Sustainability & Sediment Accretion in Beneficial Use Marshes

Caitlin Hoch, Brandon Boyd, Joseph Z. Gailani
USACE-ERDC Coastal and Hydraulics Lab

Problem

Several hundred million cubic meters of sediment is dredged each year from U.S. ports, harbors and waterways. The sediment is commonly disposed of in open water or upland disposal facilities but new disposal areas are becoming increasingly difficult to locate and more expensive to utilize.

Often, the dredged material is a valuable resource that can be used for beneficial use projects such as beach restoration, store protection, marsh enhancement and more.

Increasingly, estuarine marshes are being restored using dredged material through thin layer placement (TLP). However, the efficacy and sustainability of marsh accretion processes using TLP is not well understood and there is a need to understand the long-term effects.

Hypothesis

BU marshes accumulate sediment at rates comparable to "natural" marshes

If not, then why?

…

Results will be used to better inform design and planning

If true, are there conditions?

…

- Only after X-amount of time?
- Once plants have grown to X-density/height or biomass?
- If wave attenuation measures are taken?
- If X-amount of dredged material was placed?

Case Study – Hamilton Wetlands, San Francisco , CA

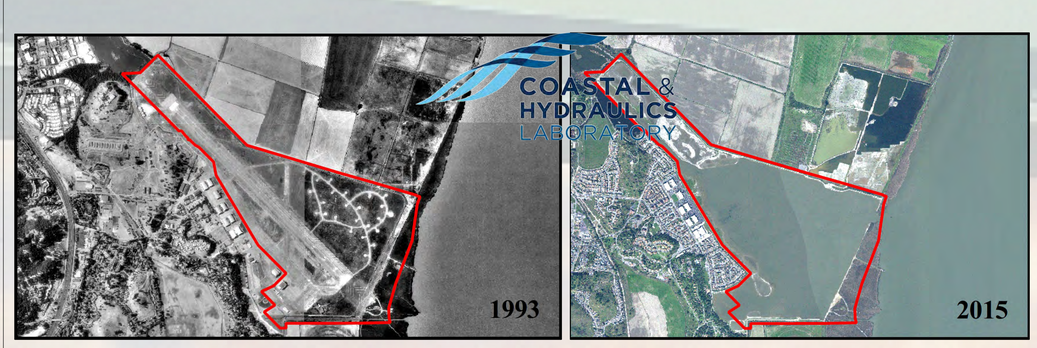
San Francisco Bay has lost more than 80% of its tidal wetlands due to decades of diking and farming. The restoration of tidal and seasonal wetlands on the former Hamilton Army Airfield has placed approximately 6,000,000 cubic yards of dredged sediment to raise the land surface elevations suitable for creating tidal marsh.

The Hamilton Wetlands project was chosen as a test site to determine the sustainability benefits derived from TLP.

Testing Methods

Field Analysis & collection of marsh sediment cores

Remote Sensing



Lab Testing

A gamma spectroscopy system is used for ^{210}Pb and ^{137}Cs analysis.

^{210}Pb radiochronology produces a depth-age relationship spanning 50 to 100 years from which accretion rates and mineral and organic accumulation rates can be calculated.

Study Objective

Comparison of the sediment record in TLP and adjacent reference marshes will help determine the trajectory and timeline of recovery of natural accretion dynamics to TLP marshes and any alterations in the accretionary process that should be expected temporarily or long-term. Understanding these processes will squarely address gaps in the USACE's fundamental knowledge of:

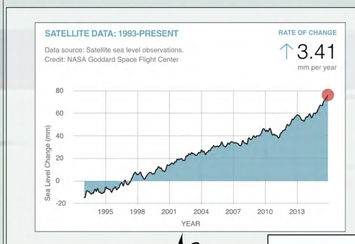
1) Optimizing design of TLP projects
2) How and for how long these beneficial use practices will persist and,
3) How TLP site sediment accretion dynamics differs from natural marsh systems.

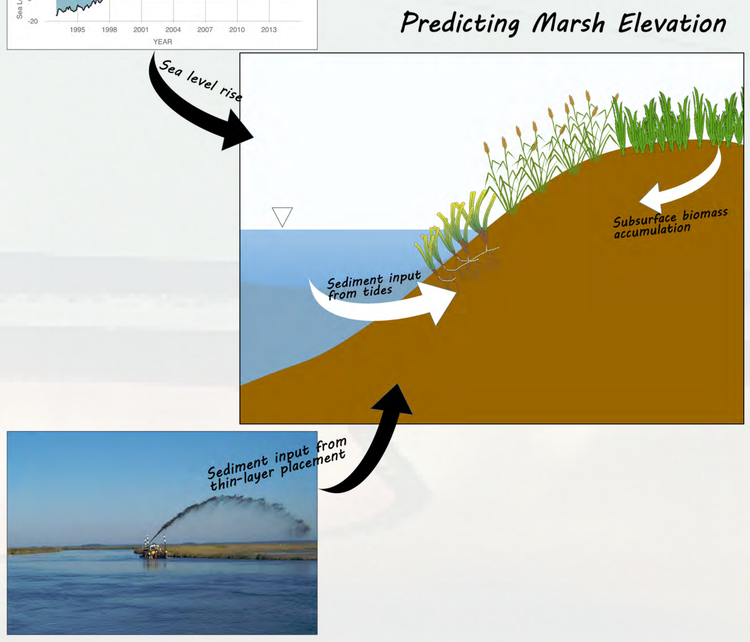
Product

Data from BU and reference natural marshes collected during this research will be used to develop technical guidance on:

1) Expected effects of BU on marsh accretionary processes
2) Standardized methods for measuring marsh accretionary processes using ^{137}Cs and ^{210}Pb chronology
3) Best practice measures for measuring accretion in BU marshes

Data produced could be used to parameterize and improve the predictive capabilities of existing marsh accretion models used by USACE to demonstrate the benefit of BU projects and optimize design of the projects





Thin Layer Placement (TLP)

TLP is the purposeful placement of thin layers of sediment in an environmentally acceptable manner to achieve a target elevation or thickness.

Thin layer placement objectives include infrastructure maintenance and the creation, maintenance, enhancement, or restoration of ecological function.

Marsh Sustainability

In a healthy estuarine ecosystem, there is a balance between the amount of sediment entering and existing the system. A sustainable marsh is one that maintains it's natural/functioning elevation and experiences 0 elevation loss.

Beneficial Use (BU)

BU is defined as the use of dredged materials, by placing them where they can maximize the most good, rather than wasting them by disposal. BU embraces the idea that dredged material can be used in a manner that will benefit both society and the natural environment.

Balancing operational and environmental initiatives and meeting complex challenges of dredging and dredged material placement in support of the navigation mission.

Questions? Send to brandon.m.boyd@erdc.dren.mil