

HAYWARD, CALIFORNIA

Early on a bright fall morning, dozens of black-necked stilts pick their way across a shallow pond at the edge of San Francisco Bay, feeding on tiny floating brine shrimp. Each bird is about a foot tall, with a black face and back, white undersides and spindly red legs. The water is so calm that they seem to walk on a mirror, bending down to admire their own reflections.

The setting is Eden Landing, a complex of manmade ponds next to the San Mateo/Hayward Bridge. It's a tranquil scene but hardly paradise: Commuter traffic buzzes past, jets descend to nearby airports, and a rising breeze carries whiffs of rot from a shoreline landfill. The ponds themselves are industrial sites, built decades ago to make salt by concentrating and evaporating bay water. Viewed from the air, the progression of ponds look like colored tiles: First, algae tints the "starter" ponds green, then brine shrimp and salt-loving bacteria turn the thickening solution orange and finally red.

Before the Gold Rush, San Francisco Bay was bordered by 200,000 acres of tidal marshes that provided rich habitat for fish and birds. Today, 90 percent of those tracts have been filled in for farming, development and salt making. This spring, state and federal agencies will launch a 50-year program to convert up to 15,000 acres of salt ponds back into tidal wetlands.

Most wetlands in the West lie inland, but those in coastal estuaries (mixed saltwater and freshwater zones) like San Francisco Bay have special biological and economic value. They support millions of birds that migrate along the Pacific Flyway and provide spawning grounds for many fish and shellfish species. Wetlands also are natural sponges that soak up flood tides — a service that will become more critical as global warming raises sea levels.

The salt-pond project dwarfs other wetland restoration initiatives in the West, which typically cover a few thousand acres at most. Working at this scale could yield major payoffs, says David Lewis, executive director of Save The Bay. "San Francisco Bay is part of a huge ecosystem," Lewis



PHOTO COURTESY CARGILL INC.

Hold the salt

The largest wetland restoration project on the West Coast shifts into gear

says. "Forty percent of California's watershed flows into it, so improving the health of the Bay can have a big impact."

Project managers are analyzing many intricate issues, such as sediment flows in the Bay and birds' foraging habits in ponds and marshes. But the biggest challenges are economic and political. No central structure exists to coordinate the many federal, state and local agencies involved in the project or raise enough money to completely restore the salt ponds and other wetlands around the Bay.

Meanwhile, new shoreline development proposals divert energy and government attention from the slower work of bringing wetlands back to life.

THE SECOND-LARGEST ESTUARY IN THE NATION, San Francisco Bay is ringed by highways and 7 million people but still provides nesting and breeding grounds for birds, fish and mammals. Dozens of endangered or threatened species use the estuary, including the brown pelican, Delta smelt, and northern sea lion.

Local advocates have been lobbying to clean up the Bay since the 1960s, when raw sewage flowed

straight into it and only four of its 276 miles of shoreline were publicly accessible. Starting in 1972, groups like Save the Bay helped to build support for restoring some 5,000 acres of tidal marsh. When Cargill Salt, which owned many of the area's salt ponds, decided to consolidate its holdings in 2000, advocates saw a bigger opportunity. With private foundation support, a partnership of state and federal agencies bought three tracts of salt ponds for \$100 million.

Cargill sold the ponds as-is. Many are full of highly saline brine, so the first step in restoring them is letting water flow in to recreate natural tidal patterns. "We've simplified the ecology of the Bay over time by creating a very hard, diked edge," says Lynne Trulio, professor of environmental studies at San Jose State University and the project's science team leader. "Restoring tidal action and marsh vegetation aims to remedy that and make the South Bay ecosystem richer and more self-sustaining."

In 2004, managers installed tidal gates to cycle water periodically through some ponds. Salinity levels fell, and the ponds supported

growing numbers of shrimp, flies and fish, which in turn drew dunlins, sandpipers and many species of ducks. The change was bigger and faster than expected: Counts of some species rose as much as sevenfold in the first year. When three isolated "island" ponds that had only been used by gulls were breached permanently in 2006, thousands of shorebirds and fish-eating birds immediately began feeding there.

The long-term restoration plan, which is jointly managed by the U.S. Fish and Wildlife Service, the California State Coastal Conservancy, and the California Department of Fish and Game, calls for converting 50 to 90 percent of the ponds to tidal wetlands. Some will remain as "managed" ponds that can be customized for certain bird species. By adding islands or changing water depths, wildlife managers can create different habitats for birds that forage or nest in and around the ponds, such as the western snowy plover, a threatened species that nests on salt pond islands and levees.

THE SECOND INGREDIENT IN WETLANDS RESTORATION is dirt — plenty of it. Before

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it became Silicon Valley, the area around the South Bay was an agricultural zone known as “The Valley of Heart’s Delight.” Farmers pumped out groundwater for decades to irrigate fruit and nut trees, lowering water tables. Some pond bottoms sank by as much as 13 feet, too far below the water line to support marsh plants.

To start recreating marshes, workers will breach the dikes so that waves can carry in fresh sediment. In 10 to 15 years, when enough sediment has piled up, cordgrass and pickleweed will start to colonize the mud flats. Eventually the plants will thicken into habitat for species like the endangered California clapper rail and salt marsh harvest mouse.

But because the project covers such a big area, breaching ponds could interfere with larger processes in the Bay. “We know a lot about tidal marsh restoration, but there are questions that stem from the ecosystem scale of this project,” says Trulio. For example, opening up the salt ponds could draw sediments from existing mud flats farther north in the Bay that provide crucial foraging areas for migrating water birds. “Losing all the mud flats and not gaining any marsh is everybody’s nightmare,” says executive project

manager Steve Ritchie of the California State Coastal Conservancy. “We’re pretty confident that we know how sediment moves in the Bay, but we’re going to go slowly on opening up the southern ponds.”

Mercury is also a concern. For over a century, mercury deposits from the New Almaden mines near San Jose and other sources have washed into the Bay, and stronger tidal circulation could stir them up. Bacteria found in wetlands can convert mercury to toxic methylmercury, the form that moves up through food chains. And high mercury levels have already been found in clapper rail and tern eggs in the area.

Yet another uncertainty is whether invasive species will move into new marshes. Many non-native species are present in the Bay, notably *spartina altiflora*, a non-native cordgrass that was planted several decades ago to stabilize shorelines. Here as well as in Washington’s Puget Sound, *spartina* is displacing native grasses and reducing water circulation despite energetic weeding by hundreds of volunteers. Breaching ponds may also displace existing colonies of California gulls. These large, aggressive birds prey on smaller species like snowy plovers and may

compete with them for space on the remaining managed ponds.

Restoration agencies plan to tackle these uncertainties through adaptive management, an approach that uses careful trials — such as breaching specific ponds or moving dikes — to determine which actions succeed or fail. Results from one step will help scientists decide what to do next, and ultimately will determine what fraction of the salt ponds are converted back to marshes. Phase I of the project will restore about 1,500 acres of tidal habitat between 2008 and 2010.

ALL TOLD, THE SALT-POND restoration is projected to cost nearly \$1 billion over 50 years. A dozen other, smaller wetland restoration projects covering more than 23,000 acres are planned or under way around the Bay. Save the Bay estimates that all of these projects could be completed for a total of \$1.43 billion, of which about \$370 million has already been invested.

What’s needed now is a cohesive strategy to raise the balance from federal, state and local sources and target the projects that are the most scientifically sound. A 2006 survey of Bay Area residents found that about 80 per-

cent were willing to pay \$10 yearly in taxes or fees to improve the Bay. Save the Bay would like to see managers tap this goodwill through local funding measures rather than looking to Congress for most of the money. “Often politicians are behind the curve on how willing the public is to pay for environmental benefits,” says Lewis. The funding process is especially complicated in San Francisco because nine counties and dozens of towns adjoin the Bay, and each has different concerns about flooding, infrastructure, land conservation and other issues.

California has lost at least 90 percent of its wetlands, more than other West Coast states, but development and pollution are also stressing important estuaries like the lower Columbia River in Oregon and Puget Sound. Water diversion projects have reduced river flows into these bodies, causing saltwater intrusion that changes the estuaries’ chemistry and destroys fish habitat. And growth in areas like King County, Wash., and coastal Oregon creates constant pressure to dredge or fill in wetlands for other uses.

“Wetlands are inconvenient. If we want to build a road from point A to point B and there’s a wetland in the way, it will always lose,” says Robin Clark, habitat restoration manager at People for Puget Sound.

If local agencies find a way to meld their budgets and agendas, the salt pond project could energize similar efforts to restore other West Coast wetlands. “Hopefully, we can show that even with multiple jurisdictions, you can take a regional approach and find ways of collaborating,” Lewis says. “Political boundaries have to recognize ecological boundaries. If the West had been required to develop based on watersheds and water realities, instead of artificial political lines and invented water boundaries, growth patterns would have been very different from what we see today.”

BY JENNIFER WEEKS

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PHOTO COURTESY MARK BITTNER

Development rings the South Bay (facing page) and its multicolored salt ponds. Green algae dominate the ponds with low- to mid-salinity levels; red indicates higher levels. Above, a small crowd watches the opening of one of the former salt ponds to tidal action.