CITY OF SAN JOSE
CAPITAL OF SILICON VALLEY

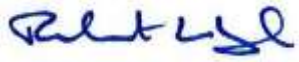
Memorandum

TO: TRANSPORTATION AND ENVIRONMENT COMMITTEE

FROM: Kerrie Romanow

SUBJECT: **NUTRIENT REGULATIONS IMPACTS ON THE SAN JOSÉ-SANTA CLARA REGIONAL WASTEWATER FACILITY STATUS REPORT**

DATE: October 18, 2023

Approved  Date **10/20/23**

RECOMMENDATION

Accept a status report on new nutrient regulatory requirements to be issued by the San Francisco Bay Regional Water Quality Control Board under NPDES Permit No. CA0038873, affecting the San José-Santa Clara Regional Wastewater Facility.

BACKGROUND

Wastewater discharges are major contributors of nutrient compounds that accumulate in the San Francisco Bay, specifically nitrogen and phosphorus. Nitrogen levels in the Bay are elevated compared to other large urban water bodies in the United States, such as Chesapeake Bay, Puget Sound, Boston Harbor, and Tampa Bay. For decades, elevated Bay nitrogen has not caused environmental impacts, which would have manifested through effects like harmful algal blooms and low dissolved oxygen levels. Historically, this was referred to as the Bay's resistance to the harmful effects of excessive nitrogen.

More than a decade ago, long-term trend monitoring of environmental indicators, conducted since the 1980s, suggested that the historic resistance to harmful effects of high nitrogen was weakening. The waning resistance prompted increased scientific study of the potential impacts of elevated nitrogen in the Bay. The weakened resistance also led to a new nutrient-specific permit for all wastewater treatment plants, including the San José-Santa Clara Regional Wastewater Facility (RWF) that was first issued by the San Francisco Bay Regional Water Quality Control Board (Water Board) in 2014, under NPDES Permit No. CA0038873 (Nutrient Permit). The permit is reissued and updated every five years. The first and second versions of the permit required increased monitoring of nutrients and evaluations of management actions that would reduce nitrogen. A third version of the Nutrient Permit will be reissued in late spring 2024.

While the region's scientists, engineers, and regulators continued to study environmental trends and the costs and effectiveness of potential management options, San Francisco Bay experienced a harmful algae bloom dominated by the red tide species *Heterosigma akashiwo*, which spread from the Alameda Inner Harbor to throughout the entire Bay. The algae bloom lasted for the entire month of August 2022 and extended from Suisun Bay in the north down into the Lower South Bay. The severe effects of the bloom were widespread, and massive fish kills occurred from the Richmond Bridge in the north to the Dumbarton Bridge in the south. While the harmful algae species were detected in the Lower South Bay by City of San José staff and contractors, it was at lower concentrations than other, more impacted regions of the Bay, and there were no documented fish kills within the RWF's area of influence. A smaller bloom event with the same species of algae occurred again in late August 2023. This year's event was shorter, had minimal environmental impact, and did not extend to the Lower South Bay. However, its recurrence indicates that the red tide algae species is likely to keep returning.

Before the August 2022 and 2023 events, regulators were poised to implement a hard limit, or cap, on nutrient loads discharged and not allow any future nitrogen increases as a requirement in the 2024 reissued Nutrient Permit. Because of the blooms, regulators will now require substantial reductions in nitrogen loads from wastewater treatment plants. A preliminary summary of the pending nutrient regulations was provided to the Transportation and Environment Committee in May 2023 as part of a general update on regulations affecting the RWF. While they are not finalized, the requirements in the 2024 Nutrient Permit are taking shape to include specific requirements for the RWF and the timing of those requirements. This memo summarizes those requirements, their timing and potential impacts, and a menu of strategies to maintain compliance with the new requirements.

ANALYSIS

The Nutrient Permit will be reissued in July 2024 and will require reductions to nitrogen discharges to the Bay over the next ten years. This will be implemented by imposing two limits:

(1) An interim discharge limit that must be achieved immediately and cannot be exceeded in the future, and
(2) A lower limit that requires substantial regional reductions in nitrogen discharges to the Bay that must be achieved within ten years.

Both limits will be set based on the total inorganic nitrogen (TIN) discharged to the Bay. The Water Board will set the interim limit, which will not require immediate reductions, to reflect our current performance and account for inherent variability. This interim limit is intended to serve as a backstop so that nitrogen discharges do not increase while agencies are implementing projects that will reduce their nitrogen levels. Projects to reduce nitrogen levels in wastewater take several years to implement and often involve significant capital and maintenance expenditures.

The lower limit, which will not be effective until 2034, will be imposed equitably across all wastewater treatment plants so that all facilities are required to achieve a minimum level of nitrogen reduction. The method to determine the lower limit will be performance-based. This minimum performance measure is still not finalized but is likely to require a percent reduction of current nitrogen loads received for each facility, with the actions to achieve those reductions left to the discretion of each agency.

Current nitrogen reduction performance and future projections for the RWF

The RWF already removes a significant portion of the nitrogen it receives due to the advanced secondary treatment process in place since 1998. This process, combined with recent optimizations implemented by the RWF Operations team and loads diverted from the Bay through non-potable reuse water recycling, results in an 85% nitrogen reduction throughout the plant. This high removal efficiency puts the RWF ahead of other large and medium-sized wastewater treatment plants in the region. It exceeds the minimum performance measures under consideration by the Water Board. Because the RWF's current discharge already meets anticipated new performance standards, it will not be required to achieve the additional substantial nitrogen reductions imposed on other facilities who have not yet upgraded to reduce nitrogen. However, the RWF will be required to maintain its existing nitrogen loads discharged in perpetuity, which means the interim limit and final limit for the RWF will likely be similar values. Maintaining current discharged loads is anticipated to be more challenging for the RWF as the population increases and changes to solids processing occur, both of which will increase the nitrogen levels the RWF must manage.

Current load projections indicate one or more actions will be needed to maintain current nitrogen loads to the Bay. If no further action is taken to reduce loads, the RWF is projected to exceed the nitrogen load cap by 2029. Actions to reduce and maintain the RWF's nitrogen loads to the Bay could include process treatment upgrades, expansion of non-potable reuse recycled water, or use of nature-based treatment systems such as engineered marshes or wetlands that sequester and beneficially use nitrogen. The RWF is also not limited to only one of these options, and a combination of strategies could be pursued.

Strategies and actions to reduce nitrogen discharges from the RWF

Process Treatment upgrades – In anticipation of future nitrogen requirements, RWF staff initiated a comprehensive process optimization study in early 2020 to evaluate how the RWF could respond to future nutrient load limits and other regulatory requirements in a cost-effective and environmentally protective manner. The process optimization study identified upgrading the existing advanced secondary treatment as the best option to keep the RWF compliant with its nitrogen load cap until 2051. As a result of the study, the initial phase of the Aeration Basin Modification Project was programmed into the five-year Capital Improvement Program (CIP). This first phase will upgrade approximately 1/6th of the RWF's secondary treatment capacity. The budget for Phase 1 is approximately $128 million and includes rehabilitation and improvements to the infrastructure, as well as the planned treatment upgrades. The entire

upgrade will need to be phased over time because it requires taking significant portions of the RWF offline to modify and upgrade those systems. The timing and phasing of nutrient treatment system upgrades beyond Phase 1 are under evaluation to ensure they will keep pace with future nutrient increases and regulations as needed.

Non-potable recycled water **–** Concurrent with the CIP evaluation of necessary upgrades to meet nitrogen requirements, the RWF participated in a regional study that the Nutrient Permit required. The study evaluated the opportunities, costs, and benefits of nitrogen reduction by expanding recycled water. The study was closely coordinated with Environmental Services Department staff who manage the South Bay Water Recycling program. It incorporated the anticipated expansion of non-potable recycled water over the next 20 years consistent with the South Bay Water Recycling Master Plan. The projected expansion approximately doubles the current non-potable recycled water delivery, reducing the nitrogen discharge to the Bay by nearly 1000 kg/day, or about a 15% – 20% reduction of the RWF's projected 2045 loads. If realized, this could provide significant flexibility in the timing and phasing of future treatment system upgrades. In addition to providing a significant nitrogen load reduction, non-potable recycled water provides multiple other benefits, including reducing other pollutants from entering the Bay and reducing demand for potable water by offsetting potable water use for non-potable uses.

Purified water for potable reuse **–** Purified water projects for either indirect or direct potable reuse provide very little to no reduction of nitrogen discharges to the Bay. This is because purified water projects produce a concentrated waste stream known as reverse osmosis concentrate (ROC), which contains most of the nitrogen and other pollutants that remain in the treated wastewater before purification. To date, purified water projects have envisioned managing the ROC by discharging it directly to the Bay, often combining it or blending it with existing discharges. This practice reduces the cost of disposal of the concentrated waste stream but presents challenges to managing nitrogen and toxic pollutant discharges. As the nitrogen levels sent to the RWF increase with increasing population, projects that do not reduce pollutant levels and instead concentrate them, put additional cost and stress on existing treatment systems. The cost to manage ROC in purified water projects in a way that reduces the nitrogen and toxic pollutants in the concentrated waste stream should be incorporated into the projects. Potable reuse projects are costly and present challenges but provide benefits through the ongoing potable water supply. The regional study that evaluated opportunities, costs, and benefits of nitrogen reduction by new or expanded recycled water also included conceptual evaluations of potable reuse projects. This provided a cost per unit of nitrogen reduction for each strategy to compare the cost-effectiveness between non-potable and purified water projects in meeting regulatory discharge requirements.

Nature-based solutions **–** The RWF participated in a second regional study that evaluated the opportunities and benefits of implementing nature-based solutions to reduce nitrogen inputs to San Francisco Bay. A nature-based treatment system beneficially utilizes natural processes to reduce pollutant levels in wastewater. The systems evaluated for treating wastewater are hybrid systems that include engineered elements such as pumps, levees, and water control structures, but have a foundation in marsh or wetland habitats. They are located along the edges of the Bay

and incorporate shoreline resiliency, flood protection, and water treatment. Nature-based solution opportunities in the Bay Area include horizontal levees (a levee with a gentle sloping marsh plain into the Bay), open-cell wetlands, and vegetated open-water treatment systems. The RWF has opportunities for nature-based systems in its inactive biosolids lagoons and along the future flood control levee along the southern border of Pond A18. Combined, the identified opportunities total 199 acres, and initial estimates could result in roughly a 900 kg/day reduction of nitrogen discharges to the Bay.

Preliminary cost estimates for implementing the identified opportunities are still under development. Nature-based solutions opportunities present a possible option for managing ROC concentrated waste from purified water projects and additional treatment of remaining tertiary treated wastewater. Nature-based systems provide additional treatment of nitrogen and other pollutants, so they can be a tool to meet regulatory requirements. In addition, these systems provide secondary benefits by enhancing existing habitat, creating new habitat, and providing shoreline and habitat resiliency. The evaluation of nature-based systems indicates these may be long-term solutions to manage increases in nitrogen, but there are no near-term plans to implement a nature-based solutions project.

Comparison of nitrogen management strategies

The different strategies to manage and ultimately reduce nitrogen discharges to the Bay have varying costs and reliability uncertainty associated with each of them. However, the strategies have been evaluated for their potential to reduce nitrogen discharges to the Bay and provide multiple benefits such as reducing the discharge of other pollutants, enhancing or creating new habitat, and benefiting water supply.

Strategy	Implementation timing	Importance for TIN compliance	Daily cost per kg TIN reduced[a]	Provides multi-benefit?
Treatment Upgrades Phase I	2029	Very high	N/A	N
Future Treatment Upgrade Phases	2032 - 2041	Very high	N/A	N
Non-Potable Water Recycling	2034	High	$64	Y
Purified (Potable) Water Reuse	TBD	Low	$15,560	Y
Nature-Based Solutions	TBD	Medium	TBD	Y

[a]Daily cost per kg TIN reduced taken from San José dry season unit costs in BACWA Regional Evaluation of Potential Nutrient Discharge Reduction by Water Recycling.

Of the various strategies, treatment upgrades, while costly, represent the highest level of certainty for reducing nitrogen and meeting future discharge requirements. Expansion of non-potable water recycling is the next most certain and cost-effective means of reducing nitrogen discharges to the Bay. Increasing non-potable reuse alone to projected volumes will not enable the RWF to remain below its future nitrogen limits. However, it is an attractive option due to benefits that could lessen the urgency of future treatment upgrades and provide flexibility with construction timing, budgeting, and regulatory requirements. In addition, expanding non-potable

water recycling reduces other pollutant discharges to the Bay, which provides additional regulatory flexibility beyond nitrogen reduction requirements. As a secondary benefit, non-potable water recycling also provides a reliable water supply that can reduce demand for potable water.

A purified water project as a stand-alone project provides the benefit of increased potable water supply but does not provide a significant reduction in nitrogen or other pollutants. These projects are not a cost-effective nitrogen management strategy and present challenges as regulations require more significant reductions of increased nitrogen loads received at the RWF. The daily cost per kg of nitrogen reduced from nature-based systems is still under evaluation but will undoubtedly be less than the per unit cost of purified water. The nature-based solutions strategies evaluated for the RWF provide an overall nitrogen reduction that is about the same as reductions from projected non-potable water recycling expansion. This may make them an attractive option, either as a stand-alone project or a project that could be paired with a future purified water project because the combined per unit cost of nitrogen reduction will be less than that of purified water alone. The multiple benefits of the two projects will also be more significant than either individually.

CEQA

Not a project, File No. PP17-009, Staff Reports that involve no approvals of any City action.

COORDINATION

This report has been coordinated with the City Attorney's Office and the City Manager's Budget Office.

/s/
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