

Concept Design Alternatives for a Beach Restoration Project at Greenwood Beach System (Blackie's Pasture), Tiburon, Marin County

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Tiburon Parks and Open Space Trust
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funded by a grant from the Marin Community Foundation and the State Coastal Conservancy



BACKGROUND

- Study funded by County MCF grant to do preliminary design at three sites in Southern Marin
 - Beaches as a softer approach to shoreline erosion
 - Modified project name to Greenwood Beach Area (includes Brunini Beach and Marsh)
 - More historically accurate
 - Avoids potential slur
 - Looking at two design approaches
 - seeking input tonight from POST and community
- ✓ Tentative award of AA grant for final design and permitting



Outline for Tonight

Background to this grant

- SLR and shoreline erosion
- Motivation for restoration at Greenwood beach
- Beaches as a living shoreline nature-based SLR adaptation
- Nearby beach design success stories and lessons learned

Two possible designs for Greenwood beach

Next steps and questions

PROJECT CONTEXT: SEA LEVEL RISE AND COASTAL FLOODING

Richardson Bay baylands are among the most vulnerable in the Bay Area



Mill Valley 101 underpass 2-3 ft deep flooding
Calm weather "King Tide"



Mill Valley, Almonte Boulevard
Calm weather "King Tide"

SEA LEVEL RISE AND REGIONAL BAY AREA SHORELINE EROSION

- Non-engineered and engineered “hard” shoreline stabilization remains after sediment-starved beaches erode away.
- Hazards and loss of recreation, esthetic, shore access, and wildlife values
- Sea level rise makes it all worse



Greenwood Beach

Recent erosion trends

- Wave-cut cliff retreat in old artificial bay fill (**asphalt, concrete debris**)
- Exposure of more concrete and asphalt in beachface, less sand 2012-2019
- Narrower and shorter high tide beach, lower beachface



Erosion of old bay fill exposes asphalt and concrete debris, rock West shore (2019)



Erosion of old bay fill exposes asphalt and concrete debris, rock
West shore (2018)



Bluff erosion and shoreline retreat exposes concrete, rock, asphalt debris

West shore (2018 - 2019)



Our Marin shoreline future...

- rock and walls?
- or natural beaches and living shorelines?



San Rafael shoreline



36-Inches Sea Level Rise at Greenwood Shoreline



Inundation at
36-inches SLR
without waves

Mid to end
century
estimates

Eastern Marin
highly
vulnerable

SLR = Loss of local recreation and public use of Bay Beaches



2019 SFEI SLR Adaptation Atlas

SAN FRANCISCO BAY SHORELINE ADAPTATION ATLAS

As sea levels continue to rise, communities will need to adapt the San Francisco Bay shoreline to create greater social, economic, and ecological resilience. A critical tool for this process is a science-based framework for developing adaptation strategies that are appropriate for the diverse shoreline of the Bay and that take advantage of natural processes. This project proposes such a framework: *Operational Landscape Units* for San Francisco Bay.

[Purchase or download the *Adaptation Atlas*](#)

Background Photo: Craig Howell / Flickr CC BY 2.0



San Francisco Bay Shoreline Adaptation Atlas

SFEI 2019

BEACH CREATION



Sand, shell hash, gravel, and cobble beaches were part of the historical ecology of San Francisco Bay.

Composite (mixed) beaches

- commonly employed soft shoreline engineered solution
- provide ecological and recreational value while dissipating wave energy, reducing erosion, and protecting infrastructure.
- may be most effective for sea level rise adaptation.



San Francisco Bay Shoreline ADAPTATION ATLAS SFEI 2019

Beach Ecosystem Functions

- High tide roosts for shorebirds and terns
- Breeding habitat for some terns and shorebirds
 - Forster's terns
 - black-necked stilts
 - black oystercatchers
- Sand beach spawning habitat for grunion
- Endangered salt marsh plant recovery: California sea-blite



April 2020

New Life for Eroding Shorelines:

Beach and Marsh Edge Change in the San Francisco Estuary



New Life for Eroding Shorelines:

Beach and Marsh Edge Change in the San Francisco Estuary

A Technical Memo Associated with the New Life for Eroding Shorelines Project

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SFEI San Francisco Estuary Institute

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<https://www.sfei.org/projects/new-life-eroding-shorelines>

SFEI San Francisco Estuary Institute



NEIGHBORING BEACH PILOT PROJECT DEMONSTRATES FEASIBILITY OF BAY BEACH ALTERNATIVES TO ARMORING

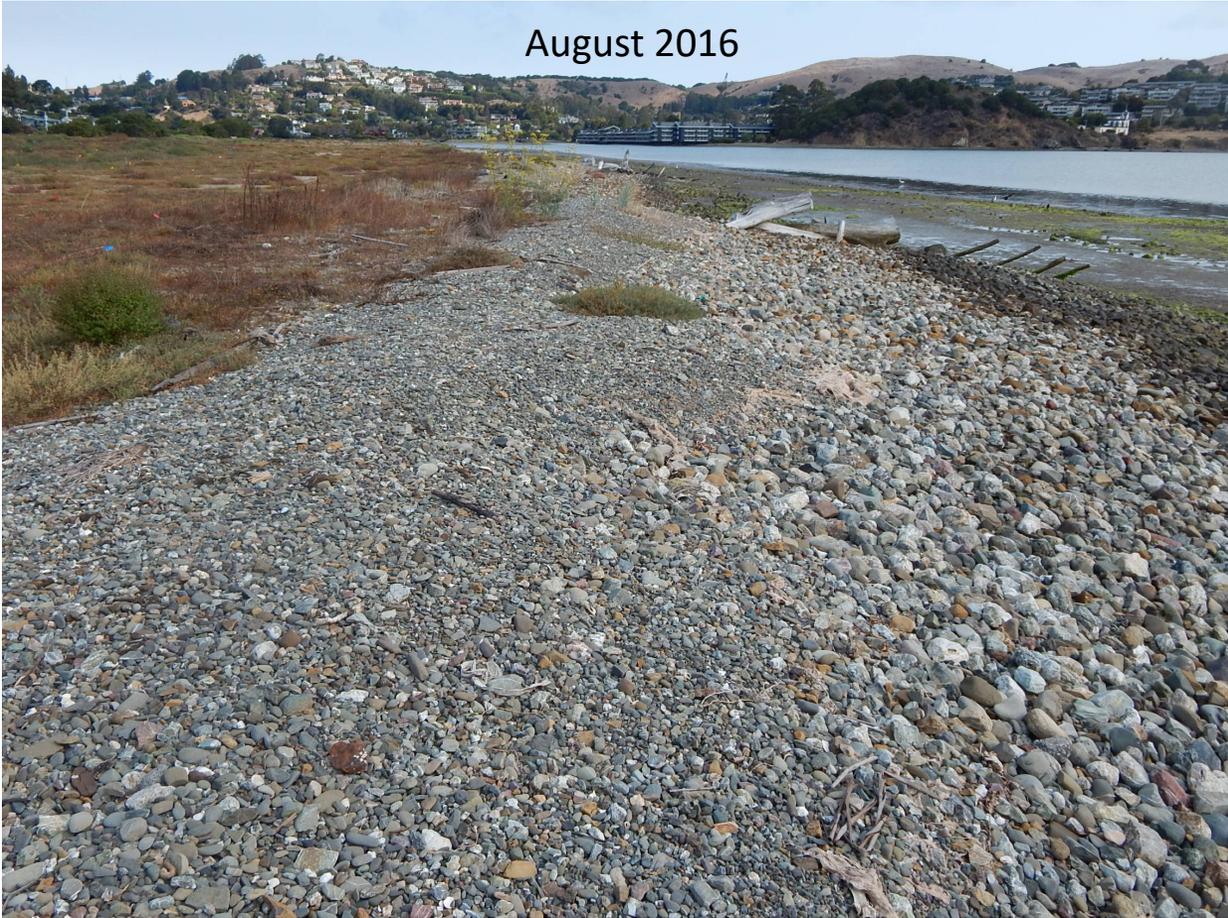
Marin County Parks – **Aramburu Island**
Pre-project erosional shore 2009



Aramburu Island – Pre-project Central Shoreline (March 2009)



Marin County Parks – **Aramburu Island Coarse Beach Nourishment**
Pre- and post-project erosional headland shore exposed to higher wave energy
Gravel and cobble berm



Aramburu Island Spring-Summer 2013

- Sandy beach and gravel storm berm – year 2
- High drift shoreline orientation – oblique wave approach



Aramburu Island beach, first winter - 2012

- Rapid wave-reworking of artificially placed beach sediment
- Strongly oblique wave approach (high drift shore orientation)



Aramburu Island 2018-2019

- Change with persistence after years of intense storm erosion and longshore drift
- Beach crest elevation is **higher** than lowland flats behind it (flood protection)

May 2018 - **Gravel beach** persists up-drift



June 2019 - **Sand beach** grows in pocket down-drift



Recent Greenwood beach erosion trend

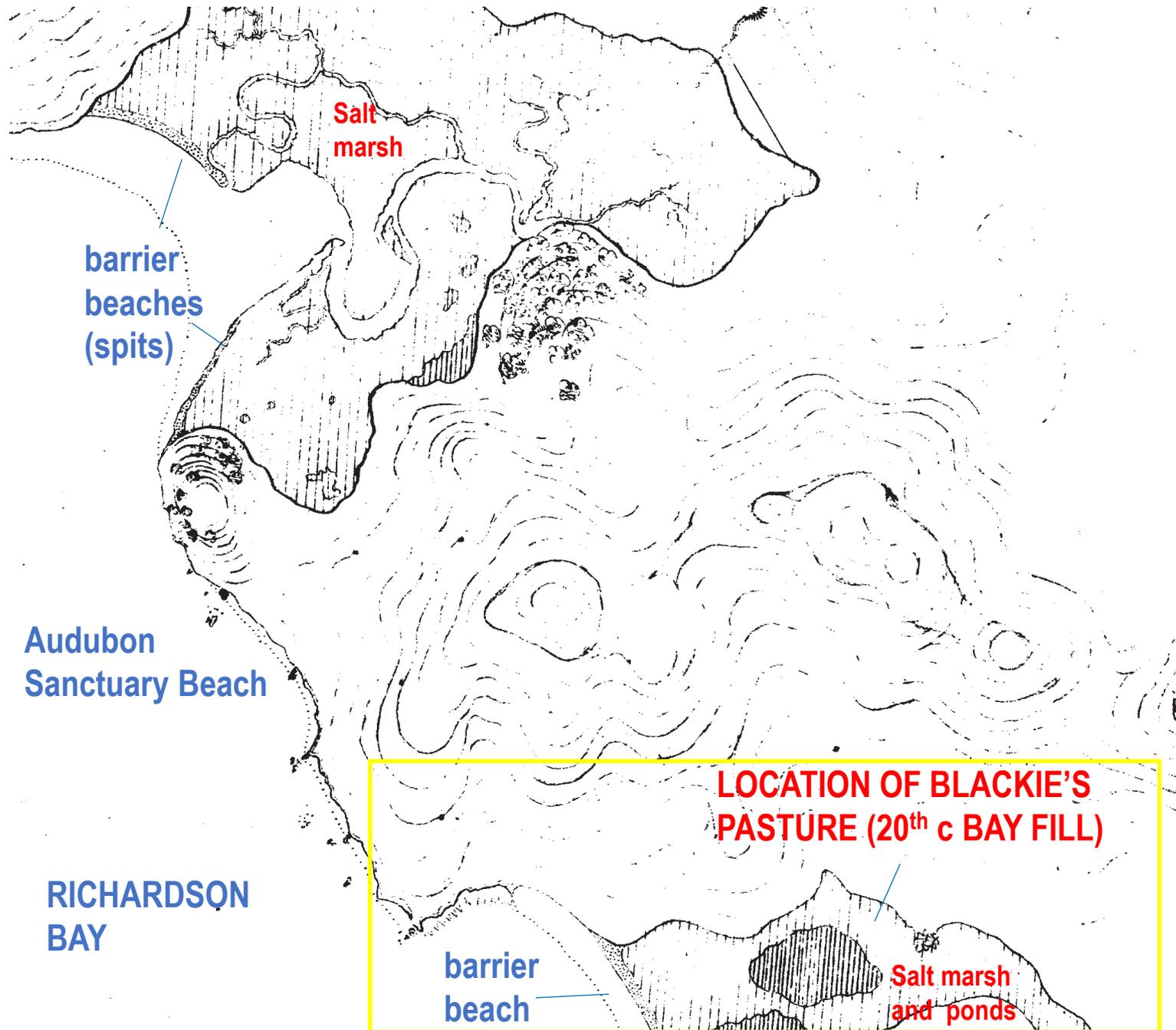
- Reduced sand
- Increased exposure of foreshore asphalt debris, concrete rubble
- Narrower and shorter backshore



Why reconstruct an beach at Greenwood?

Local Community Benefits

- **Replenish eroded beach.** The existing beach continues to narrow and erode into old bay fill. Loss of recreational area, habitat.
- **Buffer shoreline impacts of sea level rise.** Flooding, beach erosion and shoreline retreat increase in severity and frequency.
- **Eliminate nuisances of exposed concrete slab and asphalt fill –** Degrades recreational and esthetic values; safety hazards.
- **Improve Beach Access and Recreation –** Improve public use and access to the shoreline



HISTORICAL LOCAL RICHARDSON BAY BEACHES prior to bay fill

Beach sediment sources: streams and headland erosion

Excerpt from 1851 U.S. Coast Survey sheet 334N

Long term goals of the project

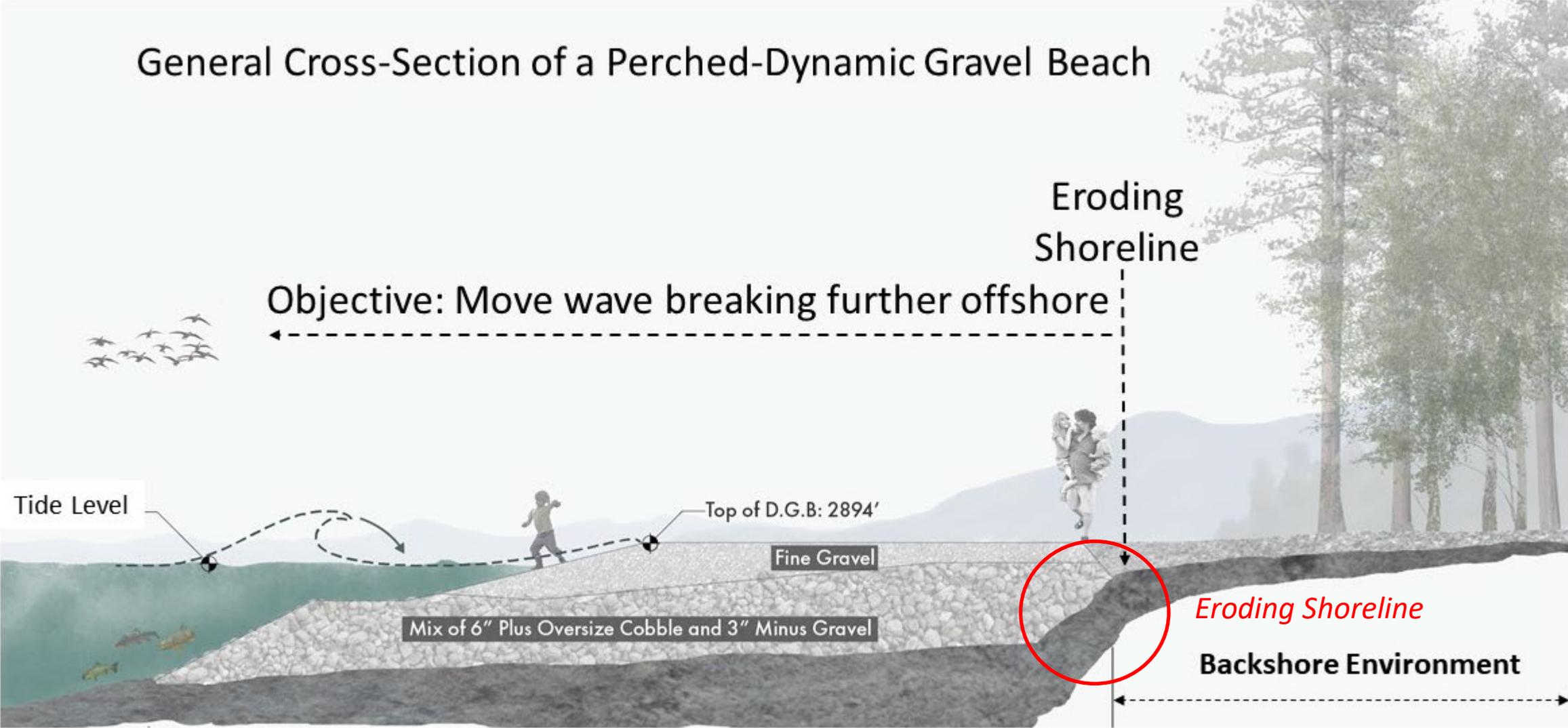
- Greenwood beach continues to be used for recreation, swimming into the next century
 - Wave attenuation/limiting shoreline erosion
 - SLR adaptation
 - Maintain and expand habitat values
- ✓ We proposed this site due to its setting and ability to serve as a demonstration project for the bay community

Two Design Approaches in Study

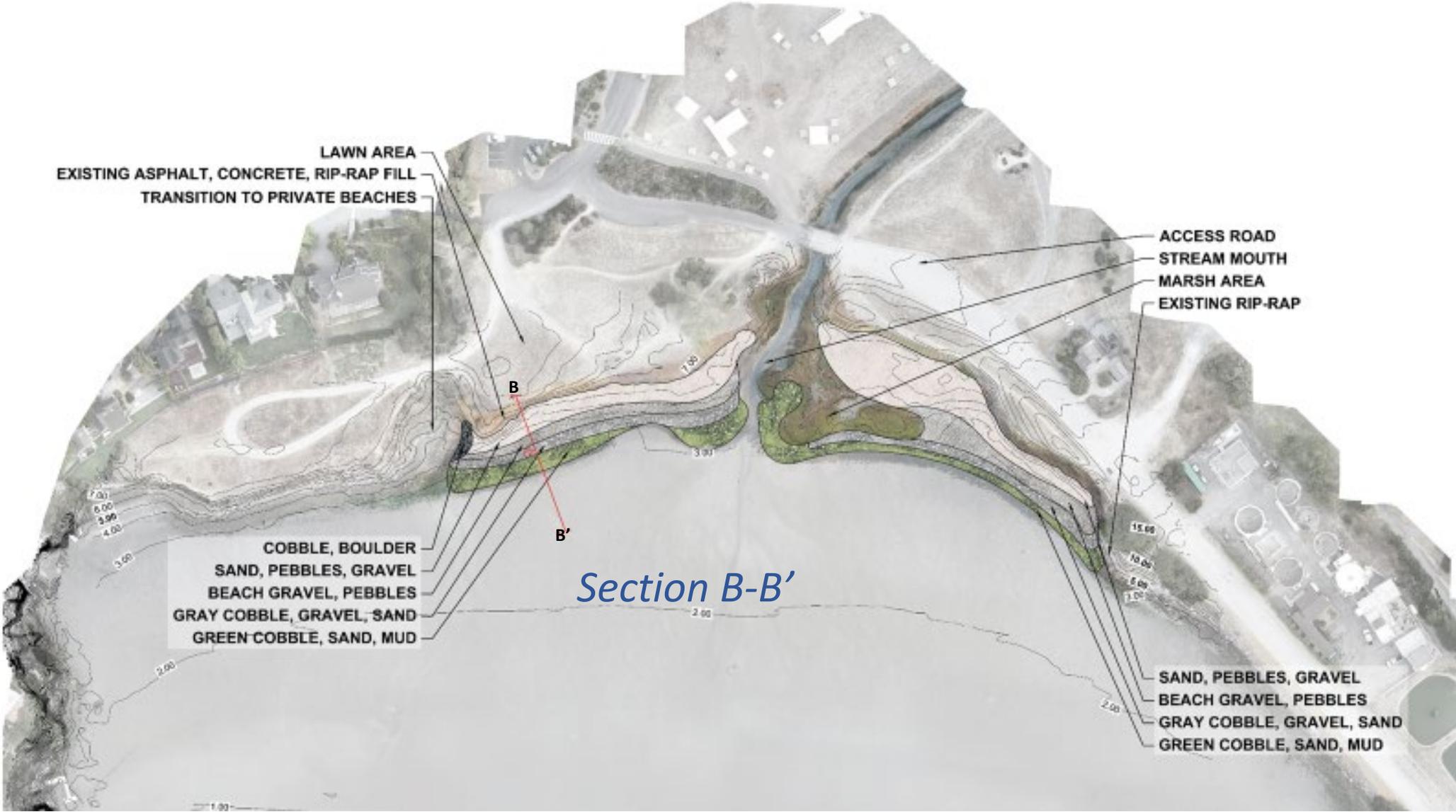
1. Gravel Beach Design Template (Lorang)- Highly engineered beach design with off-shore cobble terrace to break waves prior to hitting the shoreline
 - Potentially more capital cost upfront and less maintenance afterwards
 - Potentially more habitat impacts due to conversion of mudflats to rocky intertidal
 2. Dynamic beach nourishment design approach (Baye) – add sediment of proper size and shape where needed with small retention sills and buried gravel berm
 - Less upfront sediment import but potentially more maintenance events
 - Less habitat conversion impacts
- ✓ Permitting agencies will weigh in January 2021

Gravel Beach Design Template

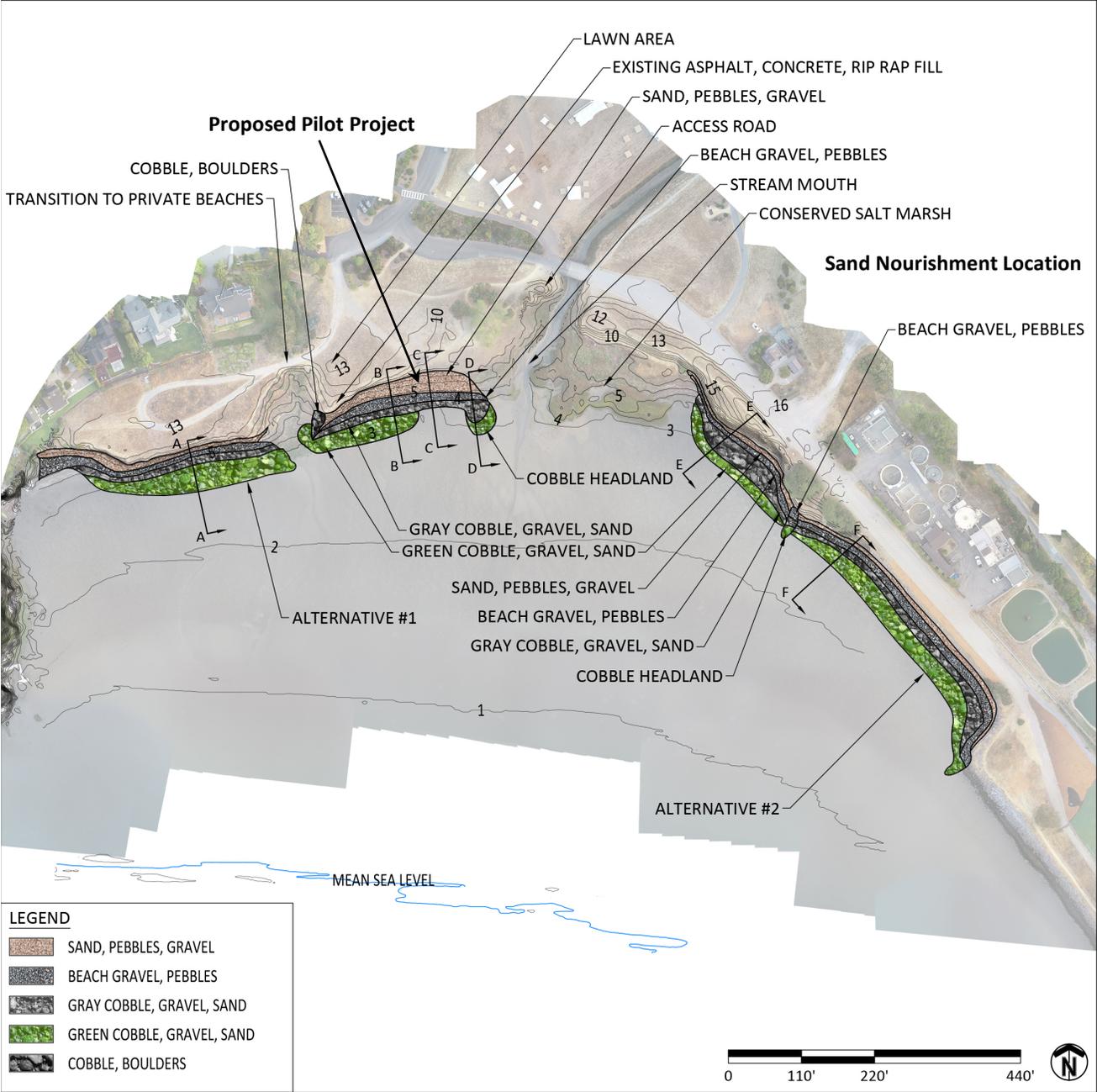
General Cross-Section of a Perched-Dynamic Gravel Beach



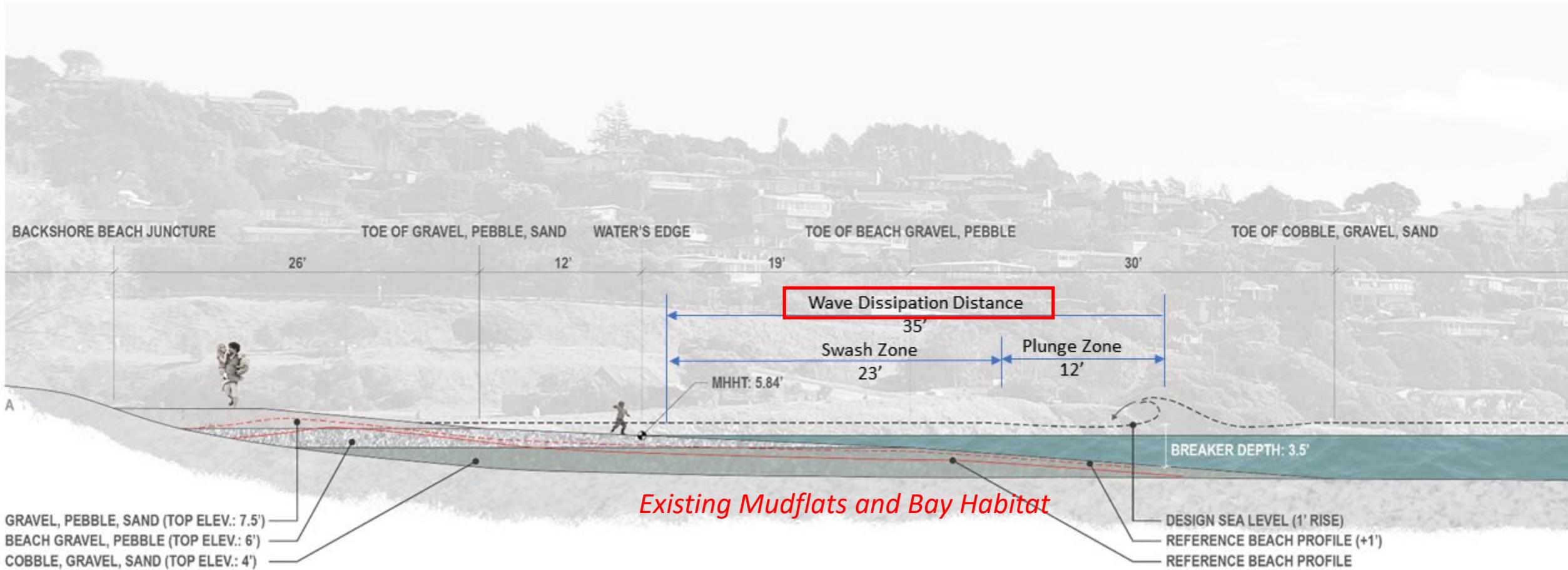
Phase I Pilot Project – Smaller Pilot Project



Phase II - Larger Project- depends on funding and community acceptance and permitting



Section B-B' Cross-Section



Blackies Low Tide (~ 1 ft below mean Sea Level)

Blackies Beach (~ 5 ft above mean sea level)

Greenwood Beach Current Condition



Proposed Beach (Alt 1)



Brunini Beach Current Condition



Proposed Brunini Beach – Alt 1

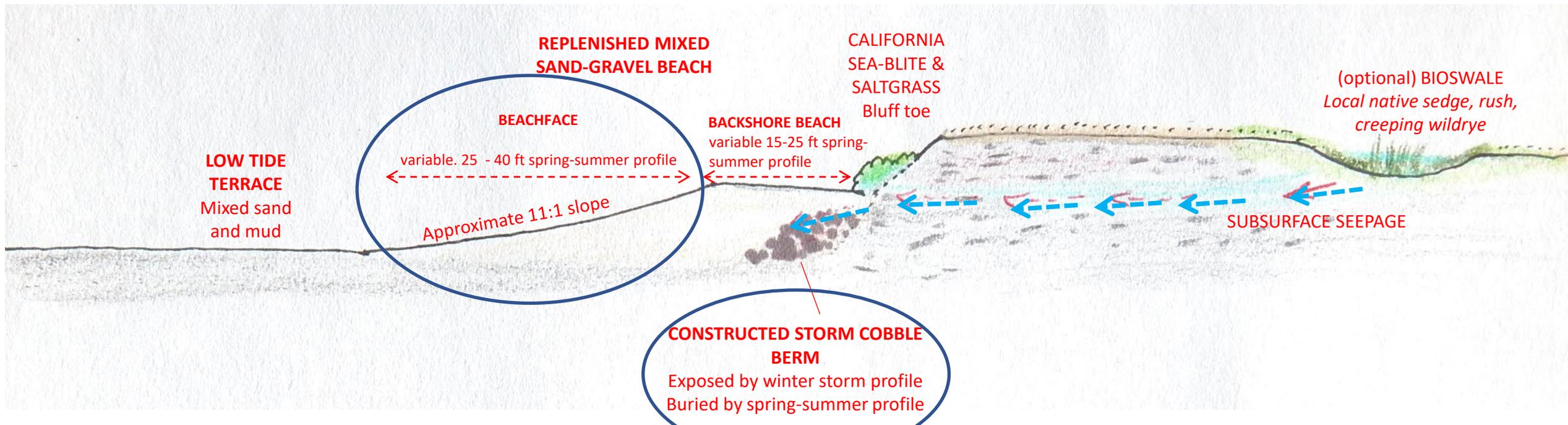


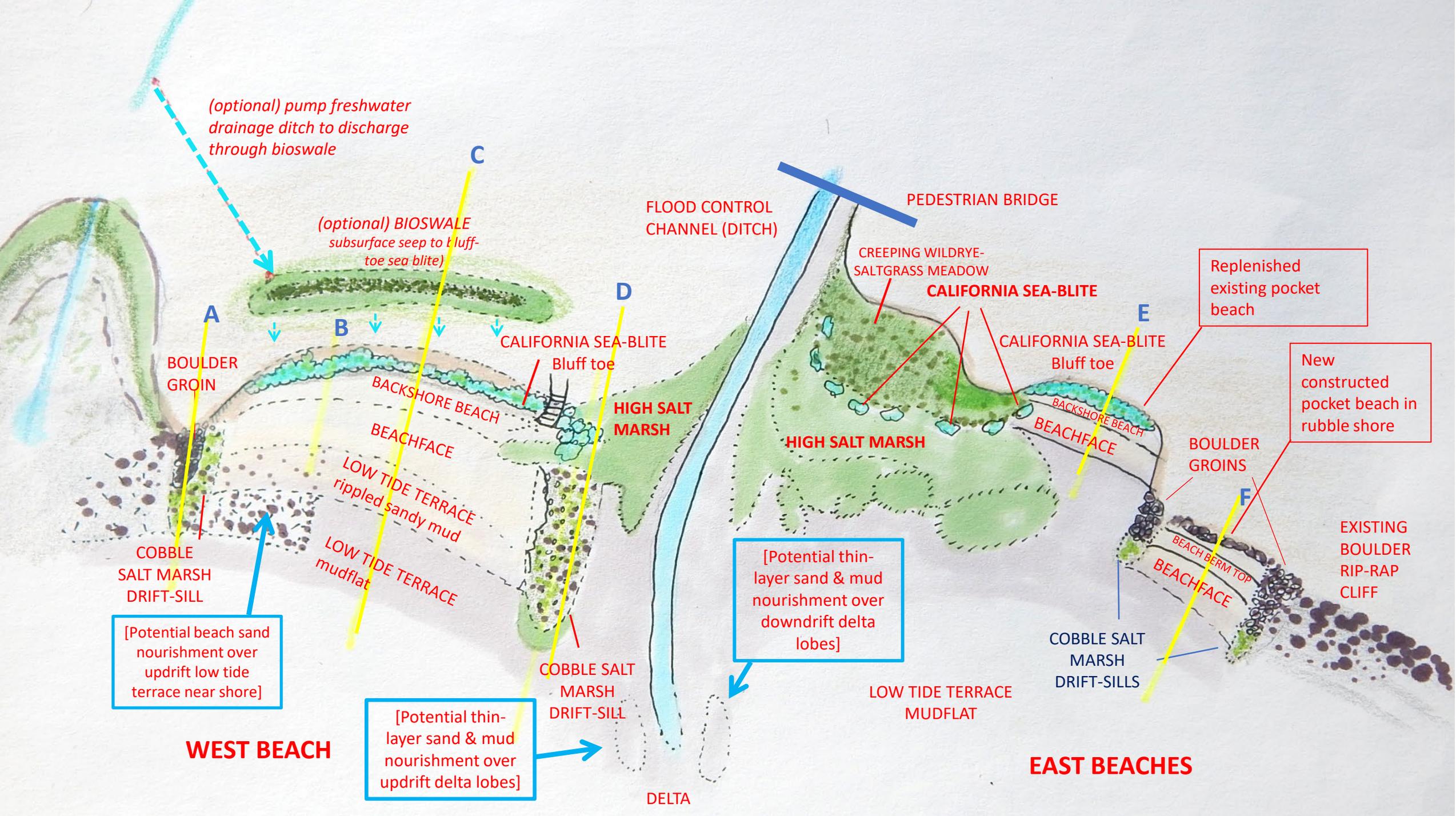
Estuarine Beach Dynamic Nourishment Concept Design Approach

Places new sand to build out beach with retention sills and buried gravel backstop of larger erosion events

“dynamic adaptive management design” rather than a single-event construction project with a target lifespan and design profile.

WEST BEACH CROSS SECTION





(optional) pump freshwater drainage ditch to discharge through bioswale

(optional) BIOSWALE subsurface seep to bluff-toe sea blite

A

BOULDER GROIN

B

BACKSHORE BEACH

C

CALIFORNIA SEA-BLITE

Bluff toe

D

HIGH SALT MARSH

FLOOD CONTROL CHANNEL (DITCH)

PEDESTRIAN BRIDGE

CREEPING WILD RYE-SALTGRASS MEADOW

CALIFORNIA SEA-BLITE

E

CALIFORNIA SEA-BLITE

Bluff toe

Replenished existing pocket beach

New constructed pocket beach in rubble shore

BEACHFACE

LOW TIDE TERRACE
rippled sandy mud

LOW TIDE TERRACE
mudflat

HIGH SALT MARSH

BACKSHORE BEACH

BEACHFACE

BOULDER GROINS

BEACH BERM TOP

BEACHFACE

EXISTING BOULDER RIP-RAP CLIFF

COBBLE SALT MARSH DRIFT-SILL

[Potential beach sand nourishment over updrift low tide terrace near shore]

[Potential thin-layer sand & mud nourishment over downdrift delta lobes]

COBBLE SALT MARSH DRIFT-SILL

[Potential thin-layer sand & mud nourishment over updrift delta lobes]

LOW TIDE TERRACE MUDFLAT

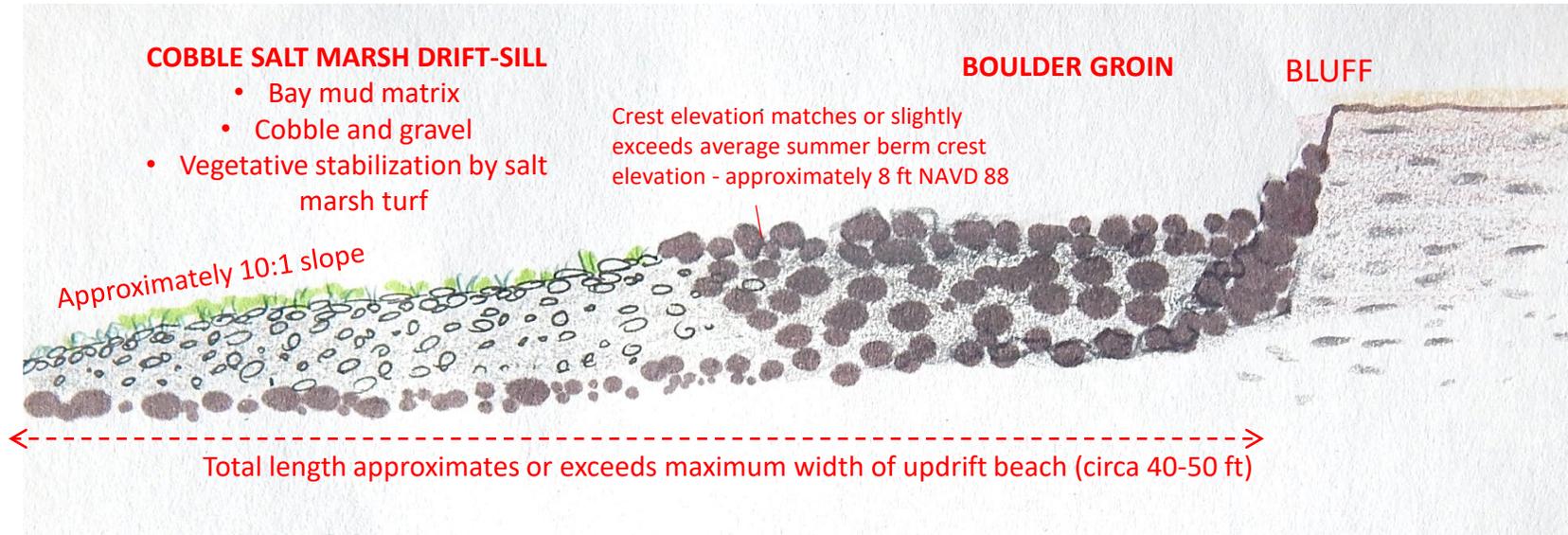
COBBLE SALT MARSH DRIFT-SILLS

WEST BEACH

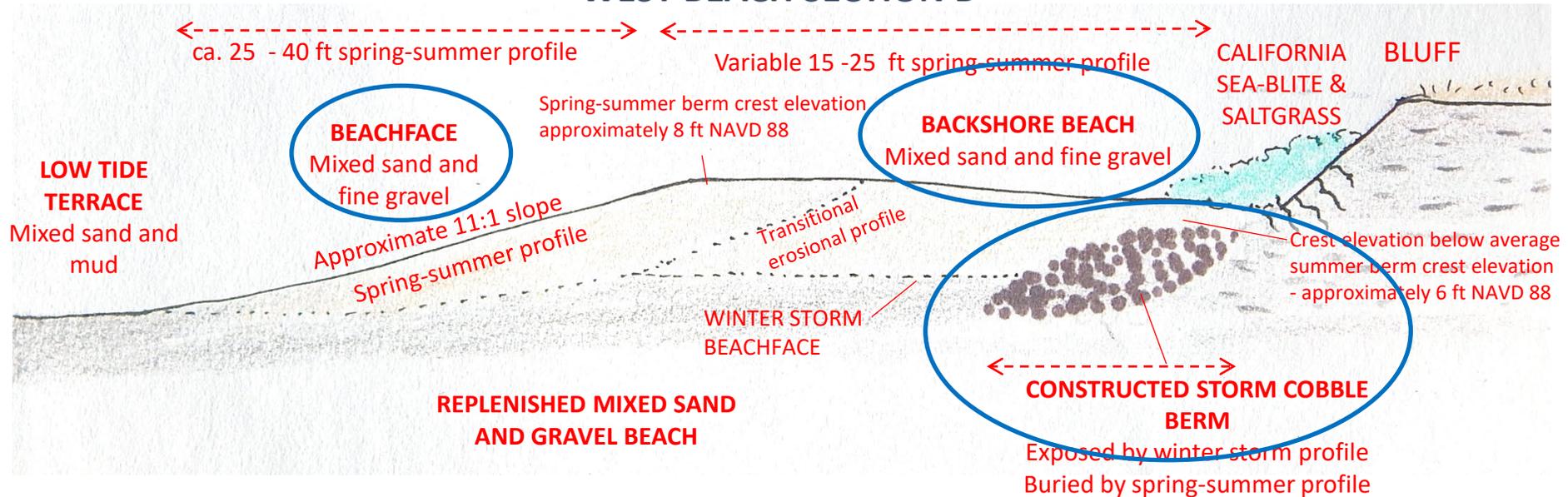
EAST BEACHES

DELTA

WEST BEACH SECTION A



WEST BEACH SECTION B



Draft Comparison Table

Criteria	GBDT (Lorang)	Dynamic Nourishment (Baye)
Shoreline erosion benefits	Larger more certain outcome under current and SLR conditions	May be sufficient , but less certainty, monitor and adjust as the system evolves
Agency Permitability (habitat impacts and benefits)	Harder to permit. impacts to existing habitat types, conversion to rocky intertidal	Lower upfront impacts, greater habitat benefits, easier to permit and lowered cost
Visual impacts	Greater with minor visual impacts due cobble/gravel layer just off-shore	Likely lower - Primarily sand in the shoreline
Public access and walkability	Improved over existing, sand added to backshore where primarily public usage is located	Improved over existing, sand added to backshore
Maintenance and sustainability	More sustainable - Design approach allows for overbuilding to account for SLR. Easier to find funding for capital costs then maintenance	Less sustainable and require funding for replenishment events. Less certainty.
Cost (\$)	Higher upfront capital cost. Lower maintenance cost	Lower capital cost and potentially higher maintenance costs

Stop for Questions and Input

- Both designs place sand on the beach of public use. Does this fit with POST and community vision for public use of the beach?
- Is POST concerned with shoreline erosion and SLR impacts to the shoreline?
- GBDT design approach places a cobble sill offshore to break waves. The size and height of this sill can be modified but does POST see any issues or concerns with this design feature? Including concerns over potential habitat or recreation impacts?
 - *Permitting agencies have power over this decision*
- The other approach emphasizes continued nourishment over time as sand and gravel may move and shoreline erosion continues (est. 6 year cycle). Given the costs and difficulties for placing add'l sediment, does POST have concerns over the more gradual approach?
 - *Note no County funding is currently available, all maintenance funds would have to be paid for by Tiburon or with future grants*
- Other issues and concerns?

Next Steps

- Present and gather public input from POST and public - *would POST recommend the Town actively adopt the project?*
- Present to Town council for their approval(?)
- Begin work on a Measure AA grant (awarded) for final design and permitting of one design alternative to start in March 2021 – includes CEQA permitting
- Go to agency permitting meeting in January 2021 for fuller evaluation of the two design approaches
 - Assessment of relative costs, impacts, longevity, habitat value etc.
- If all is successful, seek construction funding (approx. \$1.2 to \$1.5M)
- CEQA in 2020/2021 – Town would have to be lead CEQA agency

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