

## San Francisco Bay Environmental Action Plan (SEAP)

Sophie, Josh, Liam, Ryan & Mary

### San Francisco (SF) Bay History

The San Francisco Bay is approximated to be 10,000 years old. It was formed from a flooded river canyon as a result of rising sea levels. Throughout its life, the SF Bay has been filled in to make room for more industrial and commercial activity including airports, residential communities, and trash dumps. According to the San Francisco Bay Conservation and Development Commission (BCDC), at the start of California's Gold Rush in 1849, the Bay was 787 square miles. In 2020, the San Francisco Bay shrunk to 550 square miles. This rapid decline in size can be seen in the images below.

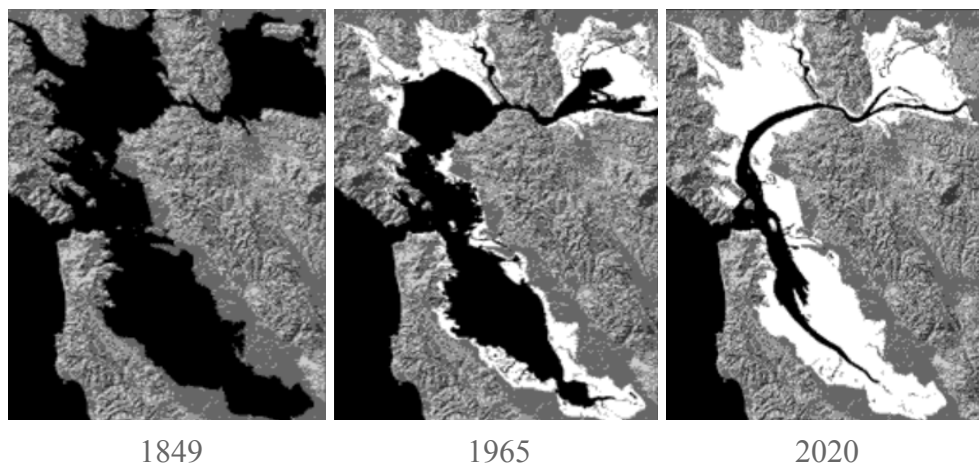


Figure 1: Shrinking of the San Francisco Bay

Luckily, the endangerment of the Bay did not go unnoticed. In 1961, California officially recognized the Save the Bay Foundation, whose goal was to “protect, restore, and celebrate” the Bay. The Save the Bay Foundation is still active today, and are doing a great job at upholding their mission statement. Today, the Save the Bay Foundation focuses specifically on adapting to climate change, restoring wetlands, preventing pollution, establishing “Bay smart” communities, and educating the public. This foundation kick started political action for protecting the Bay.

Each year, the Save the Bay Foundation publishes a strategic plan for tackling the next Bay project. The cover of the 2020 report can be seen below.



Figure 2- Save the Bay Strategic Plan

The next law passed, the McAteer-Petris Act, passed in 1965, prevents haphazard and otherwise unnecessary filling of the Bay. This Act defined the effects of filling in the Bay, including adversely affecting the water quality of the Bay and endangering natural fish and wildlife habitats. The next piece of legislation passed was the San Francisco Bay Plan which, according to the BCDC, provided “a formula for developing the Bay and shoreline to their highest potential, while protecting the Bay as an irreplaceable natural resource.” This Plan was passed in 1968 and has been pivotal in protecting the Bay.

### Governance

There are many agencies in control of governing the Bay, as outlined in the San Francisco Bay Plan. The Bay’s main agency is The San Francisco Bay Conservation and Development

Commission. Members of this commission represent various interests of the Bay including federal, state, local, and regional governments. There are also community members of the Bay area. The main objective of the Commission is to ensure that all aspects of the SF Bay Plan are executed properly.

The Bay Model Alliance, in partnership with the Aquarium of the Bay as well as the U.S. Army Corps of Engineers, is dedicated to providing free, accessible education centered around the San Francisco Bay as well as the Sacramento-San Joaquin River Delta System. This partnership focuses on preserving the natural environment for future generations, and recognizes the strain human impact and environmental changes has put on the Bay. The Alliance publishes an annual report including details on revenue, outreach, and education.

The last agency governing the San Francisco Bay is the Bay Area Regional Collaborative. This Collaborative is made up of four smaller agencies, all who work together to conserve the Bay.

These agencies are:

- Association of Bay Area Governance (ABAG)
- Bay Area Air Quality Management District (BAAQMD)
- The San Francisco Bay Conservation and Development Commission (BCDC)
- Metropolitan Transportation Commission (MTC)

There are also many non-voting members, including the SF Water Control Board and the California State Coastal Conservancy. This Collaborative is incredibly important to protecting the bay, as it voices concerns and opinions from many different departments. Collaboration between departments can ensure that projects are fulfilled to their highest potential.

Mapping the Bay

The San Francisco Bay consists of three smaller bays: the San Francisco, San Pablo, and Suisun. Its watershed drains more than 40% of California's landmass. Below is a map of the SF Bay, showing sub-bays and major cities in the area. As seen in the map, many of California's largest cities are located around the SF Bay, including Oakland, San Francisco, and San Jose.



Figure 3- Map of the San Francisco Bay

Figure 3 below shows a GIS map of the San Francisco Bay and identifies many features within the Bay including levees, embankments, and natural shorelines.

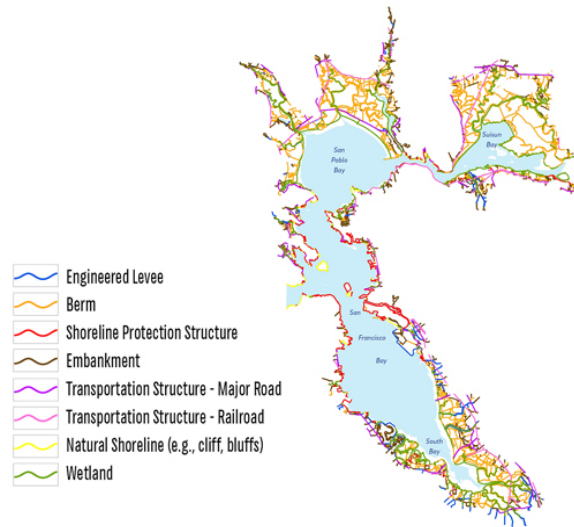


Figure 4- GIS Map of SF Bay

### San Francisco Bay Environmental Action Plan (SEAP)

The San Francisco Bay Environmental Action Plan (SEAP) is focused on restoring the SF Bay, much like the agencies listed above. The mission statement of SEAP is to improve the overall water quality of the San Francisco Bay Delta watershed. The Action Plan will target three main areas of concern in order to improve the overall health of the Bay by 2035. More importantly, SEAP plans to collaborate with existing agencies to reach their goal more efficiently. Partnering with existing SF Bay protection agencies is important for ensuring that all agendas for restoring the Bay are met properly.

The first problem SEAP has identified is pollution. The San Francisco Bay currently exceeds ‘safe’ levels for many contaminants including pesticides and metals such as mercury. Mercury is an incredibly dangerous pollutant that is toxic to many marine life including fish and shellfish. When mercury enters the food chain through fish, it poses a significant human health problem. Addressing mercury pollution is important to not only marine life, but human life as well. The San Francisco Bay also faces serious bacterial contamination, mainly from sewage spills as a result of improper sewage infrastructure. These spills can endanger aquatic life. One way to

combat pollution caused by sewage spills is to invest more money in sewage infrastructure. This includes limiting the amount of trash and debris entering the Bay by installing trash racks on any inlet or outlet structures. Figure 5 shows a trash rack.



Figure 5- Trash Rack

The next problem SEAP plans to address is invasive species. Invasive species are harmful to the Bay because they deprive native fish and wildlife of the nutrients they need to survive.

Unfortunately, it is rather difficult to identify the source of invasive species. They can come from transplanting vegetation or animals from other areas of the world (i.e. taking a plant with you when you move from Europe to America and planting it in the ground). In the San Francisco Bay, the most common entry point for invasive species is the bottom of ships entering the port. One solution to this problem is to clean off the bottom of ships before entering the Bay in order to remove invasive species. A stipulation of this is that ships should be cleaned out of the water in order to ensure complete removal of invasive species from the environment. Agencies protecting the Bay have also identified two types of invasive wildlife: the largemouth bass and the bullfrog. Images 6 and 7 show these animals.

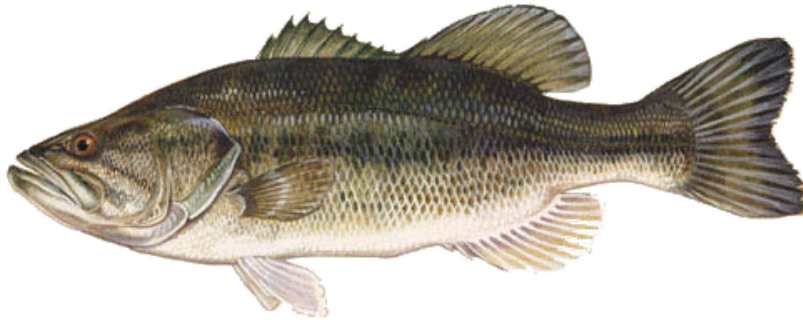


Figure 6- Largemouth Bass



Figure 7- The bullfrog

The main way to address the removal of these species is to keep the public informed about types of invasive species in the San Francisco Bay.

Finally, the third problem SEAP will address is runoff. As mentioned before, the San Francisco Bay drains 40% of California's landmass. It is also surrounded by some of California's largest cities. Runoff has been a problem for the SF Bay since the beginning of industrialization in California. Other sources of runoff include lawn fertilizer and vehicle exhaust emissions.

Overall, runoff can be attributed to an excess of impervious cover within the drainage area.

When runoff enters the Bay, it can cause erosion and flooding. SEAPs goal is to reduce runoff by implementing runoff control technologies and devices. Examples of runoff control measures include riparian buffers, permeable pavers and introducing native plants to the area.



Figures 8 and 9- Permeable pavers and Rain Garden

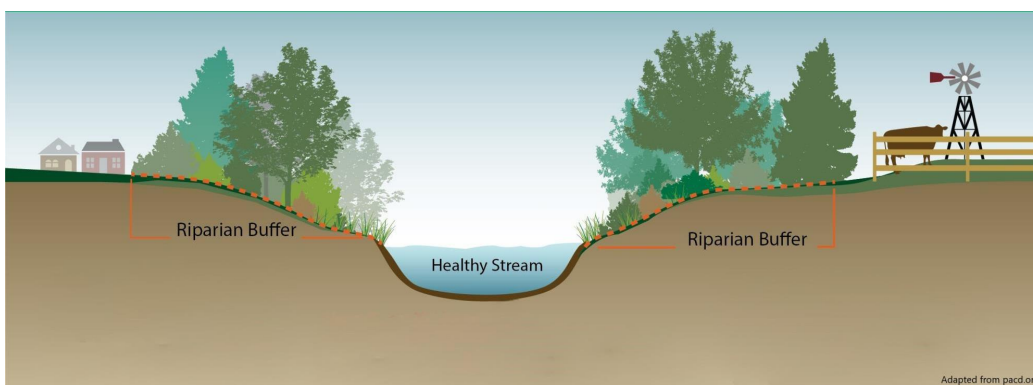


Figure 10- Riparian Buffer

Further runoff control measures including educating the public about lifestyle habits that could be endangering the Bay, like the use of pesticides on property. Below is a table showing each problem SEAP plans to address as well as common causes and SEAPs overall goal.

Problem	Causes	Goal
Pollutants	The San Francisco Bay Delta exceeds 'safe' levels for many contaminants including pesticides and metals. Some areas of the Bay also face serious bacteria pollutant levels, which is caused by sewage spills. This inadequate water quality level is harming aquatic life in the Bay.	One way to overcome this challenge is to improve sewage infrastructure. By improving sewage infrastructure, the amount of bacteria entering the Bay could be controlled (and eventually lessened), restoring the health of the water and marine life.



Invasive species	It is nearly impossible to pinpoint how invasive species enter the Bay. Invasive species compete with native plants and animals, depriving them of food and water.	In order to fulfill our mission statement and improve the quality of the Bay, the removal of invasive species will need to be targeted. One way to do this is to clean off the bottom of ships entering the Bay from foreign places. It is best to clean ships out of the water, which will prevent these invasive species from entering the water at all.
Runoff	Runoff can enter the bay through a variety of sources including construction, agriculture, and residential runoff.	The goal of SEAP is to reduce runoff by implementing runoff control features. This could include planting native plant species at common runoff areas (i.e. at the bottom of slopes, parking lots, etc.). Another way to reduce runoff is to reduce impervious surfaces.

Table 1- Problems, Causes, and Goals

### Economics

Potential costs of SEAPs project include costs associated with pollution clean-up, removing invasive species, planting native vegetation, and implementation of any additional runoff control technologies. One way SEAP can gather funds for this project is through grants and donations. SEAP could also reduce potential costs by including volunteers and stakeholders in the Bay restoration process. It is good to include stakeholders in the project because it helps to identify the best way to invest resources. For example, if stakeholders seem the most concerned about Mercury levels in the Bay, SEAP should focus on Mercury removal first.

Partnering with existing Bay protection agencies may also provide additional funding for SEAPs projects, as many of these companies have already established successful ways of drawing in revenue for their organizations.

#### Recommendation and Conclusion

By targeting the three main pollutant groups of the San Francisco Bay, the San Francisco Bay Environmental Action Plan will be able to improve overall water quality and health of the San Francisco Bay. SEAP will aim for low cost solutions to the problems identified above in order to ensure the plan is carried out efficiently and effectively in order to meet our goal of improving Bay health by 2035.