



## Rising Groundwater: *Flooding from Below*

*Jen Kalt, Humboldt Baykeeper Director*

In June, Humboldt Baykeeper received funding from the California Environmental Protection Agency to prioritize contaminated sites around the bay that are most at risk from rising sea level and groundwater. We first began assessing the risks to contaminated sites due to flooding and erosion from sea level rise in 2012. But rising groundwater is also a concern, since it will likely impact low-lying areas around the bay before they are affected by surface inundation.

Rising groundwater can damage building foundations and underground pipes that carry water, sewage, stormwater, and natural gas. It can also mobilize toxic compounds from contaminated groundwater and soil into adjacent areas, impacting human health and the environment. Rising groundwater can cause saltwater intrusion that affects drinking water and irrigation wells. It can kill salt-intolerant plant communities and reduce the productivity of agricultural lands. And rising groundwater can increase the chances of soil liquefaction during an earthquake or flooding during major rainstorms.

Adapting to sea level rise is not just a matter of managing the horizontal movement of the ocean. As the sea rises, salt water pushes further inland, infiltrating groundwater as well as inundating the shoreline. Rising sea level causes groundwater to rise, since fresh water is lighter and floats on top of denser saltwater. The rate at which groundwater rises depends on soil permeability, proximity to stream channels and wetlands, and the current depth of the groundwater table. Rain also temporarily increases the elevation of the water table. Around Humboldt Bay, groundwater often rises to the surface in low-lying areas in late winter. Known as emergent groundwater, these seasonal freshwater ponds are a common sight in the diked



Shallow groundwater combined with extreme high tides and lots of rain can cause flooding in coastal areas. As sea level rises, groundwater will also rise, increasing flooding and potentially mobilizing contamination groundwater off-site and into adjacent waterways. Photo by Brian Powell for the Humboldt Baykeeper King Tide Photo Initiative, Dec. 13, 2012.

former tidelands between Arcata and Eureka.

We need to do all that we can to reduce greenhouse gas emissions to slow the rate of climate change. But even if we could cut all emissions tomorrow, the ocean will continue to rise for decades. Coastal communities like ours must figure out ways to live with rising water levels.

Seawalls seem like a simple although expensive solution, but they can't stop rising groundwater, which would have to be pumped out. In some cases, relocating roads, wastewater treatment facilities, and other critical public infrastructure will be necessary in the long-term. Perhaps in some areas, elevating existing structures would help in the short-term, but eventually access roads will be flooded, toilets won't flush, and drinking water and power lines won't function unless they too are redesigned.

Contaminated sites need to be remediated before they are affected by rising groundwater. The goal of our current project is to identify the most vulnerable sites along with other factors. One important factor to consider is whether contaminants moving off these sites are likely to impact human health or the environment, including Humboldt Bay and its tributary streams.

Over the next year, we'll be consulting with the Wiyot Tribe, scientists, planners, landowners, and others to incorporate their input. Once the study is complete, the findings will guide remediation plans for the most at-risk sites, as well as potential restoration or redevelopment.

### HUMBOLDT SEA LEVEL RISE

According to the California Ocean Protection Council, sea level in the Humboldt Bay area is expected to rise as much as 1 foot by 2030, 2 feet by 2050, and 3 feet by 2060 – approximately twice as fast as in most of the California coast. That's because tectonic activity is causing the ground beneath us to sink at the same rate as sea level is rising, effectively doubling the relative rate of sea level rise.

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#### Rising Groundwater

Higher ocean water levels force up the water levels underneath the ground, leading to flooding, saltwater intrusion into fresh groundwater supplies, and toxic contamination by carrying hazardous materials to the surface.