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CONSEQUENCES OF A RISING BAY

GLOBAL WARMING: New set of maps reveals how melting polar ice could change shoreline and carry a high price for entire region

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New maps show that neighborhoods and roads in many cities near the San Francisco Bay shoreline would be under water if global warming causes tides to rise as much as 3 feet in the coming decades, and officials say regions face key decisions about where people will be able to live and build.

The maps, which the Bay Conservation and Development Commission prepared for The Chronicle, offer a detailed look at how a changing shoreline would affect life around the bay.

Parts of Corte Madera, San Rafael, Hayward and Newark and much of the Silicon Valley shoreline would be under water, including a portion of Moffett Field, the site of NASA Ames Research Center, where Google wants to build a 1 million-square-foot campus.

On the edge of the rising waters would be stadium sites proposed for the 49ers -- in Santa Clara and at the Hunters Point Shipyard in San Francisco. Fremont's proposed site for the Oakland A's ballpark also could be vulnerable to flooding in the 21st century, the maps show.

Wastewater treatment plants for more than a dozen cities in the South Bay, including San Jose, and the industrial ponds for the Valero oil refinery in Benicia and the Chevron refinery in Richmond, would be inundated by the projected rise in the bay.

While the Bay Area has done a good job designing for earthquakes, it hasn't done so for sea-level rise, said Will Travis, executive director of the bay conservation agency, which approves shoreline development. Aside from cutting greenhouse gas emissions, Travis said, "The amount of planning and preparing that we do is really what will affect how severe the impacts are here."

Cities can protect vulnerable shorelines with sea walls and levees, but the fixes and maintenance would cost billions of dollars. Officials will have to decide what to save and what to let go. Some development plans in the works may have to be shelved or drastically re-engineered, Travis said.

The maps illustrate the regions of risk. Among the areas threatened are:

-- In the North Bay, low areas include Bel Marin Keys, parts of Highway 37 and much of the former Hamilton Air Force Base around Black Point. Parts of Highway 101, Mill Valley and Sausalito would be flooded. Sections of Corte Madera would be under water, as would southern San Rafael.

-- On the San Francisco shoreline, vulnerable spots include parts of Mission Bay housing and office developments, Caltrain tracks, Candlestick Point redevelopment, Heron's Head Park and the city's sewage-treatment system on Islais Creek. Parts of Treasure Island and the San Francisco and Oakland airports would be under water.

-- Foster City and parts of San Mateo, Redwood City, Mountain View and Palo Alto would be flooded. Waters would inundate sewage treatment plants located in Palo Alto, Sunnyvale and Alviso, which serve dozens of cities and thousands of businesses. Parts of Shoreline Park at Mountain View would be at risk of flooding.

-- Parts of Alameda, San Leandro, Hayward, Union City, Fremont and Newark, including sections of Interstate 880, would be covered with water.

-- The Richmond Parkway and parts of Richmond and San Pablo are vulnerable to rising bay water, as is the enormous West County landfill.

Areas of greatest risk

The new maps showing a 1-meter rise shouldn't be used for specific planning purposes, the bay agency's representatives say, although the maps indicate which regions of the shoreline are at the greatest risk of incremental inundation.

Just how fast or how high the oceans might rise in the coming decades are points of uncertainty among climate scientists. Most models don't take into account the recent increasing rate of melt in Greenland and sloughing of ice in western Antarctica. Nor can they project with much confidence the amount of expansion of ocean waters as they warm. At this point, models show a range of rise from 0.5 meter to 5 meters by 2100.

The problems for a metropolitan estuary are enormous. Topping the list is saltwater flowing up into the Sacramento-San Joaquin River Delta, where pumps send fresh water to two-thirds of Californians. Homes, businesses, highways, groundwater and wetland habitat would be flooded.

Sea water would inundate dozens of industrial and municipal wastewater systems ringing the bay, disrupting treatment. Another worry is old shoreline dumps and military installations that could leak biological and chemical contaminants into the bay if soaked.

"Since the bay isn't going to rise over night, the landfill owners can extend dikes, as well as design for flood control, as part of a maintenance program," said Curtis Scott, chief of the ground water and waste contamination division of the San Francisco Bay Regional Water Quality Control Board.

For example, bay waters would lap up around the big West County landfill off Richmond in the event of a 1-meter rise. The owner, Republic Industries, already has dug down into the bay and built walls around it. The wall could go higher, Scott said.

Lila Tang, the regional board's division chief of wastewater permitting, said municipal and industrial wastewater treatment plants are at risk because they're generally at the low spots on the edge of the bay.

Difficult solutions

Protecting them "isn't as simple as building a berm or seawall around a sewage treatment plant," she said. "If the bay water rises, the operators would have to install additional pumping capacity to force the treated water out to a higher bay." Other problems would be backflow into the system or a rising groundwater table that would allow seepage into the collection system.

There are no current cost figures of what's at stake. In 1990, the Pacific Institute, an Oakland independent think tank, determined that a 1-meter rise would threaten $48 billion in residential, commercial and industrial property. Constructing new levees and seawalls, raising buildings, freeways and railroads and replenishing beaches, according to the estimates then, would exceed $940 million with $100 million a year to maintain.

Officials from the bay conservation agency and the Pacific Institute are seeking funds to conduct a study to identify real estate, infrastructure and natural resources at risk, and calculate the costs.

Perhaps hardest hit would be the South Bay and Silicon Valley, where government agencies and property owners have started to look at ways to reduce flooding. Some parts of Santa Clara County have dropped 14 feet as the ground sank when groundwater was pumped from the 1940s to 1960s. Agricultural lands in the North Bay and delta islands have also dropped.

The U.S. Army Corps of Engineers is poised to play a part in levee construction, and is conducting a study of South Bay shoreline flood-control with agencies including the Santa Clara Valley Water District. The work will be done in conjunction with the major transformation of some 15,000 acres of salt ponds into tidal marsh.

Few fears for sports teams

Some businesses are more concerned than others. Forty-niners spokeswoman Lisa Lang said the team owners "are aware of the predictions and the many variables associated with them" at a Santa Clara site under consideration for a new stadium. But she said the owners believe that if the site is feasible, "it will provide decades of enjoyment for our fans."

The Oakland A's plan to build a ballpark in Fremont at one of the sites at risk of rising tides. Team spokesman Jim Young has said that if the owners thought the water was a problem, they wouldn't be going ahead with planning for a Fremont park.

Officials at the NASA Ames Research Park on Moffett Field are actively working with the Corps of Engineers and others to plan levee protection from sea-level rise, said Sandy Olliges, deputy director of the environmental office. Already home to dozens of businesses, nonprofits and universities, NASA Ames is planning to build the world's largest concentration of high-tech companies, including the Google campus.

But few of California's coastal cities and counties have taken action to prepare for rising tides, said Susanne Moser, a research scientist at the National Center for Atmospheric Research in Boulder, Colo., who surveyed 300 planners, public works engineers and other officials from city and county governments

last year.

Only one city, Berkeley, and two counties, Sonoma and San Luis Obispo, had in place some plan that considers the effects of global warming. San Francisco, Alameda, Palo Alto, Solana Beach (San Diego County), Goleta (Santa Barbara County) and the counties of Contra Costa, Marin and Humboldt are preparing plans.

The officials who haven't acted blamed lack of money, staff and support from the state and federal governments, as well as the press of other obligations.

It's difficult for local officials to plan given the uncertainty of how much sea levels will rise, said Harvard University Professor John Holdren, president of the American Association for the Advancement of Science, who is in San Francisco for the group's annual meeting.

But he said a new report expected next month from the United Nations will proclaim that "prudence requires not building close to the shoreline in the future."

Learn about climate change

Discussions of climate change and other events will be held at a free Family Science Day today in San Francisco that is part of the annual meeting of the American Association for the Advancement of Science. The programs will be held in the Yosemite Room of the Hilton San Francisco, 333 O'Farrell St., between 11 a.m. and 5 p.m. For more information, go to aaasmeeting.org.

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