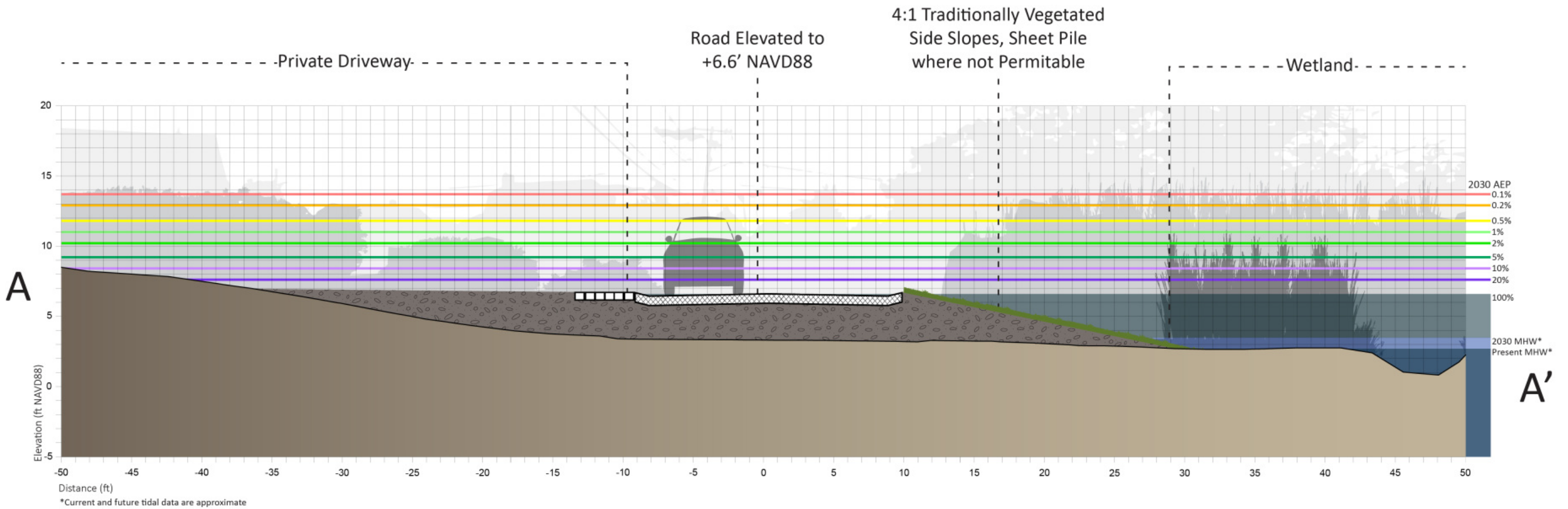




ALTERNATIVE 1: GRAY

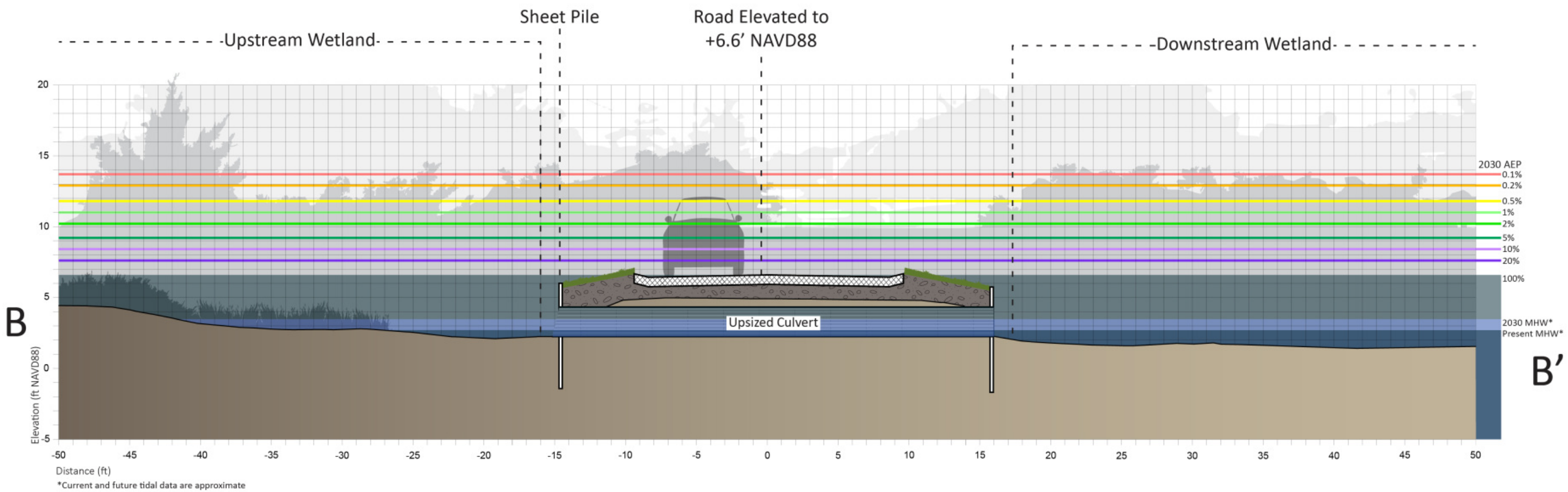
2,474 linear feet of town-owned road are elevated from a lowest point of +3.0' NAVD88 to a lowest point of +6.6' NAVD88 using 4:1 traditionally vegetated side slopes and sheet pile. Both small culverts under the road are upsized. Further modeling is needed to determine marsh and property impacts upstream. Sheet pile use may be reduced slightly if areas of salt marsh can be restored to compensate for filled wetlands.

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



ALTERNATIVE 1: GRAY

Morris Island Road, Chatham



ALTERNATIVE 1: GRAY

Morris Island Road, Chatham

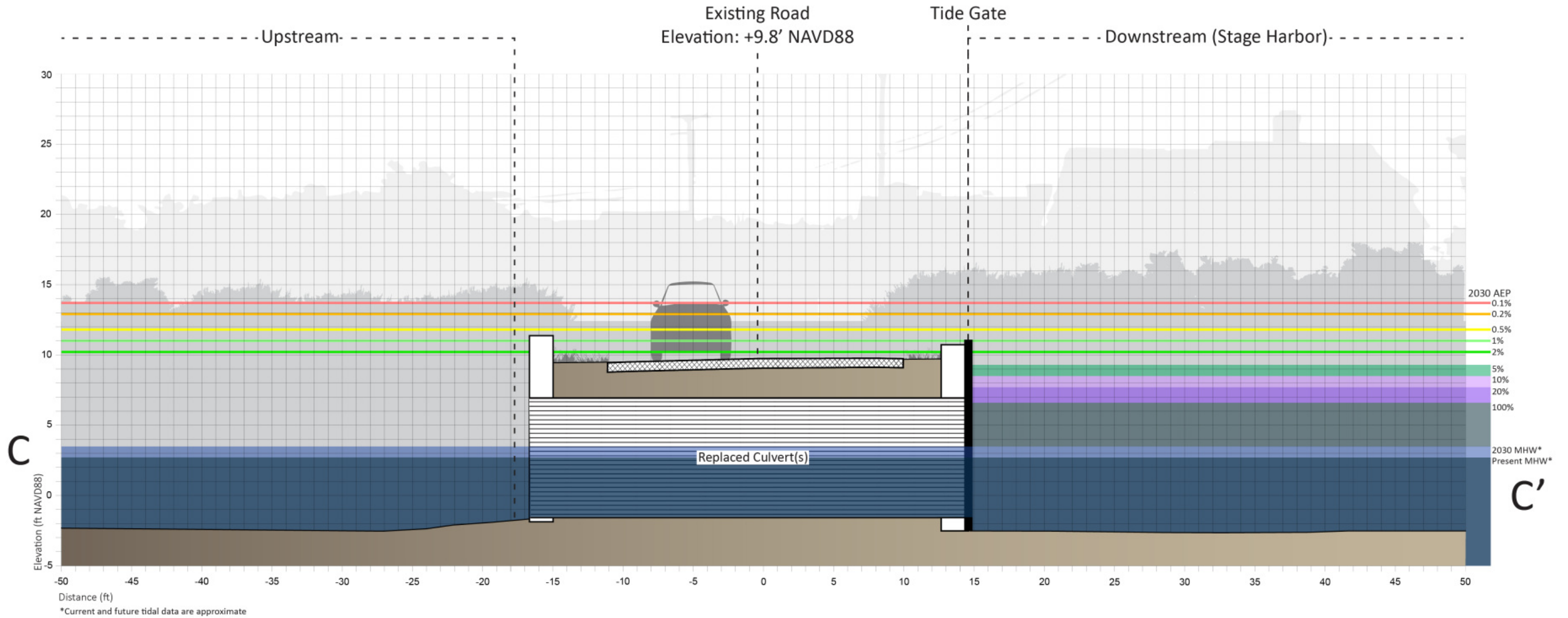


Note: Project overlap with wetland areas, rights of way and property lines is approximate and needs confirmation with a site survey



ALTERNATIVE 2: HYBRID A

Alternative 2 is based on previous coastal resilience work carried out by Horsley Witten Group and the Town of Chatham in Little Beach. In that proposal, a combination of dunes, seawalls, bulkhead elevation, and deployable barriers achieve an elevation of +8.8' NAVD88 on the ocean side. The bulkhead at Outermost Harbor is raised 1.5' in total. We propose replacing the aging culvert and tidal control to prevent flooding from Stage Harbor.



ALTERNATIVE 2: HYBRID A

Morris Island Road, Chatham

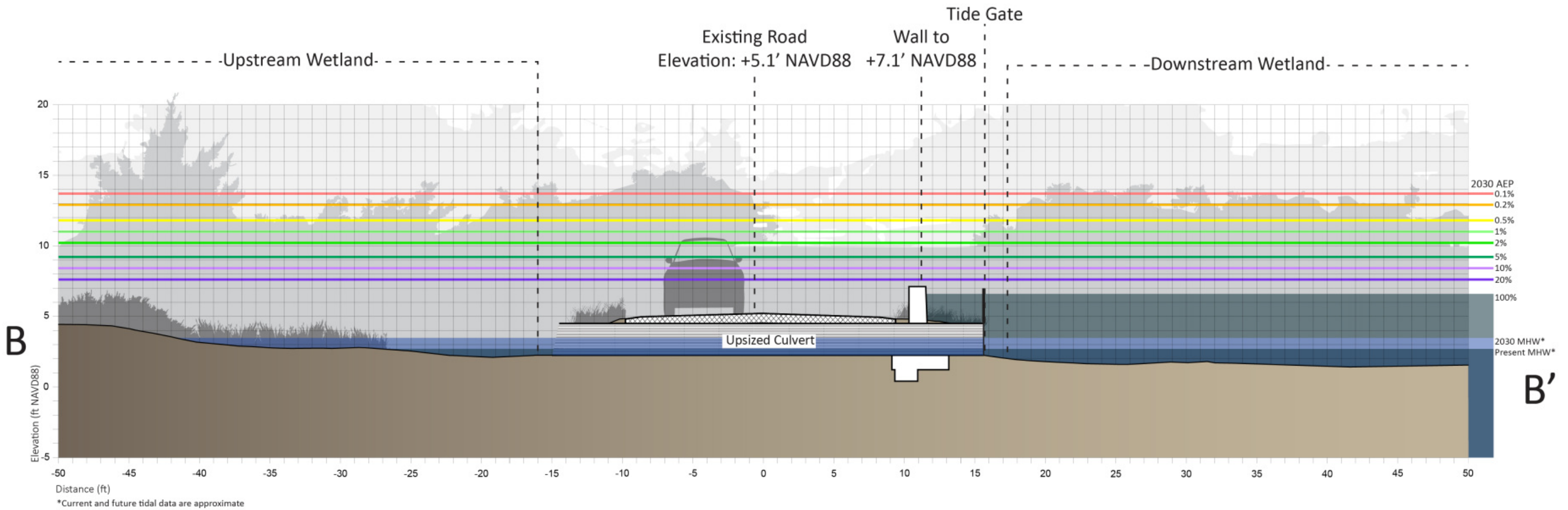


Note: Project overlap with wetland areas, rights of way and property lines is approximate and needs confirmation with a site survey



ALTERNATIVE 3: HYBRID B

Alternative 3 represents other options for work at Outermost Harbor and on the USACE culvert. A combination of dunes, concrete knee walls, and road tables achieve an elevation of +7.1' NAVD88 on the ocean side. A concrete knee wall to +7.1' NAVD88 is constructed on the southern side of Morris Island Road. The two small culverts are upsized and tide gates are added. Further modeling is needed to determine marsh and property impacts upstream. No proposed walls are taller than 3.5 feet.



ALTERNATIVE 3: HYBRID B

Morris Island Road, Chatham



GRAVEL EMERGENCY
ACCESS ROAD, EXACT
LOCATION TBD



Morris Island Road
CHATHAM

ALTERNATIVE 4: EMERGENCY ROUTE

A gravel road from Morris Island Road to Bridge Street is constructed through existing conservation land to provide emergency access via high ground to Morris Island. The land is deed-restricted for conservation, so there are significant legal challenges. The road is routed to maintain an elevation above +8.8' NAVD88, avoid impact to wetlands, and use the existing right of way at Cotton Sedge Way. This matches the 2030 5% AEP vulnerability of the Morris Island Road causeway to the west.

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

MORRIS ISLAND ROAD, CHATHAM

Summary of alternatives

	Description	Critical Elevation (NAVD88)	Annual Exceedance Probability			Vulnerable to Tidal Flooding†	Permitability Concerns	Impacts to Private Property	Estimated Cost*
			2030	2050	2070				
EXISTING	A long stretch of town-owned road through neighborhood and marsh.	3.0 feet	100%	100%	100%	2030	N/A	N/A	N/A
ALTERNATIVE 1: GRAY	2,474 linear feet of town-owned road are elevated to +6.6' NAVD88 using 4:1 traditionally vegetated side slopes and sheet pile. The two small culverts under the road are upsized.	6.6 feet	20%	100%	100%	2070	Potential for wetland impacts	Moderate	\$3,770,000
ALTERNATIVE 2: HYBRID A	A combination of dunes, seawalls, bulkhead elevation, and deployable barriers achieve an elevation of +8.8' NAVD88 on the ocean side. The aging culvert and defunct tidal control are replaced to prevent flooding from Stage Harbor.	8.8 feet	5%	20%	100%	2030	Resource area restoration	Moderate	\$3,000,000
ALTERNATIVE 3: HYBRID B	A combination of dunes, concrete knee walls, and road tables achieve an elevation of +7.1' NAVD88 on the ocean side. A concrete wall to +7.1' NAVD88 is constructed on the south side of Morris Island Road. The two small culverts are upsized and tide gates are added.	7.1 feet	20%	100%	100%	2030	Resource area restoration	Minimal	\$743,000

*2023 installed material cost +40% escalation (through 2029) and 15% contingency. Excludes design, permitting, mobilization, stormwater and wastewater infrastructure, and site controls. Costs based on experienced contractor opinion and MassDOT costing data.

†Future tidal data are approximate.