



Known for excellence. Built on trust.



Islesboro Narrows Alternative Analysis and 15% Preliminary Design

Draft Report Presentation to Islesboro Sea Level Rise Committee
12 June 2024



This [report/video/presentation/internet site] was prepared by [GZA](#) under award [CZMNA22NOS4190151](#) to the Maine Coastal Program from the National Oceanic and Atmospheric Administration, U.S. Department of Commerce. The statements, findings, conclusions, and recommendations are those of the author(s) and do not necessarily reflect the views of the National Oceanic and Atmospheric Administration or the Department of Commerce.

Project Status

- Updated to metocean analysis
- Alternatives Analysis
- 15% Preliminary Design Draft Memorandum



2024

Activity Description	January				February				March				April				May				June				July				August				September				October				November				December			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
In-Person Meetings																																																
Virtual Meetings (approximate)																																																
Check in with Town PM (approximate)																																																
Alteratives Analysis + Concept Design																																																
Preliminary Design																																																
Preapplication Meeting																																																

Metocean Data Analysis Summary

GEOTECHNICAL

ENVIRONMENTAL

ECOLOGICAL

WATER

CONSTRUCTION
MANAGEMENT

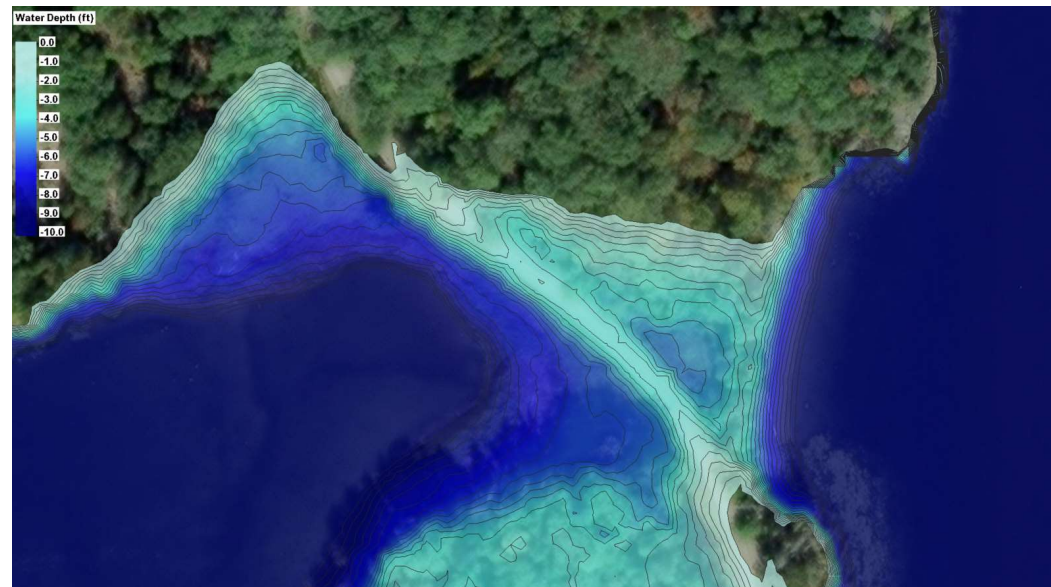
Analyzed Data	Design Value
100-year, 1-minute wind	90 mph
Mean Lower Low Water Elevation	-5.3 feet NAVD88
Mean Higher High Water Elevation	4.7 feet NAVD88
100-year Stillwater Elevation	9.4 feet NAVD88 vertical datum
100-year Significant Wave Height	7.8 feet (east-southeast direction, approx. 12-mile fetch)
2050 Relative Sea Level Rise Projections	<ul style="list-style-type: none"> 1.5 feet State of Maine "Commit to Manage" 1.2 feet to 1.3 feet NOAA 2022 (Portland – Bar Harbor) 3.0 feet State of Maine "Prepare to Manage" 1.4 feet to 1.5 feet NOAA 2022 (Portland – Bar Harbor)
2100 Relative Sea Level Rise Projections	<ul style="list-style-type: none"> 3.9 feet State of Maine "Commit to Manage" 3.5 feet to 3.7 feet NOAA 2022 (Portland – Bar Harbor) 8.8 feet State of Maine "Prepare to Manage" 6.0 feet to 6.1 feet NOAA 2022 (Portland – Bar Harbor)

Alternatives based on: *3.9 feet SLR for coastal protection options and a permissible 2 feet of water on the roadway during peak storm conditions*
6.6 feet SLR for bridge option

North Narrows Design Alternatives

Existing Conditions

- Penobscot Bay: mostly shielded by trees, vegetation and higher topography of Thorn Plum Point
- Crow Cove: Limited fetch and buffered by marsh
- Low elevation roadway is susceptible to inundation
- Existing road: ~ 1 foot higher than FEMA 100-yr water level



North Narrows Design Alternatives

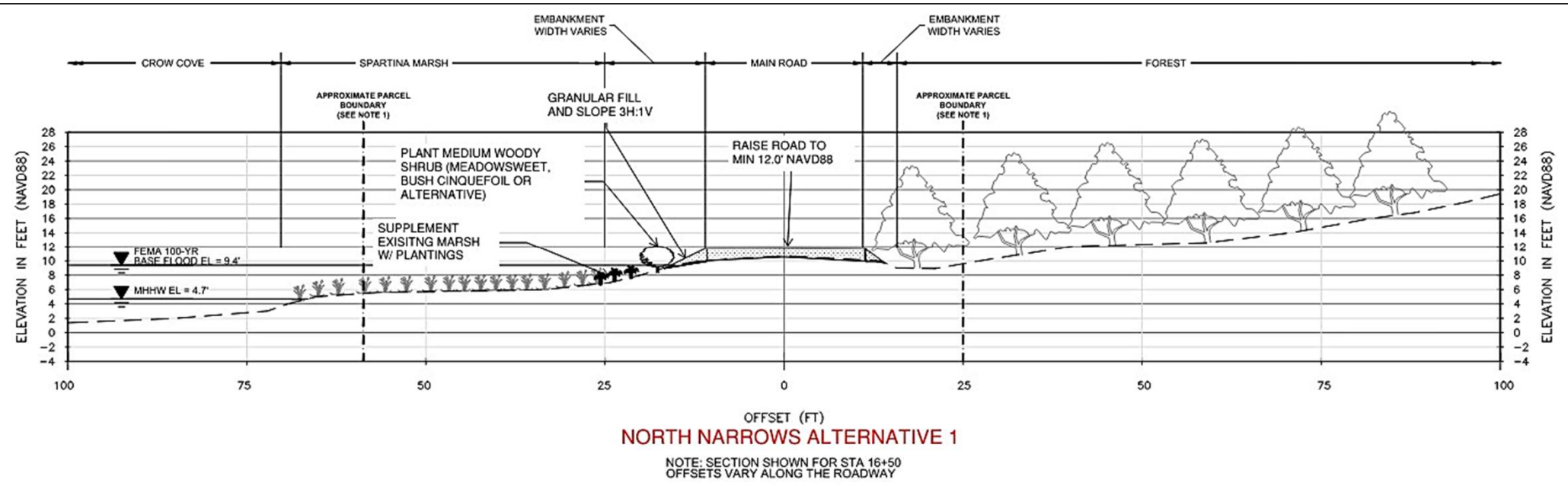
Raise Roadway with revegetated slope and marsh

Existing Average Centerline Elevation: ~10.5 feet NAVD88

Raised Average Centerline Elevation: ~12.5 feet NAVD88

Sloped Embankments with vegetation

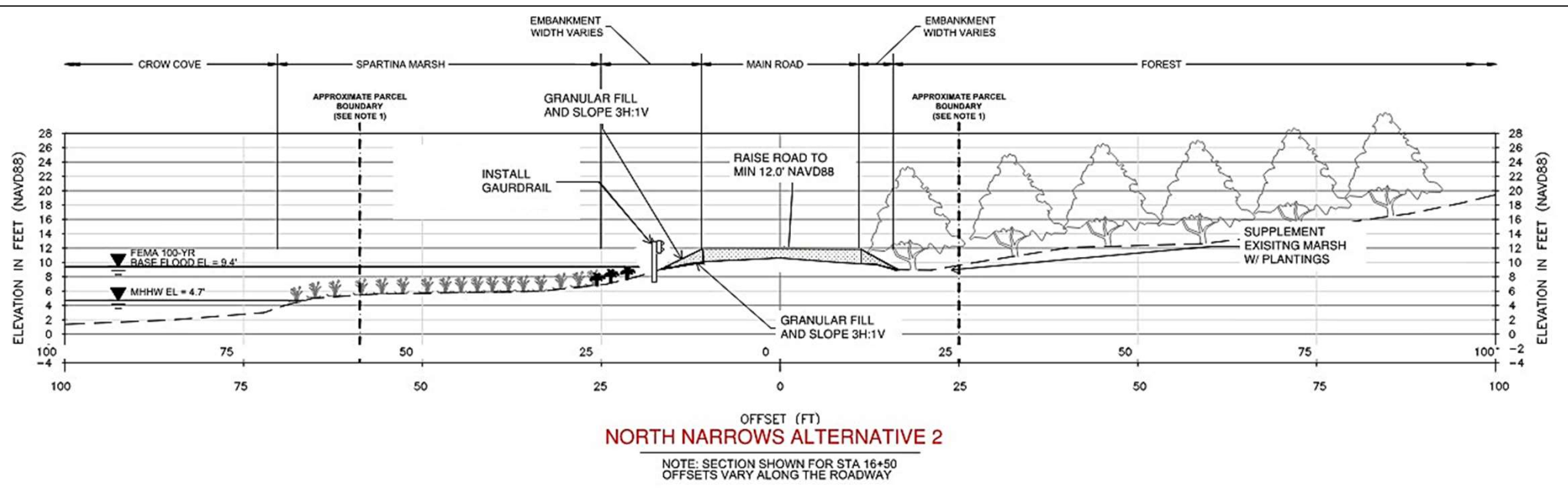
15% Preliminary Design Cost Estimate: \$1M - \$1.5M Main Road, South Narrows to North Narrows



North Narrows Design Alternatives

Raise Roadway with guardrail (debris deterrent)

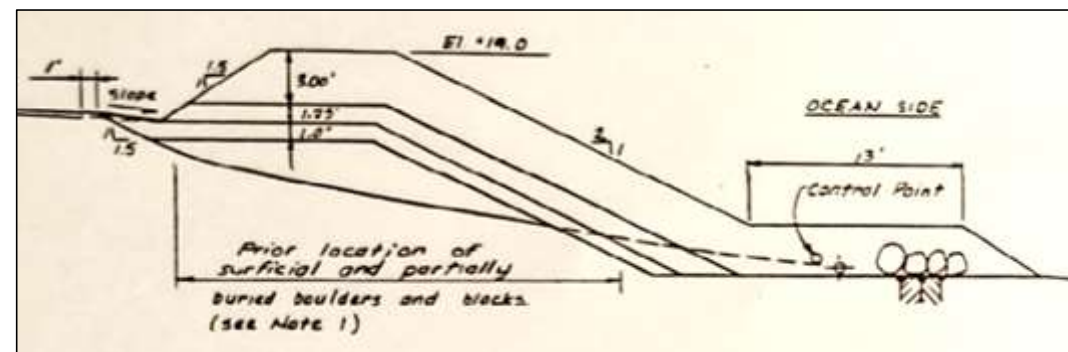
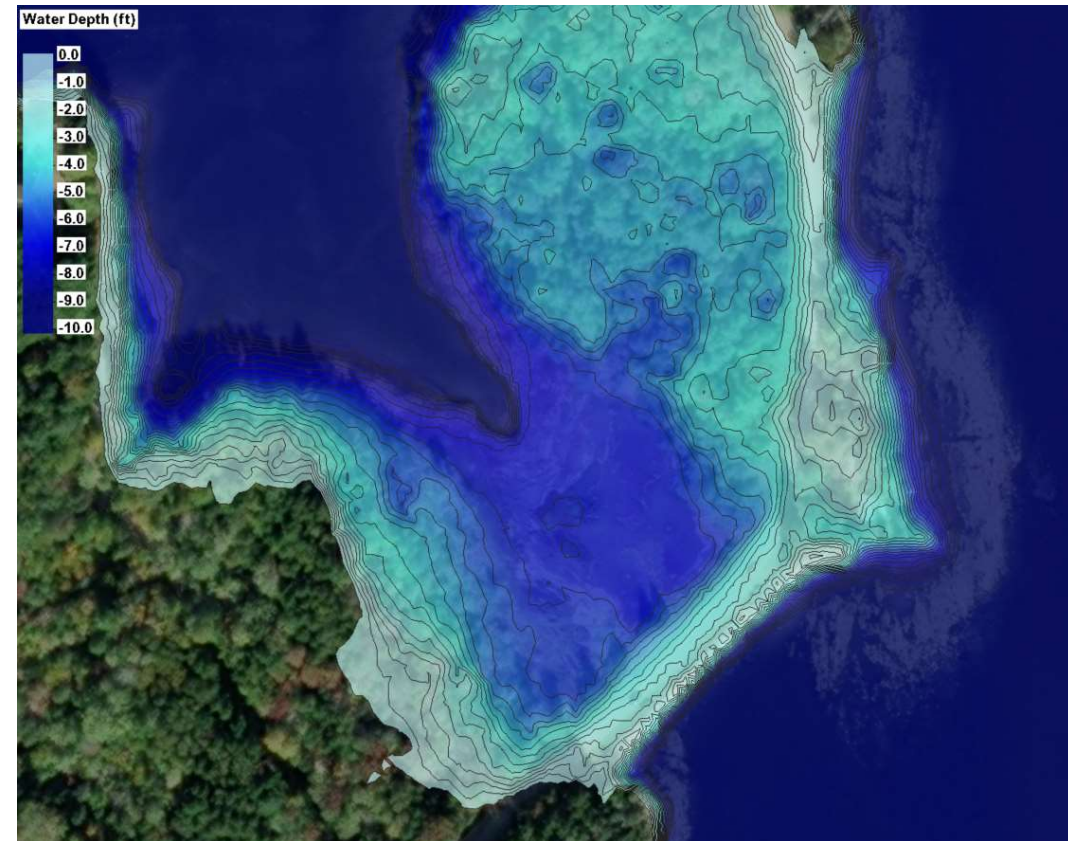
Existing Average Centerline Elevation: ~10.5 feet NAVD88
 Raised Average Centerline Elevation: ~12.5 feet NAVD88
 Sloped Embankments with vegetation
 Guardrail along west shoulder



Middle & South Narrows Design Alternatives

Existing Conditions

- East - Penobscot Bay: direct exposure, ~ 12-mile fetch
 - South Narrows – stone revetment (USACE, 1984)
 - Middle Narrows – stone protection (date and construction unknown)
- West - Crow Cove
 - South Narrows - Limited fetch and buffered by marsh
 - Middle Narrows - Oak-Pine Forest
- Low roadway elevation is susceptible to inundation, wave overtopping and debris



Middle & South Narrows Design Alternatives

- Reconstruct Stone Revetment
 - Wire Mesh TECCO® CELL System

- Reconstruct Revetment with Return Seawall

- Reconstruct Revetment and Construct Offshore Breakwater

- Reconstruct Revetment with Berm and Reef Balls

- Bridge and Raised Roadway

Middle & South Narrows Design Alternatives

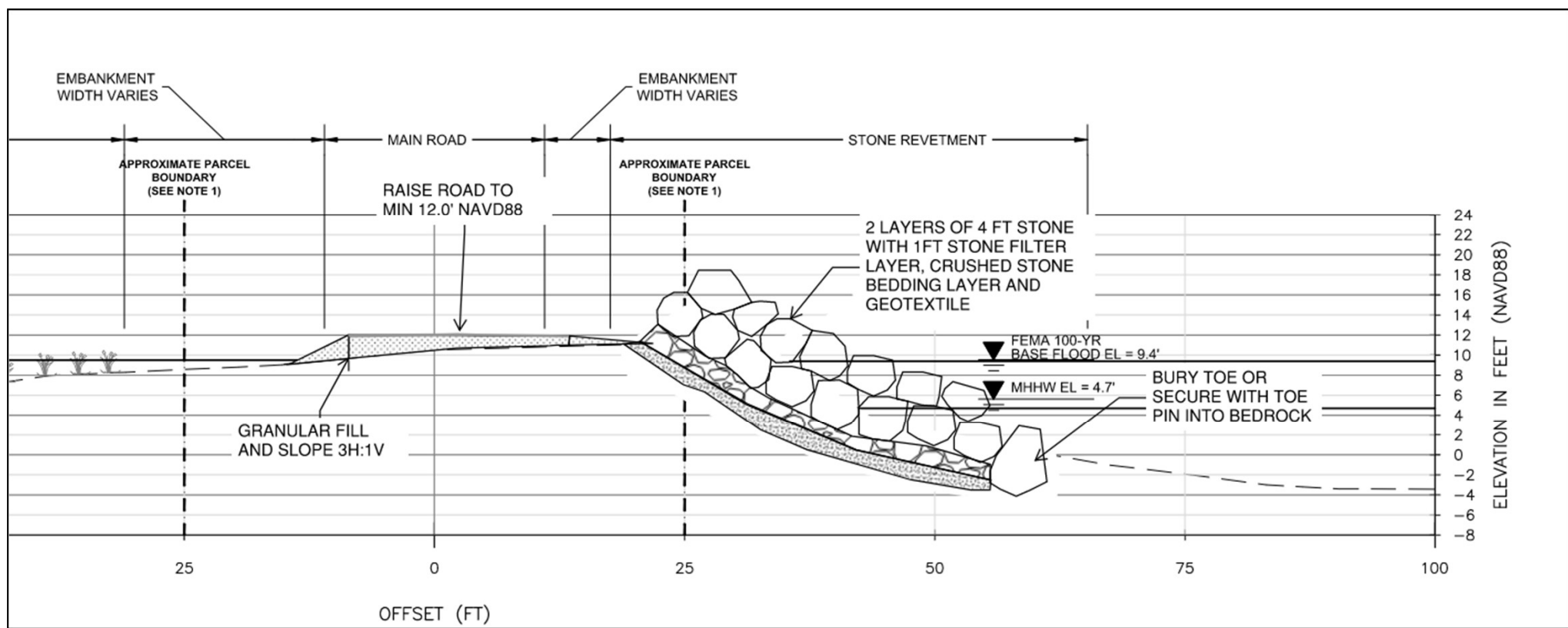
Stone Revetment

Engineered revetment for 3.9' SLR + FEMA 100-yr storm water level (Crest EL 18' – 20' NAVD88)

4.5-ton to 6-ton average stone size

15% Preliminary Design Cost Estimate: South Narrows, \$1.2M - \$1.5M

Middle Narrows, \$700K - \$900k



Middle & South Narrows Design Alternatives

Wire Mesh TECCO[®] CELL System

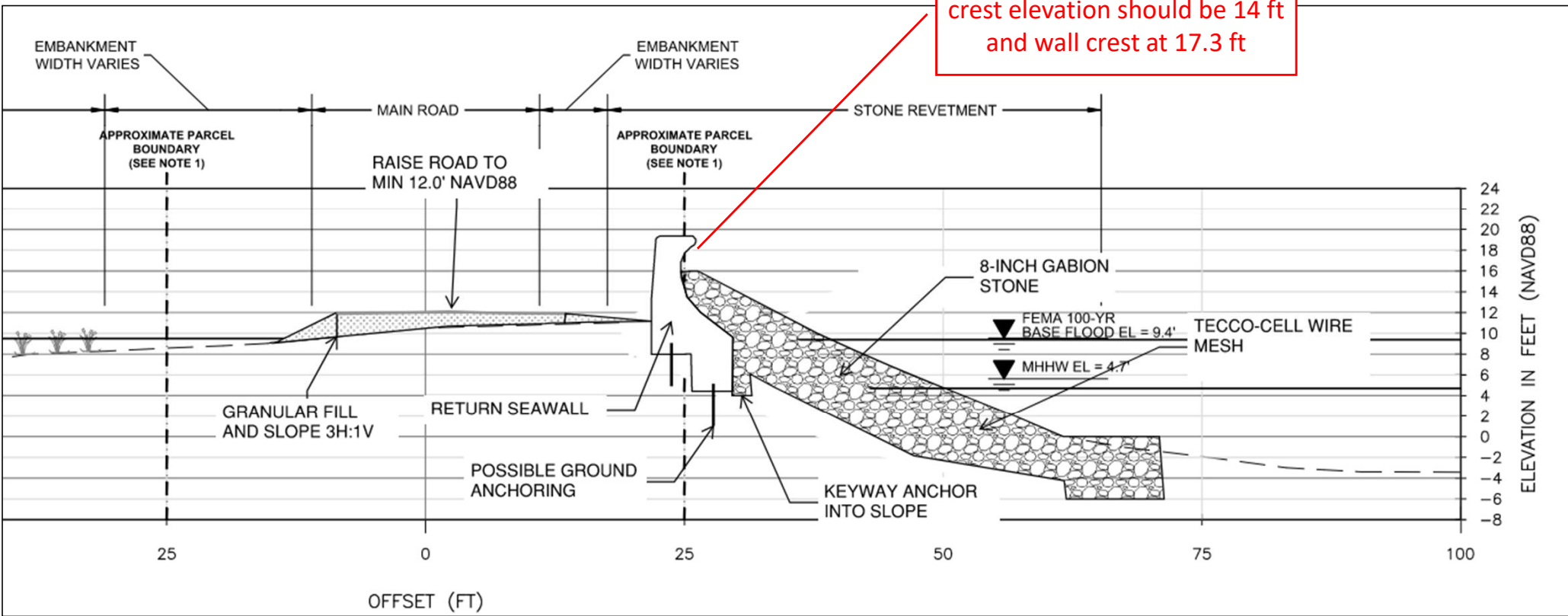
Engineered revetment for 3.9' SLR + FEMA 100-yr storm water level (Crest EL 18' – 20' NAVD88)

Gabion-type construction, smaller stone, facilitate Town repairs/modifications

Additional design considerations if advanced: potential need for rock anchors to secure the cells, potential anchoring of the toe against waves; and potential mesh lifespan considerations

15% Preliminary Design Cost Estimate: pending

Scale Issue: the revetment crest elevation should be 14 ft and wall crest at 17.3 ft



Middle & South Narrows Design Alternatives

Revetment with Return Seawall

Engineered revetment for 3.9' SLR + FEMA 100-yr storm water level

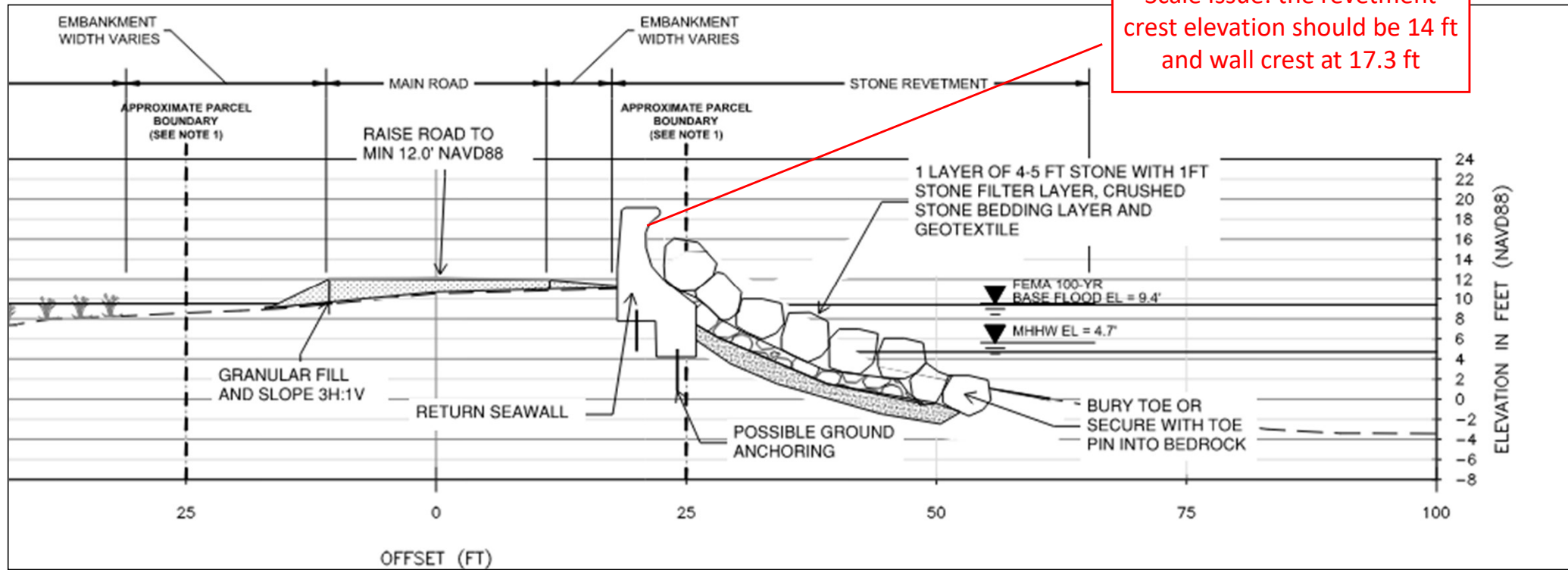
Reduces revetment crest (EL 16' NAVD88)

One layer of armor stone

15% Preliminary Design Cost Estimate: South Narrows, \$2.6M - \$3.1M

Middle Narrows, \$850K - \$1.1M

Scale Issue: the revetment crest elevation should be 14 ft and wall crest at 17.3 ft



Middle & South Narrows Design Alternatives

Revetment and Offshore Breakwater

Engineered revetment for 3.9' SLR + FEMA 100-yr storm water level

Reduces revetment crest (EL 15' NAVD88)

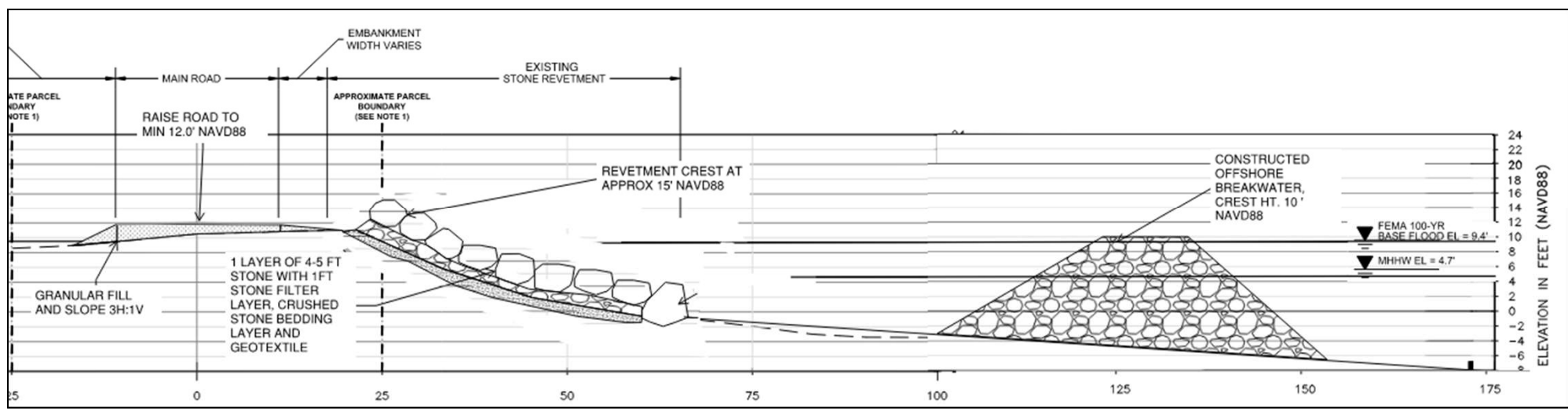
One layer of armor stone

Breakwater Crest EL 10 NAVD88, located ~ 30 offshore of revetment toe

Provides reduced wave environment, potentially favorable conditions for marine life/vegetation

15% Preliminary Design Cost Estimate: South Narrows, \$4.2M - \$5M

Middle Narrows, \$2.7K - \$3.3M



Middle & South Narrows Design Alternatives

Revetment with Berm and Reef Balls

Engineered revetment for 3.9' SLR + FEMA 100-yr storm water level

Reduces revetment crest (EL 15' NAVD88)

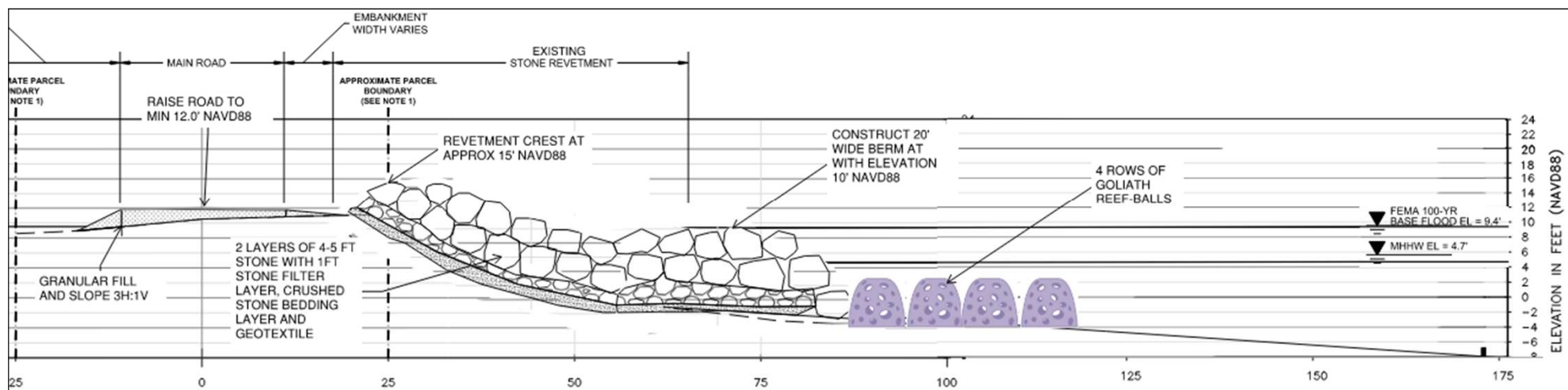
20-ft wide Berm at Toe of Revetment, Crest EL 10 NAVD88

Four rows of Reef Balls (~ 6' tall)

Provides reduced wave environment, potentially favorable conditions for marine life/vegetation

15% Preliminary Design Cost Estimate: South Narrows, \$1.5M - \$1.8M

Middle Narrows, \$850K - \$1.1M



Nature Based Solutions Design Alternatives

NBS Options

Concrete “Tide Pools” integrated into the revetment and breakwater

Reef Balls

Marsh and maritime shrub plantings



Photograph Source: [Nearshore habitats for marine life and coastal birds during coastal construction - EConcrete \(econcretetech.com\)](https://www.econcretetech.com)

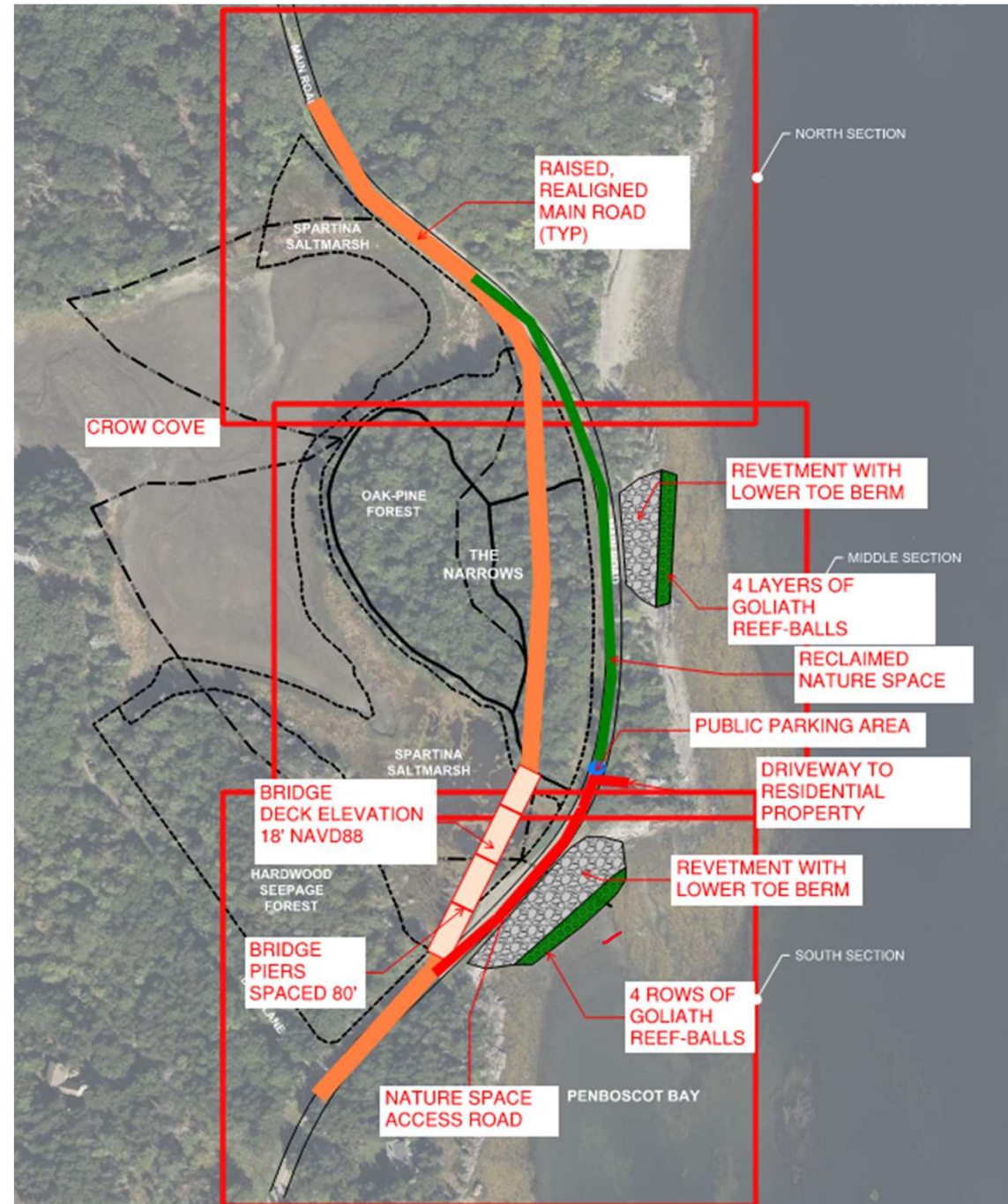


Photograph Source: Stratford Point, CT. Photo Credit: Jennifer Mattei

The Narrows Design Alternatives

Road Realignment with South Narrows Bridge

- Relocate Main Road to the West
- 300-ft long bridge at South Narrows
- Road elevation raised, with transition approaches at the bridge
- Access for private property
- Permitting, NEPA Environmental Assessment
- Geotechnical subsurface investigations
- Reclaim existing Main Road for recreation and buffering for future SLR conditions
- 15% Preliminary Design Cost Estimate: \$20M
- + Revetement and Reef Ball Estimate: \$23M



15% Preliminary Design Alternatives Comparison

Location	Alternative	Service Life	Construction Cost	Future Adaptability	Emergency Access	Envir. Impact	Permitting	Construction Considerations	Engineering Constraints	Property Impact	Total
North Narrows	Raise Roadway with revegetated slope and marsh supplement	3	5	5	4	5	4	4	4	4	38
	Raise Roadway with guardrail (debris deterrent)	3	4	5	4	4	4	4	4	4	36

Location	Alternative	Service Life	Construction Cost	Future Adaptability	Emergency Access	Envir. Impact	Permitting	Construction Considerations	Engineering Constraints	Property Impact	Total
Middle and South Narrows	Reconstruct Stone Revetment	4	3.5	3	3.5	4.5	4.5	4	4	5	36
	Wire Mesh TECCO® CELL System	3.5	3.5	3	3.5	4.5	4.5	3.5	4	5	35
	Reconstruct Revetment with Return Seawall	3.5	2.5	3	3.5	4.5	4.5	3	3	4	31.5
	Reconstruct Revetment and Construct Offshore Breakwater	4	2	3	3.5	3	3	3	4	4	29.5
	Reconstruct Revetment with Berm and Reef Balls	4	3	3.5	3.5	4	4	4	4	5	35
	Bridge and Raised Causeway	5	1	5	5	2	3	4	3	2	30

Discussion