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.

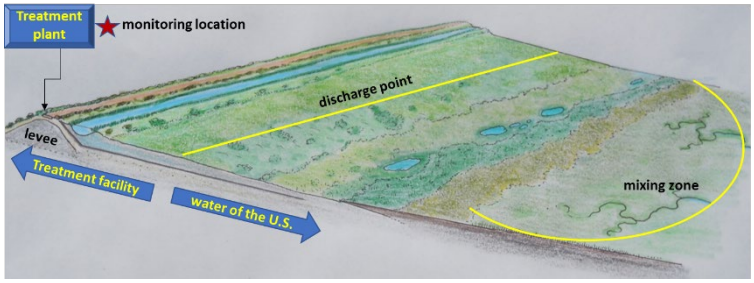
On a case-by-case basis, the Basin Plan allows for exceptions if one of the following conditions is met:

- 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.