City of Palo Alto

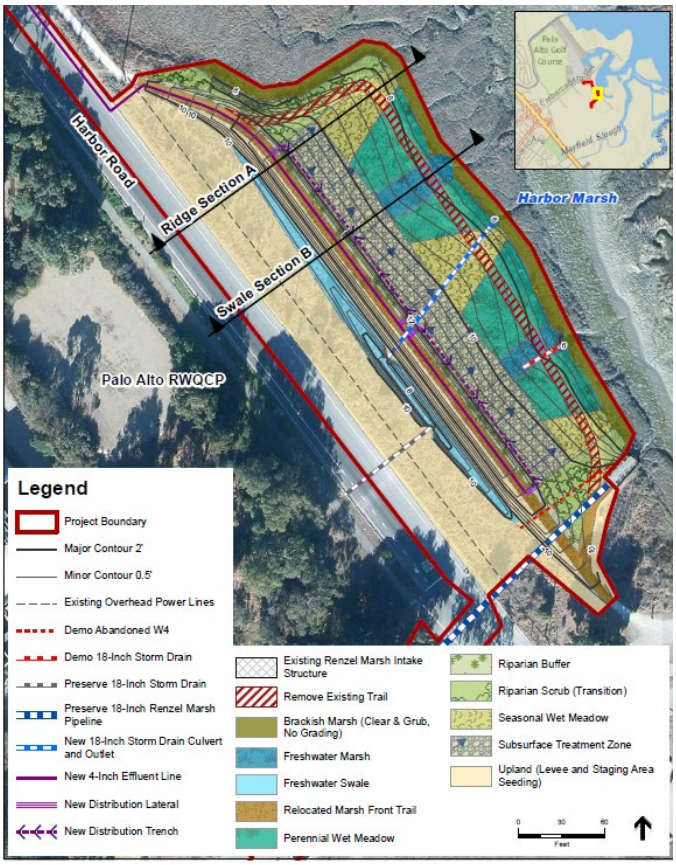
# Palo Alto Horizontal Levee Pilot Project

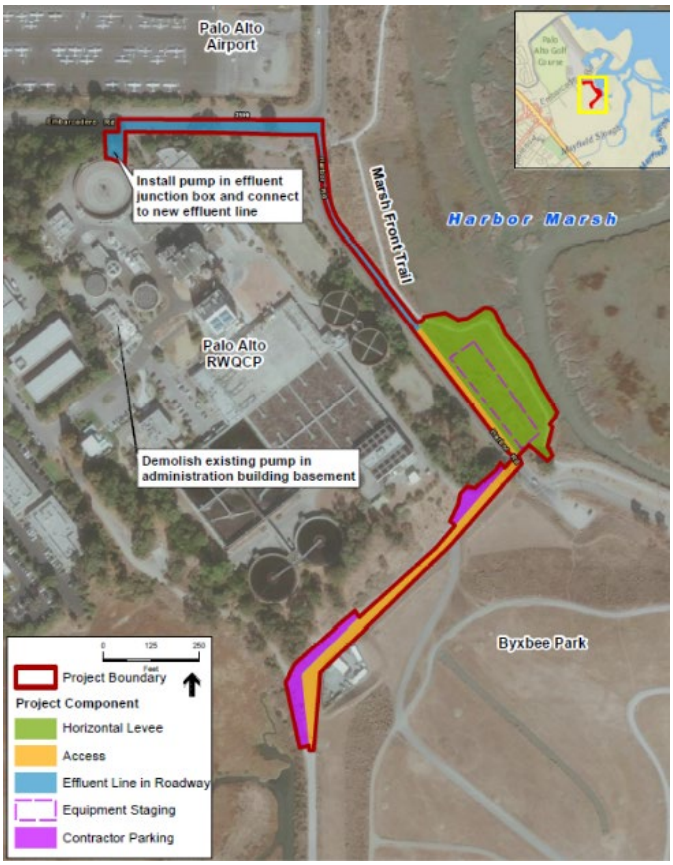
**Location**
Palo Alto, CA

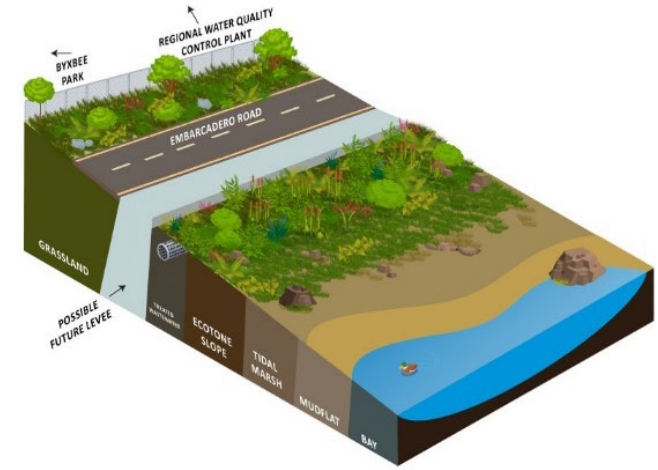
**Project Budget**
Approximately $1,650,000

**Schedule**
- Conceptual Design: 2017
- Preliminary Design: 2020
- Final Design: 2023
- Permitting/CEQA: 2023
- Construction: 2024

**Sponsors**
- City of Palo Alto
- San Francisco Estuary Partnership
- U.S. Environmental Protection Agency
- California State Coastal Conservancy




## Project Objectives

- Engage communities and technical experts to design and permit a multi-benefit horizontal levee adjacent to the RWQCP
- Restore critical habitat, support sea level rise resiliency, and improve water quality

## Project Goals

- Restore rare and historic transitional habitat along the Bay's shoreline for special status species.
- Adapt to sea level rise by providing a vegetated slope that will support freshwater plants to build organic soils to keep pace with and allow wetland habitat to migrate up slope with rising water levels.
- Provide polishing treatment of tertiary-treated wastewater.
- Engage diverse populations of residents and interested stakeholders in sea level rise adaptation, habitat restoration, and shoreline planning activities

## Project Overview

The Palo Alto Horizontal Levee Pilot Project is a multi-benefit project designed to improve and expand shoreline habitat along the perimeter of Harbor Marsh. The project will create a broad horizontal levee that is adaptable to sea level rise and provides polishing treatment to treated wastewater from the City's Regional Water Quality Control Plant (RWQCP) before it enters the San Francisco Bay. The horizontal levee will include grassy wet meadow, freshwater/tidal brackish marsh, and riparian scrub – historical transitional habitat between uplands and tidal marshes which has been decimated by development along the Bay shoreline and is therefore a high restoration priority for resource agencies.

The project involves excavating the existing berm, constructing a new 500-linear-foot levee berm and ecotone slope, installing a new pump at the RWQCP, trenching and installation of a buried pipeline along Harbor Road and Embarcadero Road, and installation of treated wastewater subsurface irrigation system at the newly created horizontal levee that is vegetated with freshwater native species. The project is designed as a permanent pilot study that would collect information on horizontal levees to eventually feed into components of larger flood protection projects in the future. As such, the project is designed to accommodate future construction of a regional flood protection levee between the horizontal levee and Embarcadero Road.

The project expects permit issuance in Fall 2023 and will break ground on construction in Summer 2024.

## Anticipated Project Benefits

This multi-benefit pilot project will create and expand aquatic tidal marsh habitat (jurisdictional waters) and rare transitional habitat types between upland and tidal salt marsh communities. The horizontal levee design provides an upland transition zone for marsh vegetation communities to adapt to predicted sea level rise while maintaining flood protection integrity for the City's vital RWQCP infrastructure and supporting future integration into a regional flood protection solution.

The horizontal levee pilot project allows design standards, planting assemblages, irrigation source water application and approach, and maintenance commitments to be tested and refined to inform implementation of similar horizontal levee designs along the South Bay shoreline.

## Regulatory Permitting Considerations

To comply with Clean Water Act (CWA) Section 404 requirements, the project must be the Least Damaging Practicable Alternative and demonstrate that aquatic and wildlife impacts have been avoided and minimized to the maximum extent feasible. The following efforts were taken to demonstrate compliance with these requirements, while meeting project goals.

- Due to the location of the project, impacts to existing wetlands were reduced (<0.1 ac perm.); most work will be conducted in less sensitive upland habitats.

- Limited change to habitats (i.e., 'type conversion' of tidal salt marsh to tidal brackish marsh) from treated wastewater irrigation.
- To minimize construction-related adverse effects to federal- and state-listed and fully-protected species, costly avoidance and minimization measures will be implemented. Example impact minimization measures include non-mechanized vegetation removal, acoustic barriers, and predator perching deterrents.
- No adverse effects to in-water aquatic species will occur.

Discharge of treated wastewater into waters of the U.S. requires a National Pollutant Discharge Elimination System (NPDES) permit under CWA Section 402. The proposed horizontal levee polishing treatment of tertiary-treated wastewater from the City's RWQCP therefore requires authorization from the San Francisco Bay RWQCB whom has delegated authority to implement CWA Section 402. The City's existing NPDES covers shallow water discharges and will be modified to add the project's horizontal levee treatment zone as an additional discharge location and receiving water. In 2022, the San Francisco Bay RWQCB developed the "NPDES Permitting Fact Sheet for Nature-Based Solutions[1]". This fact sheet is not yet posted online but is appended for reference.

The achieve the project goals and obtain approval from the San Francisco Bay Conservation and Development Commission (BCDC), which regulates activities in the Bay and within 100 feet of the Bay shoreline, public access elements are incorporated the project. Public access goals, requirements from BCDC (e.g., recreational trail and overlook amenities), and ADA compliance requirements often conflicted with wildlife protection and other project goals, and required early and frequent stakeholder outreach and collaboration to achieve.

Once the project is constructed, monitoring and adaptive management actions may be needed to maintain project goals over time, and may be required as conditions of regulatory agency permits and approvals. Post-construction actions will require a financial commitment by the project sponsors for many years following construction. Further, some adaptive management plan actions may disturb sensitive species or habitats and need additional permitting support. For example, if the levee slope needed to be regraded to improve habitat establishment and wastewater treatment polishing, that action may require regulatory agency approval due to the potential for harm to protected species during the process. This action may occur after the initial project construction permits have expired and require a new suite of regulatory agency approvals.

## Successes and Wins

Building from the success of the Oro Loma Horizontal Levee Demonstration Project, this will be the first horizontal levee project constructed with a wastewater treatment zone discharging directly to the Bay.

To advance the permitting process, the project team heavily engaged with the San Francisco Bay Restoration and Regulatory Integration Team (BRRIT) prior to submitting permitting applications. Early engagement included four pre-application meetings starting at the concept inception stage in 2019, including a site tour. This early regulatory agency engagement resulted in project design refinements that were satisfactory to the BRRIT such that permitting could be advanced.

Applying California's Cutting Green Tape (CGT) Restoration Permit Pathways has substantially reduced CEQA compliance and permitting costs. The project is utilizing the CEQA categorical exemption for small habitat restoration projects (Categorical Exemption Sec. 15333) which reduced the effort and time to prepare CEQA compliance documentation in comparison to the typical CEQA compliance pathway (i.e., IS/MND). For permitting, the project qualifies for and is requesting coverage under the following CGT Restoration Permits and Approvals: SWRCB Statewide Restoration 401 General Order (Order WQ 2022-0048-DWQ), USFWS California Statewide Restoration Programmatic Biological Opinion (FWS: 2022-0005149-S7), and CDFW Restoration Management Permit for species take coverage. The benefits to using these CGT permits include relatively standardized permit requirements (i.e., construction and post-construction conditions), faster internal agency processing time, substantially reduced application fees, and others yet to be observed.

[1] San Francisco Bay Regional Water Quality Control Board. 2022. NPDES Permitting for Nature-based Solutions Fact Sheet. Attached.

# NPDES PERMITTING FOR NATURE-BASED SOLUTIONS

The Clean Water Act requires a National Pollutant Discharge Elimination System (NPDES) permit to discharge treated wastewater to waters of the United States. Various strategies exist for crafting NPDES permits for nature-based solutions, such as treatment wetlands and horizontal levees. Many of these strategies are comparable to those for gray infrastructure. Some key NPDES permitting concepts and how they apply to nature-based solutions are presented below.

## Discharge points

"Discharge points" are locations where treated wastewater enters waters of the United States. Water quality standards apply within waters of the United States. Although these waters may naturally assimilate some pollutants, they cannot be used to treat wastewater. "Treatment" refers to pollutant removal prior to discharge; thus, treatment always occurs upstream of discharge points. Discharge points may be traditional outfall pipes, but they do not have to be. For horizontal levees, they may be lines that run parallel along the levees. The shape is typically not very important. Whether considering treatment wetlands, horizontal levees, or gray infrastructure, compliance with permit requirements is rarely evaluated at discharge points.

## Exceptions to discharge prohibitions

The *Water Quality Control Plan for the San Francisco Bay Region* (Basin Plan) prohibits certain discharges, including many discharges into shallow nearshore waters. Because the Basin Plan provides for exceptions, this is rarely a problem for municipal wastewater discharges if they receive treatment above and beyond U.S. EPA's Secondary Treatment Standards (e.g., if filtration is used to remove more suspended sediment and biochemical oxygen demand, or nitrification and denitrification processes remove ammonia and nitrogen).

The Basin Plan contains the following discharge prohibitions, among others:

1. Any wastewater (e.g., treated sewage) that has particular characteristics of concern to beneficial uses at any point at which the wastewater does not receive a minimum initial dilution of at least 10:1, or into any nontidal water, dead-end slough, or similar confined waters.
2. Any wastewater that has particular characteristics of concern to beneficial uses to San Francisco Bay south of the Dumbarton Bridge.
3. Any wastewater that has particular characteristics of concern to beneficial uses to Suisun Marsh during the dry weather period of the year.

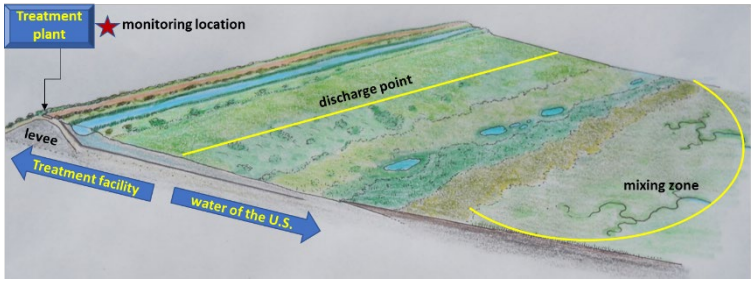
On a case-by-case basis, the Basin Plan allows for exceptions if one of the following conditions is met:

- An inordinate burden would be placed on the discharger relative to the beneficial uses protected and an equivalent level of environmental protection will be achieved by alternate means, such as an alternative discharge site, a higher level of treatment, or improved treatment reliability;
- The discharge is approved as part of a reclamation project;
- Net environmental benefits will be derived as a result of the discharge; or
- The discharge is approved as part of a groundwater clean-up project.

Most nature-based solutions qualify for the first exception ("equivalent protection") because those wastewater discharges receive treatment above and beyond Secondary Treatment Standards. If nature-based solutions are paired with reclamation projects, they may qualify for the second exception too. If nature-based solutions create new waters of the United States that could not exist without the wastewater discharges, the third exception ("net environmental benefits") may apply.

To demonstrate net environmental benefits, Water Board Resolution 94-086 ("Policy on the Use of

**Conceptual Horizontal Levee**. The discharge point is a line running parallel along the levee. Effluent limits ensure that water quality standards are maintained beyond the discharge point (or mixing zones, if any). Compliance monitoring occurs at the treatment plant. *Base drawing courtesy of Peter Baye.*




Wastewater to Create, Restore, and/or Enhance Wetlands") says, "…it will be necessary for the applicant to demonstrate that (1) full and uninterrupted protection will be given to all beneficial uses which could be made of the receiving water…in the absence of wastewater discharges and (2) that new beneficial uses will result from wetland creation, or, in rare cases, fuller realization of existing or potential uses will result from wetland restoration or enhancement beyond that which would occur in the absence of point source discharges." Wetlands used to demonstrate net environmental benefits may not be used to satisfy mitigation requirements pursuant to Clean Water Act sections 401 and 404.

## Effluent limitations

NPDES permits contain technology-based and water quality-based requirements. Technology-based requirements ensure treatment performance. U.S. EPA's Secondary Treatment Standards (40 C.F.R. Part 133) are the minimum technology-based requirements for municipal wastewater. However, if better treatment performance is used to justify an exception to a discharge prohibition based on equivalent protection, a permit may contain more stringent technology-based requirements to ensure that the exception remains justified.

Water quality-based requirements ensure that water quality standards are maintained within waters of the United States (i.e., beyond discharge points). Regulations may be very specific or more flexible, depending on the pollutant considered. For example, water quality-based effluent limitations for most "priority pollutants" must be expressed in terms of concentrations. In contrast, water quality-based effluent limitations for other pollutants, such as nutrients, may be expressed in terms of concentrations or loads.

The Water Board may authorize one or more pollutant-specific mixing zones within waters of the United States. Inside the mixing zones, ambient water mixes with treated effluent and dilutes pollutant concentrations. In these cases, concentration-based effluent limitations may be calculated to achieve water quality standards beyond the mixing zones. Since mixing zones and dilution do not affect pollutant loading, however, they have no bearing on load-based effluent limitations. Nevertheless, the Water Board may consider pollutant uptake, assimilation, or removal within waters of the United States when developing load-based effluent limitations, provided available information supports doing so.

## Facility operations and maintenance

Permits require treatment facilities, whether they be gray infrastructure, treatment wetlands, or horizontal levees, to be operated and maintained to ensure continued treatment performance. Permits may also require levee maintenance or other receiving water management provisions to ensure water quality.

## Compliance evaluation

To evaluate compliance with permit requirements, NPDES permits define "monitoring locations" where treated effluent samples are collected. For both gray infrastructure and nature-based solutions, monitoring locations are commonly placed at or near treatment plants because sampling at discharge points or at the edges of mixing zones is often infeasible, or at least very inconvenient. The Water Board may establish monitoring locations at the outfalls from treatment wetlands if there are good reasons to do so. Alternatively, the Water Board may evaluate compliance at monitoring locations at or near treatment plants, but adjust the effluent limitations to reflect demonstrated treatment downstream of the monitoring locations.

## Available exceptions to Basin Plan discharge prohibitions for generic nature-based solutions

| | Equivalent Protection | Reclamation Project | Net Environmental Benefits | Groundwater Cleanup Project |
|---|---|---|---|---|
| **Treatment Wetland Constructed Upland** | **Yes** Discharges receive treatment above and beyond Secondary Treatment Standards upstream of discharge point. | **Maybe** Exception may apply when nature-based solutions are paired with reclamation projects. | **No** No new waters of United States created. | **No** Exception does not apply. |
| **Horizontal Levee Constructed Upland** | **Yes** Discharges receive treatment above and beyond Secondary Treatment Standards upstream of discharge point. | **Maybe** Exception may apply when nature-based solutions are paired with reclamation projects. | **Maybe** New waters of United States may be created. Water Board Resolution 94-086 applies. | **No** Exception does not apply. |
| **Horizontal Levee Constructed in Waters of United States** | **Yes** Discharges receive treatment above and beyond Secondary Treatment Standards upstream of levee. | **Maybe** Exception may apply when nature-based solutions are paired with reclamation projects. | **No** No new waters of United States created. | **No** Exception does not apply. |

## Application of key concepts to generic nature-based solutions

| | Treatment Wetland Constructed Upland | Horizontal Levee Constructed Upland | Horizontal Levee Constructed in Waters of United States |
|---|---|---|---|
| **Discharge points** | Discharge point is outfall from treatment wetland to waters of United States. | Discharge point may be line parallel to, and probably through, levee, distinguishing treatment facility from waters of United States. | Discharge point may be line parallel to, and probably through, levee, distinguishing treatment facility from waters of United States. Portion of levee constructed in water of United States is subject to Clean Water Act sections 401 and 404 permitting and mitigation. |
| **Exceptions to discharge prohibitions** | Higher level of treatment justifies exception based on equivalent protection. Treatment could be filtration or nitrification prior to treatment wetland, or treatment within wetland (e.g., removal of nutrients or contaminants of emerging concern). | Wastewater must be nitrified prior to discharge through horizontal levee. This treatment justifies exception based on equivalent protection. Treatment within levee (e.g., removal of nutrients or contaminants of emerging concern) also justifies exception based on equivalent protection. | Wastewater must be nitrified prior to discharge through horizontal levee. This treatment justifies exception based on equivalent protection. Treatment within portion of levee considered part of treatment facility (e.g., removal of nutrients or contaminants of emerging concern) may also justify exception based on equivalent protection. |
| **Effluent limitations** | Technology-based effluent limitations are more stringent than Secondary Treatment Standards to ensure higher level of treatment. Water quality- | Technology-based effluent limitations are more stringent than Secondary Treatment Standards to ensure higher level of treatment (e.g., to ensure | Technology-based effluent limitations are more stringent than Secondary Treatment Standards to ensure higher level of treatment (e.g., to ensure |

| | | | |
|---|---|---|---|
| | based effluent limitations are concentration-based when necessary (mixing zones may be established) or load-based if appropriate. | effective nitrification). Water quality-based effluent limitations are concentration-based when necessary (mixing zones may be established) or load-based if appropriate. Load-based effluent limitations may account for pollutant uptake within levee. | effective nitrification). Water quality-based effluent limitations are concentration-based when necessary (mixing zones may be established) or load-based if appropriate. Load-based effluent limitations may account for pollutant uptake within levee. |
| **Facility operations and maintenance** | Maintenance requirements ensure wetland treatment performance. | Maintenance requirements ensure levee performance. | Maintenance requirements ensure levee performance. |
| **Compliance evaluation** | Compliance is evaluated at monitoring location at or near treatment plant (or at outfall from treatment wetland if warranted). | Compliance is evaluated at monitoring location at or near treatment plant. | Compliance is evaluated at monitoring location at or near treatment plant. |

## Specific examples of NPDES permits for nature-based solutions

| Permit Number | Order Number | Discharger | Facility | Discharge Prohibition Exception Based on Equivalent Protection | Discharge Prohibition Exception Based on Net Environmental Benefits |
|---|---|---|---|---|---|
| CA0038881 | R2-2022-0006 | City of San Leandro | City of San Leandro Water Pollution Control Plant – Treatment Wetland | X | |
| CA0037770 | R2-2021-0026 | Mt. View Sanitary District | Mt. View Sanitary District Wastewater Treatment Plant | X | |
| CA0037810 | R2-2021-0008 | City of Petaluma | Ellis Creek Water Recycling Facility | X | |
| CA0110116 | R2-2020-0020 | U.S. Department of Navy | Treasure Island Wastewater Treatment Plant | X | |
| CA0037958 | R2-2020-0019 | Novato Sanitary District | Novato Sanitary District Wastewater Treatment Plant | X | * |
| CA0037800 | R2-2019-0019 | Sonoma Valley County Sanitation District | Sonoma Valley County Sanitation District Wastewater Treatment Plant | X | |
| CA0037834 | R2-2019-0015 | City of Palo Alto | Palo Alto Regional Water Quality Control Plant | X | |
| CA0038776 | R2-2017-0013 | City of Pacifica | Calera Creek Water Recycling Plant | X | X |
| CA0038768 | R2-2017-0008 | City of American Canyon | American Canyon Water Reclamation Facility | X | X |
| CA0038636 | R2-2011-0058 | East Bay Regional Park District, Union Sanitary District, and East Bay Dischargers Authority | Hayward Marsh | | X |

* The Novato Sanitary District is planning to move its discharge inland to provide secondary-treated effluent as a freshwater source to a proposed new marsh. The discharge will create and sustain new brackish marsh habitat for fish, plant, and wildlife. The wetlands will provide storm and flood protection against rising sea levels and provide recreational, scenic, and education benefits. The discharge may qualify for an exception based on net environmental benefits.