



MaineDOT

Machias, Dike Bridge #2256
WIN 16714

List of Alternatives Considered to Date

The following table is a compilation of all the alternatives considered by MaineDOT to date. The evaluations and impacts noted in the table are from prior work efforts that will inform the EIS process.

ALTERNATIVE		CONFIGURATION		ALTERNATIVE EVALUATION						LANDWARD IMPACTS					CONSTRUCTION COST (Includes 5% contingency and inflation for projected 2026 construction start)			
				PURPOSE AND NEED			SECONDARY GOALS			OTHER		Water Surface Elevation (WSEL) (NAVD88)	Increased Acreage Impact	Number of Properties		Hazardous Waste Sites	Wells/Septic	
				Overall Structure Rating	Railroad Corridor	Fish passage	Sea Level Rise (SLR) Accomodation	Transportation & Community Uses	Impacts to Tidal Regime	Constructability and Maintenance	Stride Bridge (#3973)							
	See "Technical Report: Middle River Hydrologic and Alternatives Analyses (June 30, 2015)", Memo "Updated Hydraulic Analysis for Culvert Replacement Alternatives (August 29, 2019)" and Memo "1st Phase Hydraulic Analysis for Machias Dyke Bridge Planning Phase Support Services (June 2, 2021)" for additional information	Culvert or Bridge-- Number, Span and Size		Good (a rating of 7 or better on a scale 0-9)	Preserves railroad corridor in accordance with Rail Preservation Act	Improvement (Yes/No) 95% exceedance flow speed; Min water depth	Consistency with Town planning & Maine State Climate Council guidance	Causeway Parking Multi-Use Trail	Ranges from No change to full restoration (ie no tidal restriction); Increase in intertidal habitat	Water management during construction, timber cribbing causeway, dredging, and future maintenance	1948 ~ 12.5 ft span corrugated steel plate pipe arch located upstream.	MHW Water Surface Elevation LOW (<2') MEDIUM (2' to 4') HIGH (>4')	Additional acreage impacts due to change in WSEL	Parcels impacted by change in WSEL	Number of potential hazmat sites impacted by change in WSEL	Number of parcels with water supply wells & septic impacted by alternative	Low:\$2 to \$10 mil. Mid:\$10 to \$25 mil. High: > \$25 mil.	
2015 Study	Alternative 1	Existing Condition/ No Action (Not carried into 2019/2020)	Four - box culverts with Flap Gates									Existing (EL -0.7')						-
	Alternative 2	Replacement In-Kind (Refined in 2019 as Alt 1)	Four - (5 ft x 5 ft) Box Culverts with Flap Gates, No leakage	No					None			LOW						MID
		Variation A (Carried in 2019 as Alt 2,3&4)	Five - (5 ft x 5 ft) Box Culverts Flap Gates on four culverts	Yes (advection)					Improvement			2015 Study suggests a new small span bridge when Stridge Bridge needs replacement due to condition and age.	LOW					MID
		Variation B	Four - (5 ft x 5 ft) Box Culverts Flap Gates on three culverts	Yes (advection)	Not Considered in 2015, see 2019-2021 study	Not Considered in 2015, see 2019- 2021 study	Improvement	Not Considered in 2015, see 2019- 2021 study	Improvement	Not Considered in 2015, see 2019- 2021 study		LOW				Not considered in 2015, see 2019-2021 study		MID
		Variation C	Four - (5 ft x 5 ft) Box Culverts Flap Gates on two culverts	Yes (advection)					Improvement				MEDIUM					MID
		Alternative 3	Replacement Culverts (Not carried into 2019/2020)	Self-Regulating Tide Gates (SRTs)	Marginal (high flow speeds impact normal gate operation)					Evaluate Gate Alternatives								

NOTE: RAISING FINISHED GRADE ELEVATION OF THE CAUSEWAY FOR ALL ALTERNATIVES WILL HAVE ENVIRONMENTAL IMPACTS ALONG THE CAUSEWAY WITH SIDESLOPES WHICH MAY REQUIRE EARTH RETAINING STRUCTURES OR CHANGES TO THE EXISTING LANE/SHOULDER/PARKING WIDTHS.

Legend:
Alternatives Included in Phase 1 Hydraulics
Alternatives Included in Phase 1 & 2 Hydraulics
Analysis

ALTERNATIVE		CONFIGURATION		ALTERNATIVE EVALUATION						LANDWARD IMPACTS					CONSTRUCTION COST (Includes 5% contingency and inflation for projected 2026 construction start)				
				PURPOSE AND NEED		SECONDARY GOALS			OTHER		Water Surface Elevation (WSEL) (NAVD88)	Increased Acreage Impact	Number of Properties	Hazardous Waste Sites		Wells/Septic			
						Overall Structure Rating	Railroad Corridor	Fish passage	Sea Level Rise (SLR) Accomodation	Transportation & Community Uses							Impacts to Tidal Regime	Constructability and Maintenance	Stride Bridge (#3973)
	See "Technical Report: Middle River Hydrologic and Alternatives Analyses (June 30, 2015)", Memo "Updated Hydraulic Analysis for Culvert Replacement Alternatives (August 29, 2019)" and Memo "1st Phase Hydraulic Analysis for Machias Dyke Bridge Planning Phase Support Services (June 2, 2021)" for additional information	Culvert or Bridge-- Number, Span and Size		Good (a rating of 7 or better on a scale 0-9)	Preserves railroad corridor in accordance with Rail Preservation Act	Improvement (Yes/No) 95% exceedance flow speed; Min water depth	Consistency with Town planning & Maine State Climate Council guidance	Causeway Parking Multi-Use Trail	Ranges from No change to full restoration (ie no tidal restriction); Increase in intertidal habitat	Water management during construction, timber cribbing causeway, dredging, and future maintenance	1948 ~ 12.5 ft span corrugated steel plate pipe arch located upstream.	MHW Water Surface Elevation LOW (<2') MEDIUM (2' to 4') HIGH (>4')	Additional acreage impacts due to change in WSEL	Parcels impacted by change in WSEL	Number of potential hazmat sites impacted by change in WSEL	Number of parcels with water supply wells & septic impacted by alternative	Low:\$2 to \$10 mil. Mid:\$10 to \$25 mil. High: > \$25 mil.		
2015 Study Continued		Alternative 4	Replacement Culverts (Not carried into 2019/2020)	"Fish-Friendly" SRTs		Marginal (high flow speeds impact normal gate operation)	Not Considered in 2015, see 2019- 2021 study			Evaluate Gate Alternatives	2015 Study suggests a new small span bridge when Stridge Bridge needs replacement due to condition and age.		Not considered in 2015, see 2019-2021 study					MID	
	Alternative 5	Replacement Culverts (Refined in 2020 as Alt 9)	Four - (12 ft span x 15 ft rise) Box Culverts Without flap gates	Not Considered in 2015, see 2019-2021 study		Yes (advection)	Not Considered in 2015, see 2019- 2021 study			Restoration	Not Considered in 2015, see 2019- 2021 study		HIGH	Not considered in 2015, see 2019-2021 study					MID
	Alternative 6	Replacement Bridge (Refined in 2020 as Alt 10)	One - 60 ft single span bridge			Yes (volitional)				Restoration			HIGH						HIGH
	Alternative 7	Replacement Bridge & Culverts	One - 60 ft single span & Relief culverts in the causeway			Yes (volitional)				Restoration			HIGH						MID

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ALTERNATIVE		CONFIGURATION		ALTERNATIVE EVALUATION						LANDWARD IMPACTS					CONSTRUCTION COST (Includes 5% contingency and inflation for projected 2026 construction start)		
				PURPOSE AND NEED			SECONDARY GOALS			OTHER		Water Surface Elevation (WSEL) (NAVD88)	Increased Acreage Impact	Number of Properties		Hazardous Waste Sites	Wells/Septic
				Overall Structure Rating	Railroad Corridor	Fish passage	Sea Level Rise (SLR) Accomodation	Transportation & Community Uses	Impacts to Tidal Regime	Constructability and Maintenance	Stride Bridge (#3973)						
				Good (a rating of 7 or better on a scale 0-9)	Preserves railroad corridor in accordance with Rail Preservation Act	Improvement (Yes/No) 95% exceedance flow speed; Min water depth	Consistency with Town planning & Maine State Climate Council guidance	Causeway Parking Multi-Use Trail	Ranges from No change to full restoration (ie no tidal restriction); Increase in intertidal habitat	Water management during construction, timber cribbing causeway, dredging, and future maintenance	1948 ~ 12.5 ft span corrugated steel plate pipe arch located upstream.	MHW Water Surface Elevation LOW (<2') MEDIUM (2' to 4') HIGH (>4')	Additional acreage impacts due to change in WSEL	Parcels impacted by change in WSEL	Number of potential hazmat sites impacted by change in WSEL	Number of parcels with water supply wells & septic impacted by alternative	Low:\$2 to \$10 mil. Mid:\$10 to \$25 mil. High: > \$25 mil.
Alternative 1		Fully Gated Culverts (2015 Alt 2)	Four - (5 ft x 5 ft) Box Culverts With Flap Gates, No leakage	Yes	Yes	No	Yes	• Maintains parking on causeway	None			LOW (EL. -2.5' Change = -1.7')	N/A	N/A	N/A	N/A	MID (\$20-23 million)
Alternative 2		Modified Alternative 1 (2015 Alt 2A)	Five - (5 ft x 5 ft) Box Culverts With Flap Gates on 4 culverts Culverts at invert elevation -4.05 ft	Yes	Yes	Yes (advection)	Yes	• Maintains parking on causeway • Structure does not restrict amenities	Improvement	• Locate new culverts to the East to facilitate water management during construction		LOW (EL. 0.2' Change = +0.9') needs refinement	40 +/-	10 +/-	0	0	MID
Alternative 3		Modified Alternative 2 (2015 Alt 2A)	Five - (5 ft x 5 ft) Box Culverts With Flap Gates on 4 culverts Open 5th culvert at lower invert elevation -6.05 ft	Yes	Yes	Yes (advection)	Yes	• Maintains parking on causeway • Structure does not restrict amenities	Improvement	• Locate new culverts to the East to facilitate water management during construction • Constuctability more difficult for varied invert elevation		LOW (EL. 0.5' Change = +1.2') needs refinement	40 +/-	10 +/-	0	0	MID
Alternative 4		Modified Alternative 2 (2015 Alt 2A)	Five - (5 ft x 5 ft) Box Culverts With Flap Gates on 4 culverts All culverts at invert elev. -6.05 ft	Yes	Yes	Yes (advection 59% of time)	Yes	• Maintains parking on causeway • Structure does not restrict amenities	Improvement; 40 intertidal habitat acres	• ~1,100 CY of near-field dredging • Difficult dewatering		LOW (EL. 0.8' Change = +1.5') needs refinement	40	10	0	0	MID

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Legend:
Alternatives Included in Phase 1 Hydraulics
Alternatives Included in Phase 1 & 2 Hydraulics
Analysis

ALTERNATIVE		CONFIGURATION		ALTERNATIVE EVALUATION							LANDWARD IMPACTS					CONSTRUCTION COST (Includes 5% contingency and inflation for projected 2026 construction start)	
				PURPOSE AND NEED			SECONDARY GOALS			OTHER		Water Surface Elevation (WSEL) (NAVD88)	Increased Acreage Impact	Number of Properties	Hazardous Waste Sites		Wells/Septic
				Overall Structure Rating	Railroad Corridor	Fish passage	Sea Level Rise (SLR) Accommodation	Transportation & Community Uses	Impacts to Tidal Regime	Constructability and Maintenance	Stride Bridge (#3973)						
	See "Technical Report: Middle River Hydrologic and Alternatives Analyses (June 30, 2015)", Memo "Updated Hydraulic Analysis for Culvert Replacement Alternatives (August 29, 2019)" and Memo "1st Phase Hydraulic Analysis for Machias Dyke Bridge Planning Phase Support Services (June 2, 2021)" for additional information	Culvert or Bridge-- Number, Span and Size		Good (a rating of 7 or better on a scale 0-9)	Preserves railroad corridor in accordance with Rail Preservation Act	Improvement (Yes/No) 95% exceedance flow speed; Min water depth	Consistency with Town planning & Maine State Climate Council guidance	Causeway Parking Multi-Use Trail	Ranges from No change to full restoration (ie no tidal restriction); Increase in intertidal habitat	Water management during construction, timber cribbing causeway, dredging, and future maintenance	1948 ~ 12.5 ft span corrugated steel plate pipe arch located upstream.	MHW Water Surface Elevation LOW (<2') MEDIUM (2' to 4') HIGH (>4')	Additional acreage impacts due to change in WSEL	Parcels impacted by change in WSEL	Number of potential hazmat sites impacted by change in WSEL	Number of parcels with water supply wells & septic impacted by alternative	Low:\$2 to \$10 mil. Mid:\$10 to \$25 mil. High: > \$25 mil.
Alternative 4 Modified	Alternative 4 with larger culvert widths	Three - (10 ft span x 5 ft rise) Box Culverts With Flap Gates on 2 culverts Gated culverts at invert elev. -4.05 ft, open at -6.05		Yes	Yes	Yes (advection 52% of time)	Yes	• Maintains parking on causeway • Structure does not restrict amenities	Improvement; 86 intertidal habitat acres	• ~1,100 CY of near-field dredging • Constructability more difficult for varied invert elevation • Difficult dewatering		MEDIUM (EL. 2.1' Change = +2.8')	86	28	1 municipal landfill (needs further study)	0	MID (\$20-23 million)
Alternative 5	Rehabilitation (15-year)	Additional buried roadway slab over top of existing culverts		No	Yes	No	No	• Maintains parking on causeway	None	• Continued deterioration of Timber culverts • Stabilize roadway settlement		no change	N/A	0	0	0	LOW
Alternative 6	Rehabilitation (30-year)	Slipline existing <u>with</u> new flap gates & 2 new culverts <u>with</u> flap gates No leakage		No	Yes	No	No	• Maintains parking on causeway	None	• Risk damage to existing deteriorating structure • Stabilize existing timber culverts		LOW (estimated)	N/A	0	0	0	LOW
Alternative 7	Rehabilitation (30-year)	Slipline existing culverts <u>without</u> flap gates & 2 new culverts <u>without</u> flap gates		No	Yes	Yes (advection)	No	• Maintains parking on causeway	Improvement	• Risk damage to existing deteriorating structure • Stabilize existing timber culverts • No flap gates to maintain		MEDIUM/HIGH (estimated)	100 to 200 +/-	38 +/-	0	1 (parcel P well near NE corner of causeway)	LOW
Alternative 8	Phased Alternative - Replacement Culverts (Alt 4) & Future Replacement Bridge (Alt 10)	Five new culverts located to the East (intermediate SLR accommodation) Future Bridge to the west (high SLR accommodation)		Yes	Yes	Yes (advection now)	Yes	• Maintains parking on causeway (Now)	Improvement (Now)	• Can locate culverts to the East to facilitate water management during construction	• Requires replacement due to increased hydraulic opening, salinity, and ice floes (in future)	LOW (now, estimated)	40 +/-	10 +/-	0		HIGH
		Flap gates on four culverts		Yes	Yes (dependent on final highway bridge roadway profile)	Yes (volitional later)	Yes	• May not maintain full parking (future)	Restoration (future)			HIGH (future, estimated)	415 +/-	54 +/-	1 municipal landfill (needs further study)	5 (parcels F & G well/sewer near Stride Bridge; P, O, N wells near NE corner of causeway)	
Alternative 9	Replacement Culverts	Four - (5 ft x 5 ft) Box Culverts without Flap Gates		Yes	Yes	Yes (advection 41% of time)	Yes	• Maintains full parking • Structure does not restrict amenities	Improvement; 168 intertidal habitat acres	• No flap gates to maintain • Difficult dewatering	• Requires replacement sooner due to increased hydraulic opening, and salinity, and ice floes	MEDIUM/HIGH (EL. 4.1' Change = +4.8')	168	38	1 municipal landfill (needs further study)	1 (parcel P well near NE corner of causeway)	MID

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2020-2023 Planning

ALTERNATIVE		CONFIGURATION		ALTERNATIVE EVALUATION							LANDWARD IMPACTS					CONSTRUCTION COST (Includes 5% contingency and inflation for projected 2026 construction start)		
				PURPOSE AND NEED			SECONDARY GOALS			OTHER			Water Surface Elevation (WSEL) (NAVD88)	Increased Acreage Impact	Number of Properties		Hazardous Waste Sites	Wells/Septic
				Overall Structure Rating	Railroad Corridor	Fish passage	Sea Level Rise (SLR) Accomodation	Transportation & Community Uses	Impacts to Tidal Regime	Constructability and Maintenance	Stride Bridge (#3973)	NOTE: Impacts noted are from differences in normal water levels for normal tides and normal riverine flow (impacts do NOT include riverine floods, spring tides, storm surges or SLR)						
	See "Technical Report: Middle River Hydrologic and Alternatives Analyses (June 30, 2015)", Memo "Updated Hydraulic Analysis for Culvert Replacement Alternatives (August 29, 2019)" and Memo "1st Phase Hydraulic Analysis for Machias Dyke Bridge Planning Phase Support Services (June 2, 2021)" for additional information	Culvert or Bridge-- Number, Span and Size		Good (a rating of 7 or better on a scale 0-9)	Preserves railroad corridor in accordance with Rail Preservation Act	Improvement (Yes/No) 95% exceedance flow speed; Min water depth	Consistency with Town planning & Maine State Climate Council guidance	Causeway Parking Multi-Use Trail	Ranges from No change to full restoration (ie no tidal restriction); Increase in intertidal habitat	Water management during construction, timber cribbing causeway, dredging, and future maintenance	1948 ~ 12.5 ft span corrugated steel plate pipe arch located upstream.		MHW Water Surface Elevation LOW (<2') MEDIUM (2' to 4') HIGH (>4')	Additional acreage impacts due to change in WSEL	Parcels impacted by change in WSEL	Number of potential hazmat sites impacted by change in WSEL	Number of parcels with water supply wells & septic impacted by alternative	Low:\$2 to \$10 mil. Mid:\$10 to \$25 mil. High: > \$25 mil.
Alternative 10	Replacement of Dyke and Stride Bridge No parking on bridge (parking in approaches) <i>(Refined 2015 Alt 6)</i>	Dyke Bridge: Single span bridge 120' to 150' long (120' analyzed) 2 lane highway bridge Separate bridge for trail Stride Bridge: 75' +/- single span		Yes	Yes	Yes (volitional); 8.8 feet/sec; 1.3 +/- feet min.; low flow channel needed	No (potential for nuisance flooding beyond year 2070)	• May not maintain full parking, less amenities	Restoration; 398 intertidal habitat acres	• ~6,000 CY of near-field dredging • Large volume (>20,000 CY) of natural landward far-field sediment scour & seaward shoaling • Difficult to connect low flow channel landward of dredge and scour areas	• Requires replacement now due to increased hydraulic opening, salinity and ice floes	HIGH (EL. 7.9' Change = +8.6')	398	54	1 municipal landfill (needs further study)	5 (parcels F & G well/sewer near Stride Bridge; P, O, N wells near NE corner of causeway)	HIGH (\$37-41 million)	
Alternative 10A	Replacement of Dyke and Stride Bridge Parking on bridge and in the approaches <i>(Refined 2015 Alt 6)</i>	Dyke Bridge: Single span bridge 120' to 150' long (120' analyzed) Full width bridge for highway & parking Separate bridge for trail Stride Bridge: 75' +/- single span		Yes	Yes	Yes (volitional); 8.8 feet/sec; 1.3 +/- feet min.; low flow channel needed	No (potential for nuisance flooding beyond year 2070)	• Maintains parking on causeway, less amenities	Restoration; 398 intertidal habitat acres	• ~6,000 CY of near-field dredging • Large volume (>20,000 CY) of natural landward far-field sediment scour & seaward shoaling • Difficult to connect low flow channel landward of dredge and scour areas	• Requires replacement now due to increased hydraulic opening, salinity and ice floes	HIGH (EL. 7.9' Change = +8.6')	398	54	1 municipal landfill (needs further study)	5 (parcels F & G well/sewer near Stride Bridge; P, O, N wells near NE corner of causeway)	HIGH (\$39-43 million)	
Alternative 11	Replacement of Dyke and Stride Bridge No parking on bridge (parking in approaches)	Dyke Bridge: 2 span bridge 150' to 250' long 2 lane highway bridge Separate bridge for trail Stride Bridge: 75' +/- single span		Yes	Maybe (dependent on final bridge roadway profile)	Yes (volitional); 4.2 to 6.2 feet/sec; 1 +/- foot min.; low flow channel needed	No (potential for nuisance flooding beyond year 2050)	• May not maintain full parking, less amenities	Restoration; 405 intertidal habitat acres; not significant increase over Alternative 10	• 8,000 CY of near-field dredging • Volume of natural landward far-field sediment scour & seaward shoaling not evaluated • Difficult to connect low flow channel landward of dredge and scour areas	• Requires replacement now due to increased hydraulic opening, salinity and ice floes	HIGH (EL. 8.2' Change = +8.9')	405	56 +/-	1 municipal landfill (needs further study)	5 (parcels F & G well/sewer near Stride Bridge; P, O, N wells near NE corner of causeway)	HIGH (>\$45 million)	
Alternative 11A	Replacement of Dyke and Stride Bridge Parking on bridge and in the approaches	Dyke Bridge: 2 span bridge 150' to 250' long Full width bridge for highway & parking Separate bridge for trail Stride Bridge: 75' +/- single span		Yes	Maybe (dependent on final bridge roadway profile)	Yes (volitional); 4.2 to 6.2 feet/sec; 1 +/- foot min.; low flow channel needed	No (potential for nuisance flooding beyond year 2050)	Maintains parking on causeway, less amenities	Restoration; 405 intertidal habitat acres; not significant increase over Alternative 10	• >8,000 CY of near-field dredging • Volume of natural landward far-field sediment scour & seaward shoaling not evaluated • Difficult to connect low flow channel landward of dredge and scour areas	• Requires replacement now due to increased hydraulic opening, salinity and ice floes.	HIGH (EL. 8.2' Change = +8.9')	405	56 +/-	1 municipal landfill (needs further study)	5 (parcels F & G well/sewer near Stride Bridge; P, O, N wells near NE corner of causeway)	HIGH (>\$45 million)	
Alternative 12	Replacement of Dyke and Stride Bridge No parking on bridge (parking in approaches)	Dyke Bridge: Multi span bridge - 400' to 700' +/- long 2 lane highway bridge Separate bridge for trail Stride Bridge: 75' +/- single span		Yes	No	Yes (volitional); 2.5 feet/sec; 1 +/- foot min.; low flow channel needed	No (potential for nuisance flooding beyond year 2050)	May not maintain full parking, less amenities	Restoration; 405 intertidal habitat acres; not significant increase over Alternative 10	• >20,000 CY of near-field dredging • Volume of natural landward far-field sediment scour & seaward shoaling not evaluated • Difficult to connect low flow channel landward of dredge and scour areas	• Requires replacement now due to increased hydraulic opening, salinity and ice floes	HIGH (EL. 8.2' Change = +8.9')	405	56 +/-	1 municipal landfill (needs further study)	5 (parcels F & G well/sewer near Stride Bridge; P, O, N wells near NE corner of causeway)	HIGH (>\$50 million)	

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