Marin County

Sea Level Rise

Zone 5 Flood District Meeting

Adaptation Planning Updates

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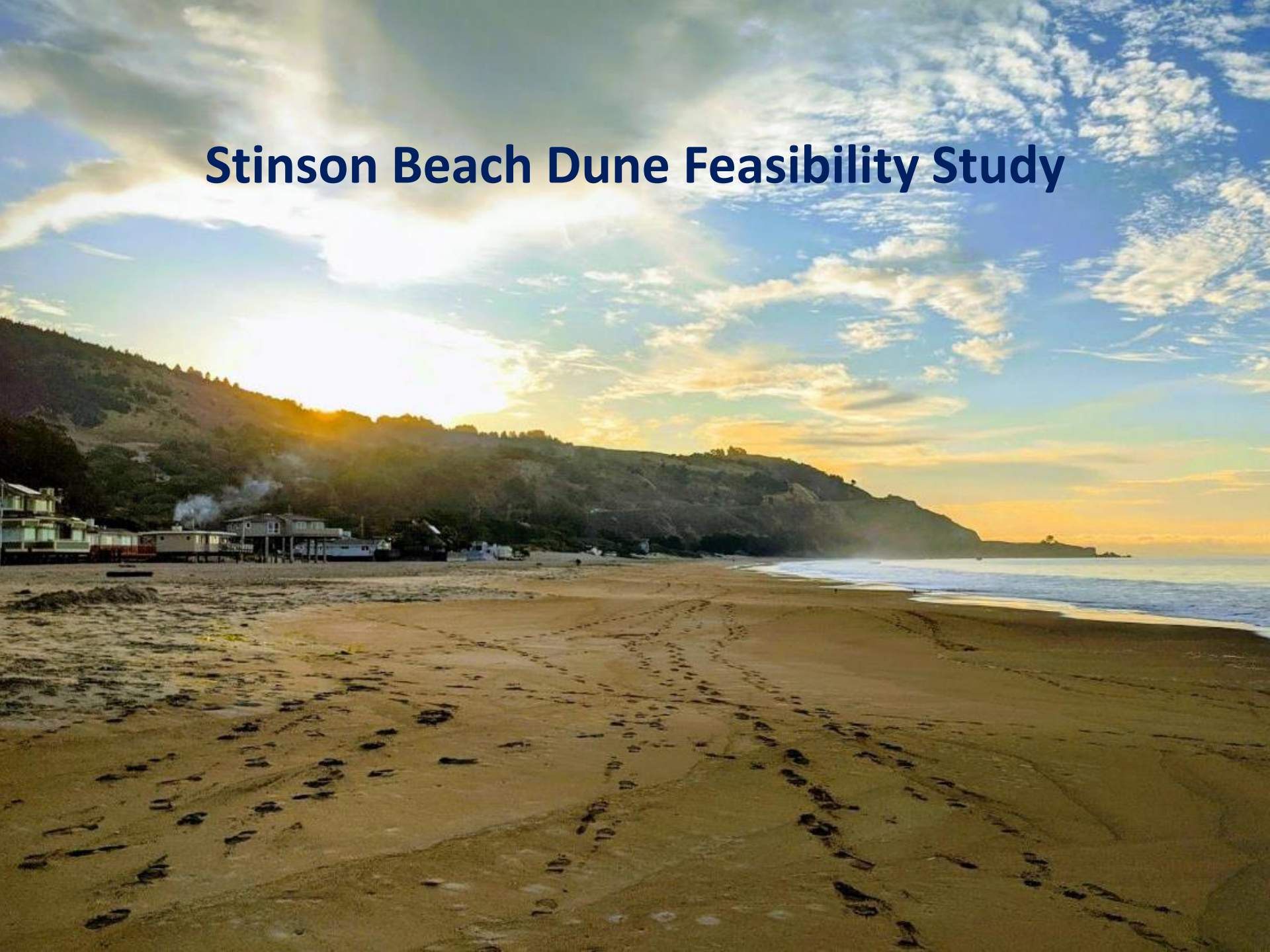
Stinson Beach Dune Feasibility Study



Stinson Beach Study Overview

Project Goal: Assess the feasibility of a resilient beach and dune ecosystem that

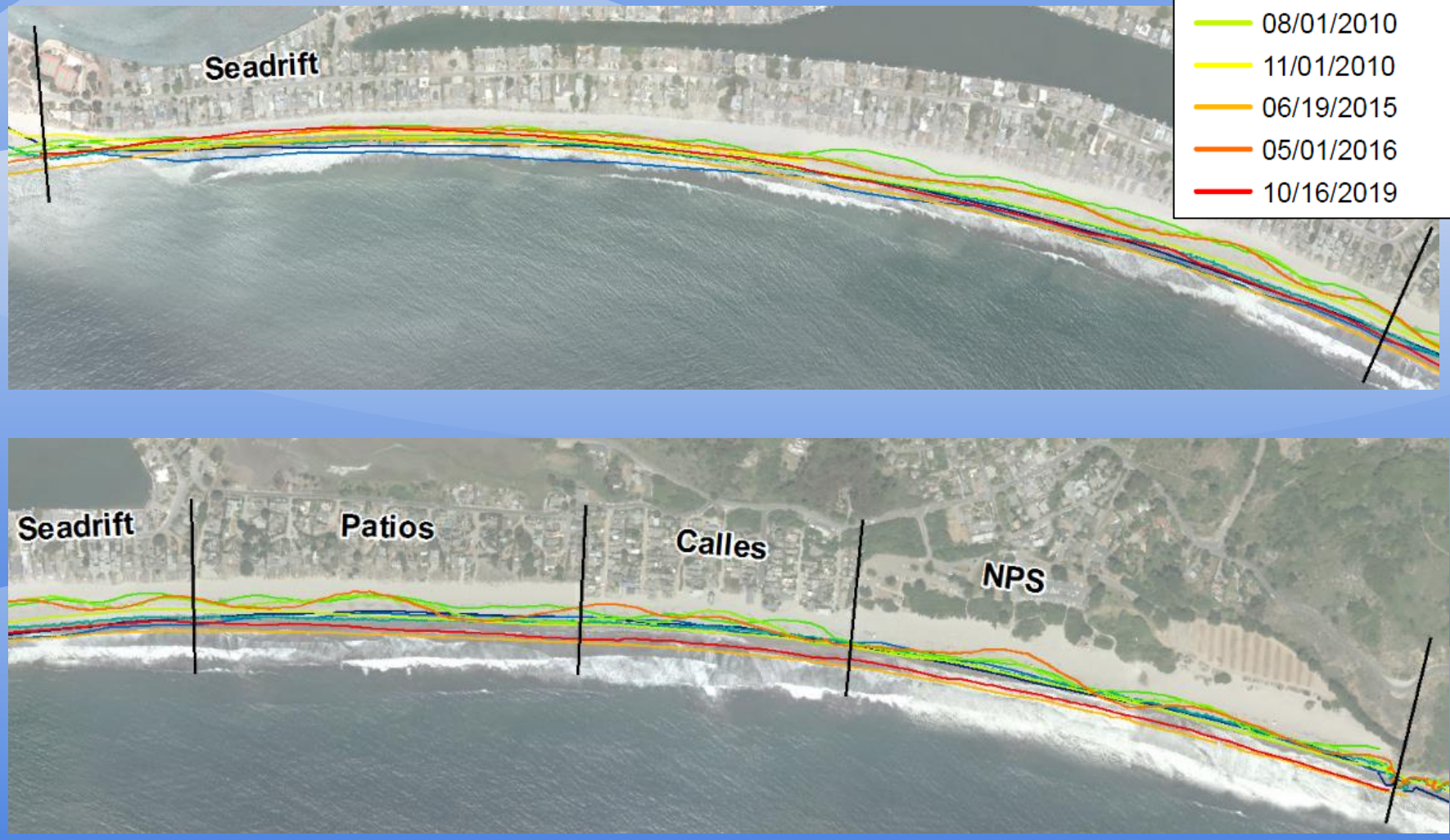
- **Enhances habitats and public access,**
- **Supports recreational opportunities for users of all socioeconomic circumstances, and**
- **Improves flood and erosion protection for public and private assets against existing coastal hazards and future sea level rise**

Study Set Up

- Beach is divided into 5 project reaches
- Several types of dunes and combinations are explored
- Criteria are used to evaluate each type of dune/dune feature
- Alternatives are presented

Shoreline Evolution

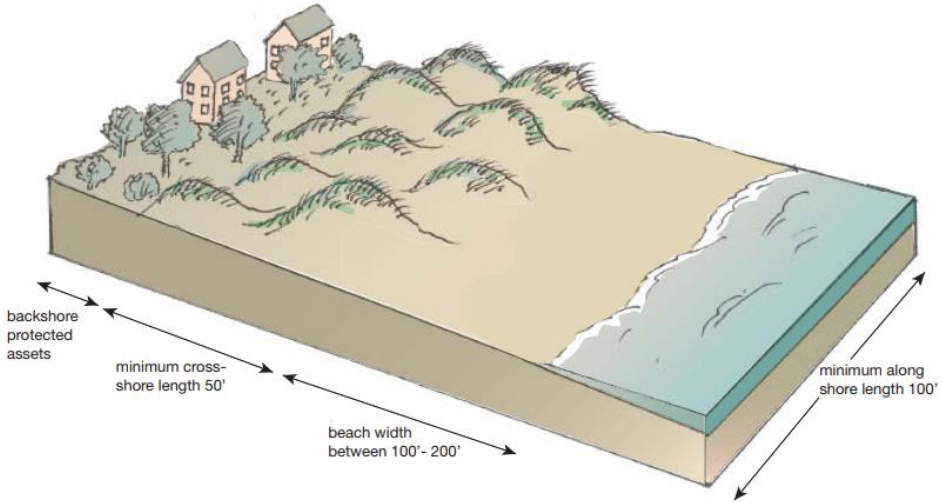
Historic Beach Widths by Project Reach



Types of Dune Systems

Foredunes

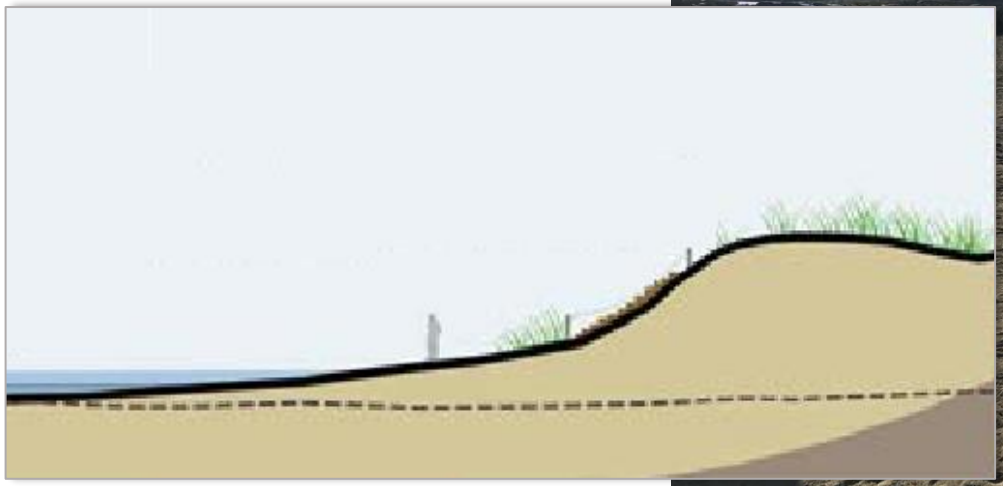
- Vegetated mounds or ridges of wind-blown sand at the back of the beach
- Manage dune vegetation to trap sand blown onshore from the beach during strong winds
- Provide a buffer from storm damage, erosion, and flooding (storm wave run-up, overwash)



Source: Natural Shoreline Infrastructure: Technical Guidelines for the CA Coast

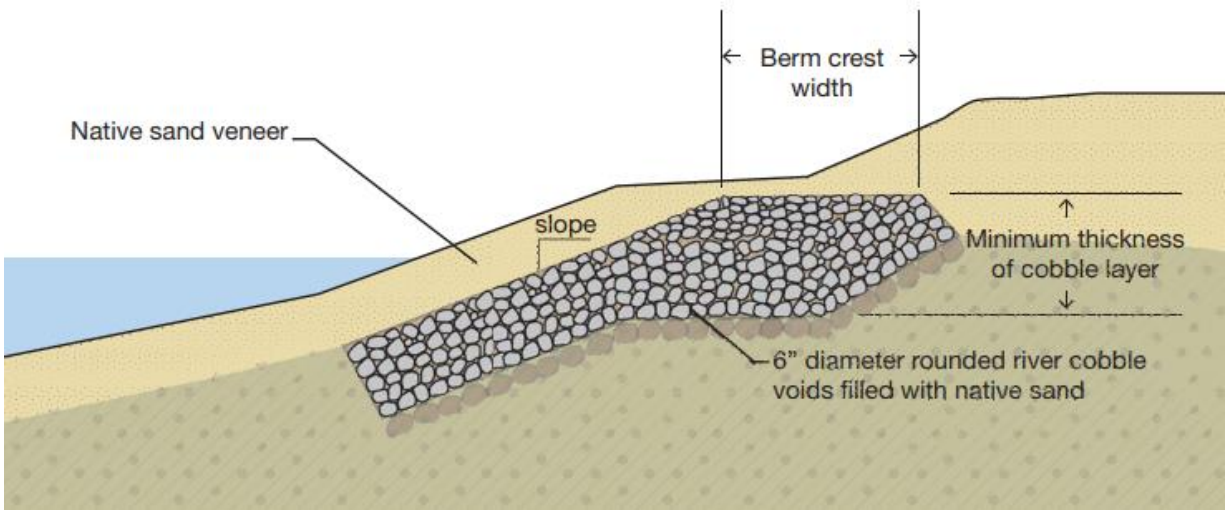
Dune Embankment

- Sacrificial, linear dune, minimal footprint
- With or without vegetation



Cobble Berm

- Dissipate wave energy and act as a "backstop," limiting landward extent of shoreline erosion
- Can provide habitat equivalency for marine invertebrates and enhance natural aesthetics
- Traversable and friendly form of armoring

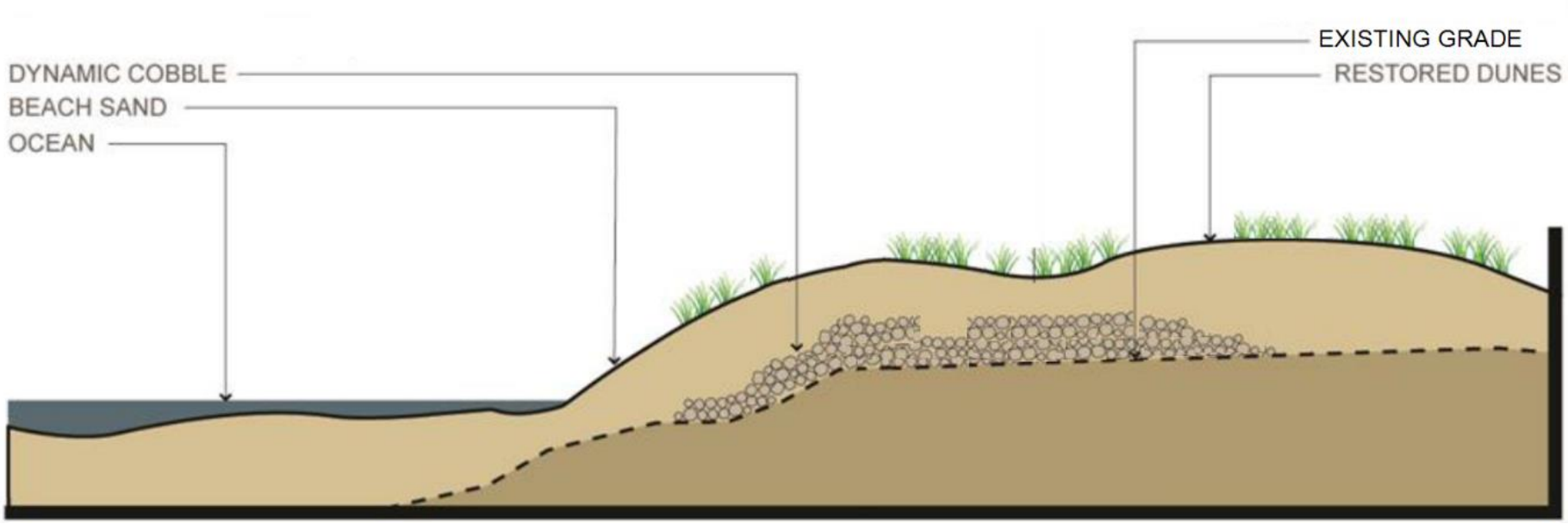


March 2016

November 2017

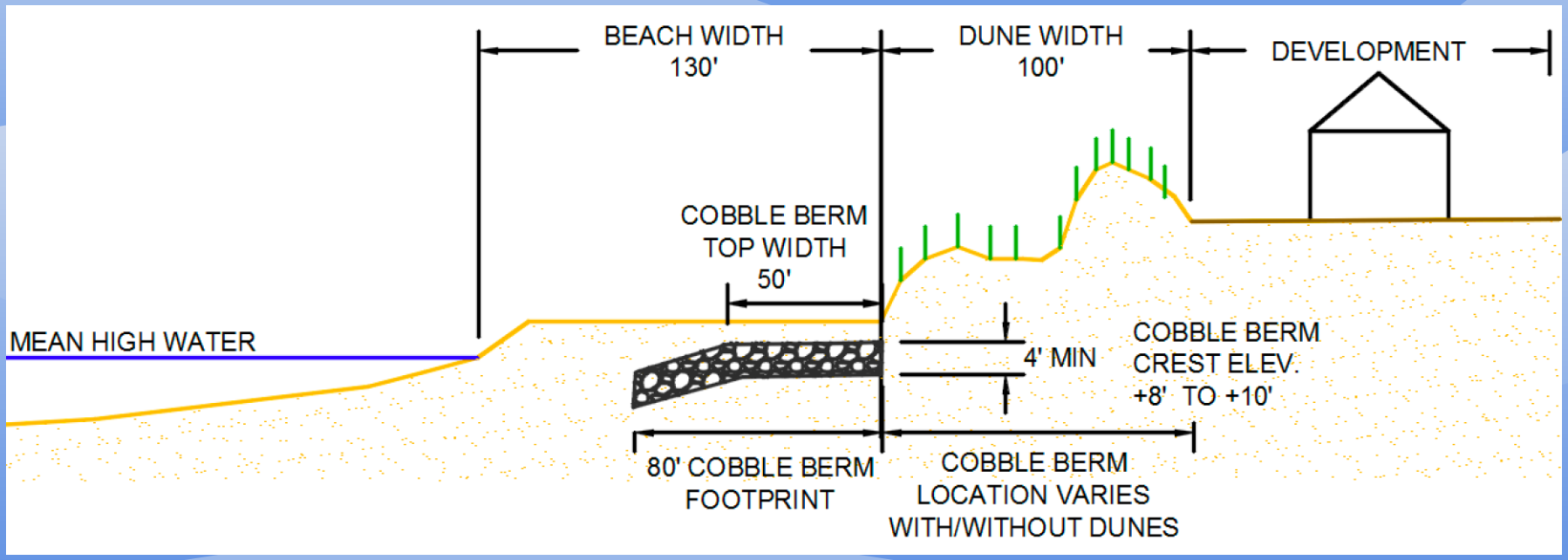
Dunes with Cobble Berm

- Dunes provide ecological value and serve as a sacrificial buffer during storms
- Cobble berm core serves as backup erosion protection for extreme winters
- Manage dune vegetation to reduce wind-blown sand



Beach Width Constraints

The minimum space requirements for each dune feature type were determined from: the C-SMART analysis and Natural Infrastructure Guidelines and compared to the existing space available in October 2019



The minimum dune width is 50 feet (foredune and dune embankment features). The minimum top width for cobble berm is 50 feet, while the minimum overall cobble berm footprint is 80 feet including the seaward sloping face. The minimum beach width is 100 feet from either the 50 feet of dunes or the 50 feet of cobble-gravel berm top width.

Selection Criteria

Selection Criteria

Natural Harmony – the dune type is consistent with natural setting

- **Foredunes already occur naturally**
- **Dune embankment & cobble-gravel berm are not native**

Selection Criteria

Ecology Benefits

- Foredunes support native plants
- Dune embankments can provide ecology benefits
- Cobble-gravel berm benefits equivalent to sandy beach

Selection Criteria

Access and Aesthetics

- Foredunes- least barrier to access & views, generally aesthetically pleasing
- Dune embankments- can make public access difficult and block views
- Cobble-gravel berm- more natural and traversable compared to other engineered structures

Selection Criteria

Effectiveness of Protective Services- protects development

- **Foredunes most efficiently provide protection**
- **Dune embankments higher relief, but will erode and scarp**
- **Cobble-gravel berms function best in combination with dunes**

Selection Criteria

Relative Costs- lower construction and lower maintenance costs are given higher rankings

- **Foredunes- lowest construction cost, low maintenance once vegetated**
- **Dune embankments- higher construction and maintenance costs**
- **Cobble-gravel berms- high construction and low maintenance costs**

Alternatives

Natural & Structural

Seadrift East: Alternative 1

"most natural" nature-based infrastructure types, consisting of foredunes where there is sufficient space and dune embankments where space is limited.

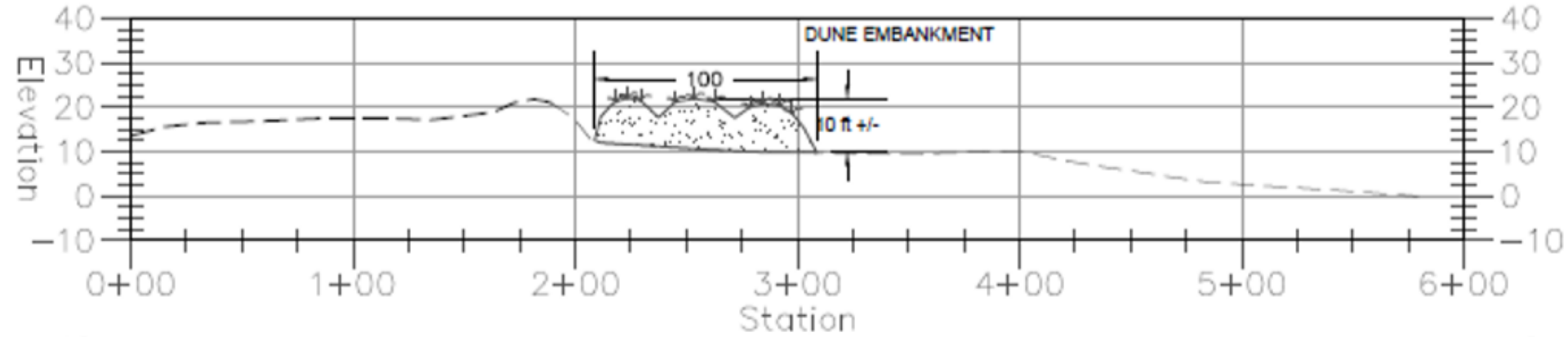
DUNE EMBANKEMENT

SEADRIFT–E

0+00

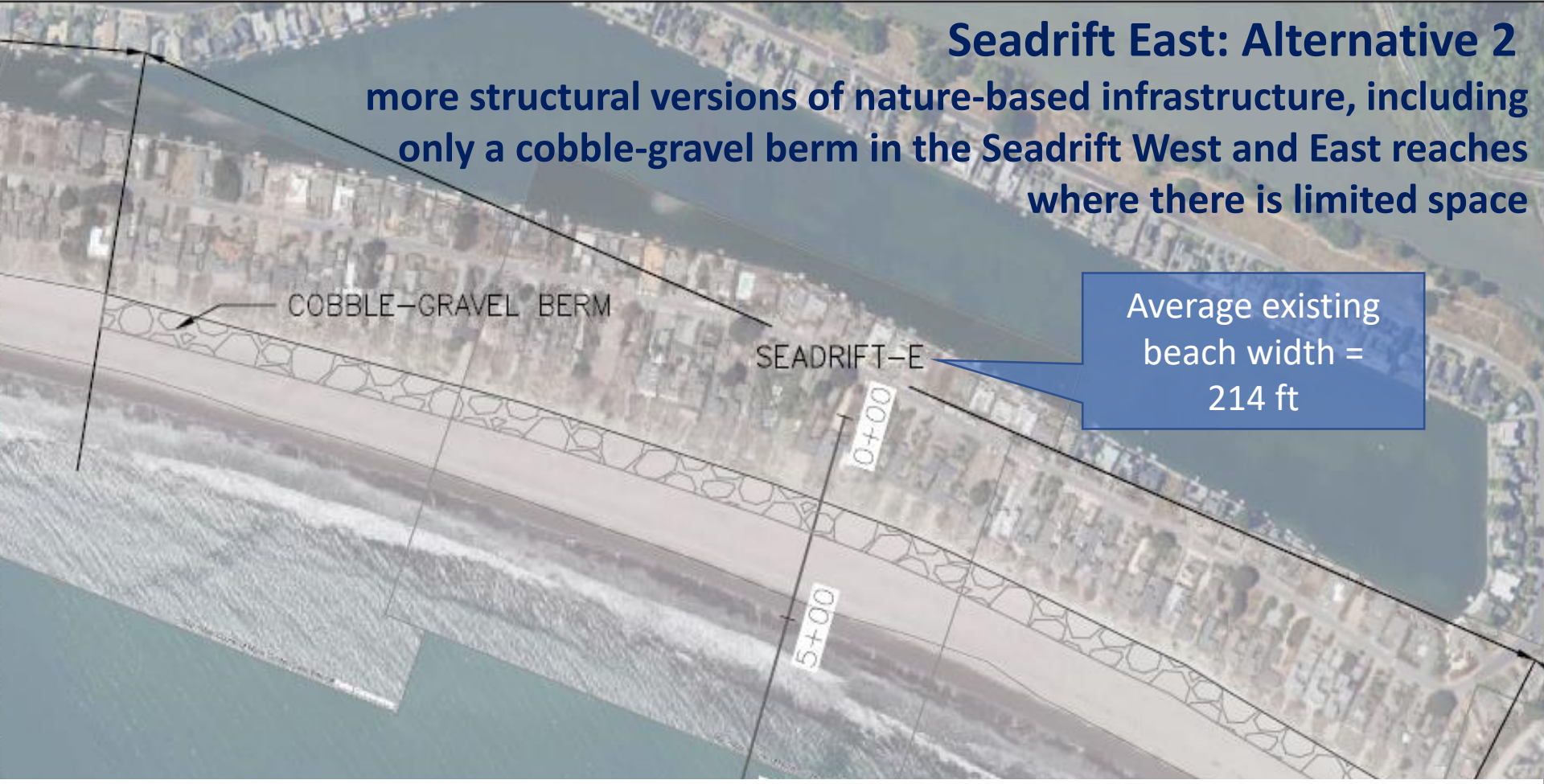
5+00

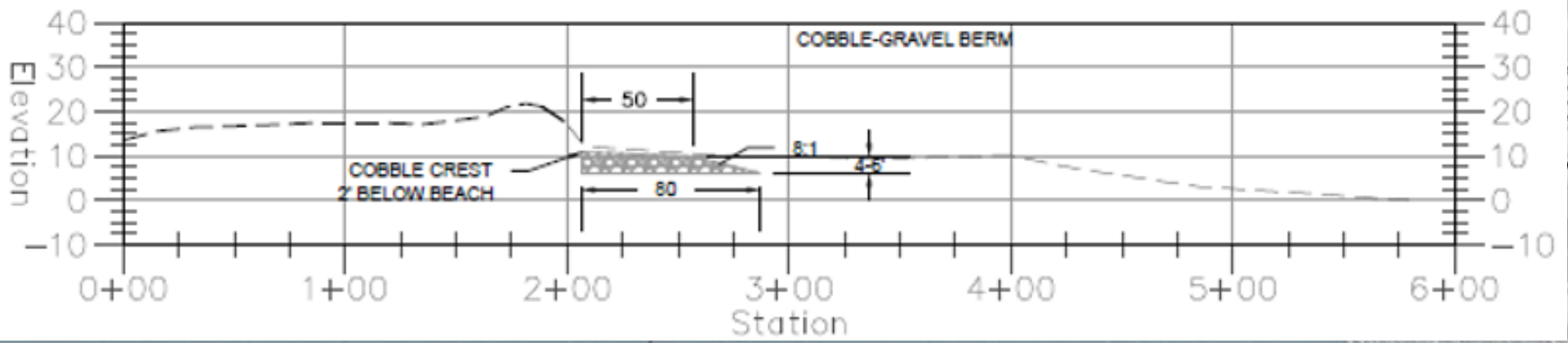
Average existing beach width = 214 ft



Seadrift East: Alternative 2

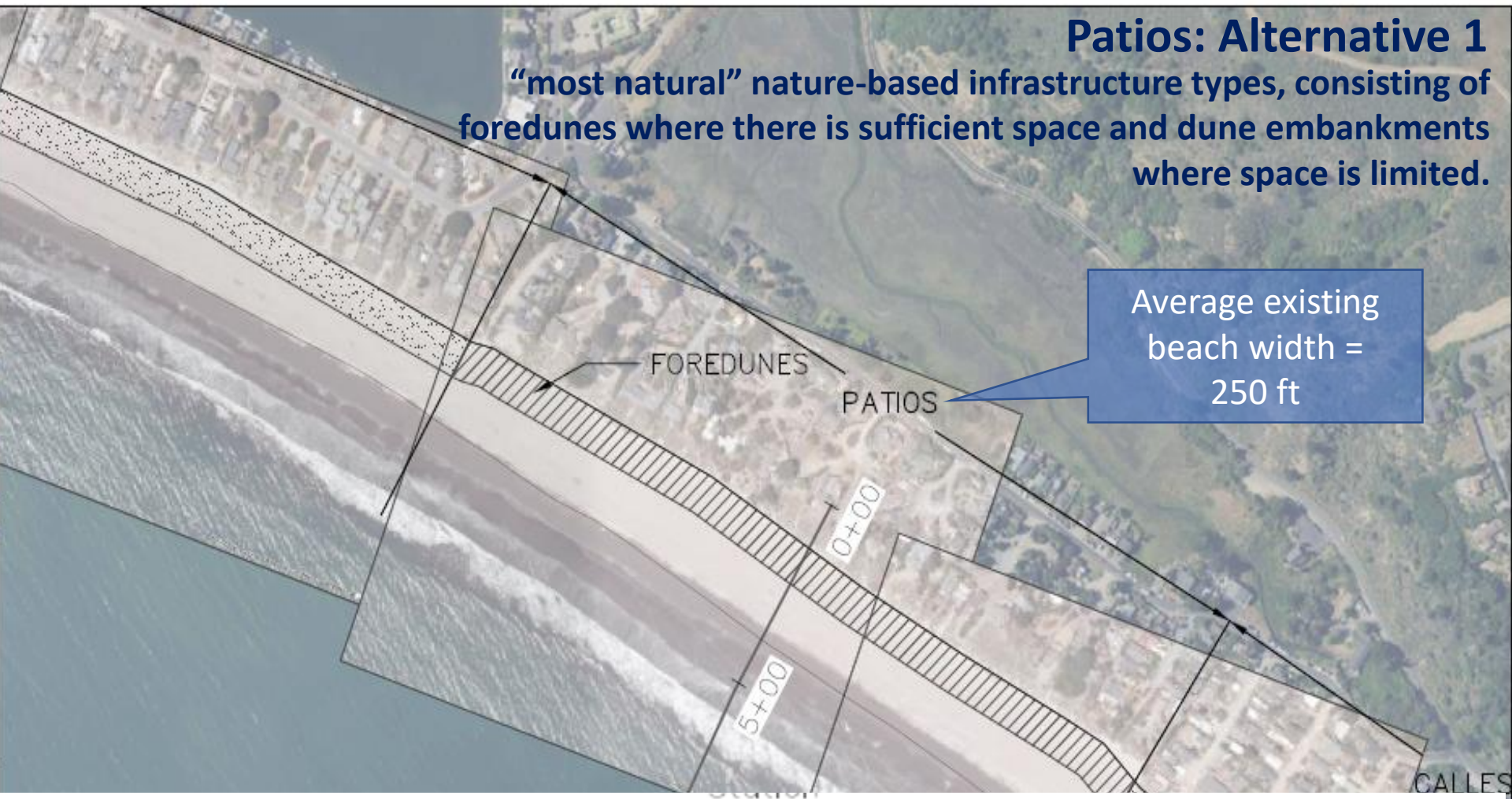
more structural versions of nature-based infrastructure, including only a cobble-gravel berm in the Seadrift West and East reaches where there is limited space

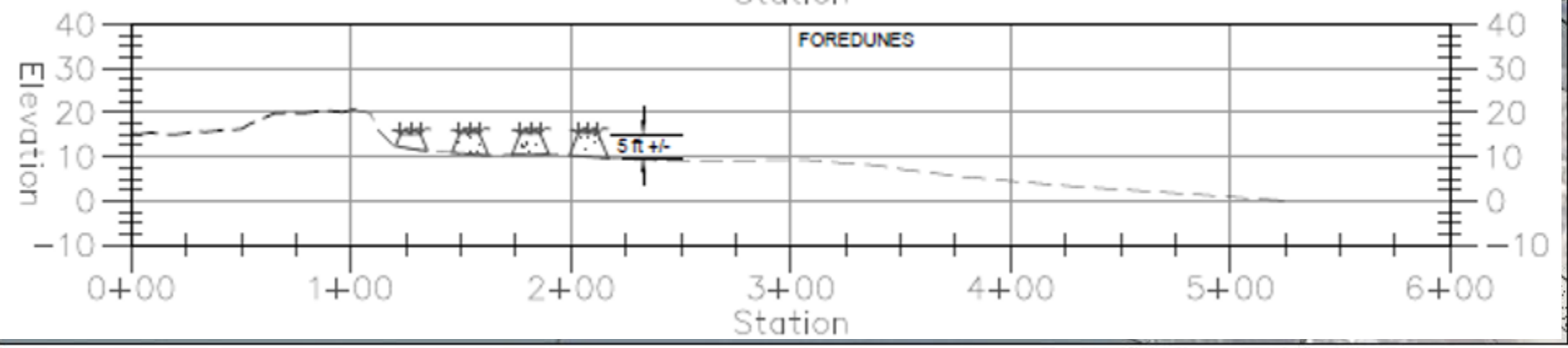




Patios: Alternative 1

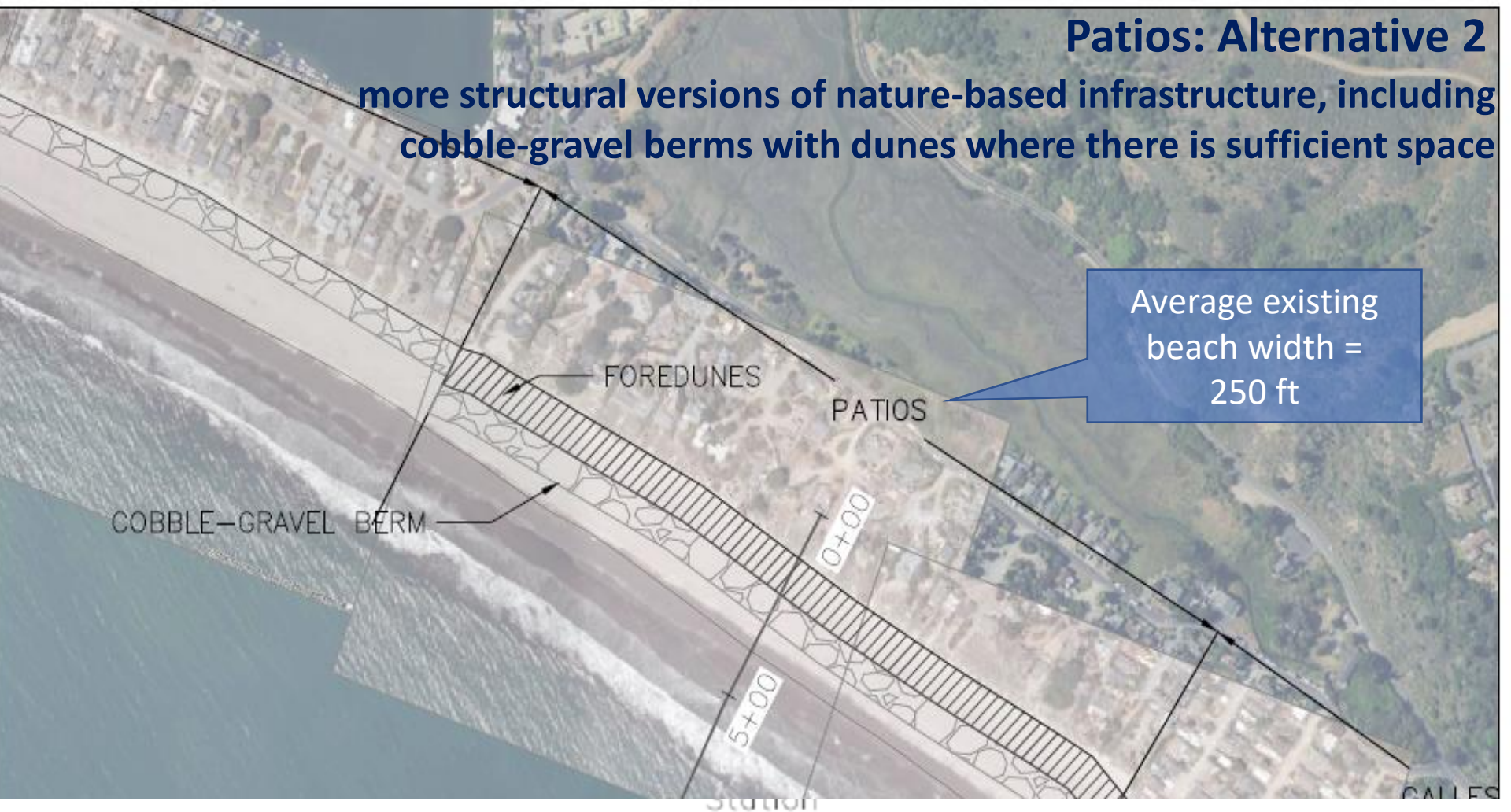
"most natural" nature-based infrastructure types, consisting of foredunes where there is sufficient space and dune embankments where space is limited.

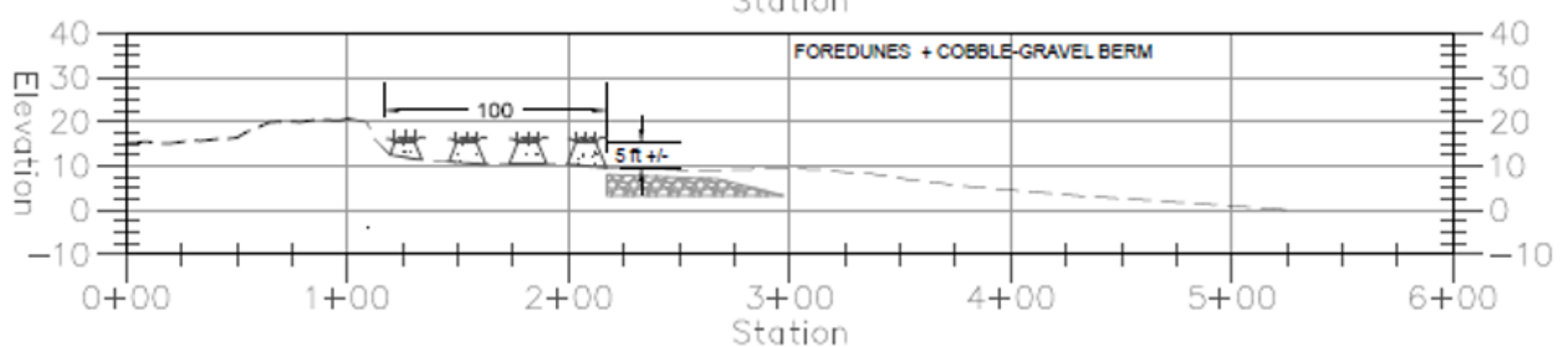




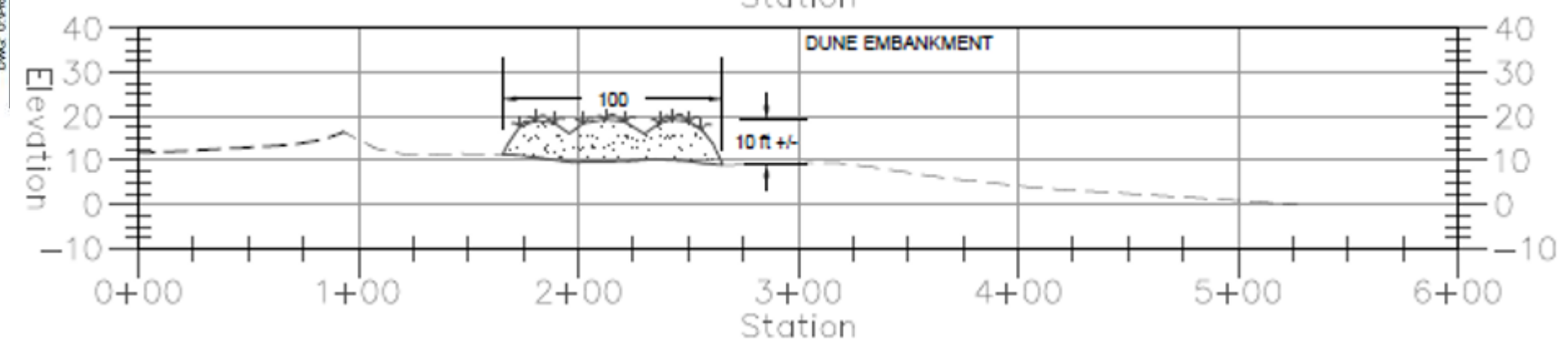
Patios: Alternative 2

more structural versions of nature-based infrastructure, including cobble-gravel berms with dunes where there is sufficient space

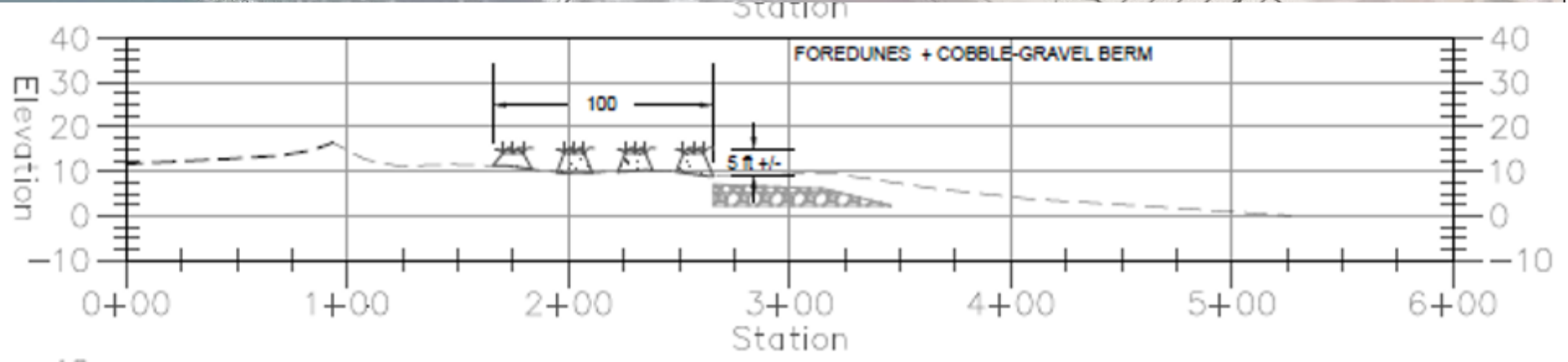




Calles: Alternative 1 "more natural"



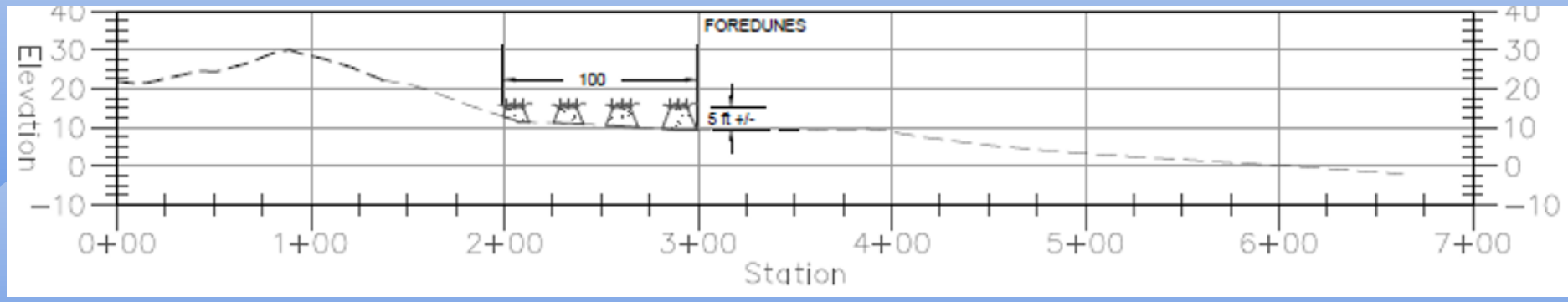
Calles: Alternative 2 "more structural"



NPS Alternatives

Average existing beach width = 264 ft

1



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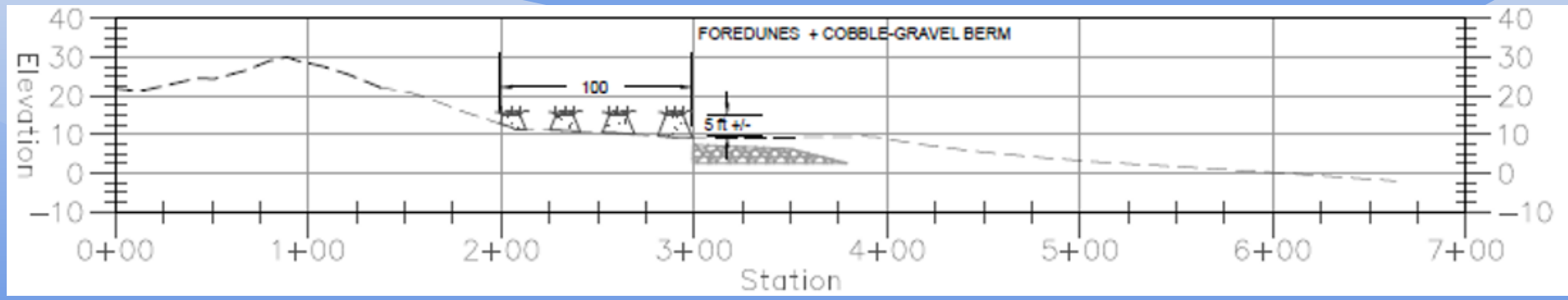

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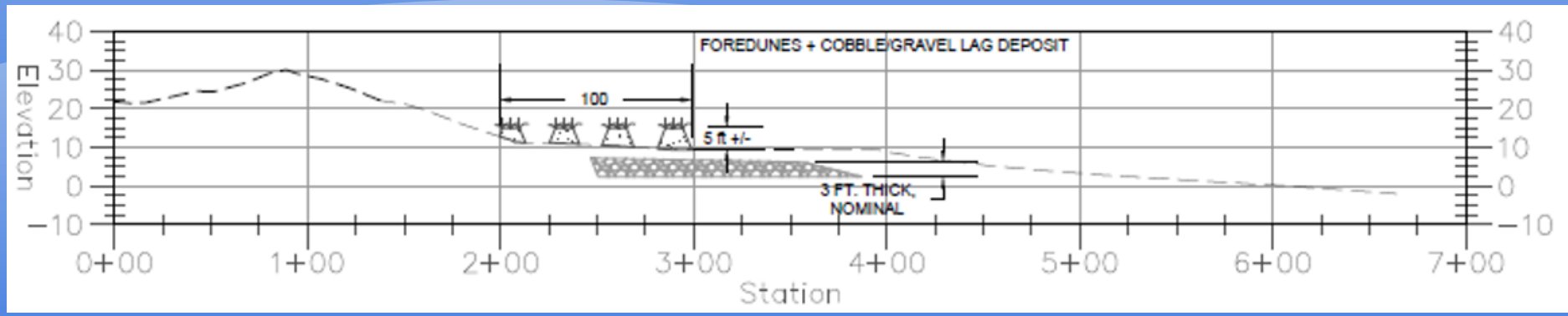

Alternatives by Reach

Reach	Potentially Suitable Screening (Table 1 space criteria)	Selected for Analysis (Table 2 Desirability Criteria)	Notes
Seadrift West	Cobble-Gravel Berm	Cobble-Gravel Berm	Limited space, existing shore armor
Seadrift East	Foredunes Foredunes + Cobble-Gravel Berm Dune Embankment Dune Embankment + Cobble-Gravel Berm Cobble-Gravel Berm	1. Dune Embankment 2. Cobble-Gravel Berm	Limited but increasing space, existing shore armor
Patios		1. Foredunes 2. Foredunes + Cobble-Gravel Berm	Development set back, some existing foredune infrastructure
Calles		1. Foredunes + Cobble-Gravel Berm 2. Dune Embankment + Cobble-Gravel Berm	Irregular development line creates pockets of additional space for natural infrastructure
NPS		1. Foredunes 2. Foredunes + Cobble-Gravel Berm 3. Foredunes + Cobble-Gravel lag deposit	Cobble-Gravel berm with cobble-gravel lag geometry added as third option

Next Steps

~Final Public Meeting

~Incorporate into Stinson ARC Project

Thank You

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