



A Collaborative Process to Develop Solutions for Tidal Road Flooding in China Camp State Park

Overview

Project Location

San Francisco Bay, California

Project Duration

September 2018 to August 2019

Project Lead

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Project Type

Catalyst – Targeted investment for advancing collaborative science

Products

- Report: [Options and Qualitative Evaluation](#)
- Report: [Road Map to Implementation](#)
- Report: [Existing Conditions](#)
- Videos and public king tide walks in January and February 2019

Project Partners

- California State Parks
- Center for Collaborative Policy
- Marin County Board of Supervisors
- Marin County Department of Public Works
- San Francisco Bay National Estuarine Research Reserve

Project Webpage

nerrsciencecollaborative.org/project/Siegel18

Coastal communities around the country are facing rising seas and tidal flooding and must find creative solutions to protect low-lying roads, homes, and other coastal infrastructure. What to do about roads that are repeatedly damaged or impassable due to storms and flooding is a common question with no easy answer. This project took a close look at one example of this complex problem—a shoreline road that bisects the San Francisco Bay National Estuarine Research Reserve's China Camp State Park. The shoreline section of North San Pedro Road is an important transportation corridor, serving as the only entry point to a popular state park, an alternative route for commuters during heavy traffic, and a critical evacuation route for local communities. However, the road crosses the landmark historic tidal marsh at China Camp and routinely floods, and its undersized culverts restrict tidal influence in the interior marshes, which limits their ability to adapt naturally to sea level rise. In discussions of short- and long-term fixes for North San Pedro Road, stakeholders agreed on the need to generate adaptation options that could protect the road, marsh, and surrounding human and natural communities.

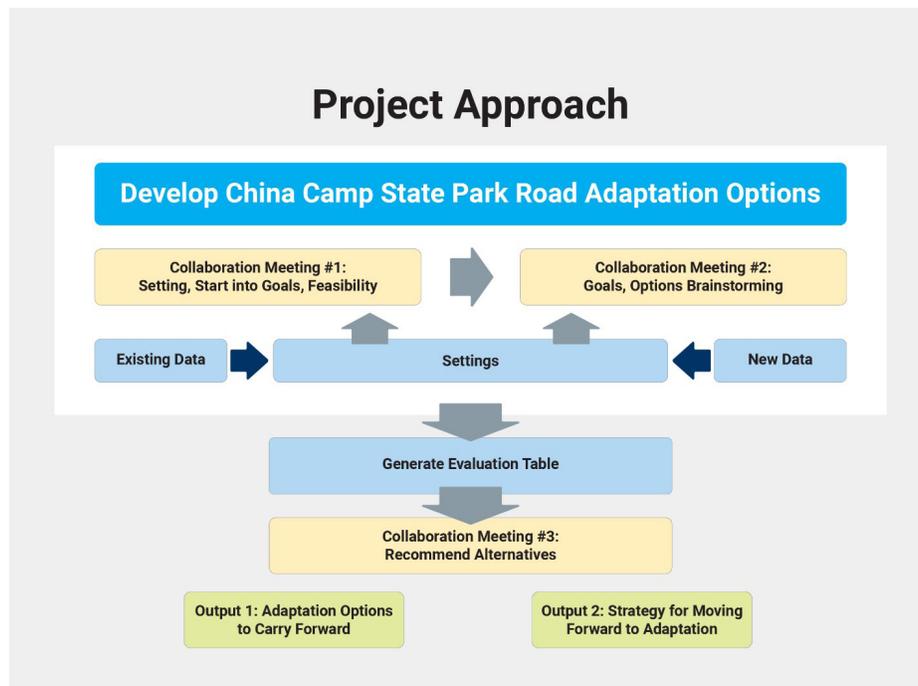
This project blended technical expertise and active community participation to initiate adaptation planning from the bottom up. A facilitated process brought together a wide range of stakeholders representing diverse local interests to identify and evaluate adaptation options for the road. The project paved the way to implement an adaptation solution at China Camp. It also offers a potential model for other communities facing similar threats to coastal infrastructure.

Project Approach

The project used a combination of technical analysis and synthesis, targeted data collection, and facilitated stakeholder meetings in order to identify, evaluate, and compare adaptation options for North San Pedro Road.

Representatives from the San Francisco Bay National Estuarine Research Reserve, California State Parks, and Marin County compiled and synthesized existing data related to land ownership, physical environment, ecology, cultural resources, and recreation. To better characterize hydrological impairments at China Camp, the project team collected new water level data for tidally constricted marshes. The project team also collected new nesting bird use data in the interior marshes to improve our understanding of their ecological functions.

The project built community participation from the bottom up by engaging nearly 40 community stakeholders with an interest in the future of the road. These included land owners and managers, county officials, public safety and road authorities, neighborhood associations, conservation groups, recreational users, and tribal representatives. In an iterative process of open forum meetings, the project team and stakeholders reviewed data and identified eight adaptation options to address road flooding by raising or rerouting the road or improving alternate routes. They performed a qualitative, comparative evaluation of these options, and assessed their ability to achieve the adopted adaptation goals and meet feasibility criteria. Finally, the group selected adaptation options to move forward to the next phase of project planning and mapped a path forward.



Overview of project approach. A more detailed version of this process diagram is available in the team's report, Options and Qualitative Evaluation.

Results

New field research has improved understanding of the extent to which sea level rise influences the shoreline, marsh, and North San Pedro Road. The project's analysis of China Camp shoreline area identified approximately a mile and a half of road at risk of increased flooding under three sea level rise scenarios, as well as recreational resources at risk from sea level rise flooding.

The project produced a clearly defined set of adaptation options and their pros and cons, and created a strategy to move forward with planning and implementation. The following four options were selected, which could secure continued road access to China Camp State Park and help marsh adapt to increased flooding due to sea level rise:

- Raise road on current alignment via solid fill and improve marsh hydrology;
- Raise road on current alignment via pile-supported modular causeway;

- Relocate the road on a low contour around Back Ranch and/or Miwok Meadows;
- Retain current road and improve marsh hydrology (note that this option would help marsh adaptation but not road use).

Along with these findings, the team's work to develop a new, bottom-up adaptation process generated several lessons relevant to future application of this model, including:

- A structured, explicit process with discrete steps and deliverables can help facilitators and participants progress methodically through to a structured decision-making outcome.
- Adaptation goals need to be articulated as explicitly and specifically as possible to allow diverse stakeholders to come together productively and brainstorm adaptation options. This oft-overlooked step is critical to complete before moving into solutions development. Allowing ample input to and discussion of goals is necessary to capture stakeholders' interests and achieve their broad acceptance.
- Individual and small group discussion and voting during workshops, as well as smaller post-meeting discussions, help to integrate and coalesce diverse views.
- An evaluation of adaptation options needs to include qualitative measures of both the ability to meet adaptation goals and implementation feasibility. Additionally, the team developed techniques for weighting factors, aggregating findings, and presenting a complex matrix that could be useful for others evaluating adaptation options.
- Visuals or multimedia that capture coastal hazards are powerful communication assets. The extremely wet 2019 winter gave the team the valuable opportunity to photograph and video road flooding during high tides and storms, illustrating the problem to stakeholders in near real time.

Benefits

- The project developed and piloted a new adaptation planning process that is being used as a model for other California State Parks struggling to manage coastal low-lying roads.
- A bottom-up approach strengthened collaborative relationships among key stakeholders, enhanced mutual understanding of each other's needs and concerns, and instilled confidence in the process. Stakeholders have a solid foundation to carry forward next steps for North San Pedro Road, and to work together to meet other climate adaptation challenges.
- The team is developing new grant proposals to support next steps identified by this project, including engineering studies and ongoing community engagement work.
- Leveraging this project and other grants, reserve education programs invited teachers to explore issues surrounding road flooding, as explained in [this video](#), which has prompted teachers to develop field trips and new lesson plans related to the road.

About the Science Collaborative

The National Estuarine Research Reserve System's Science Collaborative supports collaborative research that addresses coastal management problems important to the reserves. The Science Collaborative is managed by the University of Michigan's Water Center through a cooperative agreement with the National Oceanic and Atmospheric Administration (NOAA). Funding for the research reserves and this program comes from NOAA. Learn more at nerrsciencecollaborative.org or coast.noaa.gov/nerrs.