



## Bay Area Ecosystems Climate Change Consortium

### Responding to Sea Level Rise in the South Bay: Local and Regional Implications of Alternative Future Shoreline Configurations

#### Workshop Summary

The Bay Area Ecosystems Climate Change Consortium (BAECCC), in conjunction with the Climate Readiness Institute at UC Berkeley, convened a workshop entitled *Responding to Sea Level Rise in the South Bay: Local and Regional Implications of Alternative Future Shoreline Configurations* on September 27, 2016.

The goals of this workshop were to: (1) deepen the regional understanding about the South Bay — physical processes, geomorphology, proposed shoreline projects; (2) clarify our thinking regarding issues facing us as we plan for sea level rise, including future scenarios to be modeled to improve our understanding of regional vs. local costs and benefits, and (3) further develop the partnerships needed for collaborative planning.

The workshop explored the influence of regional and local actions on our efforts to increase South Bay shoreline resilience to sea level rise. The agenda can be viewed [here](#), along with [more information](#) regarding the goals, objectives, and background for the workshop. The workshop was attended by a broad array of scientists, managers, and other practitioners with a direct interest in sea level rise in the South Bay (see Appendix A).

The workshop included four excellent presentations that provided attendees with an introduction to the projections for sea level rise in the South Bay, some of the complexities of the physical processes that influence tidal heights, and some of the ways that our natural shorelines and our infrastructure can be modified increase our region's resilience to flooding. These presentations were:

- [Projected Inundation from Sea Level Rise in the South Bay](#) [39 MB PPTX] by Justin Vandever of AECOM. Mr. Vandever reviewed recent modeling for FEMA regarding inundation due to sea level rise, describing the physical factors forcing tides in the South Bay and the major vulnerabilities for inundation in the region.
- [Strategies for Adapting to Long Term Sea Level Rise](#) [18 MB PDF] by Professor Kristina Hill, UC Berkeley. Professor Hill reviewed possible adaptation strategies for south bay shorelines using examples from different regions, and the social and physical dynamics influencing their success.
- [Impacts of natural shoreline features on water heights at local and regional scales](#) [5 MB PPTX] by Rusty Holleman, SFEI. Dr. Holleman reviewed the flood control benefits of natural shorelines, how individual projects and sub-regional marsh complexes could influence wave heights, tidal characteristics, and sediment transport.

- [How linkages between local and regional shoreline characteristics can influence future tidal heights](#) [6.4 MB PDF] by Professor Mark Stacey, UC Berkeley. Professor Stacey reviewed in concept how local actions can create regional effects and how regional actions can set local conditions, and discuss some specific examples in the South Bay based on initial modeling results.

After a lunchtime presentation by Supervisor Dave Pine from San Mateo County (who also serves as Chair of the Governing Board of the [San Francisco Bay Restoration Authority](#)), attendees rotated through three facilitated breakout stations. At these stations participants discussed what (1) future scenarios should be prioritized for further analysis and consideration, (2) sea level rise issues should be addressed regionally as opposed to locally, (3) changes/additions are needed to a draft illustration of planned shoreline projects and the potential applications of the illustration. Each of the stations hosted wide-ranging discussions, and these are summarized below with more detailed notes available (see Appendix B).

In the future scenarios breakout, there was great interest in modeling scenarios that would demonstrate how future changes in one area of the shoreline might impact tidal heights in another. There was also interest in understanding if there are thresholds or “tipping points” in the South Bay where an additional increment of tidal height greatly increases the area of flooding. In his presentation, Professor Stacey framed two general approaches to the future, one in which we take actions to contain the growth of the Bay and one in which we accommodate the expansion of the Bay. Participants found this a useful framing for the issues, and also had many specific ideas to be investigated by modeling, including scenarios that examine:

- Maximum v. minimum wetlands restoration;
- Adaptation actions for critical infrastructure (wastewater, airports, rail and transit [especially where these linear assets also provide shoreline armoring]);
- Accommodation alternatives where we consider regional, long-term, multi-benefits of moving large shoreline assets;
- Softening hard structures (such as in Foster City) to minimize wave reflection; and
- The “patch approach” in which incremental raising of lowest points is pursued along the shoreline (piecemeal emergency repairs).

Other issues raised by participants include the impact of fluvial discharges (and the alteration of these by stormwater retention) on flooding, regional value of minor design changes in existing project plans, removal of Salt Pond Restoration Project levees (or, if breached accidentally are these levees repaired?), and discussion of appropriate time horizons for modeling (*e.g.*, 2030, 2050, 2100).

A large number of issues were identified by the breakout focusing on identifying the regional, shared agenda in relation to sea level rise. Participants noted the importance of having a shared understanding of scenarios, terms, and sea level rise projections, and an

available on-line catalog of knowledge and lessons learned from projects already completed. There was great interest in developing a coordinated permitting process possibly modeled after the Dredged Material Management Office (DMMO), and a regional monitoring program that would aggregate and share monitoring data and information, including a consistent dataset regarding the shoreline that is openly available and regularly updated (it was recognized that an independent source of funding for such a program would be required, possibly modeled after the [Regional Monitoring Program for Water Quality in San Francisco Bay](#)).

It was also noted that sediment needs for restoration and construction would benefit from regional coordination, and there is a shared need to get private entities involved in creating shoreline resiliency. Finally, there was a general agreement that shared vision about what constitutes a resilient future shoreline, including the ecological processes active and important in different sub-regions, would be valuable for the Bay Area as a whole, with some form of regional authority for moving toward this vision.

There was also a breakout group that focused on the reviewing and using the illustration of planned shoreline projects in the South Bay developed by BAECCC for the workshop (the illustration as edited by the group is found in Appendix C). The purpose of the illustration as initially developed by BAECCC was to make the point visually that a regional response to sea level rise is emerging in the South Bay based upon the actions of individual stakeholders.

There were many suggestions for adding information to the illustration, although what information to add depends upon the intended audience (could be a series of maps or information layers).

Based upon the discussion at the workshop, CRI and BAECCC are planning the following next steps:

1. Summarize the findings of the workshop and distribute them to policy makers, planners and other targeted stakeholders through web, email, webinar, or presentations.
2. Seek support from key partners to develop a design charrette in 2017 for a particular South Bay location to compare natural infrastructure/hybrid concepts with traditional engineering approaches to build resilience to sea level rise.
3. Seek partnerships and funding to work with targeted stakeholders to refine and model future regional shoreline scenarios identified in the workshop, including explicit consideration of multiple benefits (*e.g.*, ecological, flood/erosion protection, social justice) for understanding tradeoffs among scenarios, and report back on the results of the modeling to be conducted by Professor Stacey's group.

4. Explore options for convening stakeholders to outline and develop a shared regional “vision” or “principles for adaptation” that could provide regional guidance while still respecting the “bottom up” momentum that exists throughout the region.
5. Support efforts underway by regulatory agencies to advance Bay Area efforts for more efficient permitting of wetlands restoration projects.

## Appendix A: Roster of Attendees

Name	Representing
<b>Mike Connor</b>	<b>Bay Area Clean Water Agencies</b>
<b>John Bourgeois</b>	<b>South Bay Salt Ponds Restoration Program</b>
<b>Anne Morkill</b>	<b>US Fish and Wildlife Service</b>
<b>John Krause</b>	<b>California Department of Fish and Wildlife</b>
<b>Ngoc Nguyen</b>	<b>Santa Clara Valley Water District</b>
<b>Rechelle Blank</b>	<b>Santa Clara Valley Water District</b>
<b>Len Materman</b>	<b>San Francisquito Joint Powers Authority</b>
<b>Michelle Iblings</b>	<b>Alameda County Flood Control and Water Conservation District</b>
<b>Jenna Judge</b>	<b>NOAA Sentinel Site Cooperative</b>
<b>Hilary Papendick</b>	<b>San Mateo County</b>
<b>Shirley Qian</b>	<b>Capitol Corridor</b>
<b>Letitia Grenier</b>	<b>San Francisco Estuary Institute</b>
<b>Micha Solomon</b>	<b>San Francisco Estuary Institute</b>
<b>Rusty Holleman</b>	<b>San Francisco Estuary Institute</b>
<b>Louisa Valiela</b>	<b>US Environmental Protection Agency</b>
<b>Patrick O'Brien</b>	<b>US Army Corps of Engineers</b>
<b>Patrick Barnard</b>	<b>US Geological Survey</b>
<b>Laura Valoppi</b>	<b>US Geological Survey</b>
<b>Liv Herdman</b>	<b>US Geological Survey</b>
<b>Karen Thorne</b>	<b>US Geological Survey</b>
<b>Julian Wood</b>	<b>Point Blue Conservation Science</b>
<b>Maya Hayden</b>	<b>Point Blue Conservation Science</b>
<b>Laura Cholodenko</b>	<b>California State Coastal Conservancy</b>
<b>Matt Gerhart</b>	<b>California State Coastal Conservancy</b>
<b>Kelly Malinowski</b>	<b>California State Coastal Conservancy</b>
<b>Hilary Walecka</b>	<b>California State Coastal Conservancy</b>
<b>Lauren Swezey</b>	<b>Facebook, Inc.</b>
<b>Audrey Davenport</b>	<b>Google, Inc.</b>
<b>Wendy Goodfriend</b>	<b>Bay Conservation and Development Commission</b>
<b>Andy Gunther</b>	<b>Bay Area Ecosystems Climate Change Consortiu</b>
<b>Bruce Riordan</b>	<b>Climate Readiness Institute</b>
<b>Mark Stacey</b>	<b>UC Berkeley</b>
<b>Kristina Hill</b>	<b>UC Berkeley</b>
<b>Justin Vandever</b>	<b>AECOM, Inc.</b>
<b>Louis Blumberg</b>	<b>The Nature Conservancy</b>
<b>Sarah Newkirk</b>	<b>The Nature Conservancy</b>
<b>Pat Mapelli</b>	<b>Cargill, Inc.</b>
<b>Ashwini Kantak</b>	<b>City of San Jose</b>
<b>Mike Mielke</b>	<b>Silicon Valley Leadership Group</b>
<b>Dave Pine</b>	<b>San Mateo County</b>
<b>Mike Barber</b>	<b>San Mateo County</b>
<b>Glen Lubcke</b>	<b>Pacific Gas &amp; Electric</b>
<b>Naomi Feger</b>	<b>Regional Water Quality Control Board</b>

## Appendix B: Breakout session notes

### Scenarios Breakout Group -- Summary Notes

#### **General notes to consider for modeling**

- Investigate scenarios under various SLR projections
- Consider effect of an adaptation strategy in different domains (surface water, groundwater, ecological, social)
- What time horizon to model?
  - 10 year planning horizons?
  - 2030, 2050, 2100
  - Focus on thresholds/tipping points (e.g., what time horizon do you move from incremental increase in flooding to big jump in flooded area)
- Understanding relative influence of different regions of the South Bay; Differences between eastshore and westshore restoration/accommodation = consider segmenting East to West rather than North to South.

#### **Adaptation Scenario Ideas:**

1. Focus publicly funded adaptation on disadvantaged communities
  - a. Either “hard” solutions (containment protection)
  - b. Best outcome = soft/floodable solutions
  - c. Addresses financial vulnerabilities; Idea is to focus first on communities that are vulnerable to SLR/flooding and whose socio-economics/lack of resources result in low local adaptive capacity
2. Critical public infrastructure
  - Wastewater
  - Airports
  - Transportation / rail
  - Emergency services

- a. Scenario A = protect/containment
  - b. Scenario B = Move/accommodation; revisit assumptions of what can or cannot be moved
    - i. Consider Regional improvement gained from moving something we might consider too expensive from a purely local perspective, especially if multi-benefits are considered
    - ii. Consider fixed (e.g., wastewater treatment plant) vs. linear (e.g., transportation corridors) assets, especially where linear assets provide unintentional shoreline protection
  - c. Scenario C = specific to transportation, Consider effects of moving different segments of Highways – where might biggest regional gain be? What happens when the highway segment is present or not?
3. Contaminated sites – avoid accommodation into them; slurry walls
  4. Remove all South Bay salt pond levees (that are part of the SB Restoration Project)
    - a. Variation on this idea: if a breach were to happen accidentally, would you restore it or not?
  5. Soften edges (e.g., Foster City) to reduce the wave reflection impacts of hard structures
  6. Foster City rebuilt to accommodate flooding (elevated homes like those examples from K. Hill presentation)
  7. Maximum wetland restoration: Restore historic wetlands OR restore Bayland Goals recommendation of 100K acres
    - a. Look at range of sediment availability – consider end members. Incorporate marsh accretion ranges into this scenario (e.g., Scenario A might be a low accretion rate assumption, Scenario B includes high marsh accretion best case)
    - b. Consider phasing of restoration (some areas start accreting now, others won't be added to the mix until later)
    - c. What is the current benefit of present restoration? i.e., what if no restoration had been done in the past 3 decades?
  8. FEMA regulatory map as a starting point – draw a hard-line constraint
  9. Patch approach
    - a. Incremental fixing of lowest points (piecemeal emergency repairs), assume patch is of same type as existing shoreline?
  10. Explore influence of fluvial discharges – watershed-scale with upstream detention, riverine forced flooding, precipitation responses/discharges
    - a. Local watershed issue
    - b. Areas where might be accommodation = San Thomas, Calabazas, Guadalupe
  11. Small tweaks to existing planned projects (i.e., those on the “illustration”)
    - a. Provide feedback into design of current (planned) projects

- b. Would it help if we added X element to project Y?
  - c. Is it worth it to make changes?
- 12. Trade-offs – breaching certain areas sooner (based on extreme scenario showing it will eventually be flooded, so we allow accommodation sooner)
- 13. Prioritize actions depending on levee integrity



## Breakout group on regional issues/collaboration

### Group 1:

#### Needs:

- Develop quantitative objectives for SLR
  - Include explicit goals and timeframes
- Shared understanding of scenarios and maps and shared definitions of terms
- System for making policy changes and developing agreement on priorities
- Information sharing and availability from one central place
- Mechanisms for regional perspective scales up to state (and down to very local)
- Reduce duplication of parallel efforts and match needs with products
- Shared responsibility, issue of passing it among land owners, managers, and communities (represented by elected officials)
- Need a regional governing authority with ability to affect outcomes (beyond BCDC, or augmented BCDC)
- Agencies (eg. wastewater) have specific priorities, but need to pursue opportunities to leverage across agencies with co-benefits
- Regional CEQA mechanisms
- Propose functional equivalent strategies to meet goals of multiple permittees
- Clearly-elaborated, shared vision
- Shared definitions
- Catalogue of existing knowledge and lessons from projects to date
- Currently we have different rules and management strategies (for the same goal in theory), need to agree on a common strategy (eg. plant management in wetlands)
- Funding: multi-partner, leverage AA further
- Sediment: BCDC policy, sediment needs for restoration
- Build shared vision and responsibility through regional permit process
- Potential use of a DMMO (Dredged Materials Management Office) – like approach for developing coordinated permitting process.

### Group 2:

- Monitoring: program should be in lieu of permit required monitoring and should not add burden to projects
  - Tie to regional permit
  - Pay into a monitoring program
  - Responsibility on holder of regional permit, would need to investigate and define who can serve this role for SLR in the region.
  - Aggregate and share monitoring data for lessons learned, for this to be effective methods must be consistent

- Monitoring based in defined management questions with a clear purpose
- Oriented for a sustainable future
- All types of shoreline projects involved, not just restoration projects.
- Community tax levied to support project/program?
- Need a consistent dataset that is openly available and located all in one place (note to include impacts from river inputs, not just tidal/SLR)
- Two-way communication with research community and feedback for adaptive management and incorporation of data
- Other community involvement (*e.g.* businesses, environmental justice organizations)
- Provide education/outreach talking points for local agencies to communicate to communities
- Get private entities involved to fund resiliency efforts (part of “responsibility” issue)
- Use science to communicate threat/hazard to develop effective communication strategies across neighboring jurisdictions
- Shared vision needs to include watersheds and ecological processes, not just jurisdictions
- Next step: sort out problems and solutions to clarify way forward

#### Group 3:

- Tie governance to funding so that the two are linked. Potential role for SFBRA? Or other entity?
- Reduce complexity of permitting process, make it adaptable to changing conditions. Develop shared regional voice to communicate up to feds and state.
- “Vertical outreach” needed within organizations to ensure messages are translating between levels.
- Need consistent flood risk standards (FEMA may be providing some resources on this)
- Need actionable science, so need to agree on the data we use to communicate and create plans.
- Apply design criteria regionally that is based in actionable science

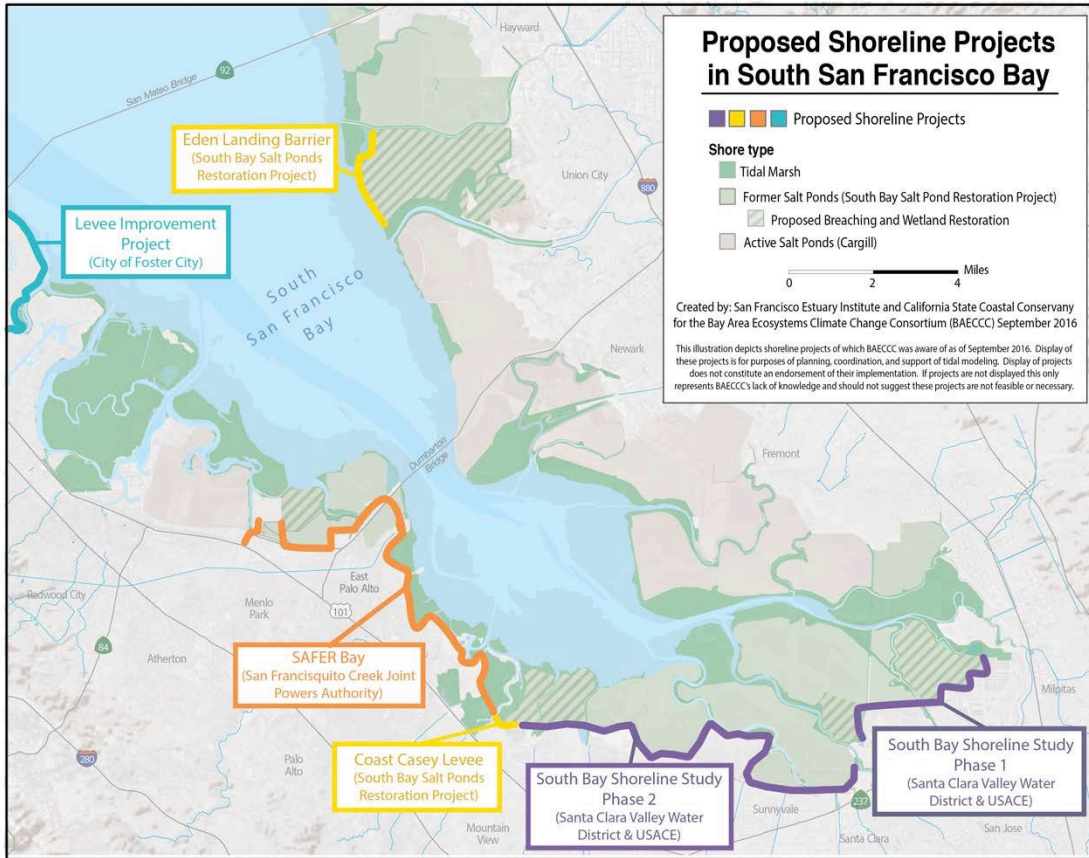
### Breakout Group #3: South Bay Illustration

- Suggestions for this map
  - Need to define what a “proposed shoreline project is”
    - Consensus that Cargill is existing and not proposed, and perhaps not qualified as “shoreline protection”, so should be removed
    - What is “shoreline”
  - If purpose of the map is to show planning projects, include more description/information about the project including:
    - What type of project (hard line not representative, not all are same)
    - Timelines and how likely they are to happen, how far along
    - Who, contact information
  - Projects to add:
    - Redwood city
    - Railroad?
    - Does it need to extend beyond S. South Bay?
- Many suggestions for additional information that could be included on map but consensus that it depends on the purpose of the map as well as audience. Could make a series of maps. Suggestions of additions to map include:
  - Ecological assets (i.e. important species)
  - Existing restoration projects (+ where practitioners see future opportunities for restoration/where it’s going)
  - Critical infrastructure
  - Ownership (public/private)
  - Public access, bay trail
  - SFEI shoreline delineation
  - Identify groundwater flooding, fluvial flooding, water supply, flood control, FIRM map, SLR areas
  - Costs of projects, understand how much \$ is needed/available
  - Materials needed (how much earth needed), timing of those projects
  - Look at connections of similar types of projects (like Stacey’s figure)
  - Stanford’s Natural Capital project
  - Add San Francisco Living Shorelines project? May affect modeling. Add subtidal projects?
  - Big \$ Map: Highlight Billion\$ companies around bay (who’s impacted). We assume public/taxpayers dollars are the ones that should pay, but show what places are at stake and how much money they have, helps to invest private \$ from those impacted.
- Applications of map:
  - Tracking decisions coming down the pipeline, looking for opportunities for shared solutions, “future plan landscape”
  - See where gaps are
  - Foundation of modeling which results would help inform:
    - Are there areas really beneficial for helping mitigate SLR
      - Help identifies important places, for instance to acquire

- Or identify where mitigation funds should go to (ex. if build levee here, have to mitigate by protecting here)
  - Identify opportunities that would remove need (ex. elevate homes for a place like foster city so don't need levee)
  - Helps people in conceptual phase—what is the right alignment?
  - Where are there more opportunities for transition zones?
  - Identify differences in E. v. W bay
- Other Observations:
  - East v. West side of Bay

## Appendix C: South Bay Project Illustration

The illustration below represents the product of discussions during the breakout session.



The most notable change from the illustration prepared prior to the workshop (found below) is the removal of the salt pond levees that are maintained by Cargill.

