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## Fighting future 'red tides' in San Francisco Bay

Reductions in nutrient pollution are already underway — but a real cure could cost up to \$15 billion. Is it worth it?



Aeration basins at the San Jose-Santa Clara Regional Wastewater Facility use microorganisms and an oxygenation process to turn the excess nitrogen in wastewater into a gas. Circular tanks, called clarifiers, allow particles to settle out. (Nhat V. Meyer/Bay Area News Group)



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The largest sources of nutrient pollution and algae blooms in the San Francisco Bay — 37 different sewage treatment plants — are cleaning up their act.

Faced with two blooms called "red tides," deadly to marine life, officials will soon recommend the first-ever restrictions on the release of the nutrients, such as nitrogen, into the Bay, a vast body of water that has long seemed resilient to trouble.





Thousands of dead fish, killed by an algae bloom, float around Lake Merritt in Oakland, Calif., on Wednesday, Aug. 31, 2022. (Ray Chavez/Bay Area News Group)

"The science is telling us that we need to reduce nutrient loads as quickly as possible," said Eileen White, executive officer for the [San Francisco Bay Regional Water Quality Control Board](#), which regulates sewage treatment plants. "What has happened is a game-changer."

More than two-thirds of the region's nitrogen comes from sewage treatment plants, which collectively dump about 50,000 kilograms into Bay waters every day. While many natural factors create a red tide, named for the discolored water, these nutrient releases are manmade — and can be controlled, experts say.

About 14 of the Bay Area's treatment plants have already modernized their facilities to clean up their chocolate-colored sludge, harnessing bacteria and aeration techniques to turn nitrogen from a liquid to a gas, then safely releasing it into the air. Several more have planned upgrades, and are studying treatment wetlands.

But others are lagging behind.

A thorough cleanup will be very pricy, boosting costs for ratepayers. To cut nitrogen releases in half, the total price tag could reach \$11.5 billion; more modest reductions of 7% to 20% would cost \$220 million to \$870 million, respectively. The most aggressive reduction — 82% — could cost nearly \$15 billion.

And the payoff may not be immediately obvious. Until last year, the Bay had no dramatic red tide die-offs of marine life. Scientists are trying to learn whether these are very rare events or the beginning of a trend. There are hints, yet no proof, that climate change could trigger repeated outbreaks.

"It's a huge challenge ... with a lot of uncertainty," said Lorien Fono, executive director of the [Bay Area Clean Water Agencies](#), whose members provide sewer services to more than 7.1 million residents. "But, working together, we have the possibility of creating a regionwide approach for nutrient reduction."

July's red tide algae bloom faded without a repeat of last summer's toll of thousands of dead fish and other marine creatures, according to an analysis by scientists at [San Francisco Baykeeper](#), an environmental group that monitors water conditions in the Bay.

But summer is not yet over. Increased algae concentrations in the 2000s, combined with these recent outbreaks, are causing authorities to take a harder look.

Discharge limits have helped reverse ecological disasters in Tampa Bay, the Long Island Sound and other estuaries around the nation. In the Chesapeake Bay, which once seemed unsavable, key fish species have rebounded, more seagrass is growing and the water holds

more life-giving oxygen.

Historically, limits have not been required in San Francisco Bay. It has fierce tides, which reduce concentrations of nitrogen. It has cloudy water, due to millions of tons of mud, gravel and sand from Gold Rush mining. And it has a large population of organisms, such as clams, that feed on algae.

"The key factors that can trigger harmful algae blooms have rarely all lined up to allow for a very, very large problem to actually occur," said [David Senn](#) of the [San Francisco Estuary Institute](#), who leads the [San Francisco Bay Nutrient Management Strategy](#), a regional initiative for developing the science needed for informed decisions about managing nitrogen loads.

But that resiliency may be fading. Water clarity is increasing due to upstream dams capturing sediment. Clam populations are declining. Climate change may cause waters to warm.

The region's 50-year-old treatment facilities are also aging, creating opportunities for upgrades, Fono said.

Limits will be placed on nitrogen discharges, said White. The San Francisco Bay Regional Water Quality Control Board issues new permits — with new regulatory requirements — every five years. The existing permits will expire next year.

"We tried to be a progressive thinker," said Jimmy Dang of Oro Loma/Castro Valley Sanitary Districts, which upgraded its decades-old facility to remove nearly 95% of nitrogen from its discharge flow, contributing to a 7% price hike for ratepayers. "It was a conscious decision to look at the environment of the Bay, ahead of any limits that were coming down the pipeline."

In its new \$25 million facility, he said, "the nitrogen becomes gas, and disappears."

San Jose-Santa Clara Regional Wastewater Facility, which sits on the edge of the shallow and slow-moving South Bay, started to remove nitrogen discharges about two decades ago. With more recent innovations, about 85% of the nitrogen is gone.

Last year, South San Francisco and San Bruno completed the construction of a technology that has also reduced nutrients by 85%.

According to the Bay Area Clean Water Agencies' [most recent report](#), Palo Alto and its partners are embarking on a major \$200 million makeover of its Regional Water Quality Control Plant. West County Wastewater, which serves San Pablo, Richmond and Pinole, has already completed plant improvements. The Dublin San Ramon District is solving its problem through a recycled water program, which uses nitrogen to fertilize fields and landscaping. San Leandro's project, under construction, should be finished this year. San Mateo began its upgrade in 2021.

The two largest dischargers — East Bay Municipal Utility District and San Francisco PUC — are off to a slower start, according to the report. EBMUD is now pilot testing treatment of about 10% of its flow, which should result in some reductions.

"It is very expensive," said Fono. "But the community, as a whole, takes this very seriously."

Given the enormous cost, how much reduction is needed? That is what Senn and his partners with the Nutrient Management Strategy are studying. They are developing computer simulations of a gradual decline in the ecosystem's health, as well as more catastrophic red tides to better understand whether massive die-offs will be rare events, or something more frequent. The goal is to generate the data needed to support major management decisions.

"What are the best investments for the region to make," Senn asked, "to try to get the biggest improvements?"

"How do we think through something that's never happened before — that would cost \$10 billion or more to prevent from happening again?" Senn asked. "And what pace do we need to get there?"

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