The Sea Also Rises

Background

> *"Recent estimates of sea-level-rise . . . indicate Humboldt Bay has the highest sea-level-rise rate . . . in California, greater than both global and regional sea-level-rise rates, due to land subsidence in and around the bay. This suggests that global sea-level-rise will impact the Humboldt Bay area faster than other parts of the U.S. West Coast."*[1]

The above quote from *California's 4th Climate Change Assessment* was made possible by the impressive and commendable work of local scientists, engineers, environmental consultants, and professional public planners. These "coastal professionals" have published several studies and reports relating to the timing and adverse effects of sea-level-rise (SLR) to the infrastructure and communities surrounding Humboldt Bay. What's most impressive is this library of documents dates back a decade and is a testament to the forethought and proactive planning undertaken by this group of concerned coastal professionals.

Their efforts have not gone unnoticed. Through public workshops and presentations over the years, more and more community members have taken an interest in the subject of SLR. Last year alone it was the subject of the third day of the Humboldt Bay Symposium. A non-random public survey conducted in 2021 by the County Planning Department found 62% of respondents feel they are moderately to extremely well informed about SLR around Humboldt Bay. In addition, Cal Poly Humboldt (formerly Humboldt State University) has established the Sea Level Rise Initiative (SLRI) to develop a depository for current and future SLR research.

All this activity came to the attention of the Humboldt County Civil Grand Jury (Grand Jury). Upon investigating the topic of SLR around Humboldt Bay the Grand Jury became convinced that, although slow, SLR must be planned for and mitigation efforts developed now to protect communities and infrastructure. This was made abundantly clear when, during a presentation by a CalTrans official, it was noted that from conception to completion the Willits bypass project spanned forty years.

The Grand Jury is aware that other areas of Humboldt County will also experience the effects of SLR. However, we limited our investigation to the adverse effects SLR poses to the communities

[1] *California's Fourth Climate Change Assessment: North Coast Region Report,* 2018: p.27
www.ClimateAssessment.ca.gov

and infrastructure surrounding Humboldt Bay. After all, this is the well-researched area and the most threatened shoreline on the West Coast.

Summary

For more than a decade local coastal professionals have studied the future impact of sea level rise (SLR) around Humboldt Bay. Their work, documented in several reports available since 2015, indicate that a two-foot increase in Humboldt Bay's shoreline will be possible by 2050 and a three-foot rise may occur as early as 2070. During the past several years these researchers conducted numerous workshops and presentations to inform the public about the threat of SLR to the communities, infrastructure, and environment surrounding the bay.

These outreach efforts have been successful. The public interest in SLR inspired the Humboldt County Civil Grand Jury to investigate why SLR is happening, how damaging its effects will be, and what must be done to adapt to it.

Globally, SLR results from the melting of glaciers in Greenland and Antarctica and the expansion of ocean volume due to increasing water temperatures. In addition, land subsidence around Humboldt Bay increases the impact of rising seas. Humboldt Bay has a sinking land mass problem resulting in relative sea level rise greater than anywhere else on the West Coast.

With three feet of SLR around Humboldt Bay, the unincorporated communities of King Salmon and Field's Landing will experience significant monthly flooding. Fairhaven/Finntown will see its septic tank systems fail. In addition, three feet of SLR will affect:

- The only access road to King Salmon
- PG&E's Humboldt Bay Generating Station and the interim spent nuclear fuel site
- Highway 101 as it traverses South Bay, Elk River Slough, and Arcata Bay
- Highway 255 on the Mad River Bottoms
- Approximately 12 miles of railroad and the current and future sections of the Humboldt Bay Trail within the Humboldt Bay Area Plan (HBAP) planning area
- Approximately 9.6 miles of municipal water transmission lines
- The Truesdale pump station, seven wastewater lift stations, and 10.5 miles of sewer lines
- 30 electrical transmission towers and 113 transmission poles
- Sections of the South and North Jetties (867 ft. and 1,214 ft. respectively)
- Three of the 10 bulk cargo/commercial docks
- Several contaminated sites, including former pulp mills (Simpson in Fairhaven, Sierra Pacific in Manila) and former Southern Pacific Railyard (Arcata)
- 52 Wiyot cultural sites

The above list shows the scope of the problem SLR presents. Coastal professionals who have studied SLR recognize that the many entities responsible for addressing this issue must collaborate on implementing solutions. This was confirmed in a recently conducted survey of 107 coastal professionals in which 95% agreed that collaboration was essential. For example, reinforcing a shoreline dike in one section of the bay is not a solution if a neighboring dike crumbles from poor maintenance, allowing bay water to inundate the area these dikes are designed to protect.

In September 2022, the conclusion of a study conducted by the County's Planning Department is expected to recommend the collaborative approach that should be pursued to address SLR around Humboldt Bay. It may be as simple as an informal working group or as formal as a newly created regional agency. Whatever recommendation is forthcoming, the Grand Jury recommends it should be established as soon as possible due to timing and cost factors.

All projects planned along California's coast require permits from regulatory agencies. Depending on the project, multiple permits are often required. These take time (often years) and are a common complaint among planners and project engineers. In addition, SLR mitigation and adaptation projects are extremely costly. Therefore, the Grand Jury recognizes that our locally elected state officials should be asked to help expedite our SLR plans and assist the County in securing funding from all available sources: state, national, and non-profit foundations.

The Grand Jury believes SLR planning needs to be a priority among all elected officials in the County. The County of Humboldt; the cities of Arcata and Eureka; and the Humboldt Bay Harbor, Recreation, and Conservation District should formally state their immediate and continuous support for, and commitment to, SLR mitigation and adaptation efforts.

Glossary

Terms:

Adaptation: Adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which minimizes harm or takes advantage of beneficial opportunities.
Coastal professionals: Individuals in careers related to coastal and ocean issues: scientists, educators, engineers, environmental consultants, professional public planners, and public employees in state agencies that are responsible for the protection of California's environment.
Hydrologic Unit: a surface drainage area or a groundwater basin or a combination of both.
Inundation: Inundation as used in this report is a form of tidal flooding. Intertidal areas are those lands above the lowest tide and below the highest tide elevations that periodically experience tidal inundation. Areas that are below the lowest tide elevation are submerged lands, and thus are permanently inundated.

King Tide: The highest predicted high tide of the year at a coastal location. It occurs when the orbits and alignment of the Earth, moon, and sun combine to produce the greatest tidal effects of the year.
Mean sea level: The average relative sea level over a period, such as a month or a year, long enough to average out transients such as waves and tides.
Relative sea level: Combination of regional sea level measured by a tide gauge and the vertical land motion of the land measured with GPS.
Sea level: The height of the ocean relative to land; tides, wind, atmospheric pressure changes, heating, cooling, and other factors cause sea level changes.
Storm surge: A rise above normal water level on the open coast due to the action of wind stress on the water surface. Storm surge resulting from a hurricane also includes the rise in water level due to atmospheric pressure reduction as well as that due to wind stress.
Subsidence: Sinking or down-warping of a part of the earth's surface; can result from seismic activity, changes in loadings on the earth's surface, fluid extraction, or soil settlement.
Tectonic: Of or relating to the structure of the earth's crust and the large-scale processes that take place within it.
Thermal Expansion: The process whereby water increases in volume due to an increase in temperature
Tidelands: Lands which are located between the lines of mean high tide and mean low tide.
Vulnerability: The extent to which a species, habitat, ecosystem, or human system is susceptible to harm from sea level rise impacts. More specifically, the degree to which a system is exposed to, susceptible to, and unable to cope with, the adverse effects of sea level rise, and tidal extremes.

Acronyms:

CCC: California Coastal Commission
CDP: Coastal Development Permit
HBAP: Humboldt Bay Area Plan
IPCC: Intergovernmental Panel on Climate Change
LCP: Local Coastal Plan/Local Coastal Program
NOAA: National Oceanic and Atmospheric Administration
OPC: Ocean Protection Council
SLR: Sea Level Rise

Methodology

The Grand Jury conducted interviews with individuals knowledgeable on the subject of SLR in Humboldt Bay. They included professional public planners from Humboldt County, Arcata, and Eureka; officials from Humboldt County, the Humboldt Bay Harbor, Recreation and Conservation District, The Coastal Commission, The Coastal Conservancy; environmental consultants; scientists; a tribal representative; the director of a local non-profit organization; and a state legislative analyst.

The Grand Jury also read SLR related reports and powerpoint presentations published by and for the County since 2015 as well as news reports on the current status of worldwide climate change.

Discussion

Climate change due to global warming has already caused severe wildfires, droughts and storms. SLR is less obvious today but will be just as destructive in the years to come. (See the appendix for a discussion of the latest climate change predictions.)

The National Oceanic and Atmospheric Administration (NOAA) earlier this year claimed "*by 2050, moderate (typically damaging) flooding is expected to occur ten times as often as it does today . . .*"[2] And, climate scientists in all disciplines agree that the question is **not** if sea level will increase to a certain height, but when. Therefore, it is useful to begin our discussion with the science behind SLR.

The Science of SLR

Sea levels are rising worldwide. This is due to increasing global temperature. The rise in global temperature contributes to rising sea levels in two different ways: 1) the melting of glaciers and ice on land which adds more water to the oceans; and 2) the thermal expansion of water due to an increase in water temperature.

The movement of tectonic plates can increase, decrease or have no impact on the way SLR is experienced in a given area. If the area being measured is on a tectonic plate that is being uplifted, i.e. Crescent City, relative sea level rise will be reduced. In areas where the tectonic plate is subducting, i.e. Humboldt Bay, relative sea level rise will be increased due to subsidence, i.e. the lowering of the ground level. Subsidence may also occur by the land sinking due to the

[2] "2022 Sea Level Rise Technical Report". *National Ocean Service*.

compaction of soil caused by the weight of buildings and other development, as well as by mineral and water extraction.

Most people think of SLR as a problem when barriers get overtopped. They often overlook inundation that occurs when water seeps through the barriers. Few realize that even with well-maintained barriers, sea water will permeate through the barriers and intrude into the ground water on the other side. This process is known as salt water intrusion and must be considered when protecting our threatened areas.

SLR Projections for Humboldt Bay: 2000-2100

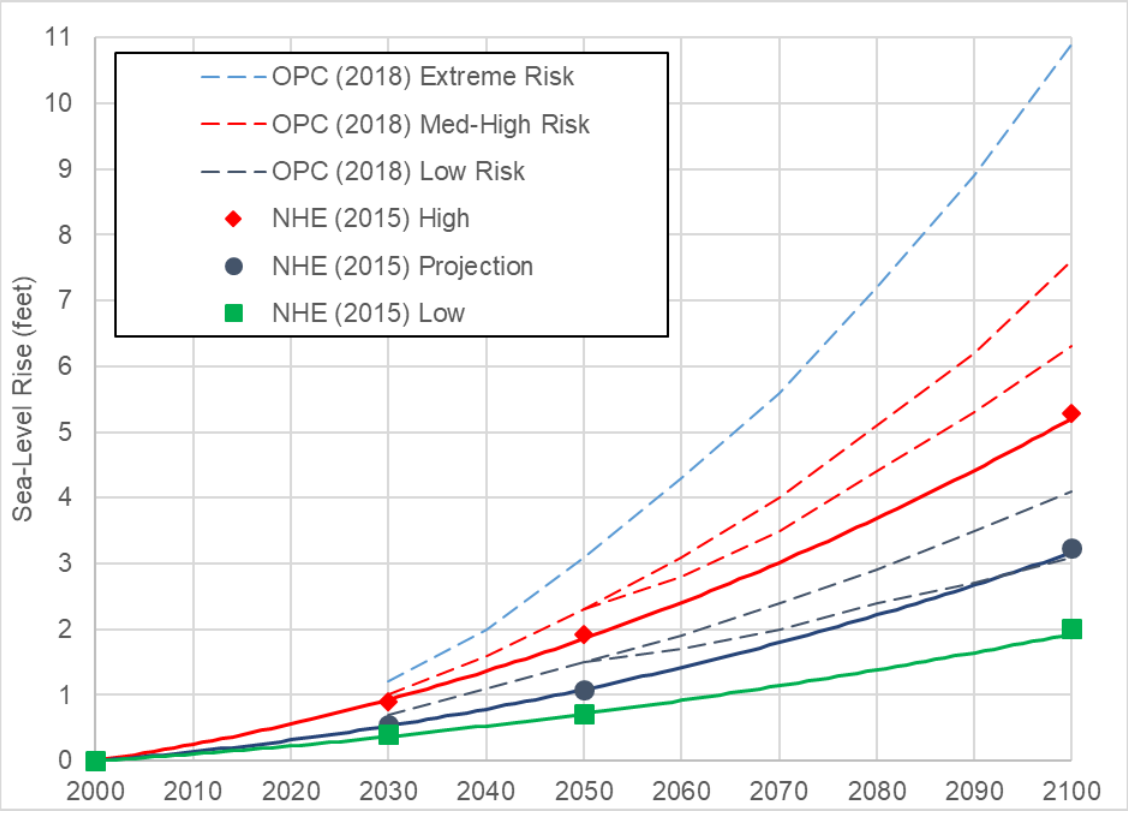

Figure 1 (above) is a combination of data developed by Northern Hydrology and Engineering in 2014 based on the science available at that time and prediction data from the Ocean Protection Council in 2018 (note, SLR is measured in feet).

Vulnerabilities[3]

The expected impacts of SLR throughout Humboldt Bay include such things as shoreline breaching and overtopping, backwater effects in tributaries draining into the bay, reduced efficiency of shoreline water control structures, rising groundwater levels, and saltwater intrusion.

Seventy-five percent of Humboldt Bay's shoreline (77 miles) is artificial. 41of those miles are earthen dikes and 11 miles are railroad beds. These were constructed between 1890 and 1915. Of those 41 miles of earthen dikes, only 11.7 miles are fortified. Salt marsh plains (natural shoreline infrastructure) can reduce wave energy and therefore offer protection to shoreline structures such as dikes. There are 18.1 miles of natural shoreline with attached salt marsh plains which represents 44.5% of the diked shoreline.

When breached, the 25.7 miles of highly vulnerable shoreline structures will expand the tidal inundation footprint of Humboldt Bay by 52% or nearly 9,000 acres. Breaching of dikes has already begun partially due to lack of, or deferred, maintenance. King Tides have also been a contributor. In addition to the dikes, there are 62 tide gates whose effectiveness can be compromised by rising sea levels. Areas impacted the most will include the Eureka Slough (7.13 miles), South Bay (5.1 miles), Mad River Slough (4.4 miles) and Arcata Bay and its railroad shoreline (4.0 miles).

Dike overtopped during a King Tide inundating lands on South Bay[4]

[3] Data in this section comes from: *Humboldt Bay Area Plan:Sea Level Rise Vulnerability Assessment,* 2018
[4] Photo by Aldaron Laird

There are approximately 11.4 miles (28%) of the 41 miles of diked shoreline that are vulnerable to being breached with 2.0 feet of SLR. That would increase to 23.4 miles (57%) with 3.0 feet of SLR.

Humboldt Bay's landmass is subsiding at a rate of 0.14 inches per year[5] at the North Spit and sea level is rising due to glacial melting and the thermal expansion of water. The Grand Jury believes immediate action must be taken. The longer we wait, the greater the adverse effects of SLR.

Three shoreline communities are presently being impacted by the increases in SLR. They are the unincorporated areas of King Salmon, Fields Landing and Fairhaven/Finntown. High tides and especially King Tides are impacting King Salmon and Fields Landing, causing flooding and damage. Fairhaven/Finntown are not yet impacted by tidal actions, but because they do not have a wastewater treatment plant and instead rely on septic and leach field systems, they are finding those systems become nonfunctional at very high tides. Property values within these communities are suffering because of these impacts.

Other areas impacted by a three-foot rise in sea level were listed in the summary section above. Due to the number and importance of these items, the list is repeated here:

- The only access road to King Salmon
- PG&E's Humboldt Bay Generating Station and the interim spent nuclear fuel site
- Highway 101 as it traverses South Bay, Elk River Slough, and Arcata Bay
- Highway 255 on the Mad River Bottoms
- Approximately 12 miles of railroad and the current and future sections of the Humboldt Bay Trail within the Humboldt Bay Area Plan (HBAP) planning area
- Approximately 9.6 miles of municipal water transmission lines
- The Truesdale pump station, seven wastewater lift stations, and 10.5 miles of sewer lines
- 30 electrical transmission towers and 113 transmission poles
- Sections of the South and North Jetties (867 ft. and 1,214 ft. respectively)
- Three of the 10 bulk cargo/commercial docks
- Several contaminated sites, including former pulp mills (Simpson in Fairhaven, Sierra Pacific in Manilla) and former Southern Pacific Railyard (Arcata)
- 52 Wiyot cultural sites

[5] Patton et. al 2017

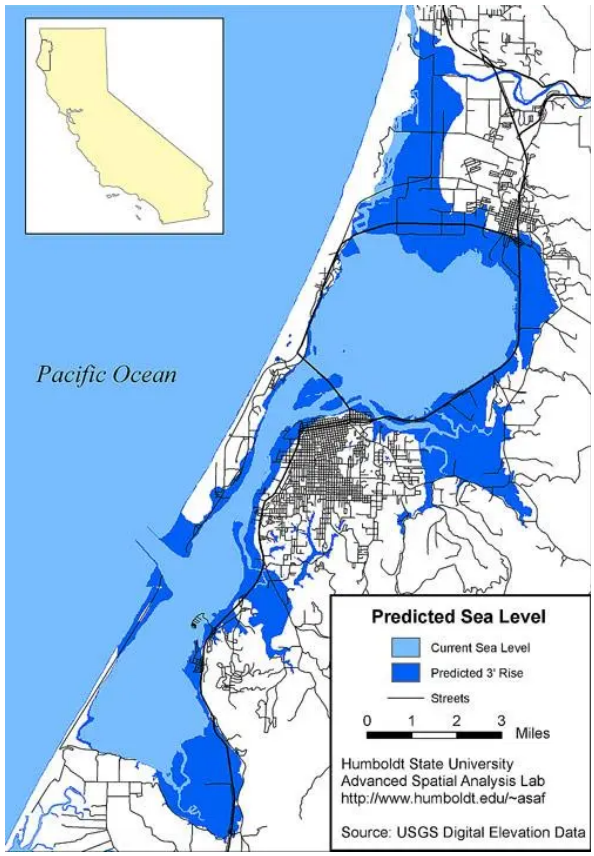

Figure 2 Predicted inundation of Humboldt Bay with three feet of SLR.

Getting Organized

There is considerable public interest in SLR. In the past two years there have been over 24 articles in local media. Staff planners at Humboldt County, Arcata, and Eureka have worked to educate the public about this issue. The Humboldt County Planning Department alone has helped fund numerous studies and held informational meetings to educate the public and all involved stakeholders. Between 2018 and 2022, the Planning Department has helped sponsor at least 22 public workshops. In June and July 2021, in cooperation with the California Coastal Commission (CCC) and Cal Poly Humboldt, the Planning Department sought feedback from people living in areas vulnerable to SLR. They conducted a non-random survey of over 500 county residents on their opinions and concerns about SLR. Almost half the participants believed SLR was now impacting Humboldt Bay and their lives.

In 2018, Cal Poly Humboldt established the Sea Level Rise Initiative[6] as a collaboration between the University and interested parties representing a broad spectrum of public and private groups

[6] www.digitalcommons.humboldt.edu/hsuslri

including tribes, academics, professionals, local government agencies, and community and nonprofit groups. Undergraduate and graduate students participate through research and reports. Along with the University library, the Initiative acts as a collection for interdisciplinary research, SLR studies, and theses.

The SLR Initiative also helps organize the Humboldt Bay Symposium, a public 2-3 day workshop held every two years, where the general public can learn about the latest developments on a variety of current issues related to the Humboldt Bay ecosystem from a collaboration of local parties. The 2021 Symposium titled "Sustainable Blue Economy" devoted its entire third day to the issue of SLR.

The Osher Lifelong Learning Institute (OLLI) at Cal Poly Humboldt has held a series of classes on SLR led by Aldaron Laird and Jerry Rhode. They were so popular that OLLI created a Special Sea Level Rise Interest Group that meets monthly.

Humboldt County is fortunate to have a variety of nonprofit organizations also involved with the issue of SLR. These organizations all have dedicated staff and volunteers to bring public awareness to this subject. Included in this group are Humboldt Baykeeper, Northcoast Environmental Center, Friends of the Dunes, Friends of the Arcata Marsh, and the Surfrider Foundation.

In February 2020, the Humboldt County Planning Department received a grant for $100,000 from the CCC for the *Humboldt Bay Sea Level Rise Regional Planning Feasibility Study.* This study will be completed by September 30, 2022. According to the grant proposal, the goal of this project is *"... to develop options for SLR adaptation planning in the Humboldt Bay region that will foster a cooperative and coordinated regional approach to the identification, funding and implementation of various SLR adaption (protection, accommodation, and retreat) policies, strategies, and measures, with resulting regulatory and financial benefits."*[7] The study includes creating an inventory of all critical assets affected by one meter or more of SLR, a survey of the affected stakeholders, and a study of all the *"...federal, state, and local governmental jurisdictions with regulatory authority over the development or public trust responsibilities for natural resources."*[8]Among coastal professionals surveyed during the Regional Feasibility Study, 70% have an overall perception SLR is already impacting the Humboldt Bay region.

Six tidally influenced drainage areas or hydrologic units divide Humboldt Bay's 102 miles of shoreline, and these units do not correspond to jurisdictional boundaries. Each hydraulic unit has an interlocking variety of local regulatory agencies and ownership, both public and private,

[7] Humboldt County Planning Department grant application to the California Coastal Commission awarded on 11/13/2019.
[8] ibid

making cooperation difficult. But SLR adaptation and planning must consider each hydraulic unit as a whole. Treating only one area of a hydrologic unit can cause unintended damage in another section of the same unit. The eroding forest area south of Fairhaven on the North Spit is an example of erosion caused by reflective waves bouncing off the sea wall across from the entrance of the harbor.

A vast majority of our local coastal professionals agree that coordination of SLR planning and adaptation is needed. The County's Regional Feasibility Study will discuss the various ways agencies and jurisdictions can work together to implement a regional strategy. There are many regional options available. Special Districts or Joint Powers Agencies can be created. With the approval of the California State Legislature, San Mateo County created the San Mateo County Flood and Sea Level Rise Resiliency District with county-wide taxing authority to generate funds for SLR adaptation and mitigation. Another example is the San Francisco Bay Conservation and Development Commission (BCDC), a precursor to the California Coastal Act of 1976.

Partnership agreements may be written with Memorandums of Understanding and Public Works Asset Base Plans. An existing agency, like the Humboldt Bay, Harbor, Recreation and Conservation District, can be reconfigured to head coordinated efforts on SLR. All of these options would allow for planning and regional implementation of projects across jurisdictional boundaries. With a regional agency and approach, Local Coastal Plans (LCP) must be updated to include cooperating and complementary approaches.

Obstacles

Coastal professionals interviewed by the Grand Jury noted two major hurdles confronting attempts to combat the adverse effects of SLR: Permitting and Funding.

Permitting:

All regulatory agencies are authorized to decide what projects can or cannot be permitted in areas under their jurisdiction. Depending on the specific project, the number of permits required can be daunting and the application process complicated, expensive, and time consuming. For example, SLR mitigation projects proposed for Humboldt Bay could need permits from multiple regulatory agencies, such as:

Humboldt County Planning Department
Arcata Planning Department

Eureka Planning Department
Humboldt Bay Harbor, Recreation and Conservation District
California Department of Fish and Wildlife
U.S. Army Corps of Engineers
California Coastal Commission
US Fish & Wildlife Service
State Lands Commission
Regional Water Quality Control Boards

Of all the potential permits needed, the most difficult one to obtain is the Coastal Development Permit (CDP) issued by the CCC. The CCC is responsible for enforcing the provisions of the California Coastal Act of 1976. It has direct authority over 75% of Humboldt Bay's shoreline and can overrule permit decisions it ceded to local jurisdictions when approving their LCPs. Although the planners the Grand Jury interviewed generally find the regional CCC's local staff cooperative and helpful, the CCC as a whole is often criticized for contradictory rules; changing or adding application requirements mid-stream; returning applications to applicants multiple times for further documentation; and, after months (or years) working to satisfy the CCC's requirements, see the application denied. Therefore, a concensus exists that our local CCC staff must be active participants in the regional SLR mitigation agency created. Their input, support, and timely advice will be crucial for speeding up permit approvals.

Funding:

Most of the research to date concerning the timing and adverse effects of SLR in Humboldt Bay was funded by grants from the CCC and the Coastal Conservancy. Once a regional SLR mitigation agency is established, the political entities involved must finance its ongoing operations. Cost sharing formulas will need to be developed like those currently in place to financially support Humboldt County's Local Area Formation Commission (LAFCO).

These ongoing costs are only the tip of the iceberg. SLR mitigation projects will be extremely costly and far exceed the capacity of local agencies to self-finance. For example, it has been estimated the cost to repair or enlarge shoreline dikes could average $2 million per mile. There are 41 miles of shoreline dikes around Humboldt Bay. Also, according to a CalTrans official, the recently completed Willits bypass project alone cost $300 million.

No California coastal area can be expected to finance SLR mitigation projects without dependable sources of funding. Concerted efforts are necessary to seek out Federal, State, and non-profit foundation grants and funding. The challenge is to ensure our county gets its fair share of the funds distributed through such programs. Humboldt County will be competing with much

larger counties and regions (i.e. the San Francisco Bay area) that are sure to request a large percentage of the monies available.

The opportunities for Humboldt County to successfully compete for SLR mitigation funds are three-fold. First, Humboldt Bay has the most vulnerable SLR coastline on the West Coast and should have top priority when funds are allocated. Second, State Senator Mike McGuire is the Senate Pro-Tem leader with considerable influence. He also sits on the Senate's budget subcommittee that will allocate climate change mitigation funds so his active support for funding SLR mitigation efforts around Humboldt Bay should produce positive results. And third, a regional voice speaks louder than multiple local voices.

For these three reasons the Grand Jury was encouraged when interviewing a senior legislative analyst who is optimistic that Humboldt County is well positioned in the competition for SLR mitigation funding. For example, consider the wording in recently passed legislation.

The California Sea Level Rise Mitigation and Adaptation Act of 2021 requires the Ocean Protection Council (OPC) to create a California sea level rise state and regional support collaborative whose mandate is to determine how to allocate up to $100 million annually to support SLR planning efforts statewide. Part of section 30973(a) in the act describes the priority the collaborative must use when allocating funds:

> *"...priority shall be given to those local and regional governments that have agreed most effectively and urgently to plan for and implement actions to address sea level rise."*

Due to the decade of work documenting SLR adverse effects on the communities, infrastructure, and environment surrounding Humboldt Bay, the county is far ahead of most California coastal areas in identifying and planning SLR mitigation actions. We must establish a regional agency to speak in a unified voice when seeking SLR mitigation funding.

Findings

F1. There is significant public interest in when and how Sea Level Rise (SLR) will impact life around Humboldt Bay.

F2. The Grand Jury agrees with the coastal professionals who deal with SLR mitigation and adaptation planning who are nearly unanimous (95%) in the belief that all entities must collaborate to successfully find solutions to the adverse effects SLR poses to the infrastructure and communities surrounding Humboldt Bay.

F3. Any SLR adaptation and mitigation regional planning group will incur ongoing costs in salaries, benefits, and overhead that will require the political entities surrounding Humboldt Bay to agree to cost sharing.

F4. The costs associated with SLR mitigation efforts will be significant and will require the diligent pursuit of Federal, State, and Public funding sources.

F5. The decade of studies that defined the areas and physical assets vulnerable to SLR around Humboldt Bay by mid-century clearly indicate there is an urgency to start developing and implementing solutions.

F6. All SLR collaboration efforts will benefit by including the permitting agencies who have the final decision on whether projects may proceed.

F7. Successful SLR mitigation efforts will benefit from the full support of our local California State Senator and Assembly Member.

F8. Former industrial and other contaminated sites around the Bay are susceptible to SLR. As such, SLR could push the contamination into wetlands, creeks, and even Humboldt Bay itself, making it harder to mitigate and clean up.

F9. Research studies of SLR impacts around Humboldt Bay indicate that if no action is taken by 2050, monthly maximum high tides will overtop bay barriers and flood existing infrastructure, wetlands and low lying communities.

Recommendations:

R1. The Grand Jury recommends the Board of Supervisors, the City Councils of both Arcata and Eureka, and the Board of Commissioners of the Humboldt Bay Harbor, Recreation, and Conservation District (Harbor District) each meet and vote to affirm a commitment to adapting to and mitigating the adverse effects of Sea Level Rise, and direct their staffs to make this commitment a priority in their planning efforts. These individual meetings and commitments should occur by September 30, 2022. (F1, F5, F9)

R2. The Grand Jury recommends the Board of Supervisors along with elected officials from Arcata, Eureka, and the Harbor District form a Humboldt Bay SLR Steering Committee composed of senior members from each entity who have decision-making authority. This committee should be formed no later than December 1, 2022. (F5)

R3. The Grand Jury recommends the Humboldt Bay SLR Steering Committee direct the implementation of a regional SLR coordination entity based on the conclusions and recommendations in the *Humboldt Bay Sea Level Rise Regional Planning Feasibility Study*. The recommended approach shall be selected no later than July 1, 2023. (F2)

R4. Once the Humboldt Bay SLR Steering Committee determines the best regional approach to implement, the Civil Grand Jury recommends the regional organization chosen be formed by July 1, 2024 and include the following stated goals:

a) seek input from all major stakeholders including, but not limited to, local and county agencies, agriculture, fishermen, aquaculture, Tribal groups, owners and occupants of threatened land, regulatory agencies, environmental groups, academia, SLR consultants, PG&E, and CalTrans; (F1, F6)

b) research and aggressively seek sources of SLR mitigation funding by State, Federal, and Public programs; (F4)

c) share the operating costs (salaries and office expenses) associated with its efforts; (F3)

d) triage the order in which mitigation/adaptation actions can be implemented; (F5, F8)

e) analyze the low-lying communities of King Salmon, Fields Landing and Fairhaven/Finntown and develop a planned retreat process for these threatened areas or find ways to successfully save them; (F5, F9)

f) solicit definitive input from regulatory agencies with jurisdiction over threatened areas so that implementation of mitigation/adaptation actions are not delayed by the permitting process; (F6, F7)

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g) hold semi-annual public presentations (also available on Zoom) of the organization's activities; (F1) and

h) start mitigation projects on or before July 1, 2025. (F5)

Required Responses

Pursuant to Penal Code sections 933 and 933.05, The Humboldt County Civil Grand Jury requests responses from the following bodies within 90 days:

- Humboldt County Board of Supervisors **(F3, F4, F5, F8, F9, R1, R2)**
- The Arcata City Council **(F3, F4, F5, F8, F9, R1, R2)**
- The Eureka City Council **(F3, F4, F5, F8, F9, R1, R2)**
- The Board of Commissioners of the Humboldt Bay Harbor, Recreation, and Conservation District **(F3, F4, F5, F8, F9, R1, R2)**

Invited Responses

- State Senator Mike McGuire
- State Assembly Representative Jim Wood
- Melissa Kraemer, North Coast Regional Director, California Coastal Commission:

Appendix

The California Coastal Commission's SLR guidance document published in 2015 recommended that all coastal communities use the high greenhouse gas emission projections when updating their LCPs. This report has done so when presenting the adverse impacts of SLR around Humboldt Bay.

The question in 2022 is whether or not the projections developed almost a decade ago are still valid. (As the graph on page six indicates, SLR high projections have increased between 2015 and 2018.) The 2015 Paris Accord based future SLR projections on the assumption nations would decrease their greenhouse gas emissions to limit global warming to no more than 2.0 degrees celsius (3.6°F) by 2100 and set a goal of limiting warming to only 1.5°C (2.7°F) by the

end of the century. Unfortunately, recent data suggests these goals are rapidly becoming unachievable.

In November 2021, the United Nations' Environment Program based in Nairobi issued its latest Emissions Gap Report which measures the difference between planned carbon cuts and what is actually needed to avoid devastating warming. It noted that current plans will reduce global greenhouse gas emissions by 3.2 billion tons by 2030, but emissions need to shrink another 14.3 billion tons to limit temperature rises to 2°C, and 30.9 billion tons to keep warming to 1.5°C. It said, *"plans to cut greenhouse gas emissions are nowhere near deep enough to prevent the planet from warming a catastrophic 2.7°C by the end of the century."*[9]

Then in April of this year the Intergovernmental Panel on Climate Change (IPCC) issued an alarming report on the shortfall between promised emissions cuts versus the actual reduction nations have so far achieved.[10] The report states "*projected global emissions from (national pledges) place limiting global warming to 1.5°C (2.7°F) (*by 2100) *beyond reach and make it harder after 2030 to limit warming by 2°C (3.6°F).*[11]

The report authors also claim with "high confidence" that without greater efforts by countries and corporations to cut greenhouse gas emissions the planet will, on average, be 2.4°C to 3.5°C (4.3°F to 6.3°F) warmer by 2100.

Those temperatures are alarming. Melting glaciers in Greenland and Antarctica contribute to SLR and global temperatures now are causing concern. News reports earlier this year informed us that Antarctica's ice shelves are melting. The Thwaites ice shelf, the size of Florida, in western Antarctica could disintegrate within ten years. This past March, in eastern Antarctica, which scientists thought was less affected by global warming, the Conger ice shelf, which is the size of New York City, disintegrated within days. Failing ice shelves such as these are important because they act as "bottle-stoppers" holding back the immense land-based glaciers behind them.

Lack of aggressive actions to limit greenhouse gas emissions isn't the only problem that will contribute to more frequent flooding by the middle of the next decade. Even now we are witnessing "bomb cyclones", extreme weather events like the massive storm that hit the Pacific Northwest last year resulting in major flooding.[12] And if this isn't enough, the earth has a "moon wobble" problem.

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[9] *The Week* magazine, 11/5/2021: p.9
[10] *Climate Change 2022: Mitigation of Climate Change,* IPCC, 4/4/2022
[11] ibid
[12] https://www.climatesignals.org/climate-signals/intense-cyclone-hurricane-typhoon-frequency-increase#more

News reports in 2021 informed us that the moon wobbles back and forth on an 18-year cycle. At one side of the cycle the moon's gravitational pull on oceans is stronger than the other side. We are presently in the trough of the cycle where tides are mildly affected. By 2030 we will begin witnessing the peak of the cycle when tides will be larger and stronger resulting in more flooding along the earth's coastlines.[13]

The April IPCC report tried to assure readers that all is not lost. It states, *"on technological and cost considerations alone, mitigation of emissions to limit warming to 1.5℃ (2.7℉) is feasible . . ."* However, the report goes on to say that to achieve this goal worldwide coal usage must be slashed 95%, oil consumption by 60%, and natural gas consumption by 45% by 2050. (An unlikely scenario based on the tepid effort, to date, to reduce greenhouse gasses.)

Jim Skea, co-chair of the IPCC working group, noted "there is increased evidence of climate action" referring to technologies and policies that do exist to enable sharp reductions in emissions – if the political will exists to implement them.

As examples of these promising technologies, the IPCC report mentions the increased adoption of alternative energy sources as their costs continue to decline. The report noted that between 2010-2019 the cost of both solar energy and lithium-ion batteries declined 85% and wind energy by 55% making them cheaper options than conventional energy sources in many cases.

Also noted were efforts to decrease the amount of methane gas released into the atmosphere. Methane, although less of a greenhouse gas contributor by volume than carbon dioxide, creates 30 times the greenhouse effect as carbon dioxide. Capping the release of methane from dormant oil wells and the extraction and transportation of natural gas (referred to as "fugitive emissions") would have a noticeable impact on decreasing global warming.

Other mitigation measures are being discussed with differing opinions on their feasibility and advisibility. These include such things as developing methods to extract carbon dioxide from the atmosphere, planting or replanting forests to absorb CO_2 as it is produced, and turning more acreage into the production of biofuels (vegetable matter) to burn rather than fossil fuels.

Co-chair Skea spoke for the IPCC when he said: *"It's now or never, if we want to limit global warming to 1.5℃. Without immediate and deep emission reductions across all sectors, it will be impossible."*[14]

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[13] www.npr.org/2021/07/14/1015800103/a-study-predicts-record-flooding-in-the-2030s-and-its-partly-because-of-the-moom

[14] "It's now or never: UN climate reports' 4 urgent takeaways", *National Geographic,* 4/4/2022. http://www.nationalgeographic.com

Optimists and pessimists alike will have to wait for the answer to the question of how disruptive climate change will be and how it will affect SLR in the short term and throughout this century. Meanwhile, the Grand Jury believes we should adhere to the adage: "hope for the best, but prepare for the worst".

Bibliography

"A study predicts record flooding in the 2030s and its partly because of the moon', www.npr.org/2021/07/14

Brownstein, Seth,"Ice shelf collapses in previously stable East Antarctica:", *Associated Press* (on-line newsletter), March 25, 2022 www.apnews,com

California Coastal Commission Sea Level Rise Policy Guidance, 2015/2018 *www.documents.coastal.org*

California's Fourth Climate Change assessment: North Coast Region Report, 2018 *www.ClimateAssessment.ca.gov*

"Climate Change 2022: Mitigation of Climate Change". *Intergovernmental Panel on Climate Change"(IPCC),* April 4, 2022

Gramling, Carolyn. "The Doomsday Glacier may soon trigger a dramatic sea level rise". *Science News for Students.* January 24,2022. *www.sciencenewsforstudents.org*

"Intense Cyclone, Hurricane, Typhoon Frequency Increase", www.climatesignals.org

"It's now or never: UN climate reports' 4 urgent takeaways". *National Geographic* (on-line), April 4, 2020. www.nationalgeographic.com

"News of the World", *The Week* magazine, November 5, 2021, p.9

Patton JR, Williams TB, Anderson J, Burgette R, Leroy T. 2017. *Tectonic land level changes and their contribution to sea-level-rise, Humboldt Bay region,* Northern California: 2017 Final Report. Cascadia GeoSciences, McKinleyville, CA.

"2022 Sea Level Rise Technical Report". *National Ocean Service. www.oceanservice.noaa.gov*

The following reports, and many others, are available on Humboldt County's website. www.humboldtgov.org (Search: Local Coastal Plan Updates).

Laird, Alderon, "Communities at Risk, King Salmon, Fields Landing and Fairhaven/Finntown: Sea Level Rise Vulnerability Assessment". *Humboldt County:Humboldt Bay Area Plan,* 2019

Laird, Alderon, "Communities at Risk, Strategic Sea Level Rise Adaptation Planning Report". *Humboldt County: Humboldt Bay Area Plan,* 2019

Laird, Alderon, "Diked Shoreline Sea Level Rise Adaptation Feasibility Study". *Humboldt County; Humboldt Bay Area Plan.* 2018

Laird, Alderon, "Humboldt Bay Sea Level Rise Adaptation Planning Project: Phase II Report". 2015

Laird, Alderon, "Sea Level Rise Vulnerability Assessment". *Humboldt County: Humboldt Bay Area Plan,* 2018.

"Sea Level Rise Policy Background Study". *Humboldt County Planning Department*, 2018