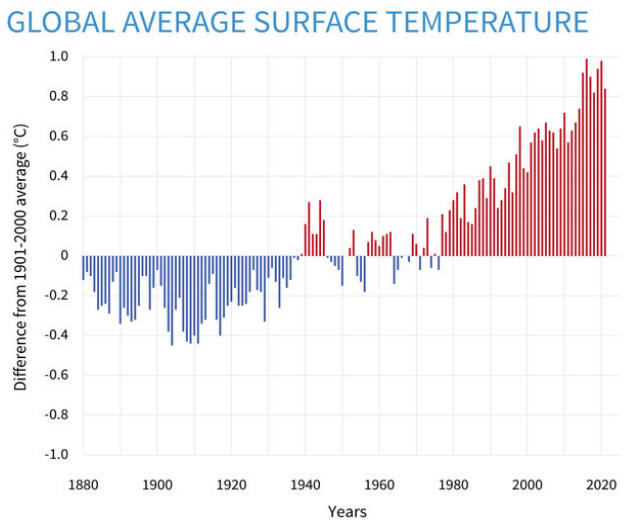
Global warming and sea-level rise for the Bay Area (for 2022-3 King Tides)

Global warming worldwide: Since the late 19th Century, Earth's surface temperature has risen close to 2 º F (1.2º C), with rates increasing (right). Evidence is overwhelming that this is due to human activities that release greenhouse gases – mainly carbon dioxide and methane. These reflect infrared energy back to earth, forming a heat-trapping blanket around our planet.



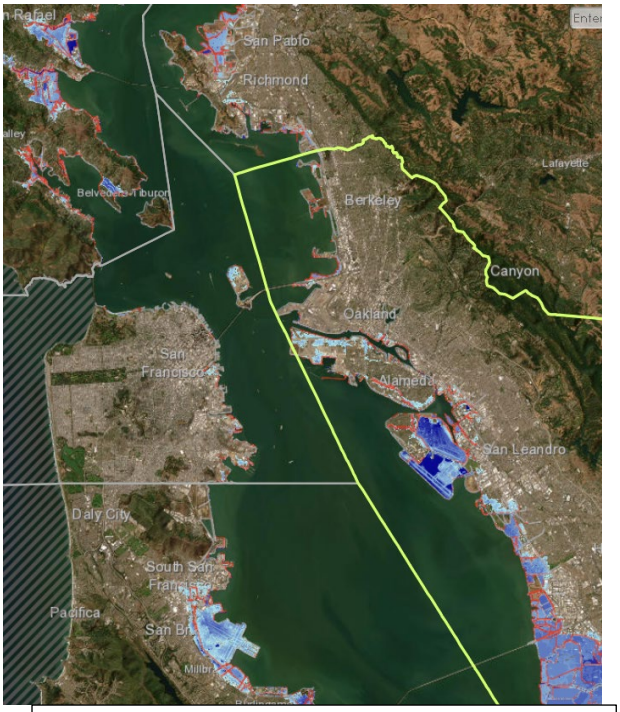
The effects of warmer air, land, and sea include melting glaciers and ice caps; sea-level rise (from melting ice and expanding warmer water), more-acidic ocean water (as oceans absorb more CO2), loss of snow cover; larger storms, changing rainfall patterns, and increased drought effects due to warmer earth and air. Heat also can directly harm plants and animals, including people.

Warming in the Bay Area: For the Bay Area, likely effects – most of them occurring now --include stronger storms, longer and more extreme hot spells and droughts, more and fiercer wildfires, less fog, uncertain water supplies due to lessened and earlier snowmelt, and change and loss in plant and animal communities. As offshore waters become more acidic, sea life from microscopic floating creatures to clams, oysters, and crabs are less able to form shells.

Economic, social, and public-health effects could include dangerous heat waves and new epidemics; decline of agriculture ; and destruction of recreational areas and infrastructure. Transportation, utilities, industry, and hazardous-materials sites are concentrated along shorelines, as are low-income communities, adding flooding to the other ways global warming is likely to affect them, including heat, job loss, and air pollution.

Bay Area sea-level rise, perhaps the most visible and costly effect of global warming here, is now projected at an additional from ½ to 2-3 ft. by 2050 and 2 to 6-7 ft. by 2100 (after a rise of about 8" since 1880).

Online maps let you explore likely effects of sea-level rise under various storm and tide conditions. For example, the map at right shows Central Bay coastal flooding plausible less than 30 years from now (**closer look available using resources, below.)**



BCDC Bay Shoreline Flood Explorer , 3' sea level rise at a King Tide. Blue=coastal flood.

Adapting to this level would cost from $315 to $570 million yearly, by official estimates. An edge in funding is Measure AA, the regional parcel tax for shoreline restoration and adaptation, passed overwhelmingly by voters in 2016. But much more would be needed.

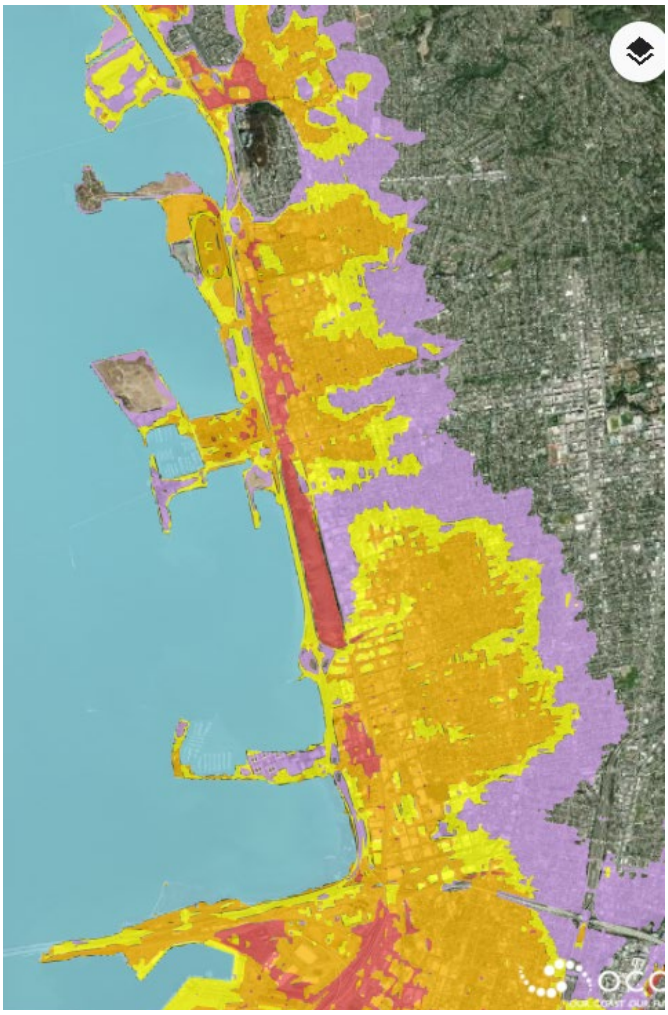
Coping also would demand unprecedented cooperation among hundreds of local agencies, and a radical speedup of the stately pace of decision making and permitting.

Scattered physical projects have begun, such as levees at Foster City, built on sinking landfill. Ground has been broken on a massive Santa Clara bayfront levee.

More progress has been made in planning. The Metropolitan Transportation Commission, Association of Bay Area Governments, and Bay Conservation and Development Commission have adopted plans, policies, and recommendations (see resources).

One attempt is to neighboring local governments facing similar physical challenges into collaborating units. The flood-endangered South Bay is home to two such collaborations: one from San Francisco Airport south to San Mateo, another from Menlo Park to East Palo Alto. In Alameda County, 30 entities around San Leandro Bay, including Oakland Airport, Alameda, Oakland, and San Leandro, are meeting to try to collaborate on flooding threats. Berkeley, Albany, and Richmond to Point Richmond, grouped as the "East Bay Crescent," face less coastal flooding and are not meeting.

For this East Bay Crescent, including El Cerrito, a bigger threat is rising groundwater, which almost no agency has begun to deal with. Levees and tide gates can't stop this seepage. The map at right **very roughly predicts, and may overestimate,** these effects, such as adding to flooding (red area) and disrupting roads, utilities, and building systems by bringing water very close to the surface (gold and yellow areas). Saltwater seeping inland can kill or transform vegetation and corrode pipes and other infrastructure. Many affected areas house low-income communities. New but incomplete maps (see sources) probably are more accurate but show how much more we need to know**.**



Our Coast Our Future Hazard Map, rough estimate of possible groundwater levels in 2030. Red = above ground surface. Orange & yellow = very shallow

Throughout the Bay, sea-level rise threatens animal and plant communities. The ring of development around most of the Bay leaves them nowhere to go.

Many regional adaptation ideas focus on so-called nature-based solutions – chiefly using sediment to build up marshes and low "horizontal levees." These can absorb wave energy and lessen erosion, at least for a time. They also can preserve the wetlands vital to wildlife.

Although Bay fill has again been legalized because of the threat of rising seas, such projects require almost unimaginable amounts of sediment – which the Bay already lacks, due to dams and depleted rivers. Despite decades of agency talk about collaboration and streamlining, projects remain few.

Here are some sources that can help us understand, track, and contribute to the effort required:

- Metropolitan Transportation Commission, Plan Bay Area 2050
- Bay Conservation and Development Commission, Adapting to Rising Tides, This includes the Bay Shoreline Flood Explorer , source of the map on the preceding age. You can see great detail and many variations on line. It also includes the San Francisco Estuary Institute's Adaptation Atlas, and Bridging the Gap, estimates costs and possible funding,
- Our Coast our Future's Hazard Map, from Point Blue and NOAA, a beginning attempt to show effects on groundwater
- Sea Level Rise and Shallow Groundwater Maps, from San Francisco Estuary Institute and Pathways Climate Institute, just-released, incomplete, but probably more accurate map for Alameda, Marin, San Francisco, and San Mateo Counties only.
- Baylands and Climate Change: 2015 update to the pioneering 1999 Baylands Habitat Goals Project.
- May 2022 talk by Warner Chabot, Exec. Dir. of San Francisco Estuary Institute.
- *Knee Deep Times*, Nonprofit online news on Bay Area climate change, independent but established and supported by regional planning agencies. Good info also in *Estuary News* and *Pearls from the Estuary* (although these are agency funded and not likely to criticize government), and *Bay Nature*.

Background for 2022-23 King Tides Walks from Friends of Five Creeks, fivecreeks.org, f5creeks@gmail.com. Suggestions and corrections welcome!