



DATE: October 23, 2019
TO: Council Infrastructure Committee
FROM: Director of Public Works
SUBJECT: Water Pollution Control Facility (WPCF) Phase II Facilities Plan Update

RECOMMENDATION

That the Committee reviews and comments on this report.

SUMMARY

On March 6, 2018, the City and Black & Veatch (B&V) entered into a professional services agreement (PSA) for B&V to provide engineering services for the development of the WPCF Phase II Facilities Plan. The Phase II Facilities Plan will serve as a long-term comprehensive planning document to guide the WPCF facility upgrades for the next 25-year planning period. Over the past eighteen months, staff has been working with B&V to identify the needs of the WPCF, evaluate alternatives, and present recommendations for the best path forward. This report summarizes the preliminary recommendations for two key tasks in the Phase II Facilities Plan: (1) Development of a long- term nutrient management strategy (NMS) and (2) Development of a schematic design for the new WPCF Administration and Laboratory Building. Staff will be presenting the project and asking the Committee for input on the preferred building design and exterior concept for the new WPCF Administration and Laboratory Building.

BACKGROUND

In 2009, the City completed the Phase I WPCF Improvements Project, which improved the redundancy and efficiency of the WPCF's secondary treatment processes. In 2014, the City prepared an update to the WPCF Master Plan (2014 Master Plan Update), that included a comprehensive list of improvement projects for the Capital Improvement Program (CIP).

Since the 2014 Master Plan Update was prepared, the City is facing more stringent wastewater discharge requirements and the need to make key decisions on investments and future upgrades of the WPCF's infrastructure. After reviewing the list of CIP projects, largely developed based on the recommendations in the 2014 Master Plan Update, staff recommended initiating the Phase II Facilities Plan to review the recommendations and refine/modify the CIP plan. The primary goals of the Phase II Facilities Plan Project include:

- Determine the most appropriate and cost-effective technology that meets the nitrogen removal requirements.
- Take a holistic approach to develop a strategic plan, which coordinates nutrient removal, water recycling, and long term near shore discharge efforts.
- Perform a schematic design and site planning for the new Administration and Laboratory Building
- Identify the project costs for inclusion in the next treatment facility upgrades.

On November 6, 2017, a request for proposals was issued to qualified consulting firms to assist with developing the Phase II Facilities Plan. On February 27, 2018, Council approved execution of an agreement with B&V and on March 6, 2018, the City and B&V entered into a PSA to commence the Phase II Facilities Plan. A more detailed discussion of the purpose and scope of work for the Phase II Facilities Plan is included in the February 27, 2018 Council staff report¹.

DISCUSSION

Nutrient Management Strategy (NMS)

An important task in the Phase II Facilities Plan is development of a nutrient management strategy to meet future regulatory requirements. Increasing nutrients in the San Francisco Bay (Bay) is a growing concern for the Bay Area water quality community. Recent data indicate an increase in algae biomass in many areas of the estuary, suggesting that the Bay's resilience to the effects of nutrients may be declining due to a variety of contributing factors. These include natural oceanic oscillations that bring in colder waters to the Bay that have reduced the Bay's clam population that feeds on algae, and decreases in sediment inflows from reduced mining activities and cleaner municipal wastewater discharges that have increased light penetration which grows algae.

In the Bay, nitrogen has a large influence on algae growth and the Bay's municipal wastewater dischargers (Dischargers) accounts for 65 percent of nitrogen discharged into the Bay. To protect the Bay from harmful effect of the discharges, the Regional Water Quality Control Board (Water Board) required the Dischargers in the first Nutrients Watershed Permit, adopted in 2014, to support scientific studies to evaluate the Bay's response to the current and future nutrient loads and also evaluate opportunities to remove nitrogen through treatment plant improvements. On May 8, 2019, the Water Board adopted the final renewed Nutrients Watershed Permit (Order No. R2-2019-0017) for managing nutrients in wastewater discharges to the Bay. This new Order, which went into effect in July 2019, requires the Dischargers to conduct additional scientific studies on the impacts of nutrients on the Bay. It also indicates that a load-cap based nitrogen regulatory framework (*i.e.* limits on kilograms of nitrogen discharge) will be utilized for establishing future nitrogen limits when reissuing this Order in 2024 to prevent further increases in nitrogen loads.

¹ <https://bit.ly/2HsEaAT>

The WPCF's existing secondary treatment process consists of the East Tricking Filter (ETF), West Tricking Filter (WTF), and two final clarifiers. The 2014 Master Plan Update recommended replacing the WTF in the next WPCF upgrades (Phase II WPCF Upgrade) as this facility has reached the end of its useful economic life. In addition to the New WTF Project, another recommended project in the secondary treatment process is the New Final Clarifier Project to improve the plant redundancy and expand the treatment capacity. The current Ten-Year Capital Improvement Program (CIP) includes \$19.5 million for the New WTF Project and \$7.9 million for the New Final Clarifier Project.

Table 1: Budgets for Secondary Treatment Projects in Current Ten-Year Capital Improvement Program (CIP)

	Secondary Treatment Projects	Cost
1.	New West Tricking Filter (WTF) Project	\$19,000,000
2.	3 rd Final Clarifier Project	\$7,900,000
	Total	\$27,400,000

The existing secondary treatment process has provided an effective and reliable treatment. However, the trickling filter technology is incapable of removing nitrogen. If the nitrogen load limits are established when the Water Board reissues the Nutrients Watershed Permit in 2024, WPCF's discharge is expected to exceed the anticipated load limit in approximately 2027. The future nitrogen limits will necessitate WPCF to upgrade the existing secondary process or implement other means to reduce the nitrogen load in the wastewater discharge to the Bay.

Development of a long- term nutrient management strategy is essential for City to address the immediate need of replacing the aging WTF facility and to take a proactive step toward nitrogen load reduction. The nutrient management strategy reviewed the recommendations in the 2014 Master Plan Update and evaluated treatment alternatives to select the most suitable biological nutrient removal (BNR) technology for the WPCF Phase II Upgrade. The primary goal of the NMS is to achieve a progression of modifications to the existing infrastructures and determine flexible solutions capable of adapting to future nitrogen removal requirements.

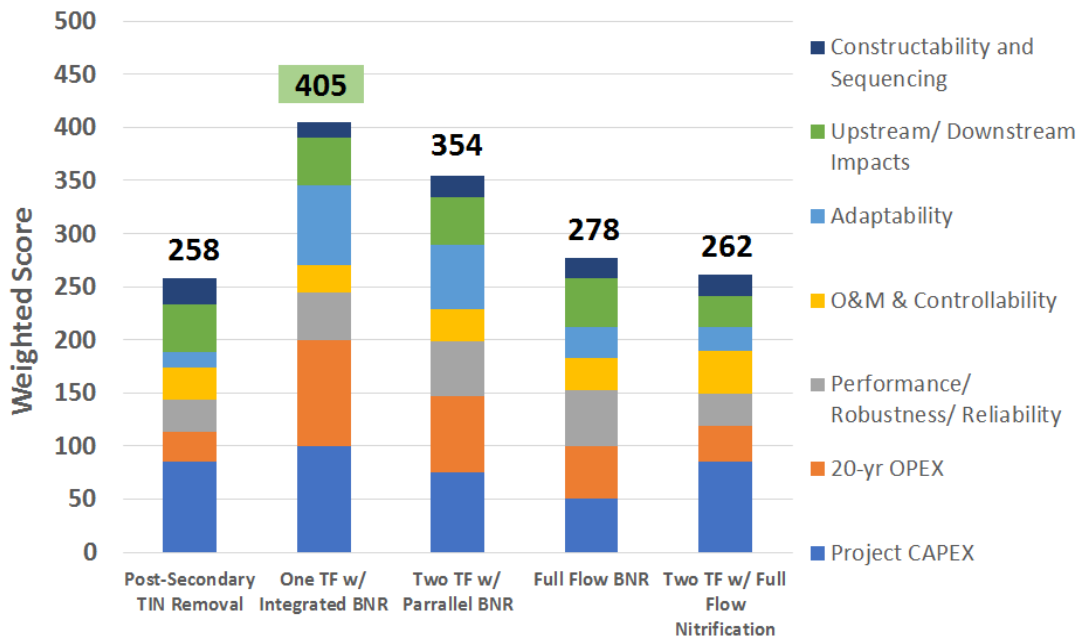
The treatment alternatives evaluation was conducted to compare five BNR alternatives using a business case evaluation (BCE) that integrates economic and non-economic factors. The economic evaluation as summarized in Table 1 considers both capital cost and 20-year present worth operating cost. The five factors in the noneconomic evaluation as shown in Figure 1 include process robustness, O&M complexity, adaptability to future requirements, impact on upstream and downstream systems, and complexity of construction and sequencing.

Table 2: Economic Evaluation Results of Five Nutrient Removal Technologies

	BNR Treatment Alternatives	Capital Cost ⁽²⁾	20-YR Present Worth O&M Cost	Total Cost
1	Full Flow BNR Upgrade	\$116,354,000	\$10,374,000	\$126,728,000
2	Two TFs w/ Parallel BNR	\$77,650,000	\$6,584,000	\$84,234,000
3	One TF w/ Integrated BNR	\$57,420,000	\$4,703,000	\$62,123,000
4	Two TFs w/ Full Flow Nitrification	\$69,523,000	\$6,987,000	\$76,510,000
5	Post-Secondary TIN Removal	\$66,349,000	\$17,959,000	\$84,308,000
Notes: 1) 3 rd Final Clarifier is included in the alternative's evaluation. 2) All costs presented are in 2019 dollar. All costs are for comparison of alternatives only and should not be used for budgeting purposes. 3) BNR: Biological Nutrient Removal; TF: Trickling Filter; TIN: Total Inorganic Nitrogen				

Based on the BCE results as shown in Figure 1, the One TF (Trickling Filter) with Integrated BNR treatment alternative, which has the best value in the BCE, is recommended for implementation to upgrade WPCF to a biological nitrogen removal facility. This alternative was found to be the most economical approach with a potential project and total present worth savings of \$14 million, relative to the next lowest option. It also scored as the most favorable approach based on the five non-economic factors.

Figure 1: Business Case Evaluation (BCE) Results of Five Nutrient Removal Technologies



The selected alternative would replace the existing WTF with a Modified Ludzack-Ettinger (MLE) BNR facility, which would treat 50 percent of the plant flow achieving nitrogen discharge reduction. The ETF facility would be retained to treat the other 50% of the plant flow, maximizing the use of existing assets. The performance of the One TF with Integrated BNR system is expected to achieve a nitrogen load reduction of 30% and an effluent nitrogen concentration of 20 mg/L. In the future, when the ETF reaches the end of its useful life or further reduction of the nitrogen load is needed, the ETF would be replaced with another BNR facility, converting the entire secondary process to a full flow (100%) BNR system.

It is also worth noting that the renewed Nutrient Watershed Permit requires the major dischargers to the Bay to evaluate options for nutrient discharge reduction by water recycling. Water recycling directs nitrogen discharge load to land, which can reduce the nitrogen load to the Bay. Implementation of the recycled water project offers an additional avenue for the City to reduce the nitrogen load, therefore helping to increase the time before the load limit to the Bay is exceeded. The selected alternative that upgrades half of the secondary process allows the City in the future to manage further reduction of nitrogen load either by increasing water recycling or implementing a full flow (100%) BNR.

New Administration and Laboratory Building

Another important task in the Phase II Facilities Plan is the development of a schematic design and site plan for the new Administration and Laboratory Building. The existing Administration and Laboratory Building was constructed in 1970. Since its construction, the WPCF has seen increased staffing levels due to increased regulations and required operation and maintenance activities. Consequently, the existing facilities can no longer accommodate

the space needs and functional requirements of daily operations. Despite a significant addition to the lab in 1995, the buildings are nearing the end of their useful life. Many employees are housed in cramped working conditions with poorly functioning building systems. The laboratory area is inadequate to support the projected growth of laboratory operations and house the new equipment needed for future regulatory compliance.

After assessing the space needs of the WPCF and evaluating multiple design alternatives, the preferred schematic design, which includes a site plan concept, a building concept, and an exterior design, has been developed.

The preferred site concept provides a functional and safe space for staff and visitors (see Figure 2). The building is consolidated on the existing WPCF plant site, with a new entrance for staff and visitors off Whitesell Street to improve site circulation. The selection of the building location also considered the construction phasing and sequencing. The new building, located at the existing parking lot, would allow WPCF to maintain the operations in the existing buildings and minimize disruption to operations during construction.

The preferred building concept proposes a new two-story Administration/Operations building and one-story Laboratory building linked by a shared lobby space (see Figure 2 and 4) to accommodate the space need of 19,750 square feet. This concept creates a separation between the Laboratory and Administration/Operations working environments while allowing for the shared lobby to be easily accessible to all occupants. The preferred exterior design is contemporary and practical, creating a forward-thinking first impression for staff and visitors.

The construction cost for the proposed 19,750 square feet building and associated site work is estimated to be \$21.1 million. The cost estimate was prepared from a survey of the quantities of work based on the preferred conceptual design. Recent historical costs from similar projects in the Bay area were used to compare and verify the unit costs (i.e. \$ per Sq. Ft.), which are \$986 per Sq. Ft. and \$1,160 per Sq. Ft. for the Administration and Laboratory Building, respectively. The Laboratory Building has a higher unit cost due to HVAC system, laboratory casework, equipment, and larger volume of space required above and below ceiling.

Table 3: Estimated Construction Cost for New Administration and Laboratory Building

	Admin.	Laboratory	Total
Space Area, Sq. Ft.	10,720	9,030	19,750
Estimated Construction Cost, \$-Mil.	10.6	10.5	21.1
Unit Cost, \$/ Sq. Ft.	986	1,160	1,066
Notes:			
1) The estimated cost was prepared in accordance with AACE International (Association for the Advancement of Cost Engineering) Class 4, which is generally used for conceptual approval and preliminary budget approval.			

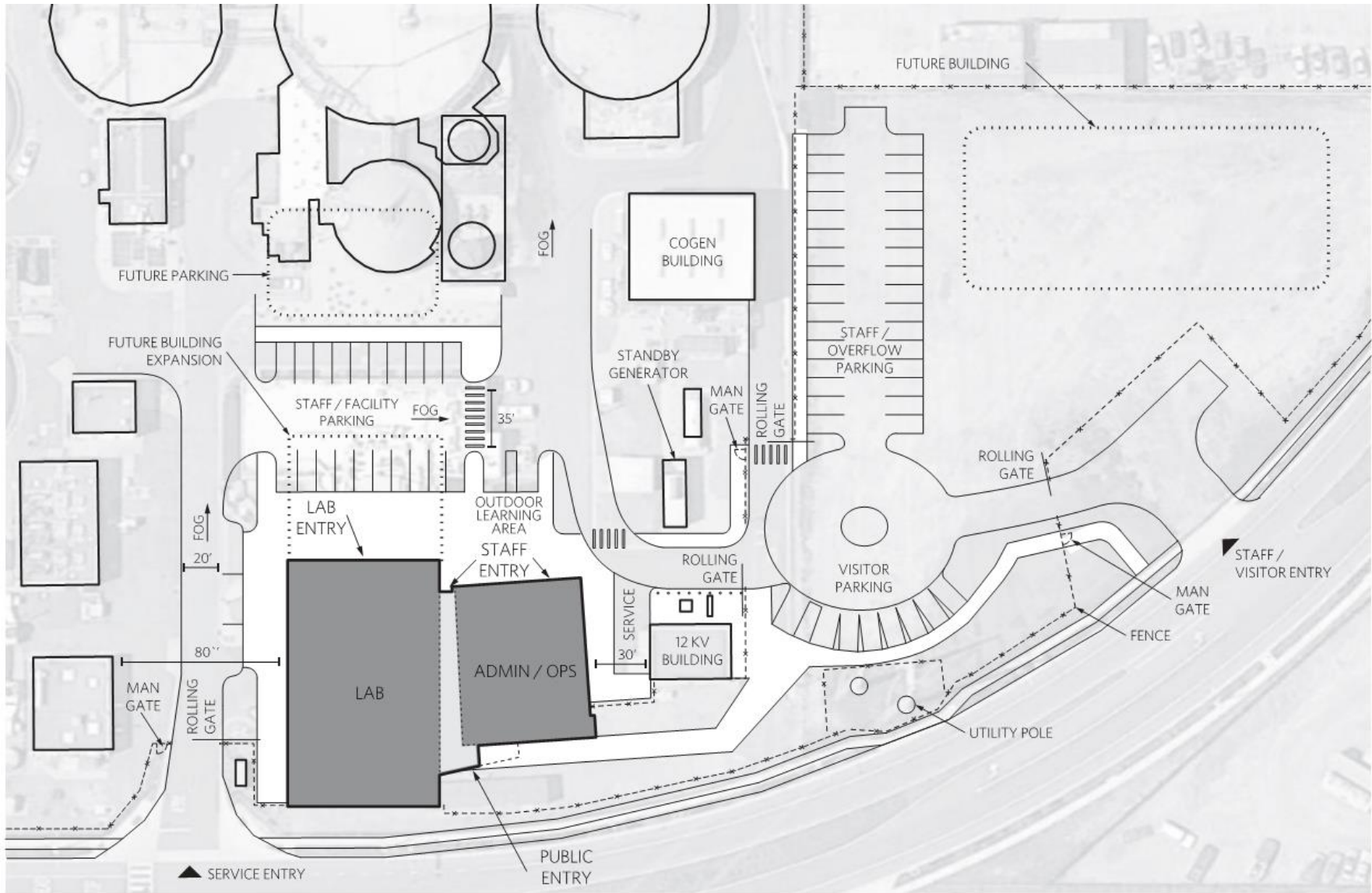


Figure 2: Preferred Site Concept

19,750 SF Total

GROUND FLOOR:

Lab Building: 9,030 SF
Support, Admin, and Lobby Building: 5,770 SF

SECOND FLOOR:

Control Room: 850 SF
Support, Admin, and Circulation: 4,100 SF

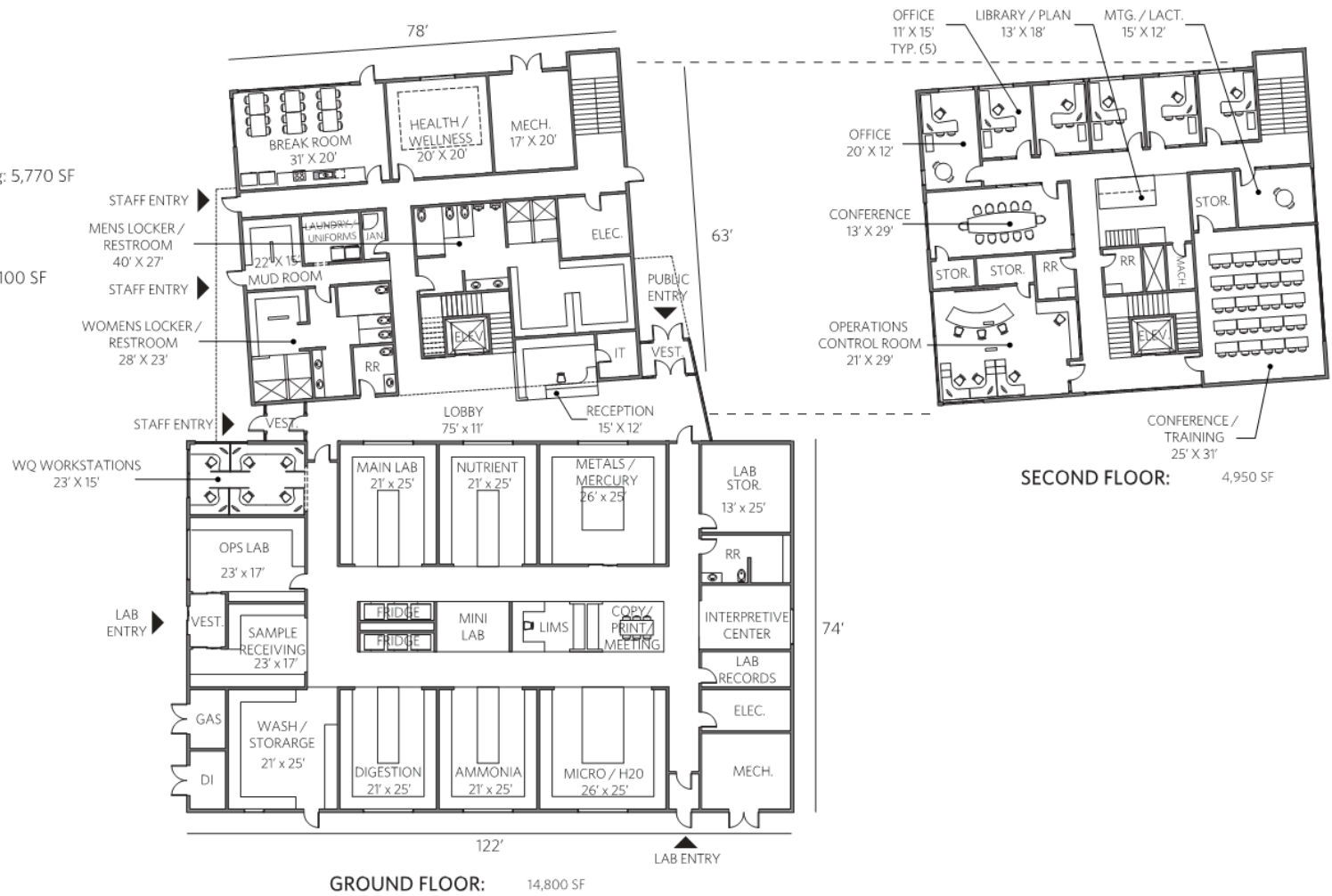


Figure 3: Preferred Building Floorplan

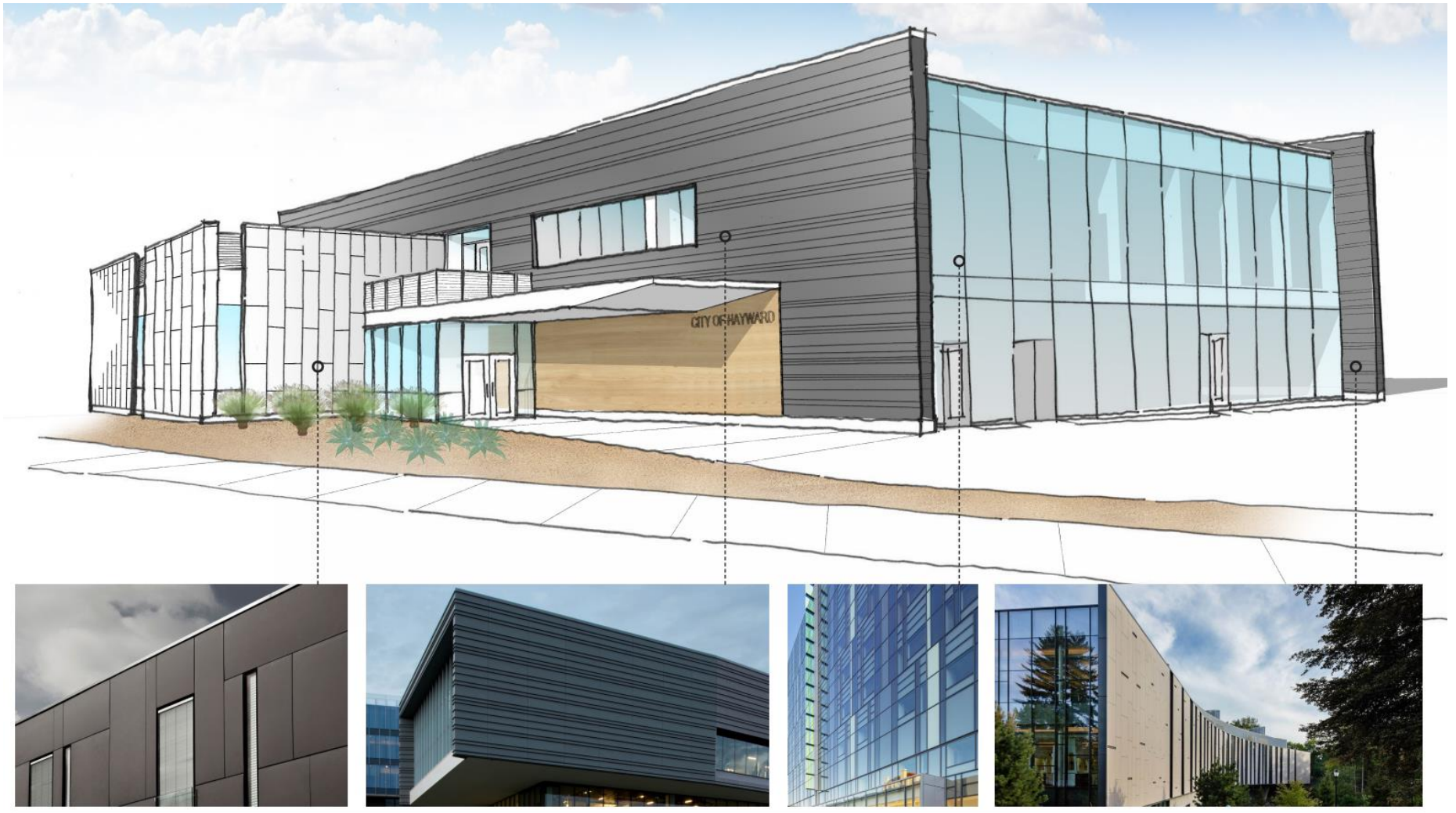


Figure 4: Preferred Building Exterior

ECONOMIC IMPACT

Many of the Phase II improvements were identified in the 2014 Master Plan update and funded in the adopted Capital Improvement Program. Phase II has evolved to include the Nutrient Removal Strategy to address new regulatory requirements in the near term. This proactive approach will result in the City being identified as an “early actor” by the Regional Water Quality Control Board and provide protection against having to implement additional, potentially more costly improvements if the regulations change.

Total project costs will be developed as part of the Phase II Facilities Plan. Staff will return to the Committee for consideration of project construction, which will include detailed information regarding costs. Staff anticipates that these improvements will affect sewer service rates and sewer connection fees; however, the extent to which rates will need to be adjusted cannot be determined with certainty at this point. Staff intends to aggressively pursue grants and low-interest loans to minimize the impact to customers. It is also worth noting that Hayward’s sewer-related fees are currently among the lowest in the area and that all wastewater treatment facilities will be required to implement nutrient removal technologies.

FISCAL IMPACT

The current Ten-Year Capital Improvement Program includes sufficient funding in the Sewer Capital Improvement Fund (Fund 612) and the Sewer Replacement Fund (Fund 611) for B&V to perform the Phase II Facilities Plan work.

The fiscal impacts of the recommended upgrades in the Phase II Facilities Plan will be evaluated as the project components and associated cost information are developed. Staff will modify/change the current nutrient removal CIP projects, which were developed in the 2015 Master Plan Update for consideration. Comparing the conceptual cost of the selected BNR alternative with the current CIP budgets of the Nutrient Removal projects as summarized in Table 4, staff anticipates that that the fiscal impacts would be significantly reduced if the selected alternative (One TF w/ Integrated BNR) is implemented.

Table 4: Cost Comparison of Selected BNR Alternative with Current CIP Projects

Nutrient Removal Project	Cost
Current CIP Projects developed on 2014 Master Plan Update: <ul style="list-style-type: none"> • Nitrifying Trickling Filters, Denitrification and Deep-bed Filters and Final Clarifier Projects 	\$76,100,000
Selected BNR Alternative in 2019 Phase II Facilities Plan: <ul style="list-style-type: none"> • One Trickling Filter (TF) w/ Integrated BNR 	\$57,420,000
Notes: 1) Costs escalated to 2019 dollar for comparison purpose	

Projects would be primarily funded from the Sewer Capital Funds, comprised largely of sewer connection fees and transfers from the Wastewater Operating Fund. Staff will pursue funding opportunities to minimize fiscal impacts. There would be no impact on the General Fund.

STRATEGIC INITIATIVES

This agenda item supports the Complete Communities Strategic Initiative. The purpose of the Complete Communities initiative is to create and support structures, services, and amenities to provide inclusive and equitable access with the goal of becoming a thriving and promising place to live, work and play for all. This agenda item advances the following goal and objective:

Goal 1: Improve quality of life for residents, business owners, and community members in all Hayward neighborhoods.

Objective 4: Create resilient and sustainable neighborhoods

The WPCF Phase II Facilities Plan identifies WPCF infrastructure needs and improvements to increase the reliability of the City's treatment plant, further supporting the goals of the City Council.

SUSTAINABILITY FEATURES

This agenda item does not incorporate sustainability features. However, future Phase II projects will help maintain and improve the biology and health of the San Francisco Bay, which is vital for the region and the State.

The effects and risks of sea water rise were assessed in the site planning study for the proposed new facilities. The projected mid-century sea water rise of 16-inches by 2050 was assumed for the site planning, based on the useful life of the project. According to the 16-inch sea water rise map developed by the Francisco Bay Conservation and Development Commission, the level of sea water rise does not impact the plant main site where the proposed facilities will be located.

PUBLIC CONTACT

This agenda item does not require public contact.

NEXT STEPS

The facilities planning efforts will identify proposed upgrades to the treatment processes and support facilities at the WPCF. To ensure a defensible Facilities Plan, staff is planning to perform an independent peer review on the proposed nutrient management strategy and selected BNR technology. A peer review team consisting of independent experienced professionals will provide additional expert perspectives to affirm the path moving forward and validate current staff recommendations.

After the peer review, the Facilities Plan is scheduled to be finalized in early 2020. Included in the Facilities Plan are estimates of the design costs, construction costs, and schedules that will be used by staff to establish a comprehensive CIP for the WPCF. After the CIP is approved by the Council, staff will package the CIP components into discrete projects. Each project package will detail scope of work, design, and construction schedule and budget for carrying out the CIP projects. A Request for Proposals will be issued for each package to procure a design consultant to perform the design work.

The following comprehensive schedule has been developed for implementing the WPCF Phase II Upgrade project:

Finalize Phase II Facilities Plan	Early 2020
Establish CIP projects	Early 2020
City Council Approval	May 2020
Design and Funding (2-3 years)	2020-2022
Construction and Commissioning (2-3 years)	2023-2025

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