 Reservoir is much less than that of the Division 22 Reservoir, such that the current Division 7 pumps provide sufficient capacity and redundancy for the total design flow of 1,400 gpm. The Division 22 pumps; however, do not. To accommodate the desire for process redundancy, the District could either replace the existing Division 22 pumps with new larger units or install a third similarly sized pump. Given the current ratio of flows to each reservoir, new Division 22 pumps should have a capacity between 1,000 and 1,100 gpm each in order to provide suitable flow and redundancy. Replacing the existing pumps with larger units would not require physical building modifications or expansion; however, there would be mechanical and electrical modifications required. On the other hand, installation of a third 700 gpm pump would require expansion of the existing structure as well as mechanical and electrical modifications.

One alternative for providing additional space within the existing structure, if it is ever required, is to relocate the existing restrooms to a new separate restroom facility to accommodate Morning Beach Park users and then repurpose the existing restroom space

for District uses. The existing restrooms (Figure A-3) would provide an additional 330 sf within the existing building. This space could potentially be used to house new or relocated electrical equipment, new security monitoring equipment, storage space, or additional laboratory space.

RECOMMENDATIONS

It is difficult to provide a formal recommendation for modifications to the existing structures without considering the other issues that are being analyzed at the WTP. For example, if the District decides to replace the filtration equipment, this cannot reasonably be completed within the existing Main Building given the operational and continuity constraints, and as such a new separate building would be required. If a new building is provided for the filtration equipment, it is advantageous to relocate other treatment components such as primary treatment and/or chemical addition equipment to this building as well. The economy of scale when considering the modifications for the WTP will drive the decision-making process. However, given the goals stated previously and the considerations discussed above, constructing a new separate building for treatment equipment seems more feasible when compared with expansion of the existing structure (above or adjacent). A new building would also allow the District to easily incorporate some of the additional methods to address items identified in the Assessment Report such as additional workspace, site security, additional storage, and improving access to and within the WTP. Furthermore, expansion or modifications to the existing Finished Water Pump Building structure do not significantly benefit District operations unless a third redundant Division 22 pump is desired and additional space is needed within this specific structure. If full and complete redundancy for the Division 22 pumps is desired, we recommend the District investigate replacement of the existing pumps with larger units instead of modifying the existing building structure to accommodate a third pump.

Additional recommendations will be deferred until the final Alternatives Analysis Report is prepared that contains all of the information in the various technical memoranda to provide an optimized recommendation for the entire filter plant to ensure the District's goal of continuing to provide high-quality treated water for decades to come.

EXHIBIT A

FIGURES

FIGURE A-1

Existing WTP Main Building Structure

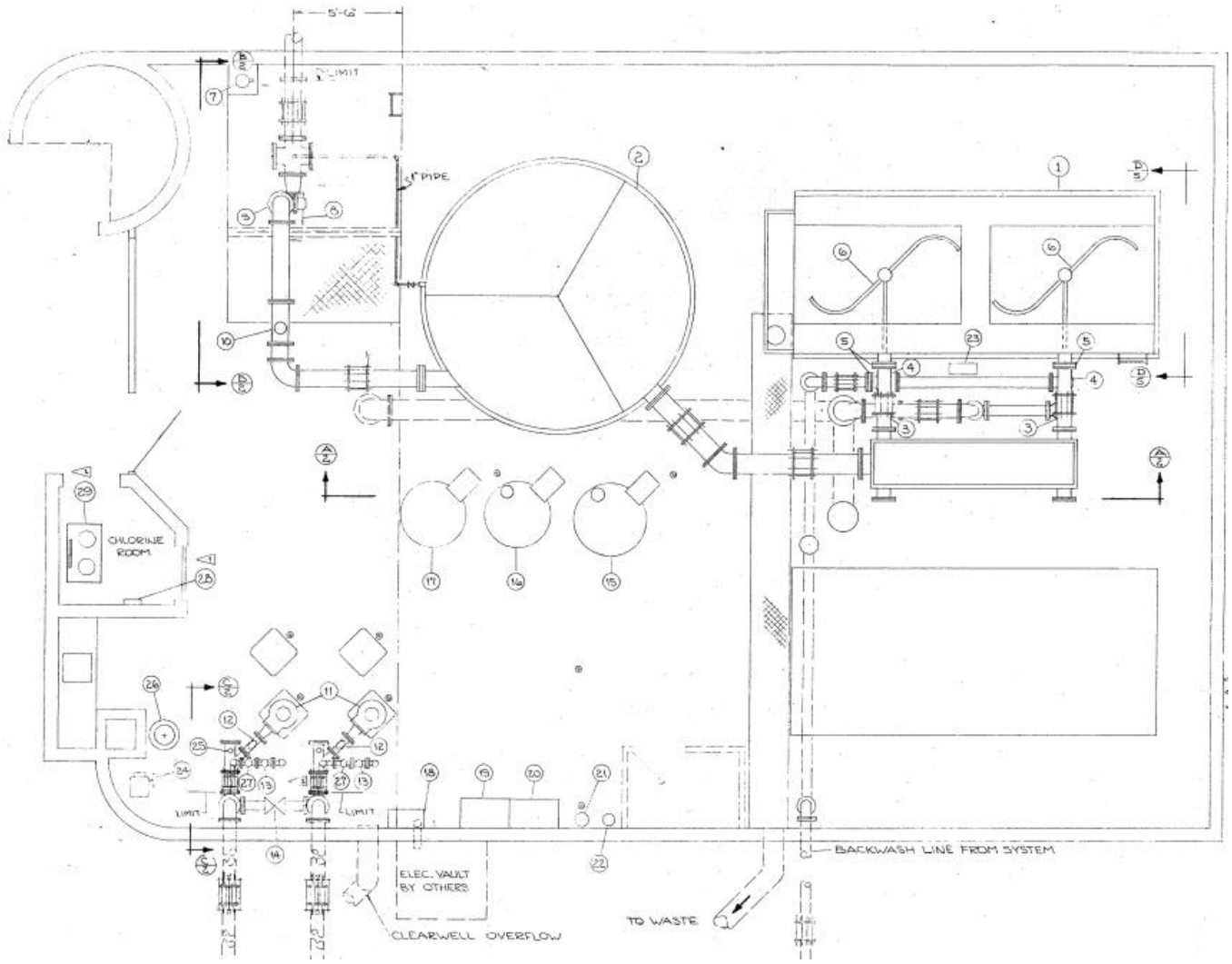

FIGURE A-2

Existing WTP Main Building Plan

FIGURE A-3

Existing Finished Water Pump Building Structure

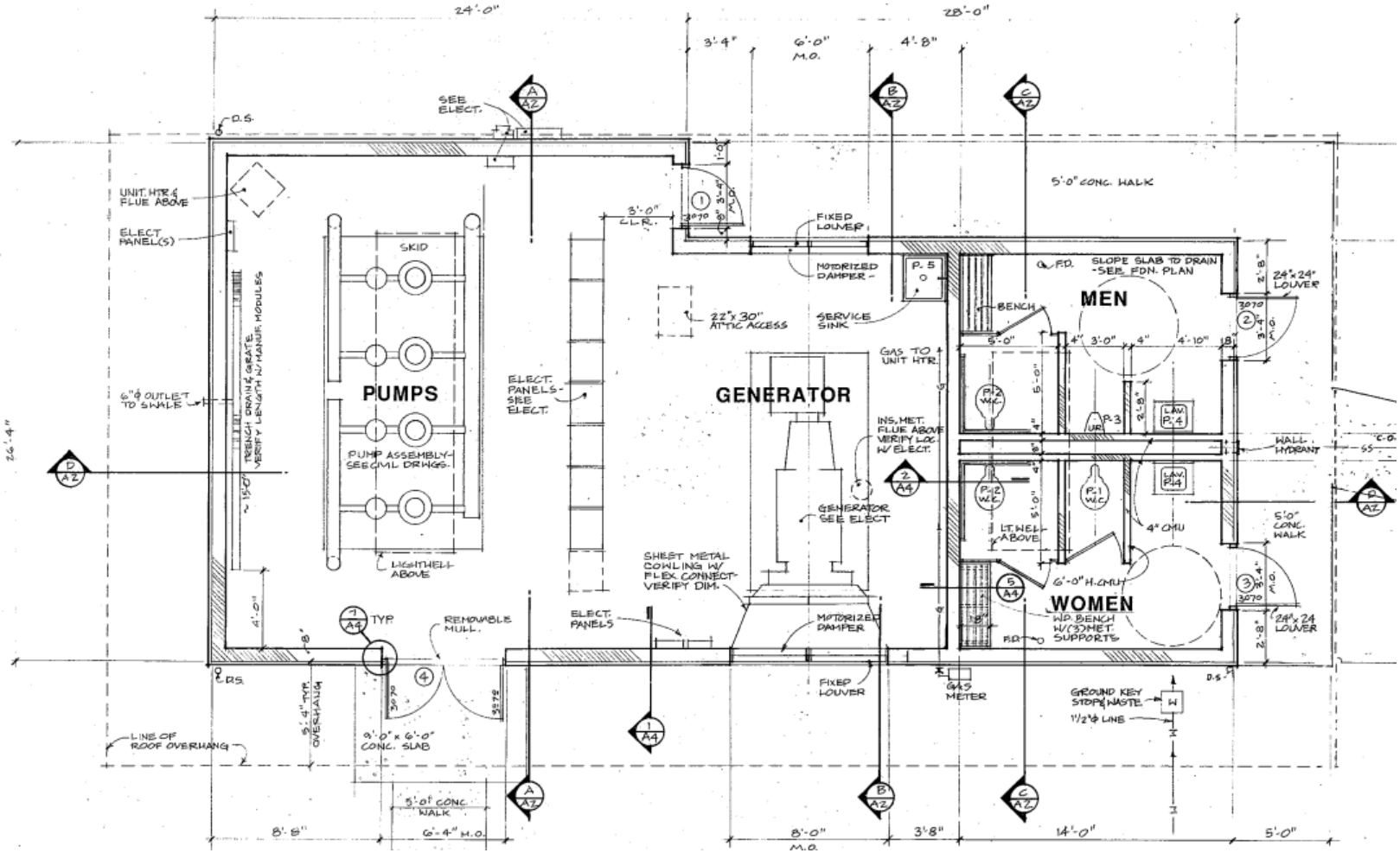

FIGURE A-4

Existing Finished Water Pump Building Plan