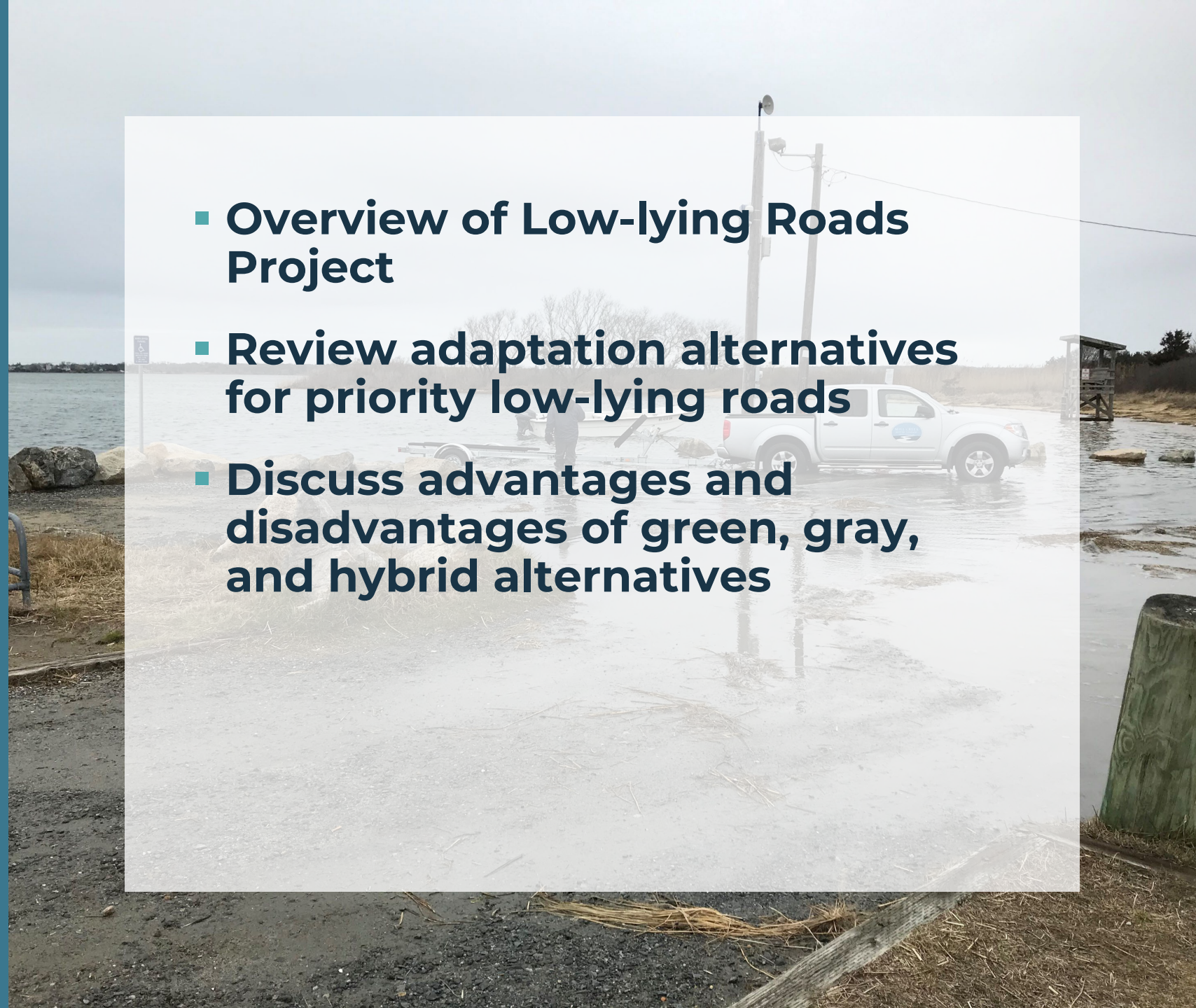
Low-lying Roads: Bourne

Project funded by the Municipal Vulnerability Preparedness Program

Purpose and Objectives of Public Meeting



- **Overview of Low-lying Roads Project**
- **Review adaptation alternatives for priority low-lying roads**
- **Discuss advantages and disadvantages of green, gray, and hybrid alternatives**

Agenda

- Project Overview
- Town staff comments
- Presentation of conceptual design alternatives
  - Circuit Avenue
  - Wings Neck Road
- Questions, comments, and discussion
- Next Steps

Low Lying Roads

10
TOWNS

Barnstable
Bourne
Brewster
Dennis
Eastham
Orleans
Sandwich
Truro
Wellfleet
Yarmouth

- Flooding vulnerability assessment of low-lying roads and transportation infrastructure
- Support municipal road segment prioritization
- Identify range of potential design solutions, costs

Work performed by Cape Cod Commission and Woods Hole Group

PROJECT TIMELINE

Vulnerability Assessment

Prioritize Roadway Segments

1st Workshop: Vulnerable & At-Risk Roads

Roadway site visits

Roadway analysis & solutions ID

2nd Workshop: Present alternatives

September 2021

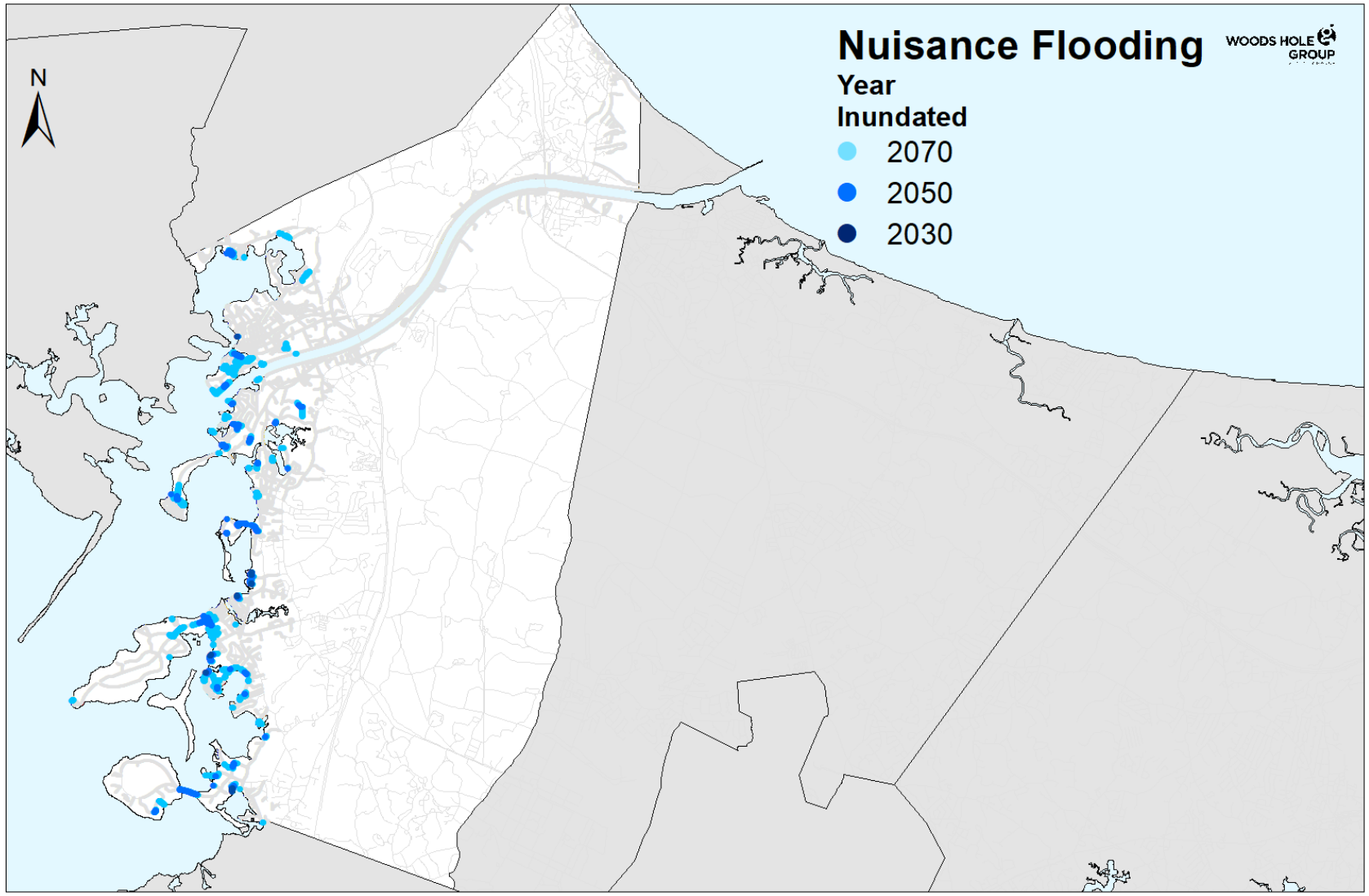
Summer 2022

March 2023

Additional Context & Information

- **Detailed information on webpages:** https://www.capecodcommission.org/our-work/low-lying-roads-project/
- **Other Bourne road projects – town comments?**
- **Clarifying questions**
- **Format for meeting**

Low Lying Roads Nuisance (MHW) Flooding (Bourne)



Road Miles 2030

0.1/129.6

Road Miles 2050

2.3/129.6

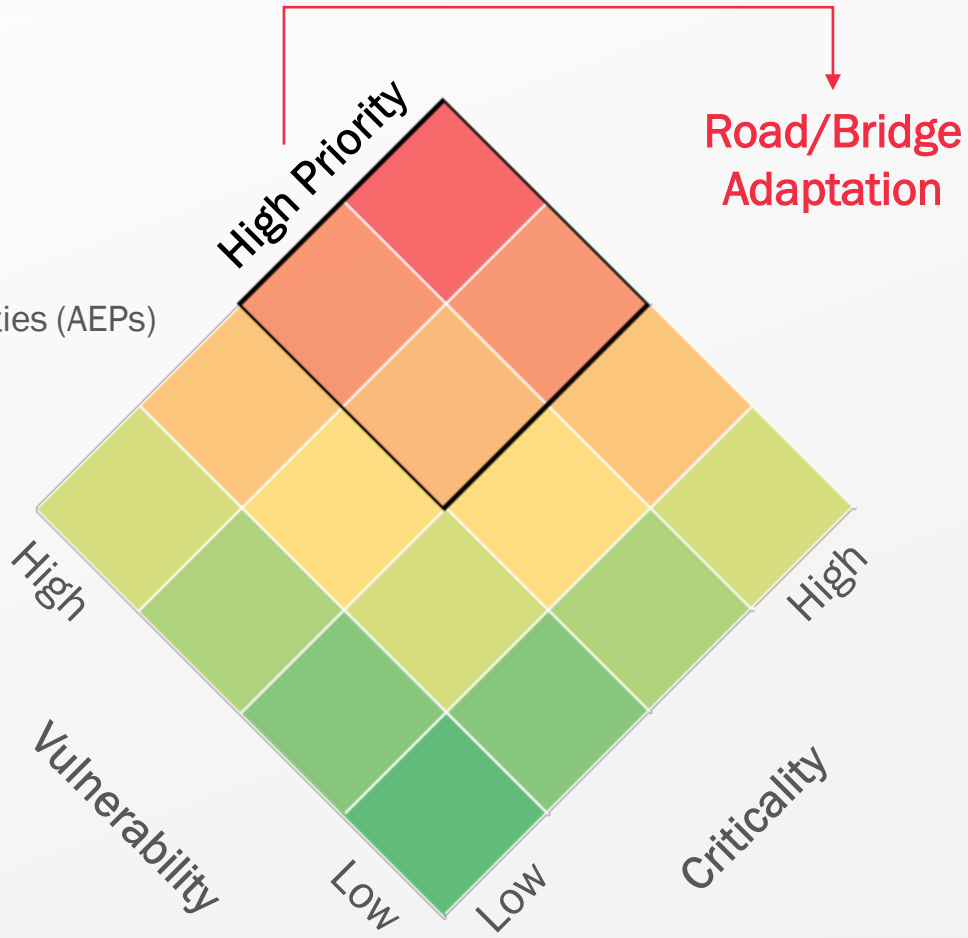
Road Miles 2070

8.1/129.6

WOODS HOLE GROUP
A CLS COMPANY

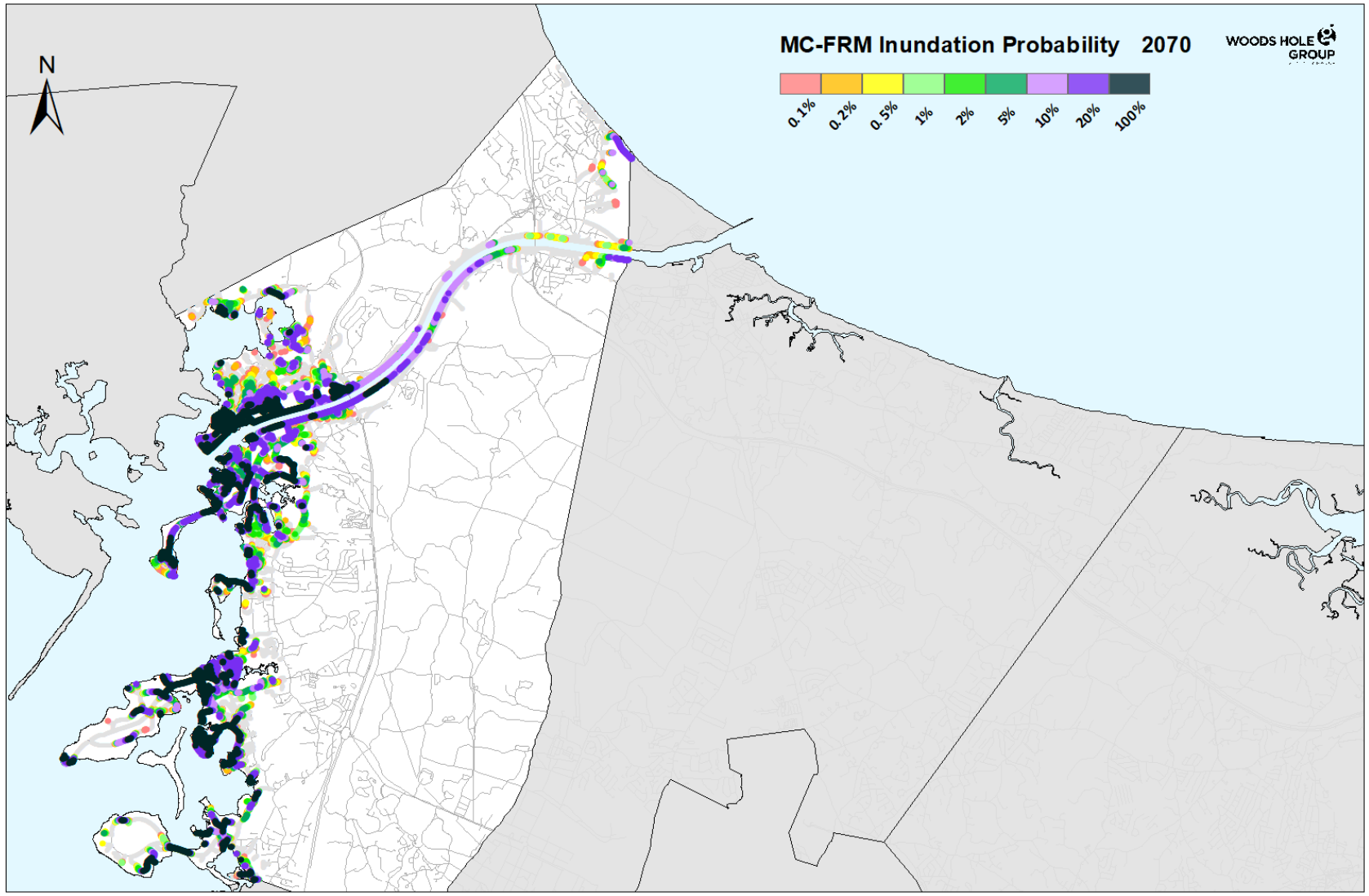
Cape Cod Low Lying Roads Risk Assessment Approach

1. Extract roadway/bridge critical elevations (CEs)
   - From LiDAR at 20m interval along surface
2. Compile 2030/2050/2070 MC-FRM water surface elevations (WSEs)
   - 0.1%, 0.2%, 0.5%, 1%, 2%, 5%, 10%, 20%, 100% Annual Exceedance Probabilities (AEPs)
3. Compare CEs to WSEs to determine vulnerability
   - Highest probability WSE exceeding CE
4. Score road segment criticality
   - Usage/Network Function
   - Economy
   - Vulnerable Populations
   - Community and Emergency Services
5. Probability * Criticality = Risk
6. Prioritize high-risk road segments for community consideration



WOODS HOLE GROUP
A CLS COMPANY

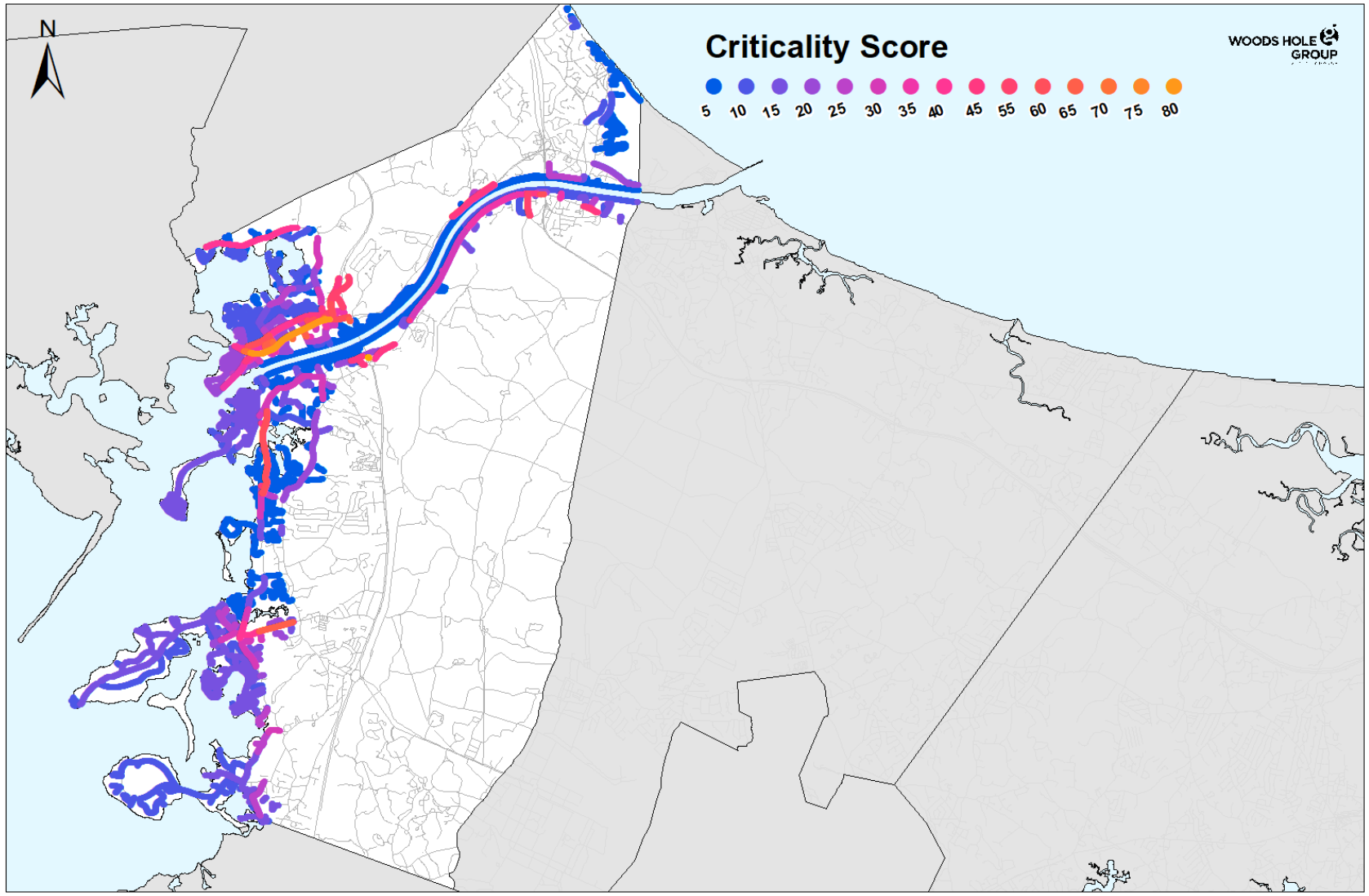
Low Lying Roads 2070 Inundation Probability (Bourne)



%	Road miles
0.1	75.8
0.2	72.2
0.5	68.0
1	63.8
2	59.2
5	52.4
10	45.9
20	37.5
100	19.7

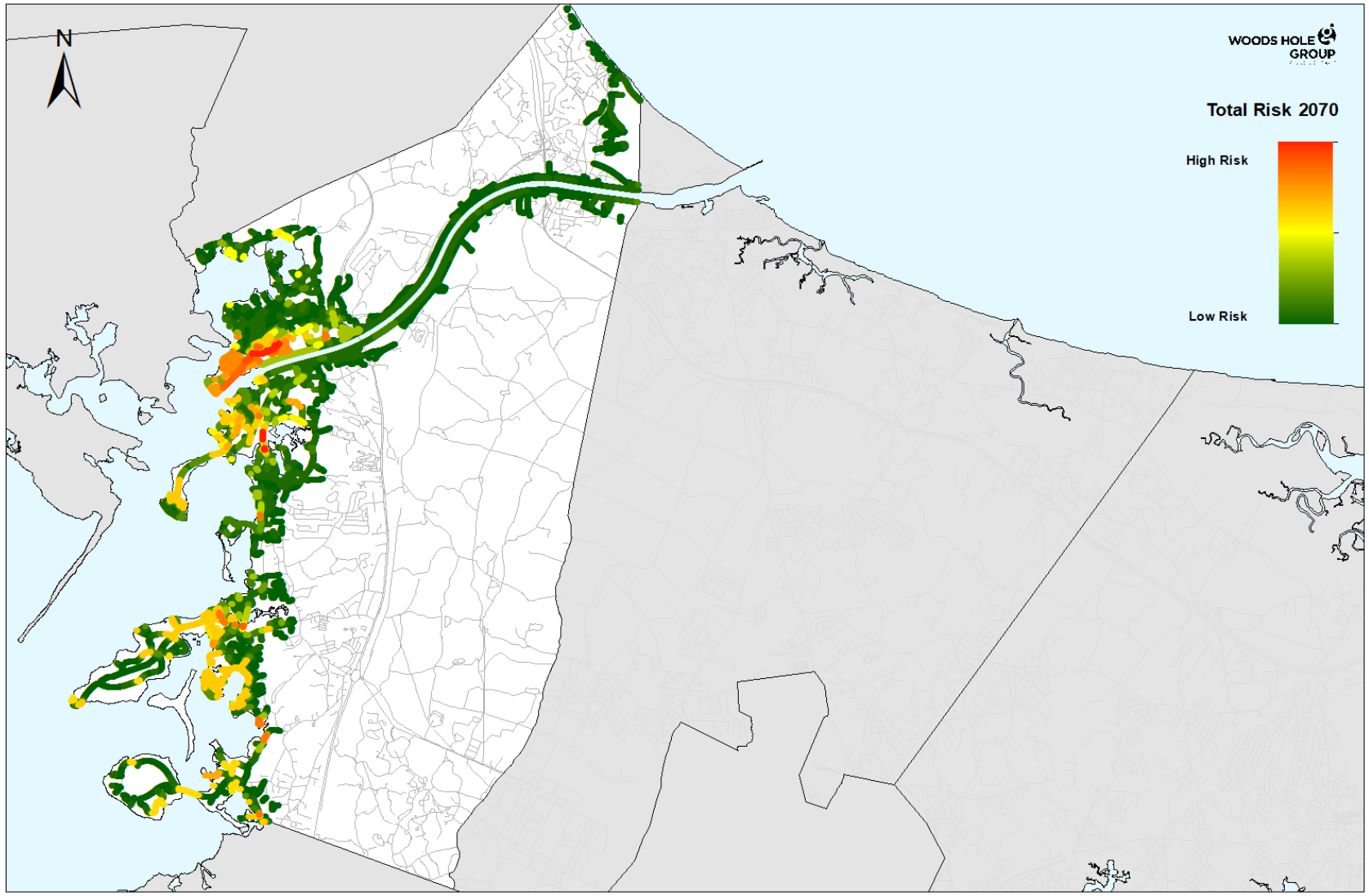
WOODS HOLE GROUP
A CLS COMPANY

Low Lying Roads Criticality Scoring (Bourne)



WOODS HOLE GROUP
A CLS COMPANY

Low Lying Roads 2070 Risk Results (Bourne)



High Risk Road Segments

Academy Dr, Taylor Rd and Wright Ln

Red Brook Harbor Rd

Harbor Pl

Main St, Holt Rd and Canal St

Shore Rd (Back River)

Wings Neck Rd and North Shore Rd

Shore Rd (Pocasset River)

Cohasset Ave and Buzzards Bay Ave

Shore Rd (Monument Beach)

Megansett Rd

Circuit Ave and Bell Buoy Rd

Mashnee Rd*

Monument Neck Rd and Presidents Rd

Emmons Rd

Scraggy Neck Rd*

WOODS HOLE GROUP
A CLS COMPANY

Summary of High Priority Road Segments (Bourne)

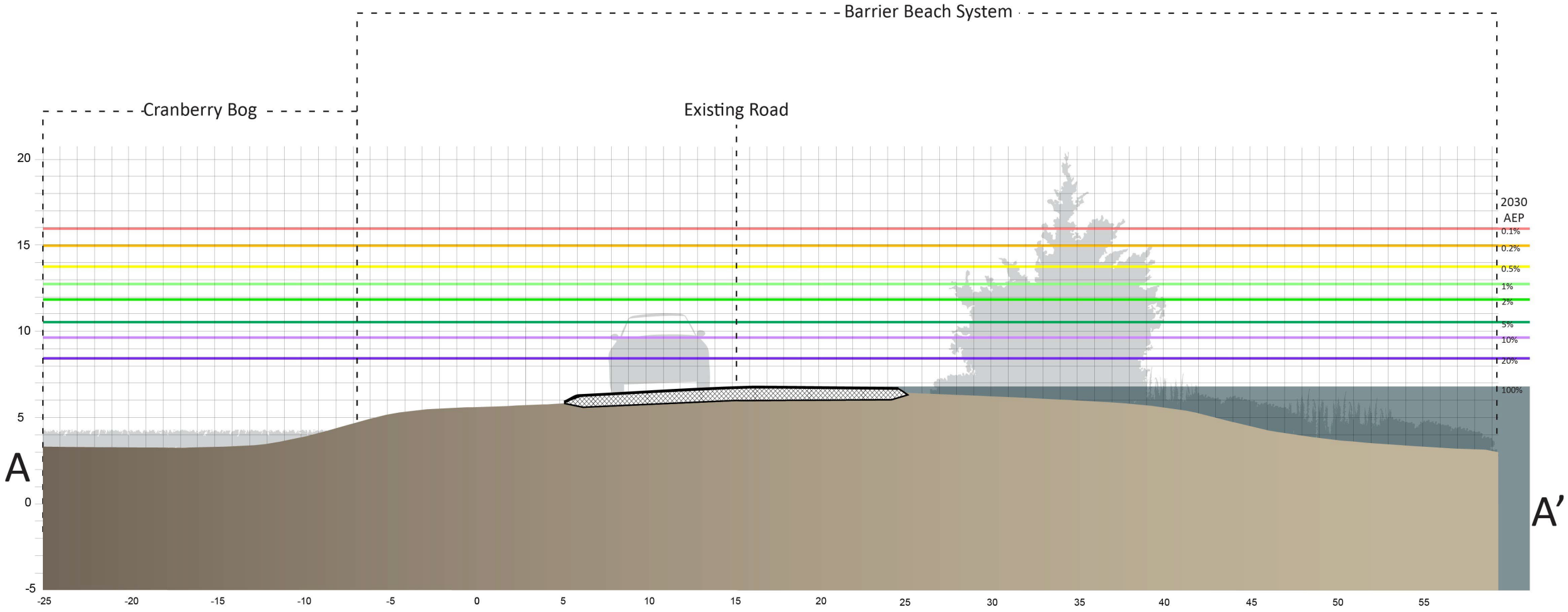
		Name	Length (ft)	Description	Segment Storm Probability (%)			Nuisance Length (ft)		
					2030	2050	2070	2030	2050	2070
	A	Academy Dr, Taylor Rd and Wright Ln	4020	Main road leading Mass Maritime	10-100	20-100	100		260	2100
	B	Red Brook Harbor Rd	440	Road backing Parkers Boat Yard	10-100	20-100	100		20	180
	C	Harbor Pl	320	Road segment along Taylor Point Marina	100	100	100		220	320
	D	Main St, Holt Rd and Canal St	3700	Long segment between Academy Dr and Smalley Rd	5-20	20-100	100			
	E	Shore Rd (Back River)	720	Road and bridge crossing Back River	10-20	20-100	100			
☑	F	Wings Neck Rd and North Shore Rd	4180	Leads to Wings Neck Island, isolated neighborhood	10-100	20-100	100		720	2720
	G	Shore Rd (Pocasset River)	180	South of Pocasset River Bridge	10-20	20	100			
	H	Cohasset Ave and Buzzards Bay Ave	400	E to W road between Buzzars Bay Bypass and Main St	5-10	20	100			
	I	Shore Rd (Monument Beach)	180	Backing Monument Beach	10-20	20	100			
	J	Megansett Rd	320	Road intersection leading to Amrita Island	2-20	10-100	100			
☑	K	Circuit Ave and Bell Buoy Rd	3260	Backing Hen's Cove Beach, isolated neighborhood	0.2-100	2-100	5-100		200	1660
	L	Mashnee Rd*	580 (5240)	Access to Mashnee Island, isolated neighborhood	0.5-100	2-100	10-100			1120
	M	Monument Neck Rd and Presidents Rd	1120	Main access point to large neighborhoods	1-20	5-20	20-100			
	N	Emmons Rd	1580	Road / bridge at Monument Beach, isolated neighborhood	5-100	20-100	20-100		1080	1280
	O	Scraggy Neck Rd*	(1300)	Isolated neighborhood	5-100	10-100	20-100			1220

* = Private or partially private

WOODS HOLE GROUP
A CLS COMPANY

Circuit Avenue

Circuit Avenue

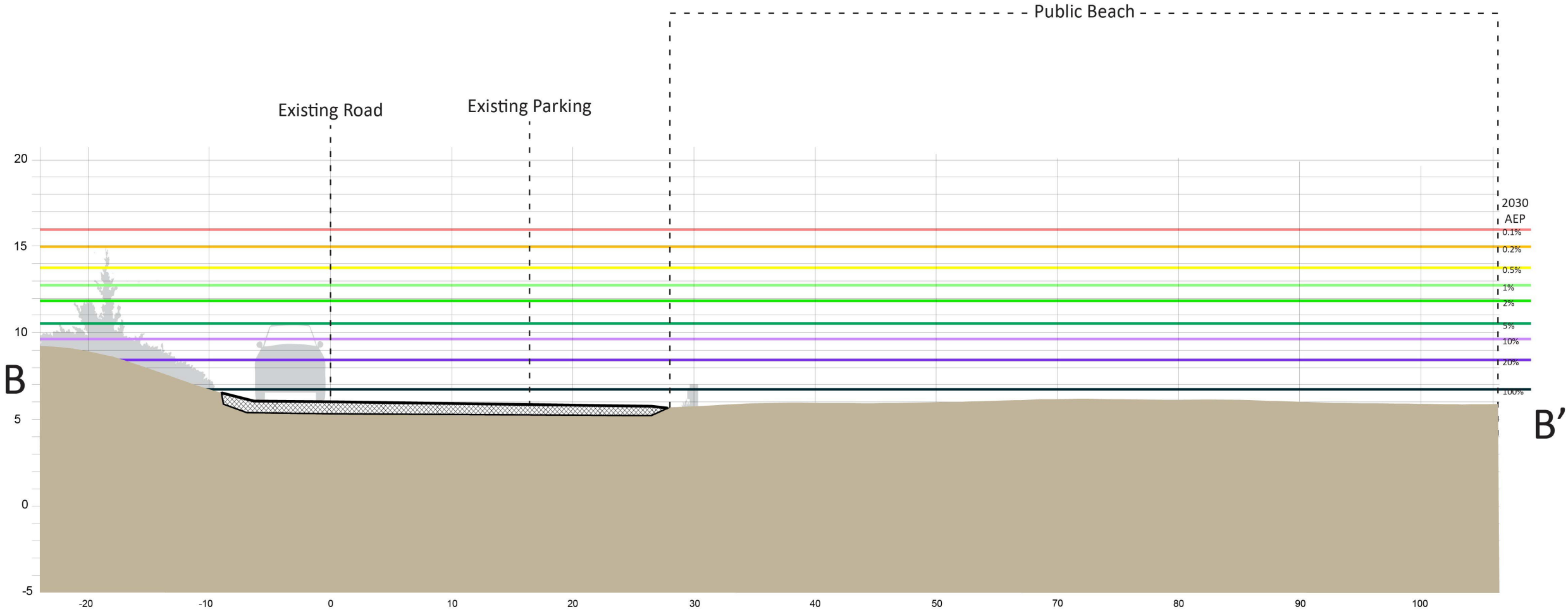


EXISTING CONDITIONS

Circuit Avenue, Bourne

WOODS HOLE GROUP
A CLS COMPANY

Circuit Avenue

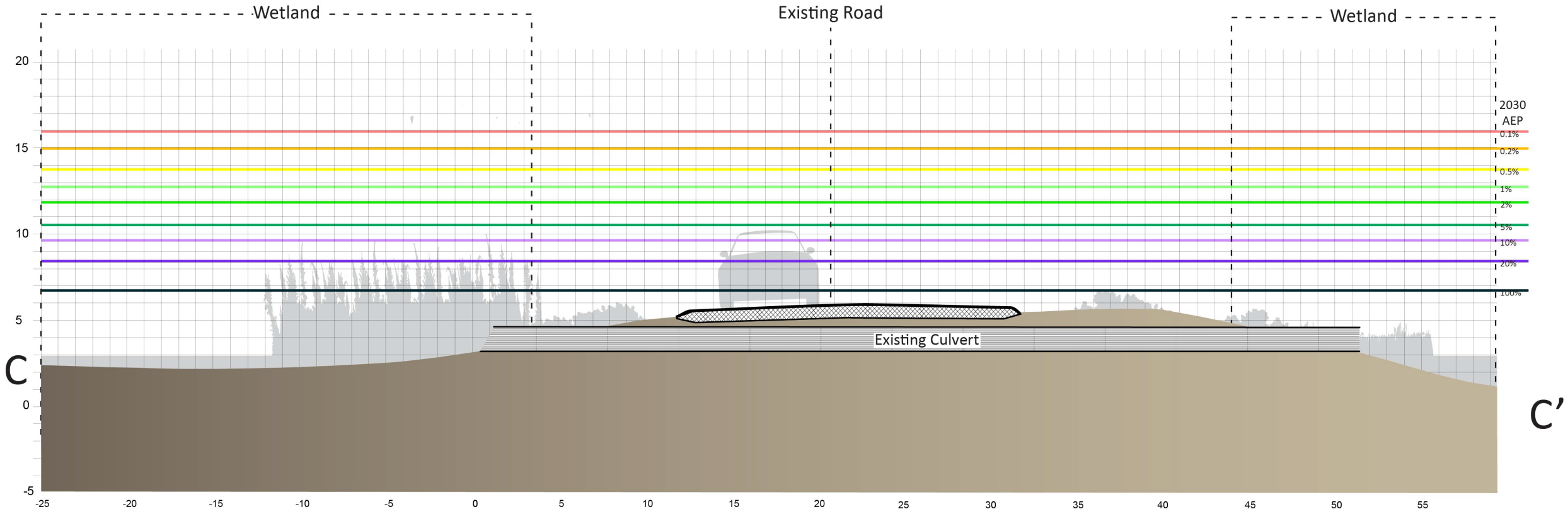


EXISTING CONDITIONS

Circuit Avenue, Bourne

WOODS HOLE GROUP
A CLS COMPANY

Circuit Avenue



EXISTING CONDITIONS

Circuit Avenue, Bourne

WOODS HOLE GROUP
A CLS COMPANY

Note: Project overlap with wetland areas, rights of way and property lines is approximate and needs confirmation with a site survey

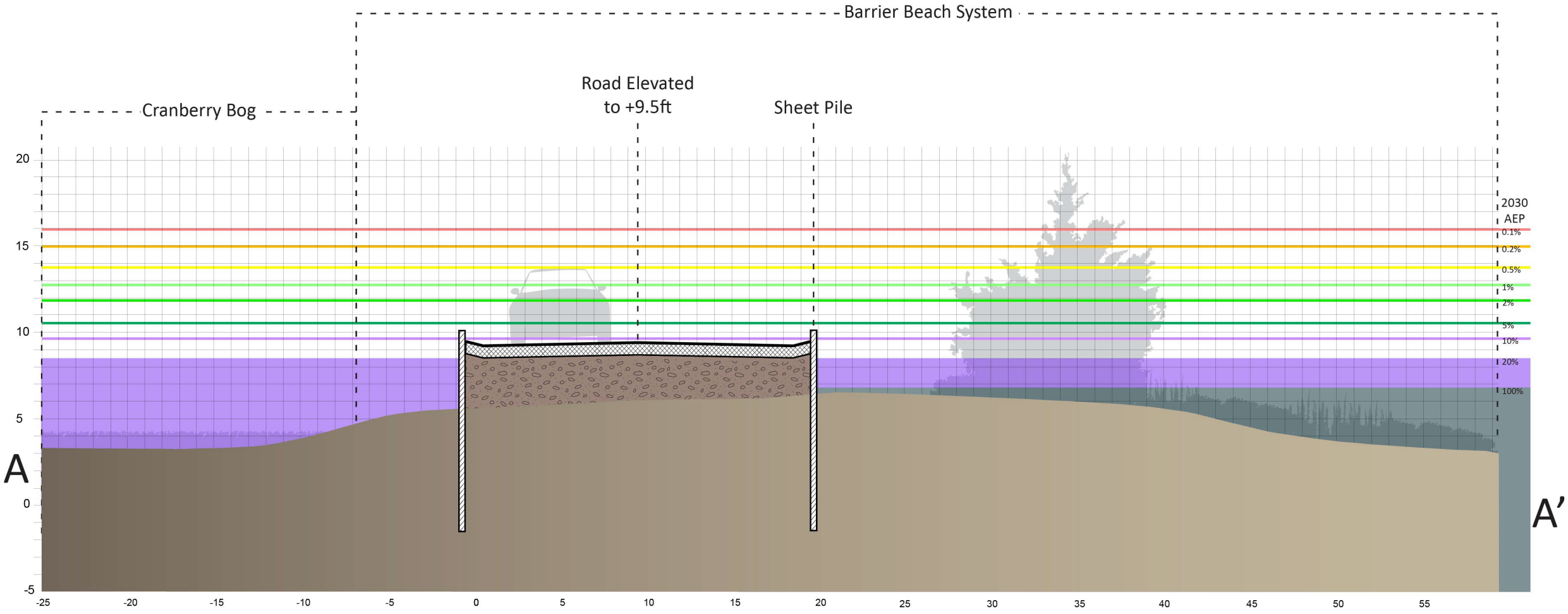
Circuit Avenue
BOURNE

ALTERNATIVE 1: GRAY

2452 linear feet of Town-owned road are elevated from a lowest point of 3.8 feet to a lowest point of 9.5 feet. Sheet pile is used to elevate the road at the cranberry bog and culvert crossing, and traditional vegetated side slopes are used at other locations.

WOODS HOLE GROUP
A CLS COMPANY

Circuit Avenue

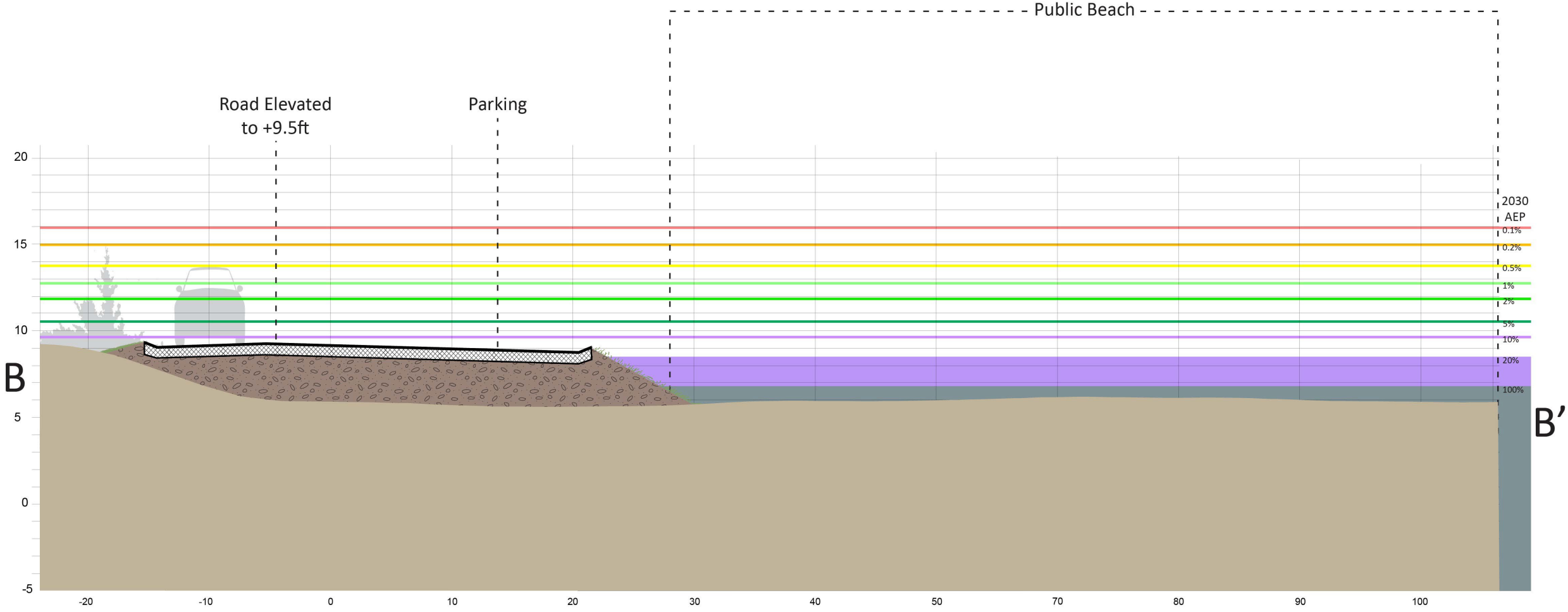


ALTERNATIVE 1: GRAY

Circuit Avenue, Bourne

WOODS HOLE GROUP
A CLS COMPANY

Circuit Avenue

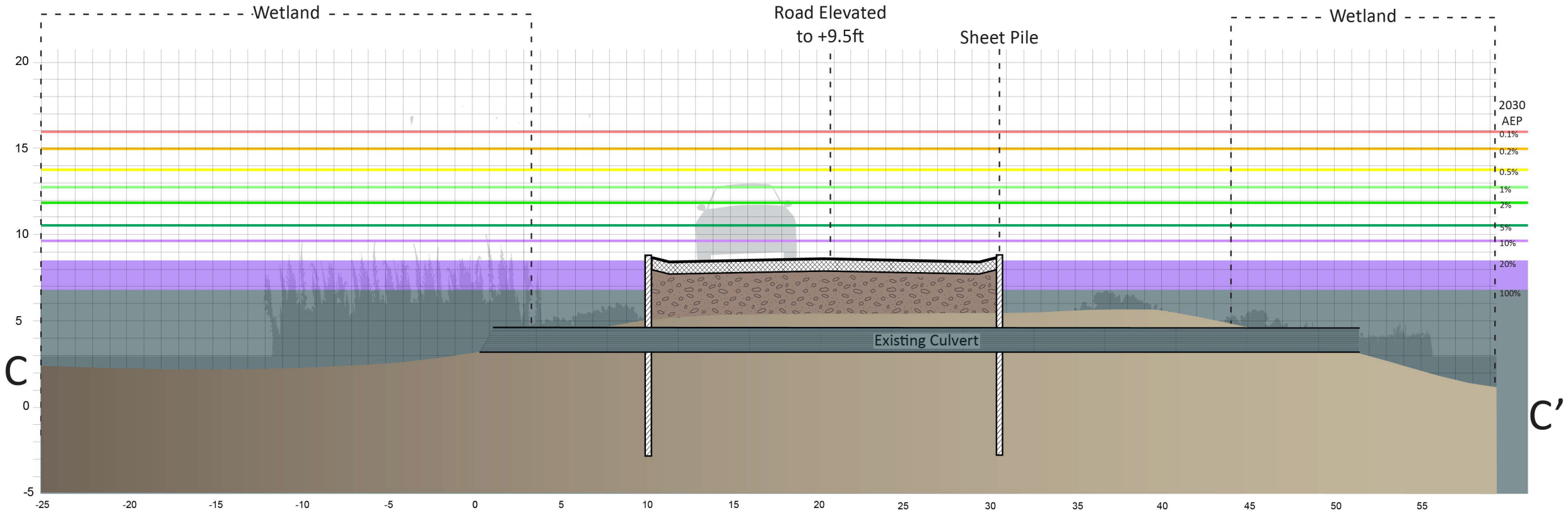


ALTERNATIVE 1: GRAY

Circuit Avenue, Bourne

WOODS HOLE GROUP
A CLS COMPANY

Circuit Avenue



ALTERNATIVE 1: GRAY

Circuit Avenue, Bourne

WOODS HOLE GROUP
A CLS COMPANY

Note: Project overlap with wetland areas, rights of way and property lines is approximate and needs confirmation with a site survey

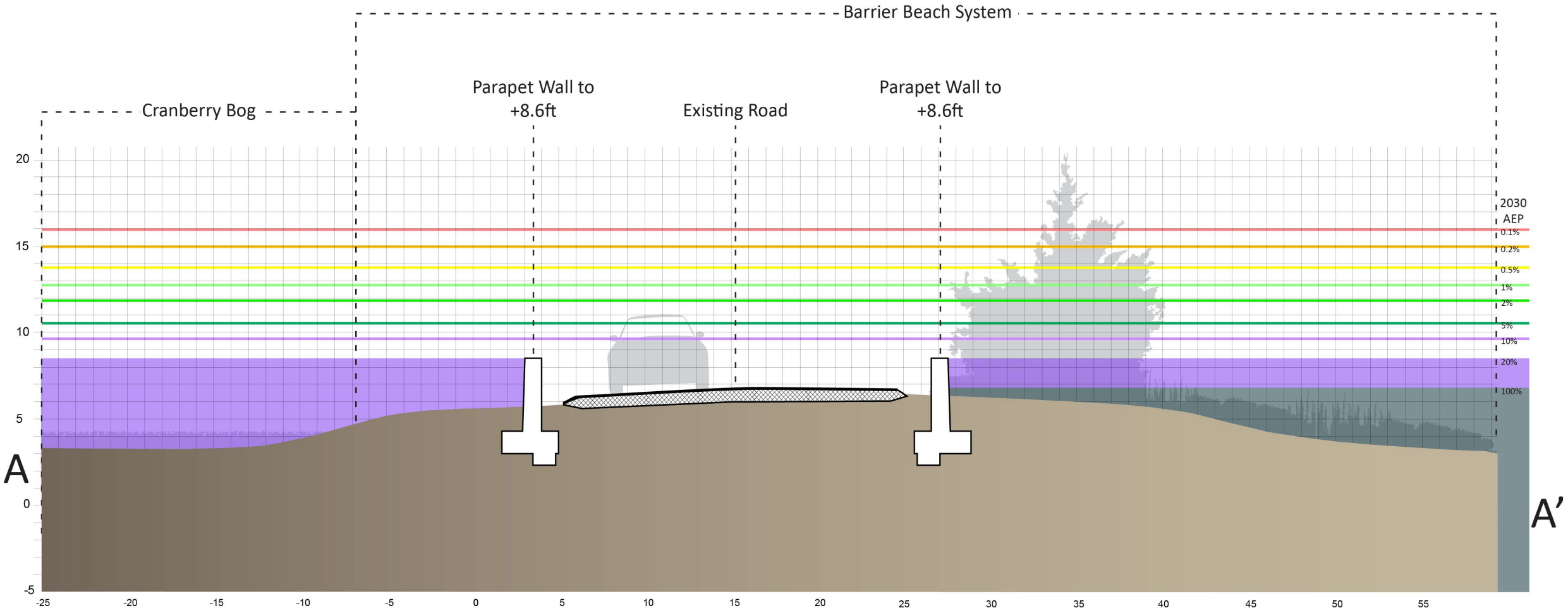
Circuit Avenue
BOURNE

ALTERNATIVE 2: HYBRID

Parapet walls to 8.6 feet are installed to tie together high points along Circuit Ave. A tide gate is added to the culvert and raised sections of pavement to side streets to prevent flanking. A dune is constructed at the public beach, and access is preserved with a wooden walkover.

WOODS HOLE GROUP
A CLS COMPANY

Circuit Avenue

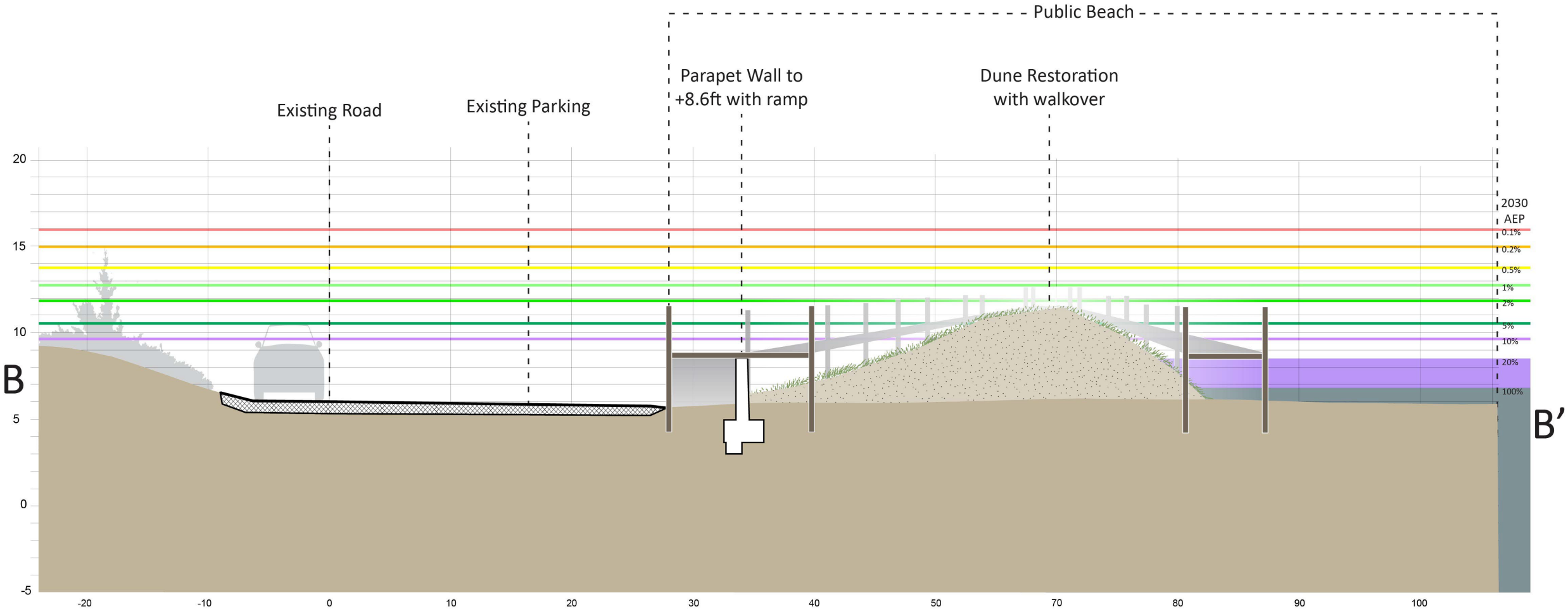


ALTERNATIVE 2: HYBRID

Circuit Avenue, Bourne

WOODS HOLE GROUP
A CLS COMPANY

Circuit Avenue

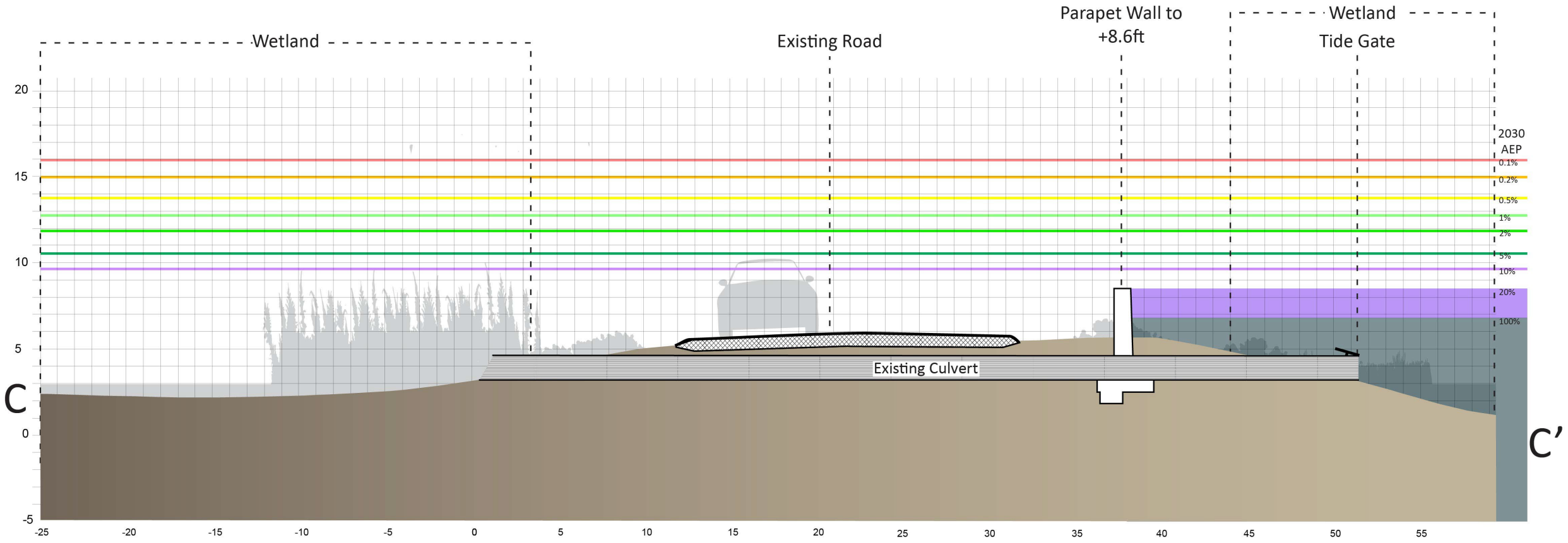


ALTERNATIVE 2: HYBRID

Circuit Avenue, Bourne

WOODS HOLE GROUP
A CLS COMPANY

Circuit Avenue

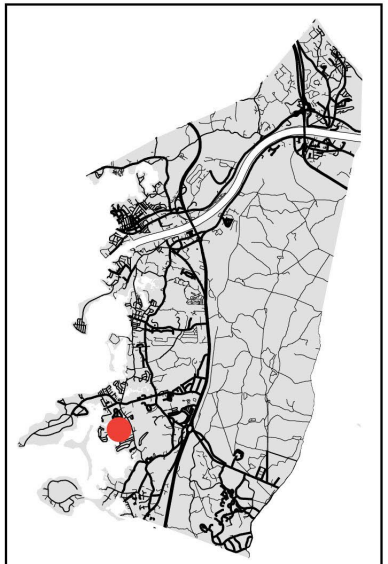


ALTERNATIVE 2: HYBRID

Circuit Avenue, Bourne

WOODS HOLE GROUP
A CLS COMPANY

Note: Project overlap with wetland areas, rights of way and property lines is approximate and needs confirmation with a site survey



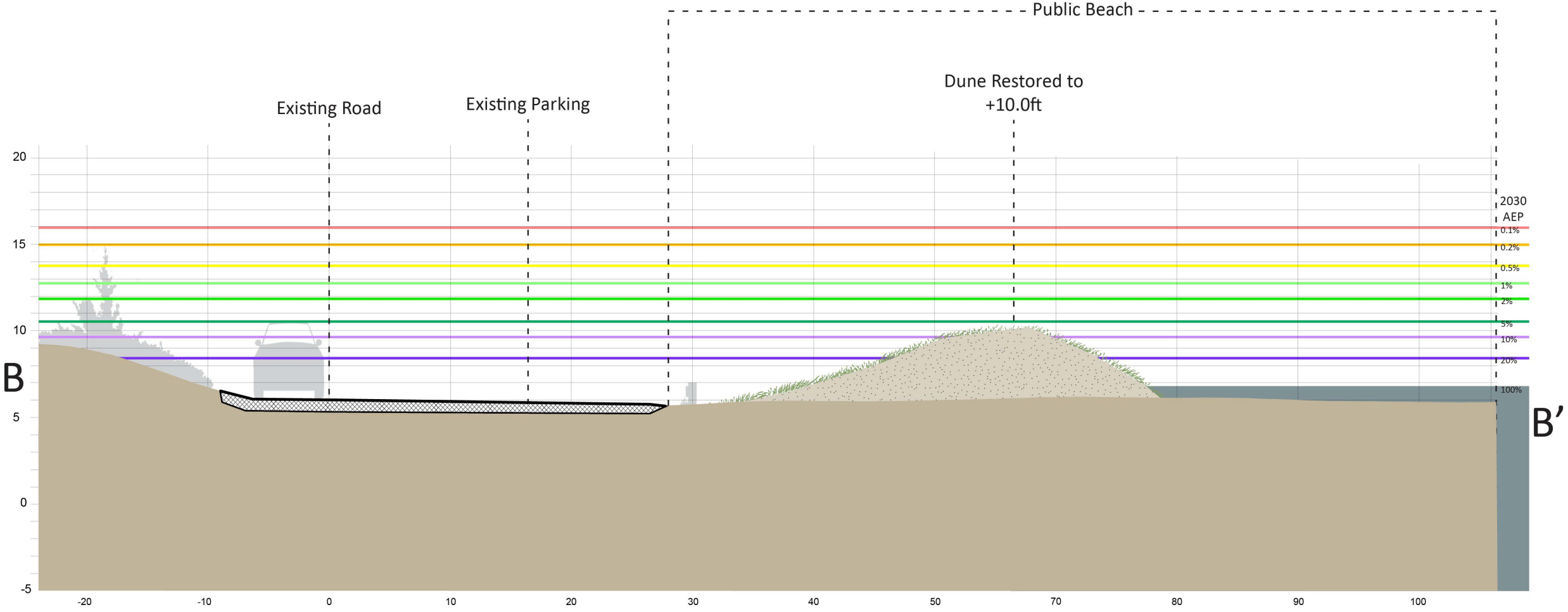
Circuit Avenue
BOURNE

ALTERNATIVE 3: GREEN

A combination of coastal bank and dune enhancements protect the road to 6.9 feet. A dune enhancement to 10.0 feet protects the beach and parking lot from erosion. The culvert is replaced and an operable tide gate is installed.

WOODS HOLE GROUP
A CLS COMPANY

Circuit Avenue

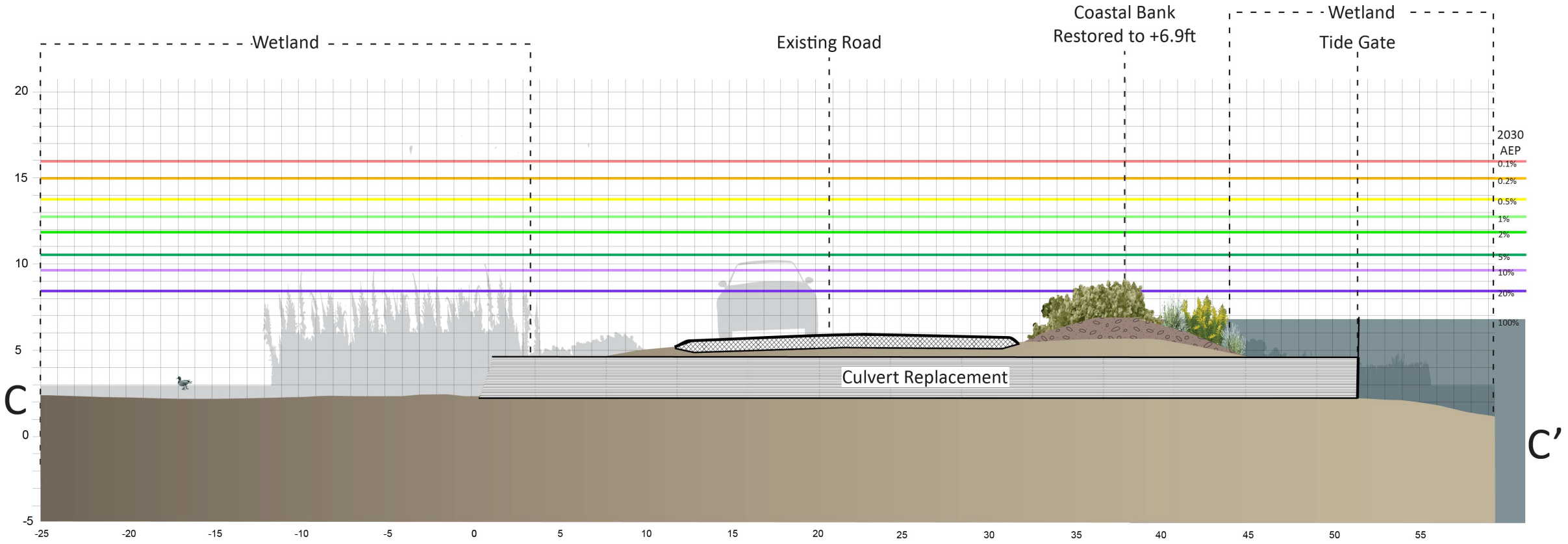


ALTERNATIVE 3: GREEN

Circuit Avenue, Bourne

WOODS HOLE GROUP
A CLS COMPANY

Circuit Avenue



ALTERNATIVE 3: GREEN

Circuit Avenue, Bourne

WOODS HOLE GROUP
A CLS COMPANY

CIRCUIT AVENUE, BOURNE

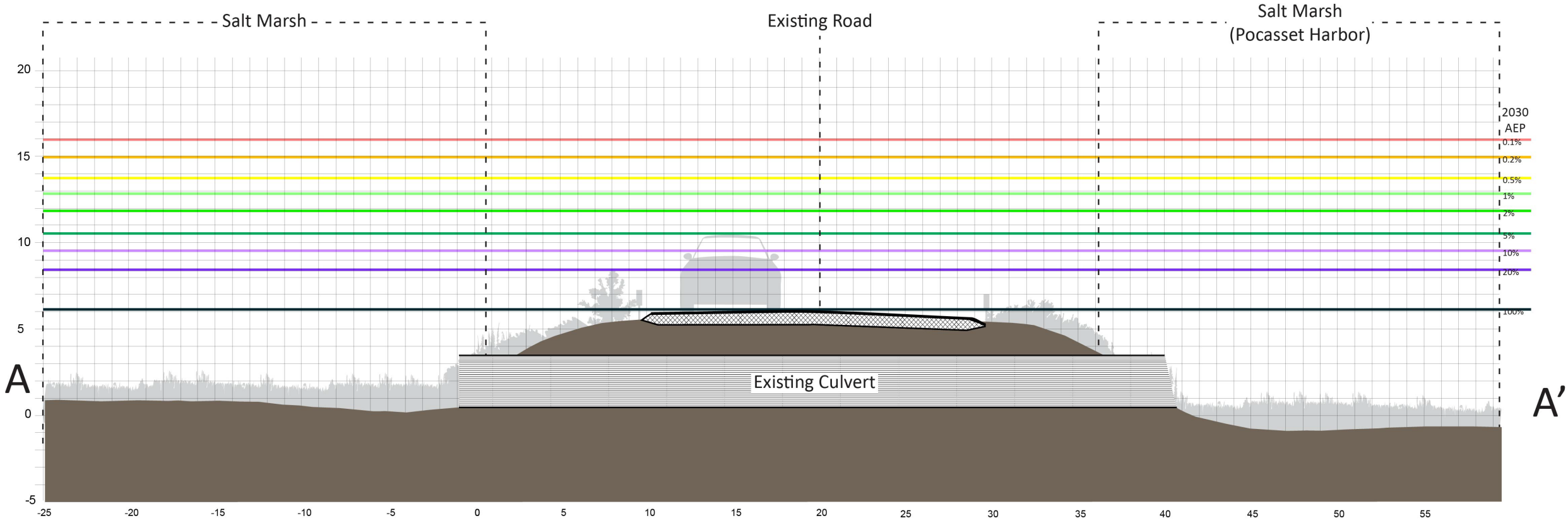
Summary of alternatives

	Description	Critical Elevation	Annual Exceedance Probability			Vulnerable to Tidal Flooding	Impacts to Wetlands	Impacts to Private Property	Estimated Cost*
			2030	2050	2070				
EXISTING	A segment of 20 foot wide road with a public beach and a culvert.	3.8 feet	100%	100%	100%	2050	N/A	N/A	N/A
ALTERNATIVE 1: GRAY	2452 linear feet of Town-owned road are elevated from a lowest point of 3.8 feet to a lowest point of 9.5 feet. Sheet pile is used to elevate the road at the cranberry bog and culvert crossing, and traditional vegetated side slopes are used at other locations.	9.5 feet	10%	20%	100%	N/A	N/A	Yes	$1,133,000
ALTERNATIVE 2: HYBRID	A parapet wall to 8.6 feet is installed to tie together high points along Circuit Ave. A tide flap is added to the culvert to prevent flanking. A dune is constructed at the public beach, and access is preserved with a wooden walkover.	8.6 feet	10%	20%	100%	N/A	Possible Positive	No	$1,386,000
ALTERNATIVE 3: GREEN	A combination of coastal bank and dune enhancements protect the road to 6.9 feet. Additional dune enhancements at the beach protect the parking lot and beach from erosion. The culvert is replaced and an operable tide gate is installed.	6.9 feet	20%	100%	100%	N/A	Positive	Yes	$1,108,000

*Installed material cost +20% contingency. Excludes design, permitting, mobilization, stormwater and wastewater infrastructure, and site controls. Costs based on RSMeans 2021 cost book and adjusted for inflation and region.

Wings Neck Road

Wings Neck Road

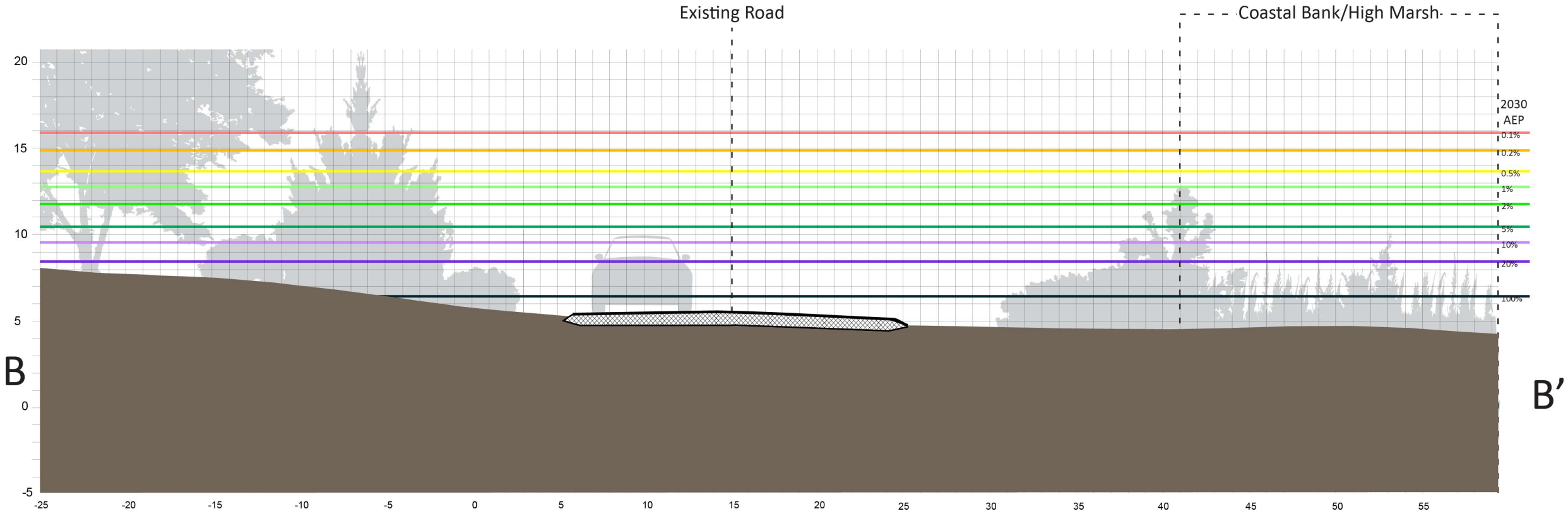


EXISTING CONDITIONS

Wings Neck Road, Bourne

WOODS HOLE GROUP
A CLS COMPANY

Wings Neck Road

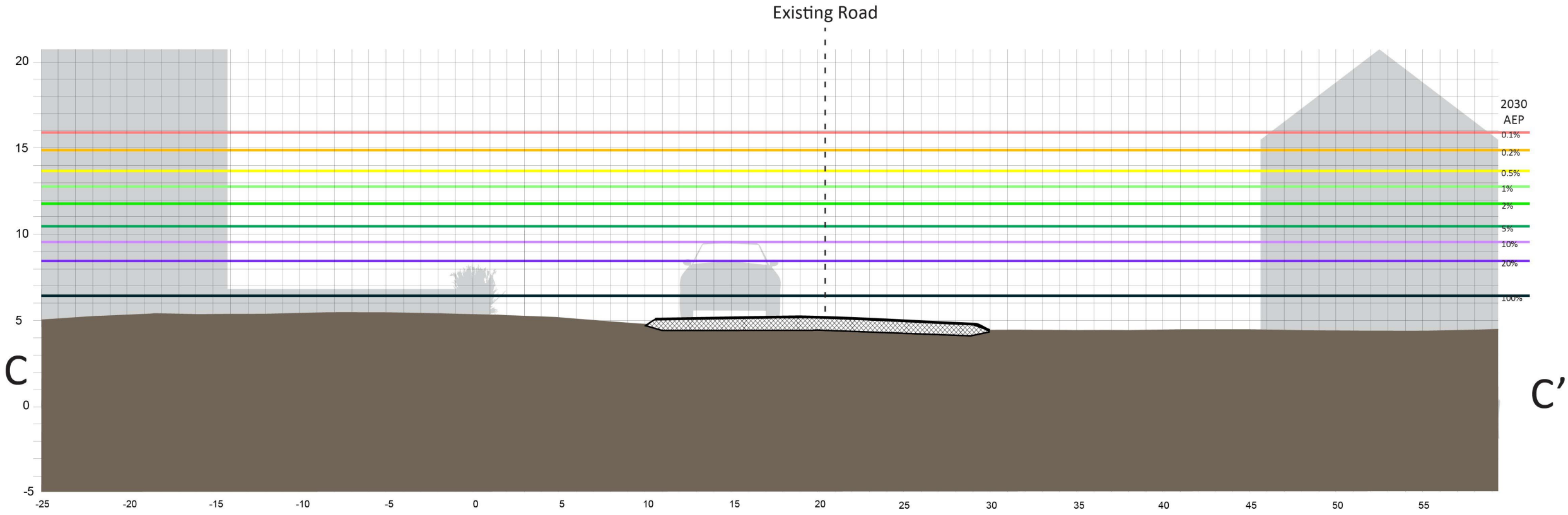


EXISTING CONDITIONS

Wings Neck Road, Bourne

WOODS HOLE GROUP
A CLS COMPANY

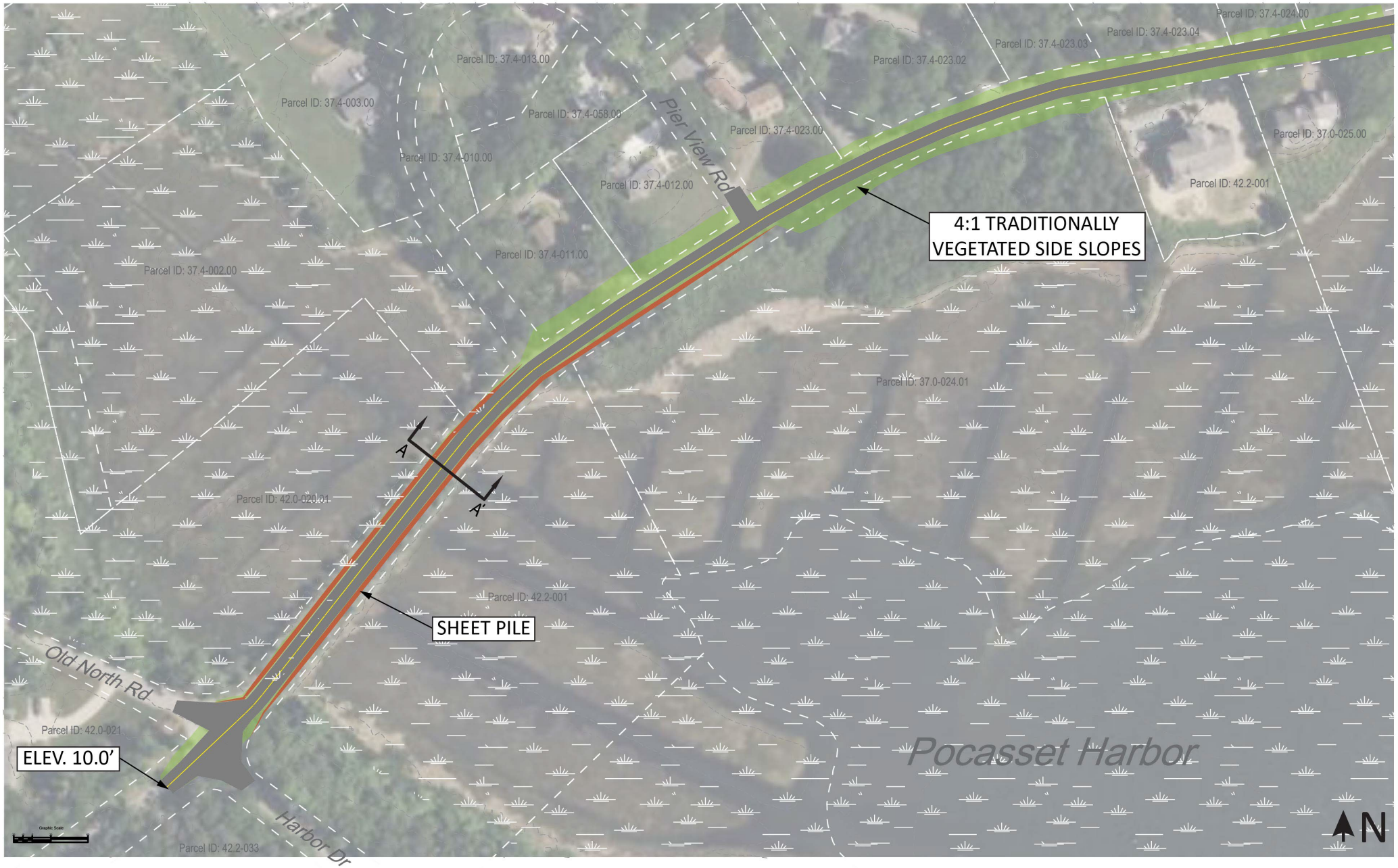
Wings Neck Road



EXISTING CONDITIONS

Wings Neck Road, Bourne

WOODS HOLE GROUP
A CLS COMPANY

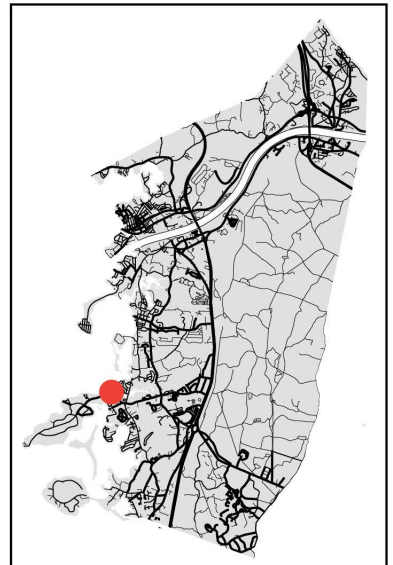


Wings Neck Road - West
BOURNE

ALTERNATIVE 1: GRAY

4038 linear feet of Town-owned road are elevated from a lowest point of 3.9 feet to a lowest point of 10.0 feet with a 4:1 traditionally vegetated side slope. Sheet pile is used at the marsh crossing.

WOODS HOLE GROUP
A CLS COMPANY



Wings Neck Road - East
BOURNE

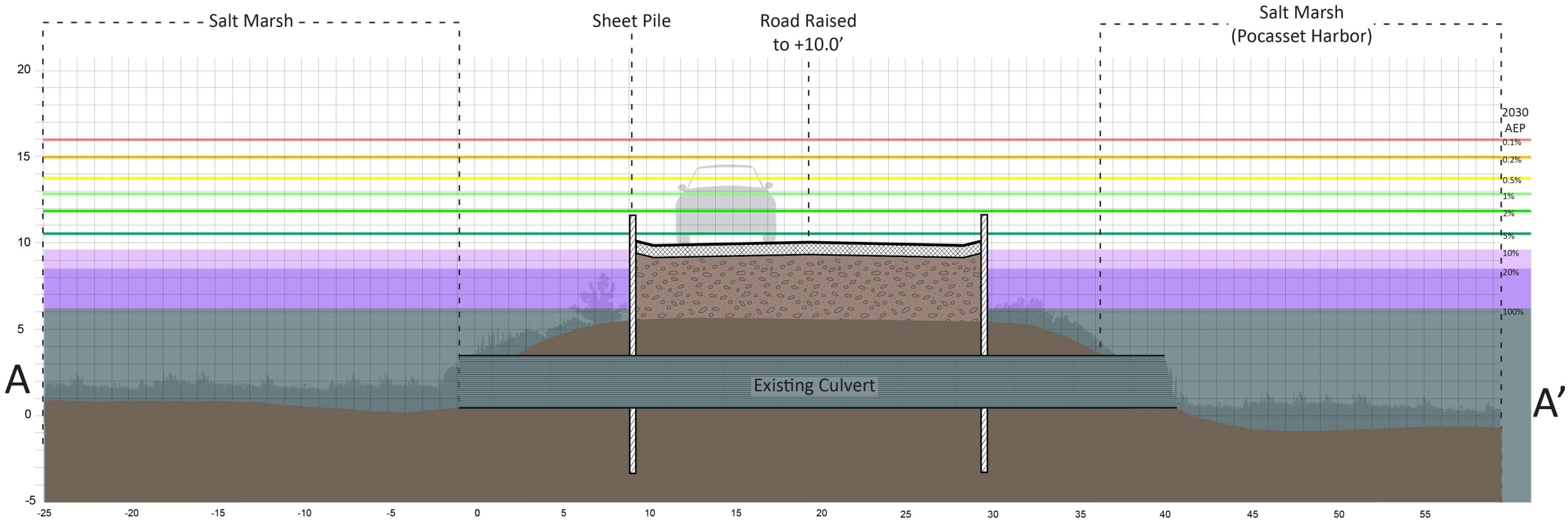
ALTERNATIVE 1: GRAY

4038 linear feet of Town-owned road are elevated from a lowest point of 3.9 feet to a lowest point of 10.0 feet with a 4:1 traditionally vegetated side slope. The side slopes encroach significantly on private property and overlap with existing structures.

Note: Project overlap with wetland areas, rights of way and property lines is approximate and needs confirmation with a site survey

WOODS HOLE GROUP
A CLS COMPANY

Wings Neck Road

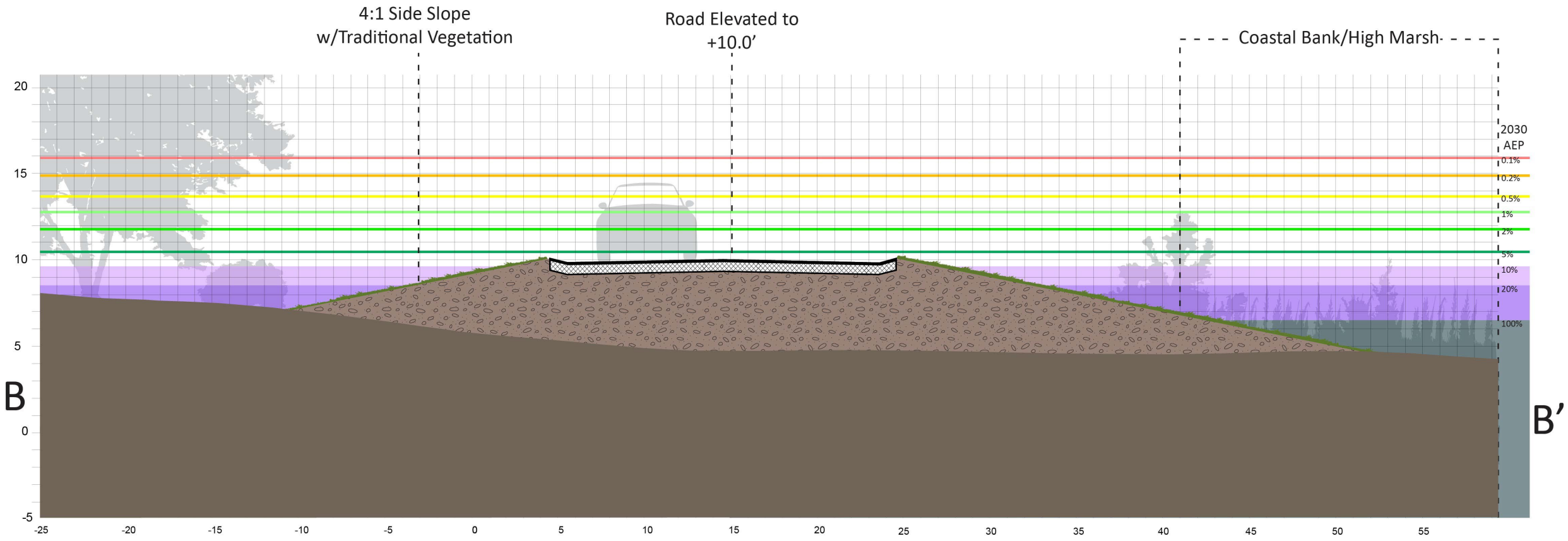


ALTERNATIVE 1: GRAY

Wings Neck Road, Bourne

WOODS HOLE GROUP
A CLS COMPANY

Wings Neck Road

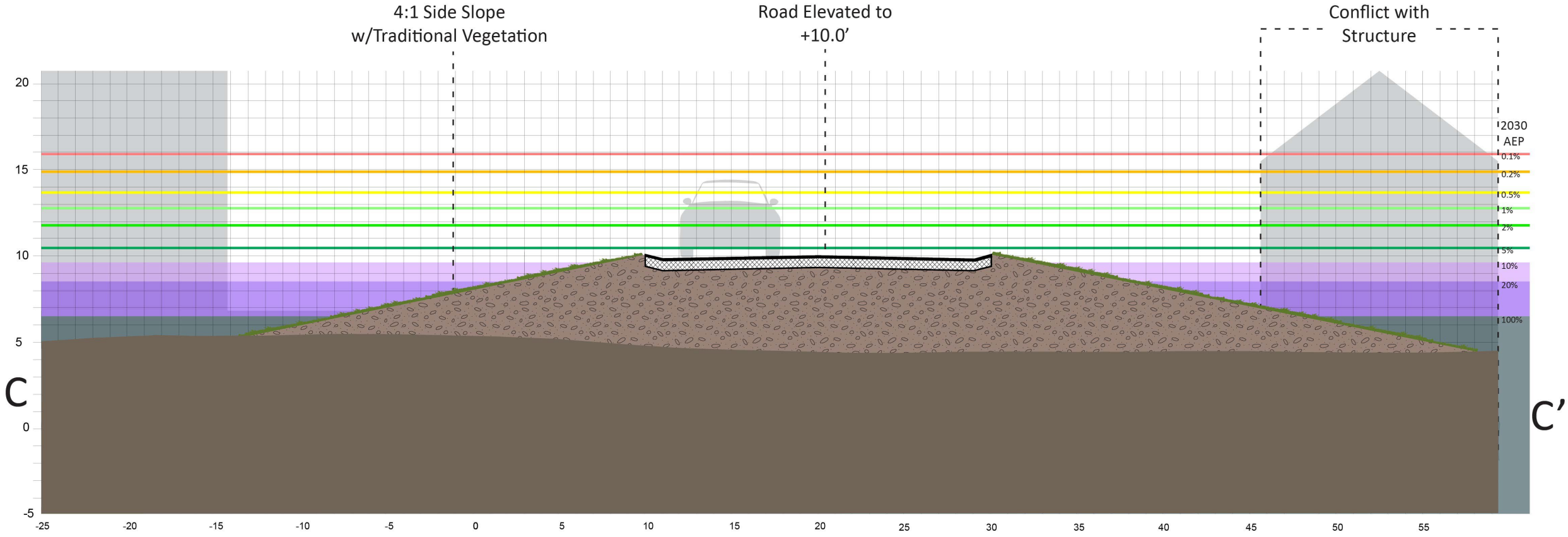


ALTERNATIVE 1: GRAY

Wings Neck Road, Bourne

WOODS HOLE GROUP
A CLS COMPANY

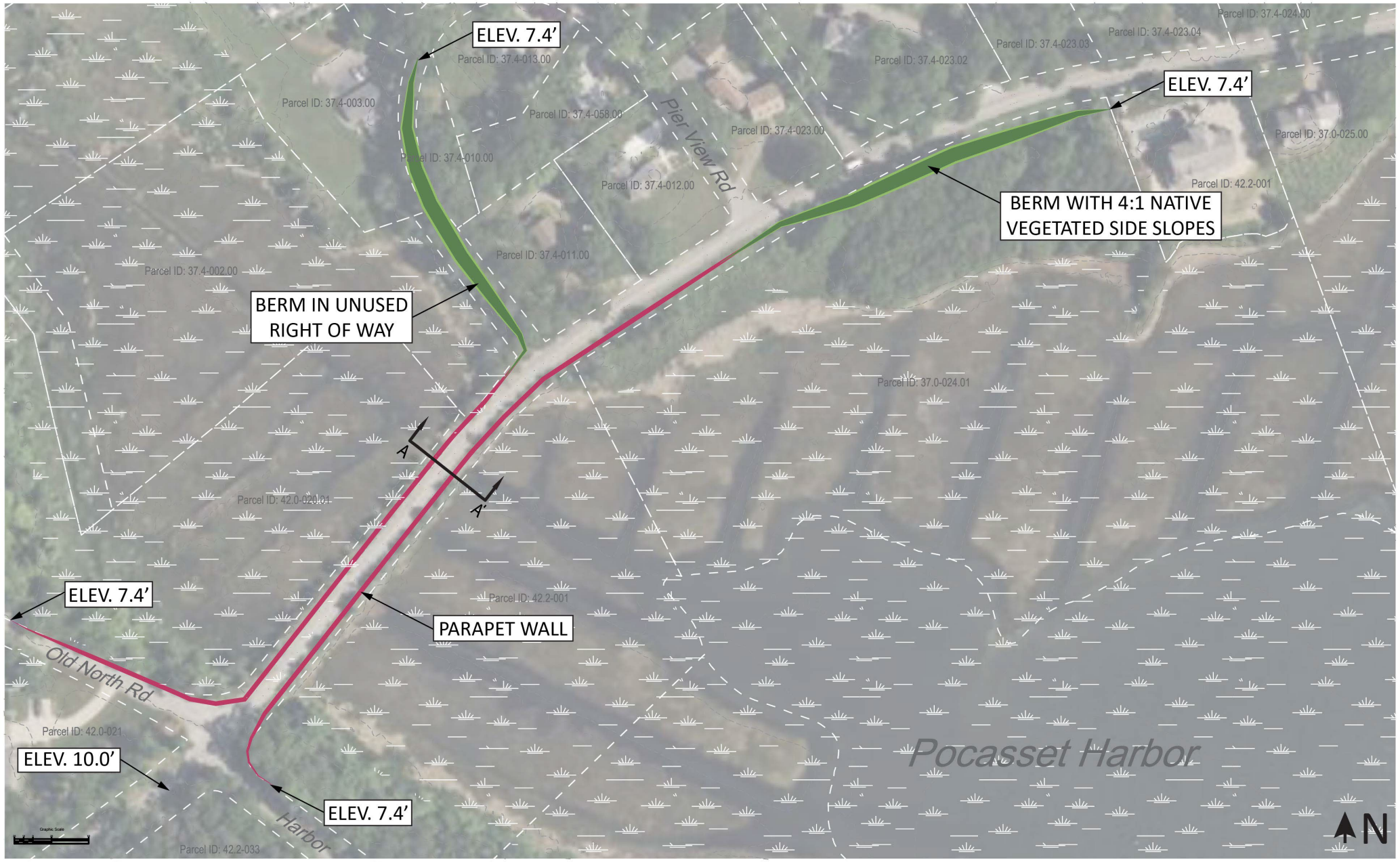
Wings Neck Road



ALTERNATIVE 1: GRAY

Wings Neck Road, Bourne

WOODS HOLE GROUP
A CLS COMPANY



Wings Neck Road - West
BOURNE

ALTERNATIVE 2: HYBRID

Parapet walls and berms protect the road to 7.4 feet without encroaching on private property.

WOODS HOLE GROUP
A CLS COMPANY

Wings Neck Road - East
BOURNE

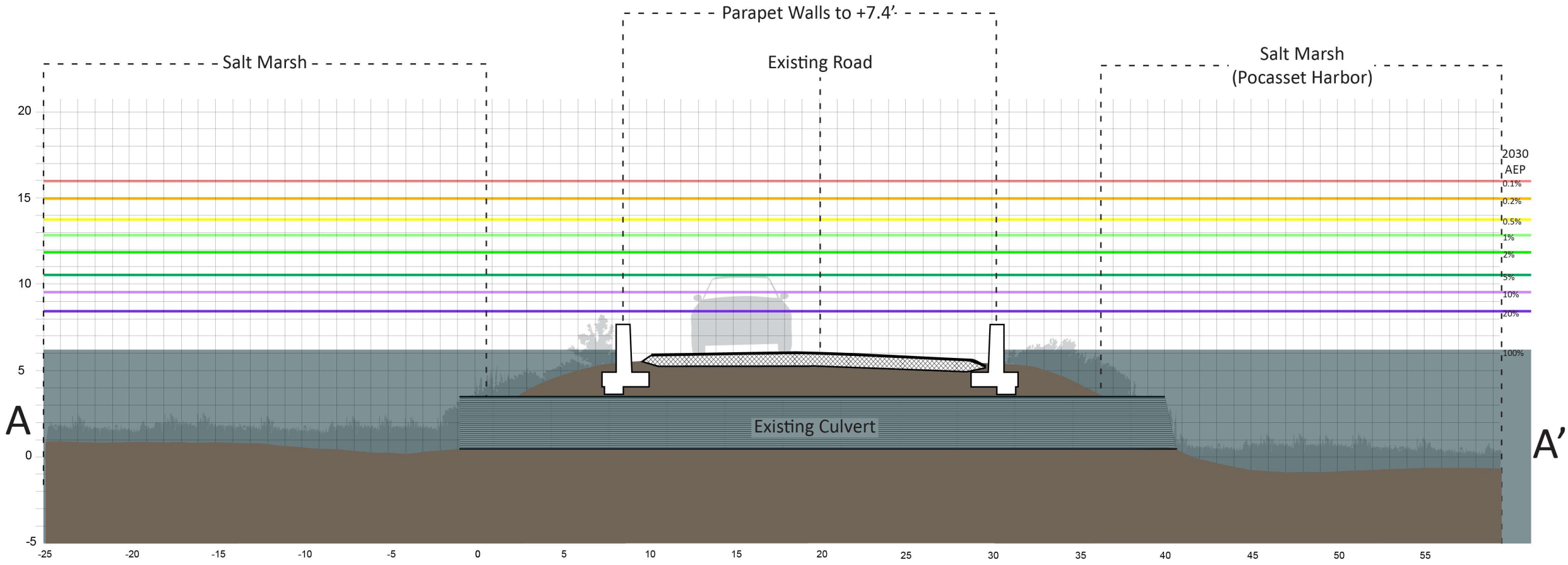
ALTERNATIVE 2: HYBRID

Parapet walls and berms protect the road to 7.4 feet. Negotiation with property owners and selective buyouts are required, along with a self-rising gate at the boat ramp at the end of Richmond Road.

Note: Project overlap with wetland areas, rights of way and property lines is approximate and needs confirmation with a site survey

WOODS HOLE GROUP
A CLS COMPANY

Wings Neck Road

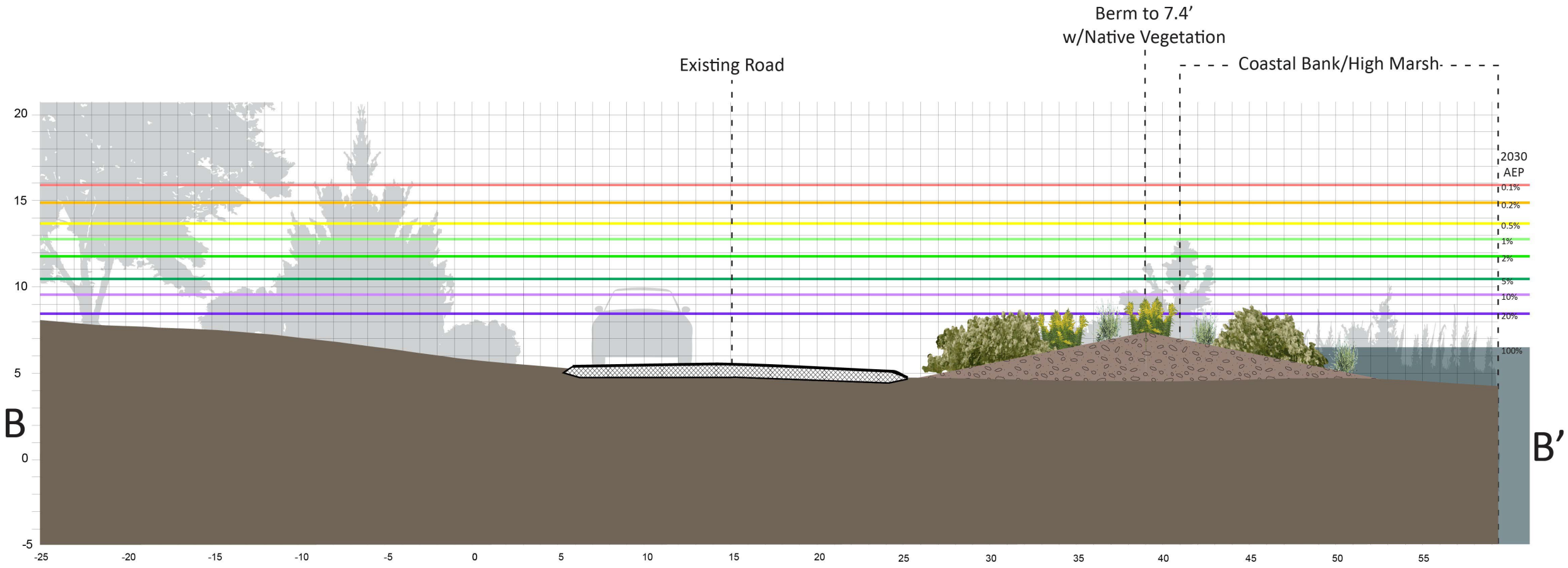


ALTERNATIVE 2: HYBRID

Wings Neck Road, Bourne

WOODS HOLE GROUP
A CLS COMPANY

Wings Neck Road



ALTERNATIVE 2: HYBRID

Wings Neck Road, Bourne

WOODS HOLE GROUP
A CLS COMPANY

WINGS NECK ROAD, BOURNE

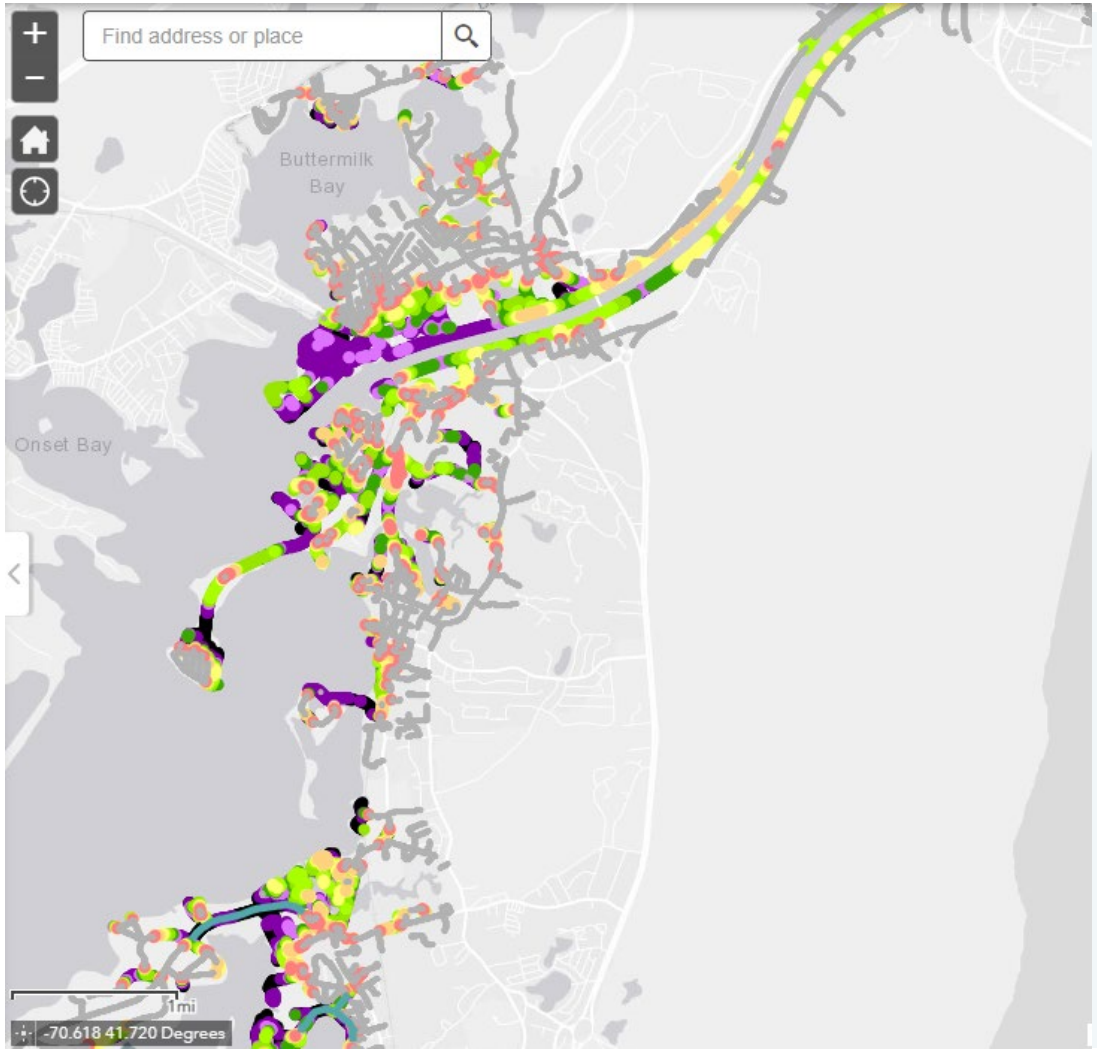
Summary of alternatives

	Segment	Description	Critical Elevation	Annual Exceedance Probability			Vulnerable to Tidal Flooding	Impacts to Wetlands	Impacts to Private Property	Estimated Cost*
				2030	2050	2070				
EXISTING	EAST	A segment of 20ft wide road with a culvert crossing.	3.9 feet	100%	100%	100%	2050	N/A	N/A	N/A
	WEST		5.0 feet	100%	100%	100%	2070			
ALTERNATIVE 1: GRAY	EAST	4038 linear feet of Town-owned road are elevated from a lowest point of 3.9 feet to a lowest point of 10.0 feet with a 4:1 traditionally vegetated side slope, except at the marsh crossing, where sheet pile is used.	10.0 feet	5%	20%	20%	N/A	Minimal	Significant	$16,529,000
	WEST		10.0 feet	5%	20%	20%	N/A	Negative	Minor	
ALTERNATIVE 2: HYBRID	EAST	Parapet walls and berms protect the road to 7.4 feet. Negotiation with property owners and selective acquisitions are required, along with a deployable barrier at the dock at the end of Richmond Road.	7.4 feet	20%	20%	100%	N/A	Negative	Significant	$1,177,000 (excluding easements and acquisitions)
	WEST		7.4 feet	20%	20%	100%	N/A	Minimal	None	

*Installed material cost +20% contingency. Excludes design, permitting, mobilization, stormwater and wastewater infrastructure, and site controls. Costs based on RSMeans 2021 cost book and adjusted for inflation and region.

LOW LYING ROADS

Discussion



- **Circuit Avenue**
- **Wings Neck Road**

NEXT STEPS

- Comments! Use form on project webpages
  https://www.capecodcommission.org/our-work/low-lying-roads-project/
- Town staff to determine which projects, designs
  - Review of community input
  - Engineering, permitting
- Identify funding

FUNDING OPPORTUNITIES

Federal Bipartisan Infrastructure Law (BIL)

Federal Highway Administration

- PROTECT – Competitive Resilience Improvement and Planning grants
- Culvert Aquatic Organism Passage Program - competitive grants for the replacement, removal, and repair of culverts or weirs that meaningfully improve or restore fish passage for anadromous fish

[NEW] PROTECT Grants (discretionary)

Purpose	Planning, resilience improvements, community resilience and evacuation routes, and at-risk coastal infrastructure
Funding	$1.4 B (FY 22-26) in Contract Authority from the HTF
Eligible entities	• State (or political subdivision of a State) • MPO • Local government • Special purpose district or public authority with a transportation function • Indian Tribe • Federal land management agency (applying jointly with State(s)) • *Different eligibilities apply for at-risk coastal infrastructure grants*
Eligible projects	• Highway, transit, intercity passenger rail, and port facilities • Resilience planning activities, including resilience improvement plans, evacuation planning and preparation, and capacity-building • Construction activities (oriented toward resilience) • Construction of (or improvement to) evacuation routes
Other key provisions	• Higher Federal share if the eligible entity develops a resilience improvement plan (or is in a State or area served by MPO that does) and the State or MPO incorporates it into its long-range transportation plan • May only use up to 40% of the grant for construction of new capacity

FUNDING OPPORTUNITIES

Nature Based Solutions, Ecological Restoration, Culverts

- FEMA Building Resilient Infrastructure and Communities (BRIC)
- National Coastal Resiliency Fund (NCRF) through National Fish and Wildlife Fund
- Natural Resources Conservation Service (NRCS) through the Cape Cod Conservation District
- Municipal Vulnerability Preparedness Program (MVP)
- Division of Ecological Restoration (DER) Culvert Replacement Municipal Assistance Grant Program