



MARIN BAYWAVE PROJECT  
BAY WATERFRONT ADAPTATION  
VULNERABILITY EVALUATION

## Marin BayWAVE (Marin Bay Waterfront Adaptation and Vulnerability Evaluation): Phase 1

Project Update: Grant Agreement 15-028

August 2017

### PROJECT OVERVIEW

BayWAVE is a focused vulnerability assessment (VA) of the eastern Marin shoreline from Sausalito to the northern end of Novato. BayWAVE will evaluate the extent of impacted assets, assess the sensitivity and adaptability of selected assets and work with the local cities and towns to plan implementation of adaptation strategies. The fundamental goal of the BayWAVE project is to increase awareness and preparation for future SLR impacts by using this coordinated, multi-jurisdictional assessment.

### TASK 1- SLR MODEL SELECTION AND SCENARIO DEVELOPMENT

#### 1.1 Evaluate Available SLR Inundation Models and Recommend Model for Vulnerability Assessment

Under this task, staff will review the most commonly used models in San Francisco Bay to assess their applicability for the vulnerability assessment in Task 3.

#### 1.2 Develop SLR Coastal Inundation Scenarios for Vulnerability Assessment

Staff will evaluate a range of direct coastal flooding and storm scenarios using the selected SLR model to assess a wide range of impacts and to make a recommendation for up to three scenarios for use in Task 3.

#### 1.3 Prepare recommendations (Basis memo)

The basis for selecting the inundation model (Task 1.1) and scenarios of SLR (Task 1.2) will be sent out for review to gain input on the scenarios selected.

**Task deliverable:** Basis memo for model and scenario selection

**Status:** Complete. A Technical Group meeting was held on November 23, 2015 to discuss the models and scenarios. Two documents, *Sea Level Rise Model Comparison Memo* and *Sea Level Rise Scenario Guidance* were completed. The memo documents the selection process and the guidance sheet offers a quick summary of the sea level rise numbers and model used for others to consider in Marin to be consistent with the

Vulnerability Assessment. Additionally, a memo was written highlighting the differences between FEMA, sea level rise, and their water surface elevations to address questions from our partners on this issue.

## TASK 2- COLLABORATION WITH RELATED PROGRAMS

### 2.1 Update Inventory of Ongoing and Completed SLR Activities Relevant to Marin County.

The inventory of related programs is available on the Marin SLR website at <http://www.marincounty.org/main/baywave/sea-level-rise-library>

### 2.2 Collaborate with Other Similar Programs in the Region and Elsewhere.

Collaborate with other groups doing SLR planning and adaptation work to share information and ideas, and, where possible, divide labor to work more efficiently. Other SLR programs in the region, state, nation and the world are addressing issues similar to those facing Marin. Work on climate resilience is being conducted in San Mateo, San Francisco, Alameda, Contra Costa and Santa Clara Counties, among other areas. This work is being supported by a several agencies and organizations, including the Bay Conservation and Development Commission's Adapting to Rising Tides Program, (BCDC's ART Program) which is leading efforts in Alameda and Contra Costa Counties; and county sustainability divisions which are leading efforts in Santa Clara, San Mateo, Sonoma and San Francisco.

**Task deliverable:** Monthly County Public Works and Community Development Agency staff meetings to coordinate on local and regional SLR planning efforts.

**Status:** Ongoing, with biweekly meetings for staff and regular, ongoing coordination with both San Mateo and our Coastal Conservancy grant manager. Biweekly meetings with the Assistant Directors of both Community Development and Public Works also became regular events as the need to coordinate both departments became apparent. Meeting minutes for all meetings are available upon request.

An in-person meeting occurred on March 20, 2017 with the Executive Steering Committee and a similar group of staff, elected, and partners in San Mateo. The purpose of the meeting was to share the efforts and learn from each other. The meeting was very beneficial for Marin County and a promise was made to continue the meetings a couple times each year. A second meeting was held August 25, 2017 with San Mateo and Marin County elected officials and staff plus Coastal Conservancy staff to share the process for both programs, including the public release of the Vulnerability Assessments and to share what follows to coordinate efforts with adaptation and resilience planning.

Staff participates in a number of efforts around the state and region to better coordinate around sea level rise planning. Staff presented at the April BCDC meeting as a "Project on Parade" and shared both the bay and coastal planning efforts. Members of the Executive Committee and Chris also participated in the Climate Readiness Institute's meetings and webinars on governance issues around sea level rise. Input has been

provided for the state planning efforts around sea level rise. Staff will also participate the ART Bay Area Regional Working Group when it begins in September 2017.

### TASK 3- PRELIMINARY VULNERABILITY ASSESSMENT (VA)

Under this task, the BayWAVE program will conduct a vulnerability assessment consisting of the tasks described below, in order to establish an initial understanding of the potential SLR conditions Marin County will face in the future.

#### 3.1 Exposure Assessment

#### 3.2 Sensitivity and Adaptive Capacity Assessment

#### 3.3 Summary of Potential Infrastructure Impacts

**Task deliverables:** Identify sea level rise exposure by reach using maps. Assess sensitivity and adaptive capacity for assets and summarize potential infrastructure impacts by type and sector.

**Status:** A public review draft Vulnerability Assessment was released on April 11, 2017. The public comment period closed on May 29<sup>th</sup> and a final report was accepted by the Marin County Board of Supervisors on June 20, 2017. Internal draft review occurred in December 2016 and again in February 2017 to incorporate comments from those who contributed to the report (cities, towns, agencies, and a small group of private landowners who maintain land on the impacted shoreline).

**Outreach:** The public release of Marin’s Vulnerability Assessment occurred through 4 meetings: a presentation to the Marin County Board of Supervisors, then 3 public engagement meetings focused on a brief overview of the assessment and then a small-group opportunity to play the Game of Floods. The meetings were well-attended with over 300 people attending the 3 meetings, extensive news coverage including broadcast news and local papers covering the assessment and meetings. The public comment period is ongoing and closes May 29<sup>th</sup>.

Over 115 interviews were held in the winter and spring of 2015-6 with city, town, special districts, agencies, and private property owners to develop the content of the Vulnerability Assessment and to verify and correct inaccuracies in the model. The Executive Steering Committee met quarterly starting in October 2015 to guide the process and adjust both schedule and scope to meet the needs of the jurisdictions and local agencies involved. Beginning January 2017, the ESC meets monthly to support the release of the Vulnerability Assessment and planning for the next phase of the program. The Technical Committee met in November 2015 to agree on a model and provide input on the scenarios (see Task 1). The Policy Committee (one elected official from each jurisdiction) met in March 2016 to gain an understanding of the deliverables and schedule. Once a draft VA was developed, all the committees met in October and December 2016 to review the content and provide feedback on the messages to

prepare our communities for public release. A Communications Plan was developed including talking points and a PowerPoint slideshow to assist our committees share the efforts around the Vulnerability Assessment (VA). This plan was intended to support partners share the need, process, and deliverable to be expected from the VA.

## TASK 4- PUBLIC AND AGENCY INVOLVEMENT

### 4.1 Executive Guidance and Management

#### Executive Steering Committee

The Executive Steering Committee provides direction and guidance to project staff and the staff of their respective jurisdictions. The committee consists of two members of the county Board of Supervisors, three elected officials representing the city and town councils, and a representative each from city and county staff. The committee will meet approximately quarterly, or as major deliverables are available.

#### Policy Group

The Policy Group consists of elected officials representing each municipality in the planning area. The group includes two members of the Marin County Board of Supervisors and one city council member from each city and town.

#### Technical Group

The Technical Group supports the project by drawing upon specific expertise to advise project staff. The group provides input on deliverables and serves as a direct contact to reach the jurisdiction's staff and community at-large. The group will be made up of staff from each of Marin's 11 municipalities as well as staff representing local agencies, utilities, and special districts with responsibility of managing lands along the impacted area in Marin. These include water and sanitary districts, school, fire, PG&E, Caltrans, National Park Service, Marin Audubon, and others. Additional local and regional partners, resource agencies, and technical experts have been included in the group to provide insight on regulations, planning efforts, and scientific knowledge to support the project.

**Status:** Executive Steering Committee meetings have become monthly since January 2017 to guide the process towards the public release and develop the next phase of the adaptation and resilience planning from the information in the VA. A key outcome of the Marin process has been the relationships built with the local and regional jurisdictions that would manage or guide the adaptation process. Our committees have served this role and we have involvement from all 11 cities and towns, have local and regional agencies' input and feel we have a strong commitment from our partners to move ahead with adaptation planning.

## 4.2 Involvement Strategy and Program Development

### 4.2.1 Engage decision-makers and staff

Utilize existing meetings to get information efficiently to the bayside Marin decision-makers and staff to foster a cooperative approach to sea level rise planning. Existing forums include: Marin County Council of Mayors and Councilmembers, Marin Watershed Program committees, North Bay Watershed Association, Marin County Stormwater Program's agency staff, MarinMap, and others. Continued outreach will occur with major milestones as needed to build support and gain input on the deliverables.

**Task deliverable:** A schedule of outreach and specific target meetings for deliverables will be developed with program deliverables.

**Status:**

Staff presented to the Sausalito Sustainability Commission, the Marin County Council of Mayors and Councilmembers (MCCMC), plus another meeting to the MCCMC subcommittee on sea level rise, and the San Rafael Chamber of Commerce's Leadership Institute.

## 4.3 Public Engagement

Outreach to the community will focus on engaging all segments of the community, including stakeholders with interests in sea level rise. BayWAVE will launch a series of community meetings once the Vulnerability Assessment is complete and again when the draft final report summarizing the early actions and next steps for BayWAVE is prepared.

### 4.3.1 Low-income area focus program

**Status:** Staff met with Shore Up Marin prior to the release of the Vulnerability Assessment to walk through the report format and provide some Q&A on the public engagement process. Staff has kept the non-profit informed of grant opportunities and assisted with access to county staff and resources, when needed.

### 4.3.2 Outreach to the public

**Task deliverable:** Update the [www.MarinSLR.org](http://www.MarinSLR.org) website. Prepare information for the public (website content, fact sheets, presentations, etc.)

**Status:** Presentations have been made to the public by request. Meetings include updates to the Marin Conservation League's Climate Action Working Group (February and April), and a community meeting at the Driver's Market in Sausalito (posted on Facebook Live). The Youth Exploring Sea Level Rise Science (YESS) program supported high school students in Marin in the 2015-6 and 2016-7 academic years. There is a page on our website dedicated to the YESS program and events are posted to the public outreach page. A student intern from the Marin School of Environmental Leadership (MSEL) is working on a class project around sea level rise. Several students from Marin

Academy used the Canal’s vulnerability as a focus for a science project and presented their information at a science symposium hosted by the school.

The Youth Exploring Sea Level Rise Science (YESS) program supported high school students in Marin in the 2015-6 and 2016-7 academic years. The high school program included targeted outreach to disadvantaged communities in the Canal (San Rafael) with [a sea level rise video produced by students](#) and supported by Community Media Center Marin and Shore Up Marin staff. There is a page on our website dedicated to the YESS program and events are posted to the public outreach page.

**YESS:** <http://www.marincounty.org/depts/cd/divisions/planning/sea-level-rise/yess-youth-project>

**Public Outreach:** <http://www.marincounty.org/main/baywave/public-outreach>

**A spreadsheet tracks all our outreach efforts, both internal and external meetings and presentations and has been included as part of this final report’s deliverables.**

## **TASK 5- EARLY ACTION: FLOOD WARNINGS, ADAPTATION TOOLKIT, AND DEMONSTRATION PROJECT DEVELOPMENT**

### **Task 5.1: Develop an Early Warning Strategy**

Based upon results of the Vulnerability Assessment, this task will identify cost-effective flood warning and avoidance actions that can be implemented early in areas identified as significantly and regularly impacted under current or near-term tidal flooding conditions. This task will draw upon project work already being conducted to develop a list of potential actions and strategies to increase awareness and mitigate impacts from known locations of chronic flooding.

Examples of actions will range from relatively easy to implement and lower cost options like warning and avoidance (i.e. lane closures and increased public notification of flooding on King Tide days) to coordination with the Office of Emergency Services (OES) to identify areas for common action, including strengthening preparations for near term effects in areas susceptible to climate change-associated flooding and other hazards. An Early Warning Strategy will be part of the Marin Multi-Jurisdictional Hazard Mitigation Plan and will outline actions that may be possible for near-term and chronic flooding.

**Task deliverable:** Coordinate with the Marin County Office of Emergency Services and the Marin Multi-Jurisdictional Hazard Mitigation Plan to develop an early warning strategy with actions to increase awareness and reduce impacts for current and near-term tidal flooding.

**Schedule:** The Marin Multi-Jurisdictional Hazard Mitigation Plan schedule has been delayed and is anticipated for public release in September 2017.

**Outreach:** Staff participated on meetings for the Hazard Mitigation Planning (HMP) effort. Marin sea level rise data was provided to the Hazard Mitigation Planning effort.

for the countywide Multi-Jurisdictional Plan and specifically to San Rafael for inclusion in their first Hazard Mitigation Plan currently in development ahead of the countywide effort. An early warning system was developed and tested in the Ross Valley for winter 2016-7. This included a reverse 911 notification system and coordinated audible sirens that were sounded when the creek nears flood stage. In past years, the sirens were sounded at different creek levels and were not coordinated in the Valley, though the creek runs through the entire valley floor. This improvement involved both technology improvements, including several cameras that were accessible online and ALERT gages to notify safety officials to sound the sirens.

**Gage and Flood Safety Information:**

[http://marinwatersheds.org/flood\\_preparedness.html](http://marinwatersheds.org/flood_preparedness.html)

## 5.2 Adaptation Toolkit

Experience and research have shown that it is important for government to identify potential solutions at the same time it introduces information about serious new problems that could affect people's lives. This subtask will provide the range of potential solutions along with a description of the general benefits and constraints of the various options to begin the education process for adaptation. A first-cut assessment of the eastern Marin shoreline will be conducted to discuss the applicability of various adaptation options along the shoreline.

### *5.2.1 Summarize available hard engineering adaptation tools*

Develop fact sheets for each tool with graphics and photos to show how these tools work. Each sheet should have a rendering (like those from landscape architects) for context and a summary of benefits and constraints. Fact sheets should note any related tools that must be considered with each tool (like pump stations with levees) and the limitations given the regulatory and natural resource concerns.

### *5.2.2 Summarize available soft engineering adaptation tools*

Develop fact sheets for each tool with graphics and photos to show how these tools work. Each sheet should have a rendering (like those from landscape architects) for context and a summary of benefits and constraints. Fact sheets should note any related tools that must be considered with each tool (like pump stations with levees) and the limitations given the regulatory and natural resource concerns.

### *5.2.3 Summarize land use and policy considerations*

Provide descriptions of potential non-structural alternatives that are available, their benefits and constraints, and applicability to Marin County.

**Task deliverable:** Develop fact sheets for each engineering adaptation tool. Develop a first-cut evaluation of appropriate locations for each tool.

**Schedule:** Toolkit to be developed in coordination with the Vulnerability Assessment in fall 2016. Evaluation of locations for tools will occur in time for inclusion with a grant

from the Conservancy to San Francisco Estuary Partnership and Point Blue Conservation Science.

**Outreach:** The toolkit will be shared with the Executive Steering Committee and Technical Group. It will be a highlight of presentations to the public in understanding the adaptation measures available for rising seas. The Fact Sheets are included with this final report.

### 5.3 Demonstration Project Development

This task will summarize the outcomes of several significant efforts to prepare the Marin shoreline for adaptation to the impacts of sea level rise. The County has been a leader in SLR adaptation already implemented several studies and one completed pilot project that will pave the way for future adaptation efforts around the bay.

#### *5.3.1 Bothin Marsh / Coyote Creek “Natural Levee”- Sediment Reuse Pilot Project Feasibility Study*

The Bothin Marsh Sediment Reuse and Wetlands SLR Enhancement Feasibility Study was completed in January 2017.

The project feasibility study will develop a site-specific plan to detail the ecological opportunities and impacts of placing dredged sediments along the back edge of the marsh. The Coyote Creek – Bothin Marsh pilot project is ideal because the volume of sediment from the Coyote Creek dredge is relatively low, (4,000 to 6,000 cubic yards) and the benefits marsh enhancement and flood attenuation are easy to monitor. Roads and infrastructure in this area currently experience flooding on high astronomical tides so this is a very visible location to test the viability of this approach.

The final report to NBWA is included as an attachment.

#### *5.3.2 Aramburu Island Constructed Beach Demonstration Project Monitoring*

The Aramburu Island Constructed Beach Project was constructed in 2011 in Richardson Bay. It was the first sea level rise adaptation project constructed in San Francisco Bay to use coarse grained bay beaches as a natural approach to mitigate shoreline erosion. Visual observations have shown that the project has been successful in halting extensive shoreline erosion and is self-adjusting its elevation to mitigate sea level rise. The constructed habitat has also been very successful for bird usage including several threatened and endangered species, such as the snowy plover. The local Marin Audubon in Richardson Bay regularly monitors the site for bird usage and the results have been highly successful.

Surveys of the constructed beach pre- and post-storms will document changes to evaluate and promote the usefulness of constructed coarse grained beaches as an approach to adapt to sea level rise with significant habitat benefits.

Monitoring through aerial photography and surveys were delayed due to the high water levels in Richardson Bay this spring. A final report will be posted to [www.MarinSLR.org](http://www.MarinSLR.org), but is not currently available. A final monitoring report will be submitted when all aerial monitoring flights are complete and the data is analyzed.

### *5.3.3 Novato Creek Baylands (Flood Control 2.0 and IRWMP)*

Marin County Department of Public Works (DPW) has been working for several years on flood control and sea level rise adaptation planning in the lower Novato Creek watershed. The Novato Creek Baylands contain large areas of diked, subsided baylands that could be restored to restore historic tidal marsh habitat to create wetlands that provide for attenuation of wave and buffering to the impacts of sea level rise as well as provide habitat for several threatened and endangered species of concern.

### *5.3.4 McInnis Marsh*

The McInnis Marsh restoration project will restore over 100 acres of diked former tidal marsh at the mouth of Gallinas Creek on lands owned by Marin County Parks. The project is in the early feasibility design phase and will use wetland as a natural adaptation approaches to combat sea level rise while providing critical habitat for a variety of threatened and endangered species. Feasibility study due by early 2016. Preliminary design work is expected to begin in 2016.

**Task deliverable:** Summarize the outcomes of feasibility studies at Bothin Marsh, McInnis Marsh, and the Novato Baylands. Identify next steps towards implementation and describe sea level rise adaptation. Summarize the lessons learned from coarse grained beach monitoring at Aramburu for usefulness as an approach to adapt to sea level rise while providing significant habitat benefits.

The demonstration project summary technical memo and public-focused booklet of all projects have been attached and are viewable on our website.

## **TASK 6- PROJECT SUMMARY REPORT AND RECOMMENDATIONS**

The deliverables for each task will be summarized in a draft and final report. The report will make a set of recommendations for future phases of sea level rise adaptation planning and implementation, including a process for updating the information in the vulnerability assessment, identifying grant funding opportunities and working with the cities, towns, and various asset managers to prepare for short-, medium-, and long-term adaptation efforts. This planning process is iterative and a key outcome of the BayWAVE project will be the discussions, tools, and coordination across the entire shoreline to prepare for a changing bay.

**Task deliverable:** Draft and final report.

A final summary report was submitted to the Marin County Board of Supervisors at the June 20, 2017 meeting. A draft scope of work for the next phase has been attached.