Resilient Tidal Crossings

An Assessment and Prioritization to Address New Hampshire's Tidal Crossing Infrastructure for Coastal Resilience

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Prepared in partnership with:
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Cover photos (clockwise from upper left): (1) Atlantic Avenue's crossing of Fresh Creek in Dover, Crossing ID 85 (credit: NHDES Coastal Program); (2) Harbor Road's crossing of an unnamed tributary to Rye Harbor in Rye, Crossing ID 132 (credit: NHDES Coastal Program); (3) Route 1A crossing of an unnamed tributary to Rye Harbor before it was replaced, Crossing ID 45 (credit: NHDOT); (4) flooding at Bay Road's crossing of Lubberland Creek in Newmarket, Crossing ID 100 (credit: The Nature Conservancy).

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1. EXECUTIVE SUMMARY

One-hundred-eighteen tidal crossings were assessed across New Hampshire's coastal zone. Scoring criteria were applied to prioritize each crossing with a focus on enhancing coastal resilience for both human and natural communities. Infrastructure condition, inundation risk, tidal restriction, fish passage and salt marsh migration were among the scoring components.

Out of the 118 tidal crossings, the following are some of the significant findings from the Resilient Tidal Crossings project:

Infrastructure Results

- Thirty-three crossings have an immediate maintenance or replacement need. Just over half of crossings are in good or fair condition.
- Eleven crossings were recently inundated by flood waters; 24 additional crossings will be subject to inundation from high tides and storms with 1.7 feet of sea level rise.
- The overall infrastructure scores show that, when pairing structure condition and inundation risk to the roadway scores, the majority of crossings (58%) are at immediate or near-term risk, while less than 20% of crossings are currently adequate.

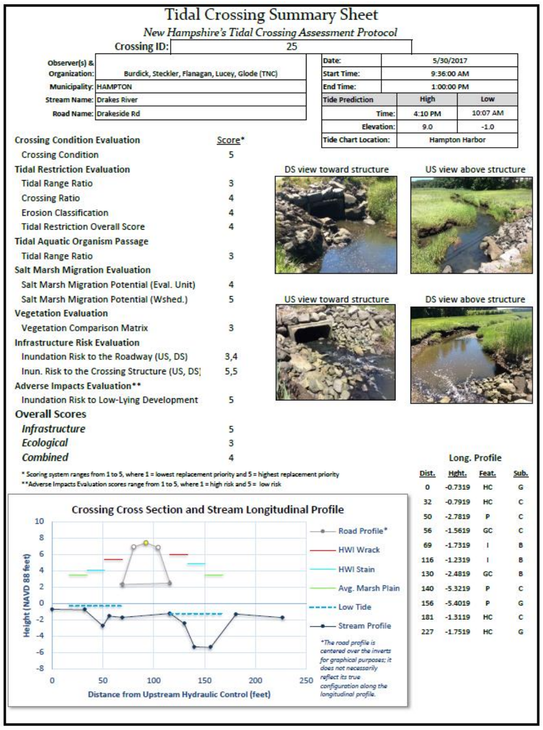
Ecological Results

- Greater than 80% of crossings are moderately to highly restrictive to tidal flows.
- Seven crossings are severe tidal restrictions and are permanent barriers to aquatic organism passage; many of these are perched at high tide or impounded.
- The majority of sites result in altered hydrology leading to severe channel erosion immediately upstream and downstream of the crossing.
- Sixty-two crossings (53%) were identified as having 5 acres or more of salt marsh migration potential.
- The overall ecological scores show that 39 crossings have high ecological priority scores, and 26 crossings have very high ecological priority. Only 17 crossings have low ecological priority.

Overall Results

- The overall combined score identifies 23 highest priority and 32 high priority crossings to be addressed or replaced.
- Seventeen crossings are currently adequate when pairing infrastructure and ecological scoring factors.

1.1 How to Access Data



Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 25

Observer(s) & Organization:	Burdick, Steckler, Flanagan, Lucey, Glode (TNC)
Municipality:	HAMPTON
Stream Name:	Drakes River
Road Name:	Drakeside Rd

Date:	5/30/2017	
Start Time:	9:36:00 AM	
End Time:	1:00:00 PM	
Tide Prediction	High	Low
Time:	4:10 PM	10:07 AM
Elevation:	9.0	-1.0
Tide Chart Location:	Hampton Harbor	

	Score*
Crossing Condition Evaluation	
Crossing Condition	5
Tidal Restriction Evaluation	
Tidal Range Ratio	3
Crossing Ratio	4
Erosion Classification	4
Tidal Restriction Overall Score	4
Tidal Aquatic Organism Passage	
Tidal Range Ratio	3
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	4
Salt Marsh Migration Potential (Wshed.)	5
Vegetation Evaluation	
Vegetation Comparison Matrix	3
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	3,4
Inun. Risk to the Crossing Structure (US, DS)	5,5
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	5
Overall Scores	
Infrastructure	5
Ecological	3
Combined	4

DS view toward structure

US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority

**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk

Crossing Cross Section and Stream Longitudinal Profile

Long. Profile

Dist.	Hght.	Feat.	Sub.
0	-0.7319	HC	G
32	-0.7919	HC	C
50	-2.7819	P	C
56	-1.5619	GC	C
69	-1.7319	I	B
116	-1.2319	I	B
130	-2.4819	GC	B
140	-5.3219	P	C
156	-5.4019	P	G
181	-1.3119	HC	C
227	-1.7519	HC	G

TIDAL CROSSING SUMMARY SHEET: Tidal Crossing Summary Sheets for each of the 118 assessed tidal crossings are available in **Appendix D.** Each of these two-page summary sheets contains crossing scores, photos, a map, and a "Crossing Cross Section and Stream Longitudinal Profile" graph. This graph illustrates the result of the elevation survey performed at each crossing, and displays key elevation data, including elevations of the road surface, stream channel, culvert and high water indicators. **Section 5.2** provides additional context for understanding the "Crossing Cross Section and Stream Longitudinal Profile." **Appendix F** contains an interpretation guide that explains the relevance of each evaluation criteria score and serves as a companion to the Tidal Crossing Summary Sheet

ONLINE DATA VIEWER: Tidal crossing results are available for viewing at:

https://www.nhcoastalviewer.org/.

This online viewer conveniently displays many of the tidal crossing scores. The scoring system of 1 (lowest replacement priority) to 5 (highest replacement priority) is color-coded to demonstrate lowest (green) to highest (red) priority scores. In addition to scoring data, five additional data layers are available in the online viewers that contain various crossing attributes, including structure condition, ecosystem attributes, local data, and past restoration and replacement information. The full project dataset can be downloaded by GIS users from ArcGIS Online as a file geodatabase (sign in is required for data download—new ArcGIS Online users can create a free account). The complete dataset can also be provided by NHDES, upon request.

2. INTRODUCTION

Tidal crossings are unique types of infrastructure that play an important role in the resilience of both the built and natural environment across the coastal zone. Significant investments have been made in New Hampshire over the last 10 years to inventory and assess freshwater road-stream crossings, but until recently, a gap has remained in the ability to assess the complexity and variability at tidal crossings. The Resilient Tidal Crossings Project (Project) set out to fill that gap with the following primary objectives:

1. Collect standardized data on each of New Hampshire's tidal crossings.
2. Prioritize each tidal crossing's attributes based on a set of management objectives.
3. Make project data and analysis results available to stakeholders.

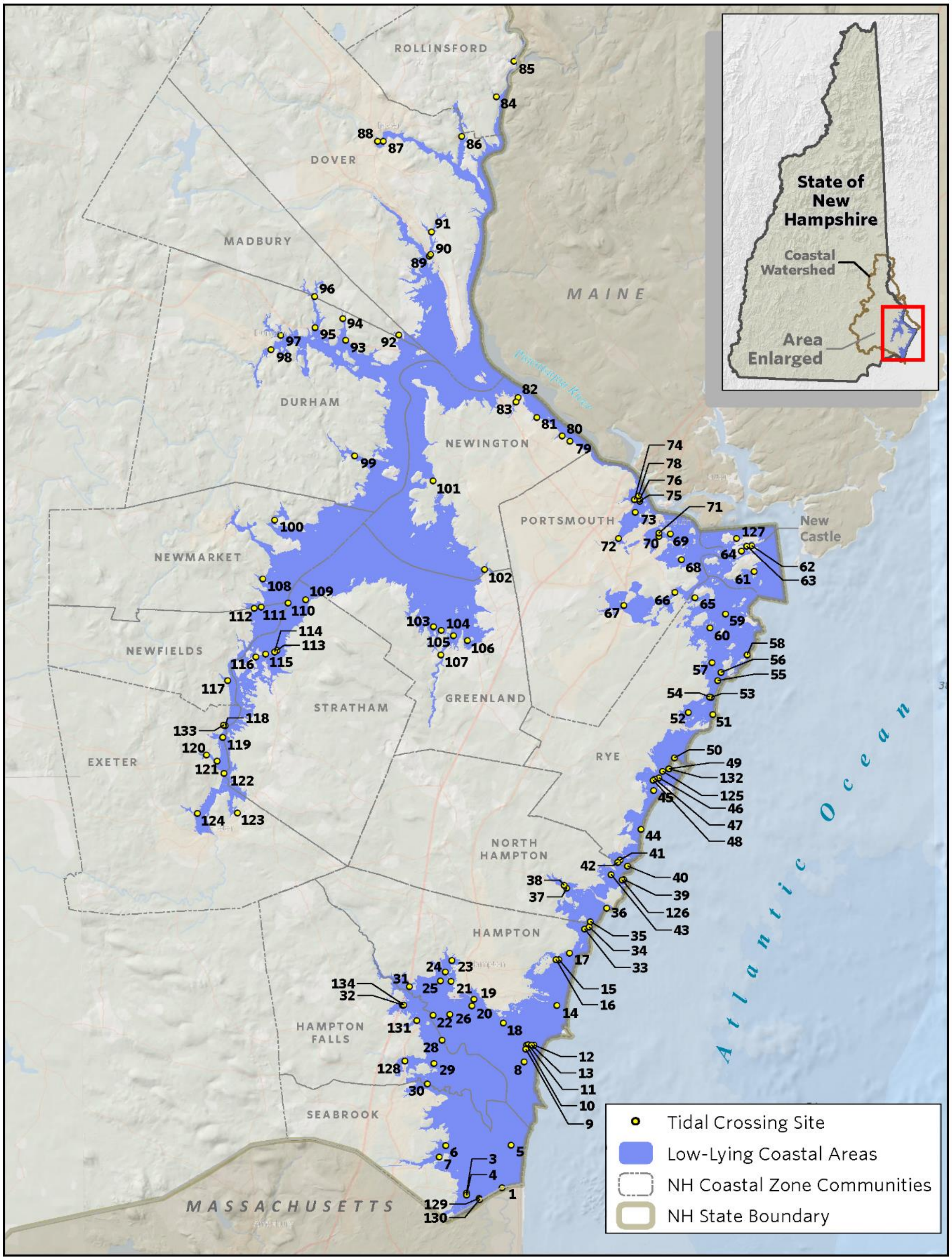
For the purpose of this Project, a tidal crossing is defined as a culvert or bridge that conveys bi-directional tidal flow, or that is predicted to become tidally influenced in the near future considering sea level rise (SLR) of 1.7 feet. Figure 1 shows the geographic distribution of New Hampshire's tidal crossings. Appendix A provides a tabular inventory of tidal crossings by town, road and stream names.

This report includes information on the Project's background, methods, a presentation of results, a discussion of results, and identification of next steps. **Section 2. Introduction** provides the broader context for why and how the Project was designed and implemented. Data collection and crossing prioritization efforts are detailed in **Section 3. Methods**. **Section 4. Results** presents distributions of scores across all prioritization categories for assessed tidal crossings. **Section 5. Discussion** considers the implications of Project results and data, including some examples of in-depth analyses that are enabled using Resilient Tidal Crossings data. **Section 6. Next Steps** identifies potential near and long-term actions to advance tidal crossing management for coastal resilience.

2.1 Project Team

The Project was performed by a team led by The Nature Conservancy (TNC) and New Hampshire Department of Environmental Services Coastal Program (NHCP) and included the University of New Hampshire (UNH) Jackson Estuarine Laboratory (JEL), UNH Technology Transfer Center (T^2), and UNH Geographically Referenced Analysis and Information Transfer System (GRANIT). Field data collection was coordinated and performed by NHCP. Desktop analysis, data quality control and data analysis were performed by TNC. JEL provided technical expertise regarding field assessments and crossing prioritization. The project's mobile data collection and management system was developed by T^2. T^2 hosts the Project's database and has made it available for public download. Primary project scoring results and select crossing attributes are displayed on GRANIT's NH Coastal Viewer.

Figure 1: Map of New Hampshire's Tidal Crossings. Each crossing is label with its unique identifier, or "Crossing ID." See Appendix A for additional crossing information details.



2.2 Funding

This Project was enabled by a $187,500 grant from the National Oceanic and Atmospheric Administration (NOAA) Office for Coastal Management (OCM) through the Projects of Special Merit (CFDA 11.419).

2.3 Context

Tidal crossings emerged as a priority for coastal zone management in 2015 when the need for asset management, coastal hazard mitigation and natural resource management converged. Sea level rise as a concept had been discussed and acknowledged for years, but newly available data products such as high-resolution topographic data, and sea level inundation and salt marsh migration mapping made detailed analyses of complex coastal management considerations possible. Similarly, the State of New Hampshire's investment in a transportation asset management system (the Statewide Asset Database Exchange System, or SADES) created an opportunity for tidal crossing asset management, while also highlighting tidal crossings as a gap in the asset management system.

As a result, TNC, NHCP and JEL developed a modern-day tool, New Hampshire's Tidal Crossing Assessment Protocol (Steckler et al. 2017) to assess and prioritize tidal crossings. The primary goal of the protocol was to assist transportation and coastal natural resource managers to maintain resilient tidal ecosystems and a safe and reliable transportation network. The protocol methodology collects a combination of field and GIS based data that feed into a prioritization process, which identifies tidal crossings in most need of attention with respect to infrastructure and ecological management. The highest priority tidal crossings are those that demonstrate the greatest potential to increase the resilience of our coastal infrastructure and tidal habitats.

Management Considerations

Tidal crossings require careful and deliberate management to maintain and protect the functions and values that estuarine habitats provide. These crossings are subject to high regulatory oversight by the NHDES Wetlands Bureau, Coastal Program and Shoreland Programs because of the unique and sensitive environments that they traverse, and the complexity of conditions that they are subject to. As with the rest of the transportation network, public safety is paramount, yet is especially challenging in these dynamic systems. Not only are tidal crossings subject to two high and two low tides most days, they are also subject to extreme precipitation events and coastal storm surges. On top of these design considerations and challenges is the need to plan for the anticipated effects of rising sea levels.

Tidal crossing replacement projects are undertaken for a variety of reasons. The driver for replacement in some cases is the failure or deterioration of existing infrastructure. Addressing a flooding problem might be a driver in other cases. And ecological restoration, such as addressing a tidal restriction that affects salt marsh health, salt marsh migration, or fish passage, is the focus of other tidal crossing replacements.

The design of a tidal crossing balances many considerations, including the drivers for replacement described above, costs, and managing risk. Cost can be considered in a number of ways, from the cost of no action, to construction, maintenance, and avoided costs depending on the scope and longevity of the engineered solution. Costs are not limited to the immediate transportation infrastructure alone; they extend to adjacent private property owners, ecosystem services and the intrinsic value of natural systems.

Managing risk is another consideration in the management of tidal crossings — but it's complicated in these low-lying coastal systems. Designing larger and taller tidal crossings to accommodate more frequent and intense storm events and higher tides will reduce the risk of road flooding and washouts. Generally speaking, these larger structures are more compatible with the ecosystems that they cross, creating a more resilient system for both people and nature. However, larger structures with greater hydraulic capacity may jeopardize upstream property and infrastructure through increased tidal flooding. On the other hand, undersized crossings risk upstream private property flooding because of limited seaward drainage capacity. This is all to say that each tidal crossing is unique and will have unique management and risk considerations when considered for replacement. The results of the Resilient Tidal Crossings Project highlights relevant management considerations at each of New Hampshire's tidal crossings.

The following sections provide additional details about management considerations at tidal crossings including sea level rise, transportation reliability, processes supporting salt marsh habitat and threats to salt marshes.

Sea Level Rise

There remains great uncertainty about the magnitude of sea level rise expected over the next 60 to 80 years as a result of our changing climate. Estimates range from 0.7 feet on the lower side (IPCC 2014) to 6.3 feet on the more extreme side (Wake et al. 2011). A 1.7-foot sea level rise (SLR) was used for this project as a near-term conservative projection in the assessment of tidal crossings. It captures the projected mean higher high water tide elevation at year 2050 under a high carbon emission scenario while also preparing for a lower SLR projection under a longer-term low emissions scenario (Wake et al., 2011). Approximately 35 additional crossings that are predicted to become tidal with 1.7 feet of SLR were included for assessment by the Project.

SLR will increase daily tidal flows at tidal crossings, adding additional pressure on crossing structures. Crossing structures already in poor condition may be more prone to failure from more intense physical exposure. High tide flooding, which is already documented at some crossings, will only become more frequent and severe, while additional crossings will become subject to regular or more regular high tide flooding. SLR will also exacerbate storm surge flooding and the negative effects of tidal restrictions on fish passage, salt marsh migration and salt marsh health. The planning need that this Project fills is even more important given the anticipated effects of SLR on tidal systems.

NH Coastal Risks and Hazards Commission

The New Hampshire Legislature created the NH Coastal Risks and Hazards Commission (CRHC) in 2013 to "recommend legislation, rules, and other actions to prepare for projected sea-level rise and other coastal and coastal watershed hazards such as storms, increased river flooding, and stormwater runoff, and the risks such hazards pose to municipalities and the state assets in New Hampshire" (CRHC 2016). The CRHC convened a Science and Technical Advisory Panel (STAP) to review available scientific information about coastal hazards and flood risks in New Hampshire. The STAP analyzed historic trends and projections out to years 2050 and 2100 for SLR, storm surge and extreme precipitation. The CRHC utilized the STAP report to make 35 recommendations to help New Hampshire Coastal Zone communities prepare for and respond to coastal risks and hazards.

For coastal infrastructure projects with a design life to 2050, CRHC recommends planning for at least 1.3 feet and as much as two feet of SLR (CRHC 2016). The Resilient Tidal Crossings Project is in service to the recommendations of the CRHC by assessing all tidal crossings and prioritizing replacements based on current and projected flood vulnerabilities.

Transportation Reliability

New Hampshire coastal communities rely on a functional, reliable and safe transportation network. Tidal crossings are a critical component of that network, which allow for the continuous flow of people, goods and services throughout the coastal zone. Across the 17 coastal communities there are over 1,300 miles of road used by nearly 150,000 residents (CRHC 2016). Tourism accounts for a considerable amount of both business revenue and roadway use across the seacoast. The views across our expansive tidal marshes from coastal roads are important to residents and visitors alike and provide a sense of place and quality of life.

Maintaining and upgrading our coastal transportation infrastructure is essential to the economic viability and vitality of the region — not to mention the safety of all public transportation system users. Many of New Hampshire's tidal crossings fall along evacuation or emergency access routes that are essential for public safety. These critical routes are needed to manage emergency response, access and egress during natural and human caused disasters, such as severe weather events or an emergency at the Seabrook Nuclear Power Plant

A recent transportation vulnerability assessment project, From Tides to Storms, identified critical infrastructure at risk. Routes 1-A, 1, and Interstate 95 — the primary north-south roads, and Routes 101 and 286 — the primary east-west roads (and evacuation routes), are all identified as vulnerable to sea level rise. For example, almost eight of Route 1-A's 18 miles will be inundated twice daily under a high SLR scenario of 6.6 feet at year 2100. Route 1-A runs adjacent to the Atlantic Coast and connects New Hampshire's most popular beaches, tourist amenities and working waterfronts, transporting 18,000 vehicles per day during the peak summer season (Rockingham Planning Commission 2015). In March of 2018 Route 1-A sustained costly damages ($3.3 million) during a series of Nor'easters, which resulted in a Presidential Disaster Declaration and FEMA Public

Assistance. The 2018 Nor'easters are likely a harbinger of challenges that the region's transportation network will face in the years to come as a result of climate change.

Salt Marsh Habitat Background

In New Hampshire, salt marshes occur along the 18-mile Atlantic coast; along the Piscataqua, Salmon Falls, and Cocheco Rivers; and around the Great Bay Estuary and its tributaries. Total salt marsh in New Hampshire as inventoried by NWIPlus (NHDES 2017) is 5,975 acres. These wetlands are subject to daily tides where the dominant vegetation is salt tolerant perennial grasses. Salt marsh formation and development, described by Redfield (1972), begins where smooth cordgrass (*Spartina alterniflora*) colonizes un-vegetated intertidal habitat. Plants grow and interact with floodwaters by capturing sediments and producing belowground biomass that forms peat. Over centuries the marsh builds to an elevation that approximates mean high tide.

Salt marsh plant communities are primarily an expression of site salinity and tidal inundation. Smooth cordgrass grows at low marsh elevations subject to twice daily flooding. High marsh habitats are dominated by salt meadow cordgrass (*Spartina patens*) and other plants, which occur above the low marsh. Salt marshes transition to either upland or to brackish and then freshwater marshes as salinity inputs decrease and hydrology is driven more by land than by sea.

Salt marsh abundance and extent depends upon the physical exposure and slope of the shoreline. Extensive marshes typically form in shallow embayments, especially landward of barrier beach systems. Examples of barrier beach estuaries in New Hampshire are the Hampton Seabrook Estuary, Little River, Bass Beach and Parsons Creek. Narrow fringe marshes typically occur along steep shorelines (Mitsch and Gosselink 2000; Morgan et al. 2009). Fringe marshes are found along the Piscataqua and Cocheco rivers, and the Great and Little Bay shorelines. New Hampshire also has several examples of brackish tidal river bank marshes that occur along the Salmon Falls, Bellamy, Lamprey and Squamscott rivers.

Salt marshes possess a variety of ecological functions that are important to humans as ecosystem services, as detailed in Table 1. These range from support of coastal food webs and biodiversity to storm protection and carbon storage (Short et al. 2000, Barbier et al. 2012). They support a suite of plants and animals that have adapted to these dynamic biophysical systems. However, without daily tidal flooding, the processes that sustain salt marshes are interrupted, leading to salt marsh degradation and a loss of functions and values.

Table 1: Ecosystem functions and values of salt marshes, adapted from Short et al. 2000.

Number	Functions	Values
1	Primary Production	Support of food webs, fisheries and wildlife
2	Canopy Structure	Habitat, refuge, nursery, and settlement; support of fisheries
3	Organic matter accumulation	Support of food webs, counter sea level rise
4	Seed production/vegetative expansion	Maintenance of plant communities and biodiversity

5	Sediment filtration and trapping	Counter sea level rise, improve water quality, and support of fisheries
6	Epibenthic and benthic production	Support of food web, fisheries and wildlife
7	Nutrient and containment filtration	Improve water quality and support of fisheries
8	Nutrient regeneration and recycling	Support of primary production and fisheries
9	Organic export	Support of estuarine, offshore food webs, and fisheries
10	Wave and current energy dampening	Protect upland from erosion and reduce flood-related damage
11	Self-sustaining ecosystem	Recreation, aesthetics, open space, education, landscape level biodiversity, and historical value.

Threats to Salt Marshes

Regional studies have shown that about 37% of tidal marsh area was lost in New England due to development (Bromberg Gedan et al. 2009). Much of the marsh that currently exists is affected by direct impacts like ditching and pollution and indirect impacts from a variety of stressors, including excess nitrogen (Deegan et al. 2013), invasive species (Hazelton et al. 2014) and climate change (Smith 2009).

Tidal crossing structures that limit tidal flows are called tidal restrictions, which are known to result in a range of negative impacts to the wetland systems that they cross. These impacts include:

- Alteration of the composition of salt marsh flora and fauna.
- Reduced inundation by spring tides that periodically flood the marsh surface. This directly interferes with marsh maintenance processes (sedimentation, marsh peat development), which have allowed New Hampshire's tidal marshes to maintain their position relative to sea level for thousands of years.
- Impounding freshwater upstream of the restriction, which creates opportunities for colonization by invasive plants such as *Phragmites australis,* and increases flooding of nearby low lying properties.
- Increased oxidation of organic matter; causing degradation of salt marsh peat and subsidence of the salt marsh plain.
- Reduced ability of the salt marsh to migrate upstream by limiting high tide inundation.

Of the 11 functions listed by Short et al. (2000) in Table 1, all are lost or reduced by tidal restrictions except for Number 10: Wave and current energy dampening. In New Hampshire, as in the rest of New England, about 20% of salt marshes are currently impacted by tidal restrictions (USDA, NRCS 1994, Bromberg and Bertness 2005). Removal of tidal restrictions has resulted in restored tidal systems by re-establishing more natural hydraulic and hydrologic conditions. Monitoring shows that the removal of tidal restrictions restores plant communities, processes that rebuild marsh surface elevation, and fish passage fairly quickly (Burdick and Roman 2012, Dibble and Meyerson 2012, Hazelton et al. 2014).

The cumulative impacts of tidal restrictions and SLR is especially concerning. It is unknown whether SLR alone will exceed the pace of salt marshes' ability to build in elevation at a commensurate rate (Kirwan et al. 2010, Raposa et al. 2015). Tidal restrictions put upstream salt marshes at a severe disadvantage in keeping up. Sea levels around the world are rising at a faster pace in the past 20 years than the previous century and global SLR has increased from 1.7 to 3.3 mm/year (Nichols and Cazenave 2010). As coastal managers work toward building resilience in anticipation of climate change impacts, it is critical to allow adequate flows through tidal crossings to upstream salt marshes so they can build in elevation and migrate inland.

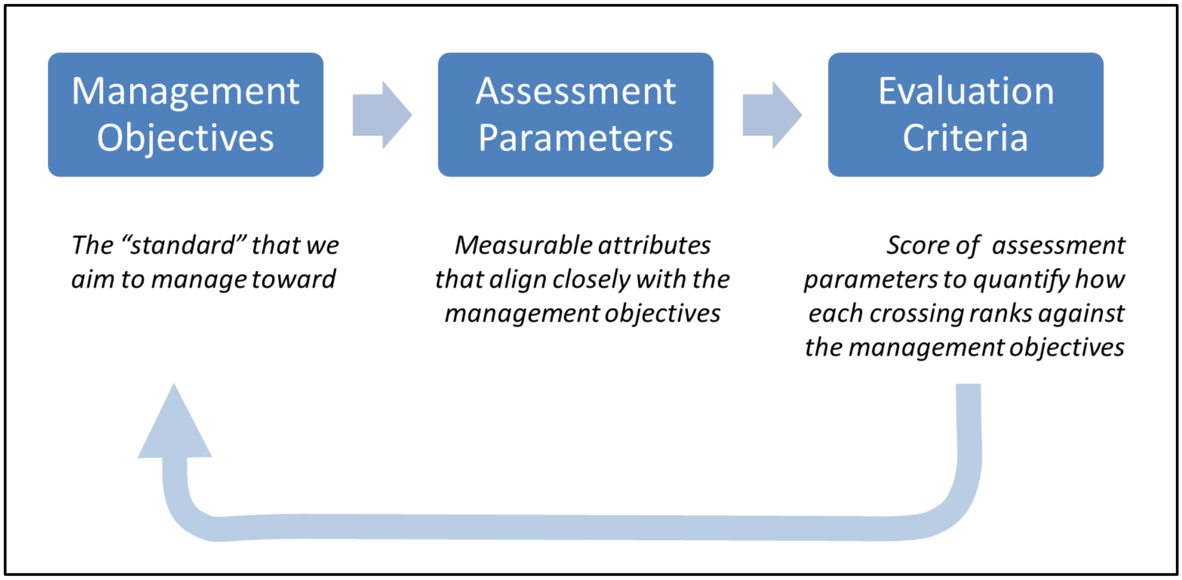
Over the previous 25 years, New Hampshire has demonstrated that the impacts of tidal restrictions are reversible. Between 1994 and 2015, salt marsh restoration was the primary design consideration for tidal crossing replacements in New Hampshire, resulting in the pro-active removal of fifteen tidal restrictions and replacement with larger structures. These restoration initiatives restored tidal flow to an estimated 635 acres of salt marsh

2.4 Tidal Protocol Background and Framework

New Hampshire's Tidal Crossing Assessment Protocol (Tidal Protocol) is a methodology to assess tidal crossings and prioritize their replacement based on a range of management objectives. Development of the Tidal Protocol began in early 2015 and was a collaborative effort led by TNC in close partnership with NHCP and UNH JEL. Broad input was solicited and received from transportation and coastal natural resource managers to inform the protocol. In addition to the formation of a Local Advisory Committee, a "Tidal Crossings Assessments Workshop" was convened in September of 2015 with nearly 50 regional, national and international professionals who provided invaluable feedback on an early draft of the protocol. After nearly two-and-a-half years of development, testing and refinement, the Tidal Protocol was completed in the summer of 2017.

The Framework (Figure 2) served as a primary guide in the Tidal Protocol's development, which includes management objectives, assessment parameters and evaluation criteria. These components of the framework are detailed in the following sections.

Figure 2: The framework that drove the development of New Hampshire's Tidal Crossing Assessment Protocol.



Management Objectives

The Tidal Protocol uses management objectives to determine how tidal crossings measure toward various performance standards. Seven management objectives are described in Table 2, which were chosen as essential drivers for the assessment and successful management of tidal crossings in New Hampshire.

Table 2: A list of the management objectives that the Tidal Protocol addresses, including an explanation of each objective's relevance.

Management Objective	Relevance of Management Objective
Crossing Condition	Understand the condition of tidal crossings to address safety and transportation infrastructure management
Tidal Restriction	Understand hydraulic compatibility of crossing structures with their tidal system
Tidal Aquatic Organism Passage	Understand the compatibility of crossing structures for fish and other aquatic organism passage
Salt Marsh Migration	Understand the upstream opportunity for salt marsh habitat to migrate inland with rising sea levels
Vegetation	Understand the influence of crossing structures on the up and downstream plant community, which can indicate effects on hydrology, salinity, and sedimentation
Infrastructure Risk	Understand the degree of risk at crossings, considering inundation risk and headwater buildup conditions
Adverse Impacts	Understand the likelihood of restoring full tidal range at a crossing given upstream low-lying infrastructure

Assessment Parameters

Assessment parameters are measurable, crossing-specific characteristics that are collected in the field and through a Geographic Information System (GIS) at each tidal crossing. Table 3 offers examples of different assessment parameters and whether they are assessed in the field or using GIS. For GIS-based assessments, a variety of data layers are used including innovative mapping products such as SLR mapping and the Sea Level Affecting Marshes Model (SLAMM).

Table 3: A summary of the Assessment Parameters.

Example Assessment Parameters	Field Assessment	GIS Assessment
Structure type and dimensions	✓	
Structure condition	✓	
Longitudinal profile	✓	✓
Roadway cross section	✓	✓
Channel characterization	✓	✓
Fish and wildlife observations	✓	
Vegetation characterization	✓	✓
Sea level rise inundation		✓
Salt marsh migration potential		✓

Evaluation Criteria

Twelve evaluation criteria are applied to select assessment parameters to score tidal crossings based on the seven management objectives. The evaluation criteria use a scoring system of 1 through 5, where a score of 1 indicates a low replacement priority or opportunity and a score of 5 indicates a high replacement priority or opportunity. In addition, three overall crossing scores are used to synthesize tidal crossing replacement priorities across many of the 12 evaluation criteria. Overall scores are tailored toward (1) infrastructure management, (2) ecological management, and (3) a combination of the two — one overall score that prioritizes based on a combination of infrastructure and ecological management considerations. Table 4 details the relationship between scores, generalized evaluation criteria, and replacement priorities from the Tidal Protocol.

Table 4: Evaluation Criteria Scoring System.

Score	Generalized Evaluation Criteria	Replacement Priority
1	**Ideal conditions:** → good structure condition → no tidal restriction → full aquatic organism passage → low salt marsh migration potential → vegetation unaffected by crossing → low flood risk	Lowest
2	Acceptable conditions	Low
3	Conditions flagged as concern	Moderate
4	Conditions flagged as high concern	High
5	**Conditions flagged as highest concern:** → poor structure condition → severe tidal restriction → reduced organism passage → high salt marsh migration potential → vegetation affected by crossing → high flood risk	Highest

3. METHODS

This section details Project methodologies for data management, field data collection, desktop analyses, quality assurance and quality control, and prioritization. The methods described in the Tidal Protocol (Steckler et al. 2017) were largely followed to conduct the field data collection, desktop analyses, and in applying the evaluation criteria. Corrections and clarifications of the tidal protocol were identified and documented during field training and follow-up quality assurance and quality control activities. Scoring criteria, as anticipated and expected in the Tidal Protocol, were adjusted to stratify scoring results in the prioritization process. An updated version of the Tidal Protocol will be released in the near future.

3.1 Data Management

A data management plan was developed to guide data collection and management, to assure data quality, and enable data quality control processes. Key components of the implemented data management plan are described in the following section; see the Quality Assurance/Quality Control (QA/QC) section for methods specifically associated with data QA/QC.

Database Development, Data Storage Structure, and Backups

A file geodatabase was created in ArcMap by UNH T^2 using parameters identified in the data dictionary (see Data Dictionary section below). The file geodatabase was loaded to an Esri Server where it was hosted as a feature service on ArcGIS Online and managed by UNH T^2. Data was shared to a private web mapping service for viewing and collection. The web mapping service interfaces with ArcMap (desktop application), Collector for ArcGIS (mobile application), and ArcGIS Online (online application).

The Esri Server stores all tidal crossing data collected. Editing access to the Esri Server was limited to stakeholders and users trained and certified in the use of the Tidal Protocol and the data collection system. UNH T2 created regular backups of the feature service during the collection period for data safety and security.

Data Dictionary

T^2 built a file geodatabase to the structure and specifications set in the project's data dictionary to store all tidal crossing data. A data dictionary details the assessment parameters to be collected at each tidal crossing based on the Tidal Protocol. The data dictionary details attribute names, data collection requirements, data type (e.g. date, integer, text), default values, and descriptions of each attribute. Appendix B includes tables from the data dictionary. Additional information about each data field is detailed in the Tidal Protocol (Steckler et al. 2017).

Table 5 details the nine discrete tables that were built into a relational database as defined by the data dictionary.

Table 5: A summary of the nine tables from the data dictionary.

Table Name	Description of Table Contents
Site Information	Basic site location attributes for each tidal crossing, such as stream name, road name, and crossing assessment status
Site Assessment	Field collected attributes relating to the crossing cross section, habitat and natural community classifications, etc.
Structure Condition	Field collected attributes pertaining to the crossing type and condition
Longitudinal Profile	Field collected attributes associated with the collection of the longitudinal profile
Desktop Assessment	GIS calculated and QAQC related attributes
Tide Gate	Field collected attributes relative to tide gate structures, if present
Replacement History	Attributes related to repair and/or replacement history
Scores	Includes the 15 score attributes based on the evaluation criteria
Tidal Crossing Photos	Photos and field collected attributes associated with crossing photos

3.2 Field Assessment Methods

Field data collection was performed by a trained field team based on the assessment guidelines laid out in the Tidal Protocol. Data collected in the field was entered electronically, using Collector for ArcGIS, Esri's mobile mapping application. An iPad protected by a water and shatterproof case was used by the field team to collect and store field data. These data were synced to ArcGIS Online via the web mapping service at the end of each field day. See Appendix C for the mobile data collection user guide that provides additional details about mobile data collection methods.

Field assessments were performed by a two-person field team. Field team availability limited the field assessment period to June through September 2018. Detailed scheduling was required to ensure that all identified tidal crossings would be assessed during low tide conditions over the field season. Tide charts for New Hampshire's semi-diurnal tide regime were reviewed and a field schedule was prepared. Given the geography of New Hampshire's coastal zone, with an outer coast and an inland estuary, the field team was generally able to conduct two crossing assessments a day because of the inland tidal delay of two or more hours.

Midday high tides periodically limited the field crew's ability to conduct two assessments in a day. On these occasions NHCP recruited volunteer assistance from partner organizations including: NH Department of Transportation, Great Bay National Estuarine Research Reserve, Piscataqua Region Estuaries Partnership, NHDES Wetlands Bureau, NHDES Watershed Assistance Section and the Maine Coastal Program. These professional volunteers enabled NHCP field staff to operate two crews on days with constrained low tide windows and maintain progress with two assessments per day. In addition to helping stay on track with the project schedule, partner involvement increased awareness and understanding about the Resilient Tidal Crossings Project and its utility to coastal resource managers.

Tidal crossings with limited or difficult access were often accessed by boat. At sites where boat access was necessary, three NHCP personnel utilized a combination of kayaks and/or canoe to transport equipment and personnel as well as for use in performing the survey. For example, kayaks were necessary for completion of longitudinal profiles with pool depths greater than 4 feet.

The primary instruments for relative elevation surveys included a laser or optical level, a 25-foot survey rod and a 300-foot measuring tape. A range finder was useful for determining the length of a culvert, the width of a bridge, or distances between longitudinal profile features. Refer to the Tidal Protocol for a full list of necessary equipment to collect field-based assessment parameters.

3.3 Desktop Assessment Methods

As with field data collection, desktop data collection was performed according to the Tidal Protocol. Desktop data was loaded directly to the project geodatabase hosted on ArcGIS Online. ArcMap 10.3 and ArcGIS Pro were used for desktop data analysis to determine or calculate assessment parameters. The sections below provide additional details about desktop assessment methods.

Watershed Delineation

Watershed delineations are required to calculate desktop assessment parameters. To maximize desktop analysis efficiency, tidal crossing watersheds were auto-delineated using a two-meter hydro corrected LiDAR-based digital elevation model (2011). Stream flow lines were burned into the digital elevation model (DEM) to guarantee appropriate drainage directions and sinks were removed, followed by flow direction and flow accumulation processes. The snap pour point tool was used to snap tidal crossing points to the nearest area of high flow accumulation. This output was used as the pour points to delineate the upstream watersheds for each tidal crossing. All pour points were verified to ensure correct placement with stream flow lines. Batch watersheds were delineated using a custom model builder tool using each tidal crossing's point location as the watershed pour point and flow direction raster as inputs. Each watershed was reviewed for accuracy and corrected as deemed appropriate.

Upstream evaluation units were delineated for all crossings. Evaluation units include the catchment or drainage area up to the next upstream tidal crossing. The watershed tool in ArcGIS 10.3 was used to auto-delineate upstream evaluation units based on the pour points used in the upstream watershed delineation process. Each evaluation unit was reviewed for accuracy and corrected as deemed appropriate.

Landscape Position

Assessments of each tidal crossing in relation to its position on the landscape were completed. Tallies of upstream and downstream tidal crossings were determined using recent high-resolution aerial imagery. Upstream and downstream tidal restrictions were tallied based on up and downstream crossings with a Tidal Restriction Overall Score of three or more. Crossings with upstream impoundments were identified using high resolution aerial imagery and NWIPlus

Wetlands data (2017). Upstream watershed land use percentages were calculated using 2011 National Land Cover Data and the delineated upstream watersheds for each tidal crossing. Watershed land use categories used included wetland, forest, impervious and developed.

Channel and Pool Widths

High resolution aerial photos were used in ArcMap 10.3 to measure upstream and downstream channel and scour pool widths. Different source imagery was used at different crossings depending on which imagery depicted low tide conditions. Channel widths were measured to be used for comparison with structure widths. Three individual channel widths were taken on the upstream and downstream sides of each tidal crossing, respectively, and then averaged independently. Scour pool widths were measured for comparison with channel widths. Pool widths were measured at the widest scour feature perpendicular to stream flow.

Salt Marsh Migration Potential

Salt marsh migration potential was calculated for each tidal crossing based on a 1.7-foot sea level rise scenario using the Sea Level Affecting Salt Marshes Model (SLAMM) tool (NHFG 2014), crossing watersheds, NWIPlus wetlands (2017), and high resolution impervious surfaces (2010). A custom model builder tool was developed in ArcMap 10.3 to batch process marsh migration potential calculations, which (1) clipped the SLAMM output to a crossing's watershed, (2) erased existing NWI salt marsh habitat, (3) erased impervious surfaces, and (4) calculated the remaining area as the salt marsh migration potential. These calculations were performed for both the entire upstream watershed and the upstream evaluation unit.

A limitation of the SLAMM data was encountered pertaining to some areas designated as inland open water, which are not addressed in the model. It appears that the NWI input for these areas include a dam modifier (or similar). These areas were originally left out of our salt marsh migration calculations, in some places resulting in donut holes of inland open water surrounded by projected salt marsh habitat. To resolve this issue, acres of inland open water surrounded by projected salt marsh habitat were added back into the salt marsh migration area. This was completed for both the upstream watershed and the evaluation unit calculations.

Inundation Risk to the Roadway

Inundation risk to the roadway was assessed through GIS using (1) the 1.7-foot SLR at mean higher high water (MHHW) and (2) the 1.7-foot SLR with 1% annual flood. Inundation risk was determined if the SLR layers inundates the roadway associated with each crossing. Comments on inundation risk were recorded.

Inundation Risk to Low-Lying Development (Non-Transportation)

Inundation risk to low-lying development was assessed through GIS using (1) the 1.7-foot SLR at mean higher high water (MHHW). Additional GIS data layers used included the latest high resolution aerial imagery, each crossing's upstream watershed, and parcel data for Strafford and Rockingham counties. Parcels upstream of each crossing with SLR impacts to low lying development were enumerated. Low-lying development included structures, driveways and lawns.

Crossing Cross Section and Stream Longitudinal Profile Completion

To complete the crossing cross section and stream longitudinal profile for each tidal crossing, additional measurements were collected using ArcMap 10.3. A LiDAR elevation was captured at the road centerline of the crossing and the road width was measured using the latest high-resolution aerial imagery. At crossings where the LiDAR was hydro-corrected, such as for larger bridge structures where the elevation at the crossing represents the water elevation and not the road surface, the road centerline elevation was extrapolated from the edges of the hydro-corrected areas.

3.4 Quality Assurance/Quality Control

Initial field trainings and follow-up trainings were conducted for overall project QA/QC. At the start of the field data collection effort, members of the project team accompanied the field team to three tidal crossings to complete field assessments and to test and correct mobile data collection procedures. Two weeks into the field data collection effort, team members accompanied field staff at three additional crossing assessments to assure consistent field data collection methodologies and to review and resolve questions arising from data collection efforts in the field. Four weeks later, team members accompanied field staff to review four crossings to address the most common QA/QC issues arising from the QA/QC process (described below). An additional crossing was assessed at that time to further assure consistent field data collection and to address other questions from the field staff. In addition to trainings and follow-up visits with field staff, clear lines of communication were maintained between team members and field staff at all times to address questions and challenges as they arose.

A QA/QC process was developed and implemented to ensure the consistent, thorough and accurate collection of field and desktop data. A Microsoft Excel-based file was used to process and summarize field and desktop data for each crossing using crossing data from the ArcGIS Online-hosted file geodatabase. QA/QC of field data provided the field team with crossing-specific feedback of any data issues or questions arising from field assessments. Steps in the QA/QC process included the following for each tidal crossing:

1. Download the latest Tidal Crossing file geodatabase from ArcGIS Online.
2. Initiate QA/QC process once the crossing's "Status" attribute was marked as "Complete."
3. Import field-based crossing data into the Microsoft Excel processing and summarization file.

4. Export site photos from ArcGIS Online and import into Microsoft Excel processing and summarization file.
5. Verify that all relevant assessment parameters were completed using aerial imagery and site photos.
6. Review "Crossing Cross Section and Stream Longitudinal Profile" graph generated in the processing and summarization file in conjunction with the crossing photos. Specifically, determine if elevations for features such as low tide water, marsh plain, HWI stain, HWI wrack and perches were accurately collected.
7. Send crossing-specific data requests or clarifications to the field team. Track QA/QC issues and communications with the field team in a QA/QC tracking spreadsheet.
8. Update the QA/QC tracking spreadsheet as data issues were resolved either through clarifications from the field team or follow-up field visits to collect additional data.
9. All data updates resulting from the QA/QC process were entered into the ArcGIS Online-hosted file geodatabase.

3.5 Prioritization

Evaluation criteria were applied to the assessment parameters to score and prioritize tidal crossings based on the set of management objectives listed in Table 2. The evaluation criteria support our understanding of how each tidal crossing performs against each management objective.

In some cases, evaluation criteria were adjusted from the Tidal Protocol to further stratify or spread scoring results. This was especially helpful for some evaluation criteria where the majority of crossings ended up scoring in a single category, which was not helpful for identifying priorities. The following sections detail the evaluation criteria and how they were applied; **Section 4. Results** presents the prioritization scores based on the evaluation criteria.

Crossing Condition Evaluation

Crossing condition was evaluated using the following nine assessment parameters:

- Structure Condition – Overall
- Headwall Condition (upstream and downstream)
- Wingwall Condition (upstream and downstream)
- Scour Severity at Structure (upstream and downstream)
- Scour Severity in Structure
- Tide Gate Device Condition

Table 6 details the crossing condition evaluation scores that were applied to their respective evaluation criteria.

Table 6: Crossing condition evaluation scores and criteria.

Evaluation Score	Evaluation Criteria
0	Crossing condition not evaluated
1	Condition mostly good (3 or more condition scores are good and no poor's or high scours, or more goods than fairs and no poor's or high scours)
2	Condition mostly fair (3 or more condition scores are fair and no poor's, or more fairs than goods and no poor's or high scours)
3	One poor condition score, or one high scour severity score, and not meeting criteria for "4" or "5"
4	Two poor condition scores or two high scour severity scores, or one of each, or overall structure condition is poor
5	Three or more poor condition scores or three high scour severity scores, or a total of three when combined (e.g. two poor's and one high), or overall structure condition is the only structure condition assessment and is poor (US and DS headwalls and wingwalls are not present)

Scores were applied in a Microsoft Excel worksheet. The algorithm used to determine each crossing's condition score is as follows:

CONDTION SCORE =IF(A="", 0, IF(OR(B>=3,AND(A="Poor", C="N/A", D="N/A", E="N/A", F="N/A")),5, IF(OR(B=2,A="Poor"),4, IF(OR(G=1,H=1),3, IF(AND(G=0, H=0, I<1), 2, IF(AND(G=0, H=0, I>0), 1, 999)))))), where

A is Overall Structure Condition
B is a sum of the tallied number of "poor" and "high" condition and scour values, respectively
C is the upstream headwall condition
D is the upstream wingwall condition
E is the downstream headwall condition
F is the downstream wingwall condition
G is a tally of the number of poor condition values
H is a tally of the number of high scour values
I is the difference between the tallied number of good and fair condition scores

Tidal Restriction Evaluation

Three tidal restriction evaluation components were scored independently. These components include tidal range ratio, crossing ratio and erosion classification. The component scores were combined into a tidal restriction overall score. The methodology for scoring component scores and the tidal restriction overall score is detailed below.

Tidal Range Ratio

Tidal range ratio compares the tidal range (elevation difference between high tide and low tide) at the upstream side of the crossing to the downstream side.

The tidal range ratio is determined from assessment parameters collected in the Site Assessment table. The Quality Control/Quality Assurance section above describes the process of importing crossing data into the Microsoft Excel processing and summarization file. Through this process, all elevation data collected are adjusted relative to the elevation of the established control point. Once adjusted, the evaluation criteria are applied as described in Table 7.

Table 7: Tidal range ratio evaluation scores and criteria.

Evaluation Score	Evaluation Criteria
1	No downstream invert perch at low tide; stream grade through the crossing matches that of the natural system (upstream tidal range is >90% of downstream tidal range), or crossings with limited tidal influence (downstream natural community is brackish or fresher) have no downstream perch and low tide water depth at crossing inverts are six inches or greater.
2	Tidal range upstream is between 80% and 90% of downstream range.
3	Tidal range upstream is between 70% and 80% of downstream range, or crossings with limited tidal influence (downstream natural community is brackish or fresher) have no downstream perch and low tide water depth at one or both crossing inverts is less than six inches.
4	Tidal range upstream is between 50% and 70% of downstream range.
5	Downstream invert is perched at high tide, or tidal range upstream is less than 50% of downstream range, or crossings with limited tidal influence (downstream natural community is brackish or fresher) have a downstream perch.

Tidal range ratio scores were applied in a Microsoft Excel worksheet. The algorithm used to determine each crossing's tidal range ratio is as follows:

<u>Microsoft Excel Based Algorithm:</u>
TIDAL RANGE RATIO SCORE=IF(AND(A=0, B=0), 0, IF(AND(C=1, D>0), 5, IF(AND(C=1, D=0, E>=0.5), 1, IF(AND(C=1, D=0, E<0.5), 3, IF(OR((F<50), (G>0)), 5, IF(AND(F>=90, D=0), 1, IF(F>=80, 2, IF(F>=70, 3, IF(F>=50, 4,))))))))), where

A is the US dimension B^{CB} (this indicates if the US side of the crossing was assessed or not)
B is the DS dimension B^{CB} (this indicates if the DS side of the crossing was assessed or not)
C indicates if the site has limited tidal influence (1=yes (DS natural community is brackish or fresher), 0=no)
D is the height of the DS low tide perch
E is the shallowest water depth at either the US or DS invert
F is the tidal range ratio ((US HWI stain elevation minus US low tide water elevation) divided by (DS HWI stain elevation minus DS low tide water elevation) multiplied by 100)
G is DS high tide perch elevation

Crossing Ratio

Crossing ratio compares the width of the upstream and downstream channels to the width of the upstream and downstream crossing structure, respectively. Crossing ratio is determined at each crossing using channel widths (see 3.3 Desktop Assessment Methods, Channel and Pool Widths) and the structure widths collected in the field. Crossing ratio scores are generated for both the upstream and downstream sides of the crossing by applying the evaluation criteria as described in Table 8.

Table 8: Upstream and downstream crossing ratio evaluation scores and criteria.

Evaluation Score		**Evaluation Criteria**
Upstream	*Downstream*	
	0	Crossing outlets to subtidal conditions (i.e. no measurable downstream channel)
1	**1**	Channel Width < Opening Width
2	**2**	Channel Width ≥ 1 and < 1.2 times opening width
3	**3**	Channel Width ≥ 1.2 and <2.5 times Opening Width
4	**4**	Channel Width ≥2.5 and <5 times Opening Width
5	**5**	Channel Width ≥5 times Opening Width, or for the upstream side only, crossing structure permanently impounds water and no channel feature is present.

Tidal range ratio scores were applied in a Microsoft Excel worksheet. The algorithm used to determine each crossing's crossing ratio score for the upstream side is as follows (crossing ratio was similarly calculated on the downstream side using the respective downstream crossing attributes):

<u>Microsoft Excel Based Algorithm:</u>
UPSTREAM CROSSING RATIO SCORE=IF(OR(A="Bridge with Side Slopes and Abutments", A="Bridge with Side Slopes"), IF(B/((C+D)/2)=0, 0, IF(B/((C+D)/2)<1, 1, IF(AND(B/((C+D)/2)>=1, B/((C+D)/2)<1.2), 2, IF(AND(B/((C+D)/2)>=1.2, B/((C+D)/2)<2.5), 3, IF(AND(B/((C+D)/2)>=2.5, B/((C+D)/2)<5), 4, IF(B/((C+D)/2)>=5, 5)))))), IF(B/C=0, 0, IF(B/C<1, 1, IF(AND(B/C>=1, B/C<1.2), 2, IF(AND(B/C>=1.2, B/C<2.5), 3, IF(AND(B/C>=2.5, B/C<5), 4, IF(B/C>=5, 5))))))), where

A is the crossing structure type
B is the upstream channel width
C is the upstream structure dimension A
D is the upstream structure dimension C

Erosion Classification

Erosion classification compares the width of the scour pool to the channel width (see 3.3 Desktop Assessment Methods, Channel and Pool Widths). Erosion classification scores are generated for both the upstream and downstream sides of the crossing by applying the evaluation criteria as described in Table 9.

Table 9: Upstream and downstream erosion classification evaluation scores and criteria.

Evaluation Score		**Evaluation Criteria**
Upstream	*Downstream*	

0	0	For upstream only: if the crossing serves as an impoundment resulting in no detectable scour pool For downstream only: if the crossing outlets directly to subtidal conditions resulting in no detectable scour pool
1	1	Unrestricted/ No Pooling (erosion classification <=1)
2	2	Flow Detained/ Slight Erosion (>1, <=1.2, pool width is up to 20% wider than channel)
3	3	Minor Pooling/ Erosion Present (>1.2, <=2, pool width is between 20% and 100% wider than channel)
4	4	Significant Pooling/Erosion Present (>2, <=3, pool width is two to three times wider than channel)
5	5	Major Pooling/ Major Erosion Present (>3, pool width is more than three times as wide as channel)

Erosion classification scores were applied in a Microsoft Excel worksheet. The algorithm used to determine each crossing's erosion classification score for the upstream side is as follows (erosion classification was similarly calculated on the downstream side using the respective downstream crossing attributes):

Microsoft Excel Based Algorithm:
UPSTREAM EROSION CLASSIFICATION SCORE =IF(A/B <=1, 1, (IF(AND(A/B>1, A/B<=1.2), 2, IF(AND(A/B>1.2, A/B<=2), 3, IF(AND(A/B>2, A/B<=3), 4, IF(A/B>3, 5)))))), where

A is the upstream scour pool width
B is the upstream channel width

Tidal Restriction Overall Score

The Tidal Restriction Overall score is an average of the scores resulting from tidal range ratio, crossing ratio, and erosion classification. The higher of the two scores (i.e. upstream or downstream) for crossing ratio and erosion classification were used. At crossings where both upstream and downstream erosion classification scores are 0, erosion classification was removed from the average altogether.

Tidal Aquatic Organism Passage

Scores for tidal aquatic organism passage were calculated using the methodology for Tidal Range Ratio, which is detailed under the Tidal Restriction Evaluation section above.

Salt Marsh Migration Evaluation

The salt marsh migration evaluation ranks crossings based on their upstream or inland salt marsh migration potential. Salt marsh migration potential was calculated two different ways: (1) considering the entire upstream watershed for each crossing and (2) considering just the upstream evaluation unit (or catchment) at crossings where additional upstream tidal crossings occur. Methods for calculating these attributes are detailed in section 3.3 Desktop Assessment Methods under Salt Marsh Migration Potential. Both salt marsh migration potential evaluations use the same evaluation scores and criteria, which is provided in Table 10.

Table 10: Salt marsh migration evaluation scores and criteria for both the entire upstream watershed and the upstream evaluation unit.

Evaluation Score	Evaluation Criteria
1	0-1 acre potential salt marsh increase
2	1-2 acre potential salt marsh increase
3	2-5 acre potential salt marsh increase
4	5-10 acre potential salt marsh increase
5	>10 acre potential salt marsh increase

Salt marsh migration evaluation scores were applied in a Microsoft Excel worksheet for both the entire upstream watershed and the upstream evaluation unit. Areas of salt marsh increase at each site were sorted by size and scores were applied to their respective size class based on Table 10.

Vegetation Comparison Evaluation

Vegetation comparison evaluations, which compared upstream and downstream plant communities at each crossing, were performed in the field. The vegetation comparison matrix shown in Table 11 was used to translate the vegetation comparison matrix code (e.g. 1A, 1B, 1C, etc.) collected in the field into a vegetation evaluation score. Scores were applied directly in the file geodatabase structure through a one-to-one relational scoring approach.

Table 11: Vegetation comparison matrix used to determine a vegetation comparison evaluation score.

Vegetation Comparison Matrix*	The plant community appears to be the same on both sides of the crossing; both sides are occupied by tidal marsh of similar species and structure	The up and downstream plant communities appear different (i.e. two different expressions of tidal marsh are on either side of the crossing)	The up and downstream plant communities are different. One side is tidal marsh, while the other side is unvegetated, open water, un-naturally modified (i.e. armored, channeled), or is occupied by a completely different structure or suite of plants
Native plant species only	**1A (Score: 1)**	**1B (Score: 3)**	**1C (Score: 5)**
Invasive plants prevalent over a wide area of the marsh plain on both sides of the crossing**	**2A (Score: 0)**	**2B (Score: 0)**	**2C (Score: 0)**
Invasive plants present within the marsh plain near one side of the crossing, and absent (or present in a constricted area close to the crossing) on the other side	**3A (Score: 3)**	**3B (Score: 4)**	**3C (Score: 5)**

* Crossings that outlet directly to the Atlantic Ocean receive a score of 1
**If invasive species are prevalent in the plant community on both sides of the crossing, there is likely another issue beyond the crossing that is affecting the vegetation. A vegetation comparison is unlikely to help understand inundation and salinity conditions at a site with these conditions.

Infrastructure Risk Evaluation

The infrastructure risk evaluation includes two evaluations: inundation risk to the roadway and inundation risk to the crossing structure. Methods for evaluating and scoring both are detailed in the following sections.

Inundation Risk to the Roadway

Inundation risk to the roadway considers and scores the upstream and downstream vertical distance between the highest water indicator (wrack) and the road surface. Upstream and downstream inundation risk to the roadway is determined from assessment parameters collected in the Site Assessment table. The Quality Control/Quality Assurance section above describes the process of importing crossing data into the Microsoft Excel processing and summarization file. Through this process, all elevation data collected are adjusted relative to the elevation of the established control point. Once adjusted, the evaluation criteria are applied as described in Table 12.

Table 12: Upstream and downstream inundation risk to the roadway scores and criteria.

Evaluation Score		Evaluation Criteria
Upstream	*Downstream*	
1	**1**	High water indicator is greater than 6' from road surface
2	**2**	High water indicator is between 3 and 6' from road surface
3	**3**	High water indicator is between 1.5 and 3' from road surface
4	**4**	High water indicator is less than 1.5' from road surface
5	**5**	High water indicator suggests road is occasionally inundated

Inundation risk to the roadway scores were applied in a Microsoft Excel worksheet. The algorithm used to determine each crossing's score is as follows:

Microsoft Excel Based Algorithm:
INUNDATION RISK TO ROADWAY SCORE =IF(A<=0, 5, IF(A<1.5, 4, IF(AND(A<3, A>=1.5), 3, IF(AND(A<=6, A>=3), 2, IF(A>6, 1))))), where

A is the lesser of the upstream or downstream distances between the low road surface elevation and the high water wrack indicator, respectively.

Inundation Risk to the Crossing Structure

Inundation risk to the crossing structure considers and scores the upstream and downstream vertical distance between the high water indicator (stain) and ceiling of the structure. Upstream and downstream inundation risk to the structure is determined from assessment parameters collected in the Site Assessment table. The Quality Control/Quality Assurance section above describes the process of importing crossing data into the Microsoft Excel processing and summarization file. Through this process, all elevation data collected are adjusted relative to the elevation of the established control point. Once adjusted, the evaluation criteria are applied as described in Table 13.

Table 13: Upstream and downstream inundation risk to the crossing structure scores and criteria.

Evaluation Score		Evaluation Criteria
Upstream	*Downstream*	
1	**1**	High water indicator is greater than 3' from ceiling of structure
2	**2**	High water indicator is between 2 and 3' from ceiling of structure
3	**3**	High water indicator is between 1 and 2' from ceiling of structure
4	**4**	High water indicator is less than 1' from ceiling of structure
5	**5**	High water indicator is above ceiling of structure

Inundation risk to the crossing structure scores were applied in a Microsoft Excel worksheet. The algorithm used to determine each crossing's score for the upstream side is as follows (scores were similarly calculated on the downstream side using the respective downstream crossing attributes):

<u>Microsoft Excel Based Algorithm:</u>

UPSTREAM INUNDATION RISK TO STRUCTURE SCORE =IF(A>3, 1, IF(A<=0, 5, IF(AND(A <=3, A >2), 2, IF(AND(A <=2, A >1), 3, IF(AND(A <=1, A >0), 4))))), where

A is the distance between the US ceiling of structure and US high water stain indicator

Adverse Impacts Evaluation

The adverse impacts evaluation considered the inundation risk to low-lying development (non-transportation) attribute detailed in the 3.3 Desktop Assessment Methods section. Inundation risk to low lying development (non-transportation) scores were applied in a Microsoft Excel worksheet. The number of potential upstream impacts at each site were sorted and scores were applied to their respective criteria class based on Table 14.

Table 14: Inundation risk to low-lying development evaluation scores and criteria.

Evaluation Score	Evaluation Criteria
1	> 5 impacts identified
2	3-5 impacts identified
3	2 impacts identified
4	1 impact identified
5	No impacts identified

Overall Crossing Evaluations

In addition to the seven evaluations detailed above, three overall crossing evaluation scores were developed targeting a rolled-up prioritization for infrastructure management, ecological management, and a combination of the two — one overall score that prioritizes based on a combination of infrastructure and ecological management considerations. The prioritization methods for overall crossing evaluation scores are detailed below.

Overall Infrastructure Score

The overall infrastructure score considers the crossing condition score and the inundation risk to the roadway score, as detailed in Table 15.

Table 15: Overall infrastructure evaluation scores and criteria. The overall infrastructure score uses a combination of the crossing condition and the inundation risk to the roadway scores.

Evaluation Score	Evaluation Criteria
1	**Good Crossing Condition, Low Inundation Risk** Crossing Condition = 1, AND Inundation Risk to the Roadway ≤ 2
2	**Fair Crossing Condition, Low/Moderate Inundation Risk** Crossing Condition = 2, AND Inundation Risk to the Roadway ≤ 3
3	**Poor Crossing Condition OR Moderate Inundation Risk** Crossing Condition = 3, OR Inundation Risk to the Roadway = 3
4	**Very Poor Crossing Condition OR High Inundation Risk** Crossing Condition ≥ 4, OR Inundation Risk to the Roadway ≥ 4
5	**Failing Crossing Condition OR Very High Inundation Risk** Crossing Condition = 5, OR Inundation Risk to the Roadway = 5

Overall infrastructure scores were applied in a Microsoft Excel worksheet. The algorithm used to determine each crossing's score is as follows:

Microsoft Excel Based Algorithm:
OVERALL INFRASTRUCTURE SCORE = IF(AND(A=1, B<=2), 1, IF(AND(A=2, B<=3), 2, IF(OR(A=5, B=5), 5, IF(OR(A>=4, B>=4), 4, IF(OR(A=3, B=3), 3))))), where

A is the crossing condition score
B is the inundation risk to the roadway score

Overall Ecological Score:

The overall ecological score considers the scores for tidal restriction overall, tidal aquatic organism passage, salt marsh migration (using the entire upstream watershed score), and vegetation comparison evaluation, as detailed in Table 16.

Table 16: Overall ecological evaluation scores and criteria. The overall ecological score uses a combination of scores from tidal restriction overall, tidal aquatic organism passage, salt marsh migration potential, and vegetation comparison evaluation.

Evaluation Score	Evaluation Criteria
1	**Limited Tidal Restriction** Tidal Restriction < 3, AND Vegetation = 1 Aquatic Organism Passage (not included because of limited tidal restriction) Salt Marsh Migration (not included because of limited tidal restriction)

3	**Moderate Tidal Restriction, TAOP Reduced, OR Moderate Salt Marsh Migration Potential** Tidal Restriction is < 4 AND ≥ 3), OR Aquatic Organism Passage = 3, OR Salt Marsh Migration = 3, OR Vegetation = 3
4	**Severe Tidal Restriction, TAOP Very Reduced, High Salt Marsh Migration Potential if Tidally Restricted, OR Vegetation Different or Invasive Dominant** Tidal Restriction ≥ 4, OR Aquatic Organism Passage ≥ 4, OR Salt Marsh Migration ≥ 4 AND Tidal Restriction ≥ 4, OR Vegetation ≥ 4, OR Vegetation = 0
5	**Very Severe Tidal Restriction, TAOP Barrier, Very High Salt Marsh Migration Potential if Tidally Restricted, OR Vegetation Very Different if Tidally Restricted** Tidal Restriction = 5, OR Aquatic Organism Passage = 5, OR Salt Marsh Migration = 5 AND Tidal Restriction ≥ 4, OR Vegetation = 5 AND Tidal Restriction ≥ 4

Overall ecological scores were applied in a Microsoft Excel worksheet. The algorithm used to determine each crossing's score is as follows:

Microsoft Excel Based Algorithm:
OVERALL ECOLOGICAL SCORE =IF(OR(A=5, B=5), 5, IF(AND(C=5, A>=4), 5, IF(AND(D=5, A>=4), 5, IF(OR(AND(C>=4, A>=4), A>4, B>=4, D>=4, D=0), 4, IF(OR(AND(A<4, A>=3), B=3, C=3, D=3), 3,IF(AND(A<3, D=1), 1)))))), where

A is the tidal restriction overall score
B is the tidal aquatic organism passage score
C is salt marsh migration score for the entire upstream watershed
D is the vegetation evaluation score

Overall Combined Crossing Score

The overall combined crossing score considers the scores for salt marsh migration (using the entire upstream watershed score), tidal restriction overall, vegetation comparison evaluation, crossing condition, inundation risk to the roadway, and tidal aquatic organism passage, as detailed in Table 17.

Table 17: Overall combined crossing evaluation scores and criteria. The overall combined crossing score uses a combination of scores from crossing condition, inundation risk to the roadway, tidal restriction overall, tidal aquatic organism passage, salt marsh migration potential and vegetation comparison evaluation.

Evaluation Score	Evaluation Criteria
1	**Good Crossing Condition AND Limited Tidal Restriction, AND Vegetation similar AND Inundation Risk to Road is low**

	Crossing Condition ≤ 2, AND Tidal Restriction ≤ 2, AND Vegetation = 1, AND Inundation Risk to the Roadway ≤ 2 Aquatic Organism Passage (not included because of limited tidal restriction) Salt Marsh Migration (not included because of limited tidal restriction)
2	**Fair Crossing Condition, Limited Tidal Restriction OR Low/Moderate Infrastructure Risk** Crossing Condition ≤ 2, OR Tidal Restriction < 3, OR Vegetation = 1, OR Inundation Risk to the Roadway ≤ 3 Aquatic Organism Passage (not included because of limited tidal restriction) Salt Marsh Migration (not included because of limited tidal restriction)
3	**Poor Crossing Condition, Tidal Aquatic Organism Passage reduced, OR moderate Salt Marsh Migration Potential AND moderate Tidal Restriction, OR Vegetation different AND moderate Tidal Restriction, OR moderate Infrastructure Risk** Crossing Condition ≥ 3, OR Tidal Aquatic Organism Passage ≥ 3, OR Salt Marsh Migration (upstream watershed) ≥ 3 AND Tidal Restriction > 3, OR Vegetation ≥ 3 AND Tidal Restriction > 3, OR Inundation Risk to the Roadway ≥ 3
4	**Failing Crossing Condition, OR very poor Crossing Condition AND high Inundation Risk to Road, OR Tidal Aquatic Organism Passage reduced AND severe Tidal Restriction AND Vegetation different, OR high Salt Marsh Migration Potential AND severe Tidal Restriction** Crossing Condition = 5, OR Crossing Condition ≥ 4 AND Inundation Risk to the Roadway ≥ 4, OR Aquatic Organism Passage ≥ 4 AND Tidal Restriction ≥ 4 AND Vegetation ≥ 4, OR Salt Marsh Migration (upstream watershed) ≥ 4 AND Tidal Restriction ≥ 4
5	**Failing Crossing Condition AND very high Inundation Risk to Road, OR Tidal Aquatic Organism barrier AND very severe Tidal Restriction, OR very high Salt Marsh Migration Potential AND severe Tidal Restriction, OR Vegetation very different AND severe Tidal Restriction** Crossing Condition = 5 AND Inundation Risk to the Roadway = 5, OR Aquatic Organism Passage = 5 AND Tidal Restriction = 5, OR Salt Marsh Migration = 5 AND Tidal Restriction ≥ 4, OR Vegetation = 5 AND Tidal Restriction ≥ 4

Overall combined crossing scores were applied in a Microsoft Excel worksheet. The algorithm used to determine each crossing's score is as follows:

Microsoft Excel Based Algorithm:

OVERALL COMBINED CROSSING SCORE =IF(OR(AND(A=5, B>=4), AND(C=5, B>=4), AND(D=5, E=5), AND(B=5, F=5)), 5, IF(OR(AND(A>=4, B>=4), AND(B>=4, F>=4, C>=4), AND(D>=4, E>=4), D=5), 4, IF(OR(AND(A>=3, B>3), AND(C>=3, B>3),D>=3, F>=3, E>=3), 3, IF(OR(D<=2, B<3, C=1, E<=3), 2, IF(AND(D<=2, B<=2, C=1, E<=2), 1))))), where

A is the salt marsh migration score for the entire upstream watershed
B is the tidal restriction overall score

C is the vegetation evaluation score
D is the crossing condition score
E is the inundation risk to the roadway score
F is the tidal aquatic organism passage score

4. RESULTS

Data were collected, analyzed and prioritized at 118 tidal crossings to identify replacement and/or restoration priorities based on individual and collective management objectives. Fifteen scores were generated for each assessed crossing. Table 18 details the distribution of crossing scores across each score category.

Table 18: Distribution of crossing scores across each score category.

Score Category*	Number of Crossings by Score					
	0	**1**	**2**	**3**	**4**	**5**
Crossing Condition	12	35	29	6	15	33
Tidal Restriction Overall	12	4	18	52	37	7
Tidal Range Ratio	*12*	*53*	*12*	*25*	*6*	*22*
Crossing Ratio	*12*	*12*	*8*	*29*	*32*	*37*
Erosion Classification	*18*	*7*	*5*	*34*	*40*	*26*
Tidal Aquatic Organism Passage	12	53	12	25	6	22
Salt Marsh Migration Potential: US Watershed	12	34	10	12	14	48
Salt Marsh Migration Potential: Evaluation Unit	12	41	9	13	18	37
Vegetation Comparison	33	48	0	22	11	16
Inundation Risk to Roadway	13	30	26	26	24	11
Inundation Risk to Crossing Structure	12	25	11	21	22	39
Inundation Risk to Low-Lying Development**	13	21	8	5	10	73
Overall Infrastructure Score	12	17	18	15	27	41
Overall Ecological Score	12	18	0	37	37	26
Overall Combined Score	12	0	17	46	32	23

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority

** Inundation Risk to Low-Lying Development scores range from 1 to 5, where 1 = high risk and 5 = low risk

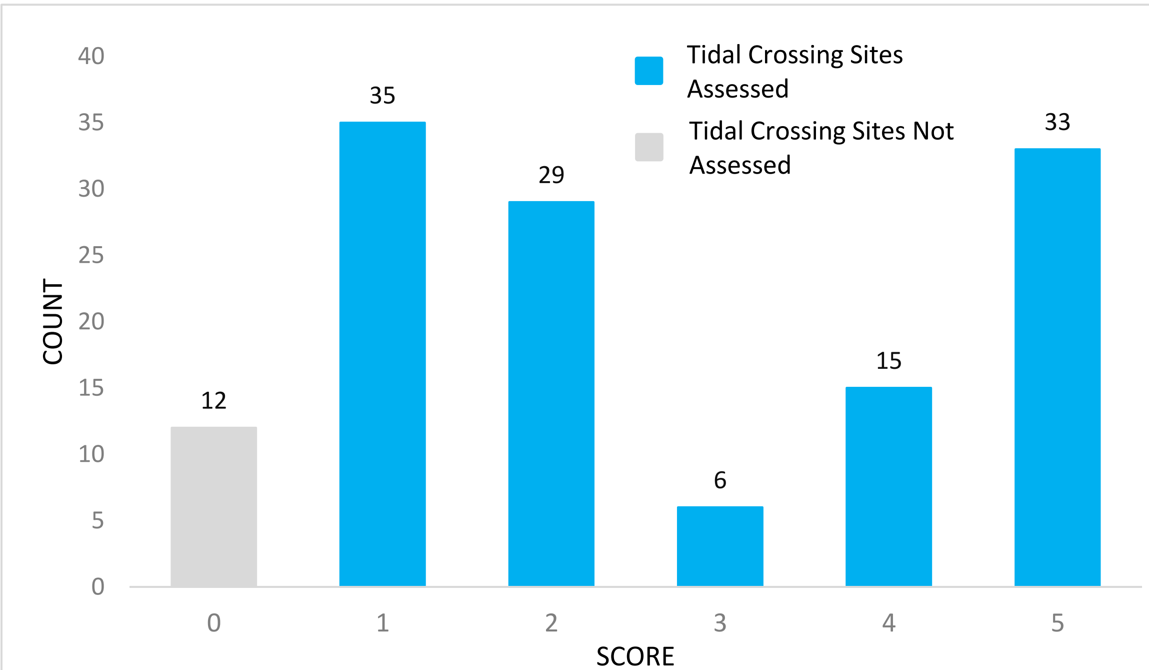
The scoring system from the Tidal Protocol was designed to meet the decision making and management needs of a broad group of coastal stakeholders. Road managers are likely drawn to condition and inundation scores; natural resource managers to tidal restriction, fish passage, marsh migration and vegetation comparison, while municipal decision makers might be particularly interested in inundation risk to low-lying development. No matter the category of interest, stakeholders can access results in various forms and levels of resolution; see section **1.1 How to Access Data** for details. Each of the scoring categories from Table 18, including a closer look at score distributions, are detailed in the following sections.

4.1 Crossing Condition Score

New Hampshire coastal communities depend on a functional, reliable, and safe transportation network. Tidal crossings are a critical component of that network, which allow for the continuous flow of people, goods and services across the coastal zone. Reliable tidal crossings are especially important when we need them most, which also corresponds to when they may be most susceptible to failure during major storm events.

Figure 3 illustrates the distribution of crossing condition scores, where a score of one indicates a "good" crossing structure condition and a score of five indicates a structure with an exceedingly poor condition, such as having an immediate maintenance and/or replacement need.

Figure 3: Distribution of crossing condition scores.



The distribution of crossing condition scores shows that just over 50% of crossings are in good or fair condition (scores one and two, respectively). Scores three, four and five indicate increasing levels of poor condition. Twelve crossings were not assessed and are represented by a score of zero. From an infrastructure management standpoint, the 33 crossings with a score of five present an immediate need to be addressed.

4.2 Tidal Restriction Evaluation

Tidal habitats are special systems with complex hydraulic and hydrologic processes. Tidal crossings often affect these processes by restricting the tidal range upstream of the crossing. Three scores are used to characterize the degree that each crossing is a tidal restriction, from a score of one (limited restriction) to five (severe restriction). Each of these scores, tidal range ratio, crossing ratio and erosion classification, consider different measurable indicators or expressions of a tidal restriction. For example, the tidal range ratio score considers the crossing structure's ability to pass the full vertical extent of the tide to the tidal system beyond the structure; whereas, the crossing ratio considers the cross-sectional width compatibility of the crossing structure to the tidal system; and the erosion classification determines how eroded the channel is at both the upstream and downstream outlet due to the accelerated water velocity through an undersized structure. Once independently scored, the three component scores are combined into the tidal restriction overall score. Each of these scores are detailed in their respective sections below.

For simplicity of data display and usability, the NH Coastal Viewer only offers the tidal restriction overall score for viewing. Users can access crossing-specific component scores for the tidal restriction evaluation on the Tidal Crossing Summary Sheets (Appendix D), and in the Crossing Scores Table (Appendix E), and are available for download from ArcGIS Online. The tidal aquatic organism passage score (detailed later) is based on the tidal range ratio scoring criteria. NH Coastal Viewer users can view tidal range ratio scores using the tidal aquatic organism passage data layer.

Tidal Range Ratio Score

Tidal range ratio compares the tidal range (elevation difference between high tide and low tide) at the upstream side of the crossing to the downstream side. A crossing where the tidal range is similar on both sides indicates no tidal restriction from a tidal range standpoint (i.e. tidal range ratio score is low). Increasing differences in tidal range between the upstream and downstream sides of the crossing indicate increasing severity of a tidal restriction, and therefore a higher tidal range ratio score. Figure 4 illustrates the distribution of tidal range ratio scores.

Figure 4: Distribution of tidal range ratio scores.

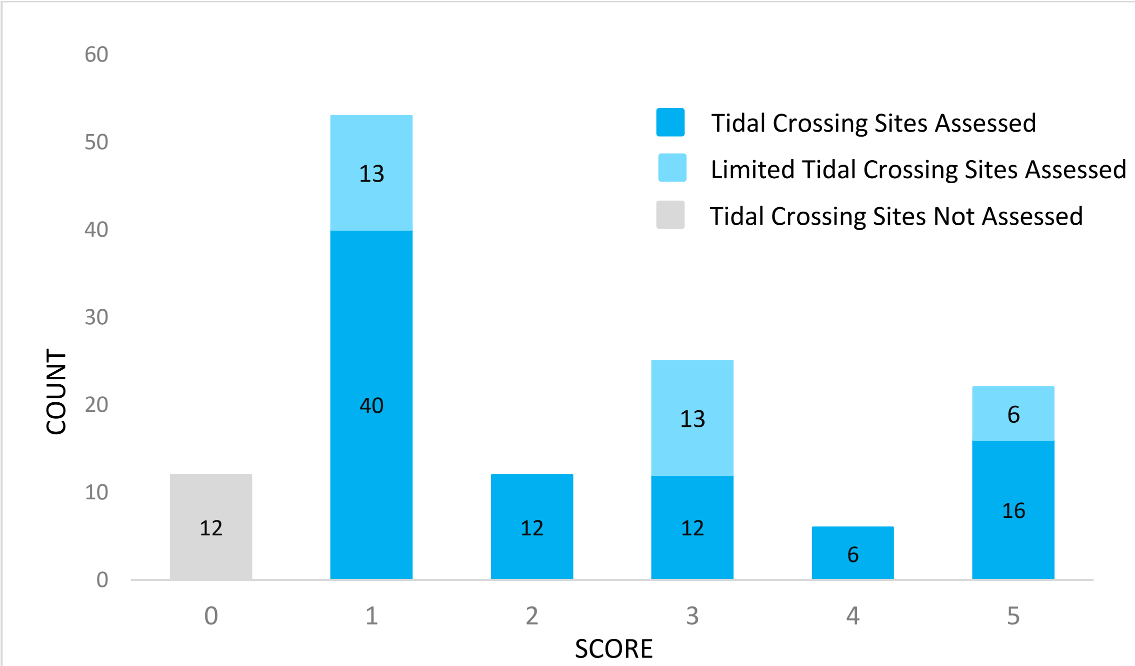


Figure 4 differentiates the results for crossings that are subject to “full tidal” (darker blue) and “limited tidal” (lighter blue) influence, as well as crossings not assessed (score of zero). This differentiation between full and limited tidal sites was necessary to adequately characterize the variability of tidal range found at tidal crossing sites. For instance, a 6-inch tidal range restriction is more significant at a site with a 1-foot tidal range than for a site with a 10-foot tidal range. Therefore, limited tidal sites were scored differently, as described in Section 3.5 Prioritization.

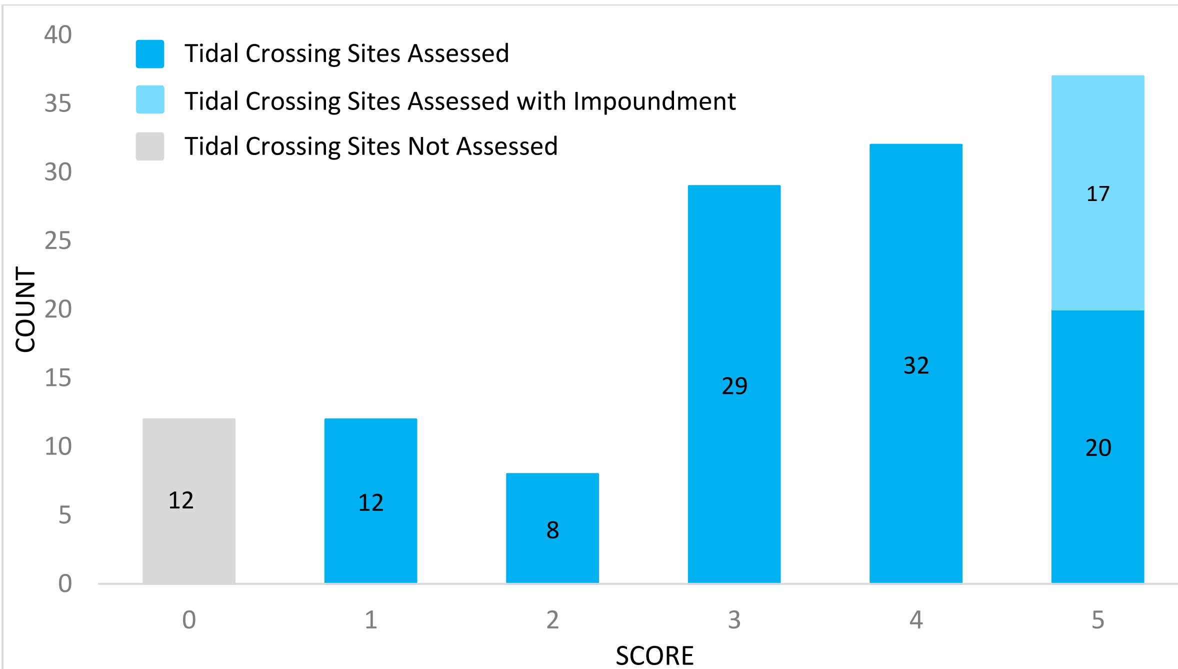
Out of the full tidal crossing sites, just over 60% of crossings assessed are not significant tidal restrictions (scores one and two). The remaining 34 full tidal crossings indicate restricted tidal ranges that prevent tidal flooding and interfere with aquatic organism passage. Tidal flooding is necessary to build marsh elevation and enable inland migration.

Out of the 32 limited tidal crossings, 13 sites are unrestricted (score of one) with water depths of six inches or more through the crossing structure at low tide. Six inches of water depth is a fish passage design criteria used based on spawning habitat for alewife (Pardue 1983). An additional 13 sites have less than six inches of water depth at low tide and no downstream perch, which receive a score of three. Six limited tidal crossings received a score of five, meaning they are perched on the downstream side under low tide conditions. Given the limited tidal ranges at these sites, a low tide perch is generally much more restrictive than a low tide perch at crossings with greater tidal range.

Crossing Ratio Score

Crossing ratio is an evaluation developed by Purinton and Mountain (1996) that compares the width of the upstream and downstream channels to the width of the crossing structure. A crossing structure that spans the stream channel should be adequately sized in terms of the width dimension. Narrowing structure widths, when compared to the stream channel, are indicative of increasingly severe tidal restrictions and will receive higher scores. A relatively narrow structure will act like a funnel and result in greater water velocities through the structure with headwater buildup from the direction of flow (depending on tide direction). This can result in a reduced upstream tidal range and the desynchronization of tidal flows from the normal tide cycle. Figure 5 illustrates the distribution of crossing ratio scores.

Figure 5: Distribution of crossing ratio scores.

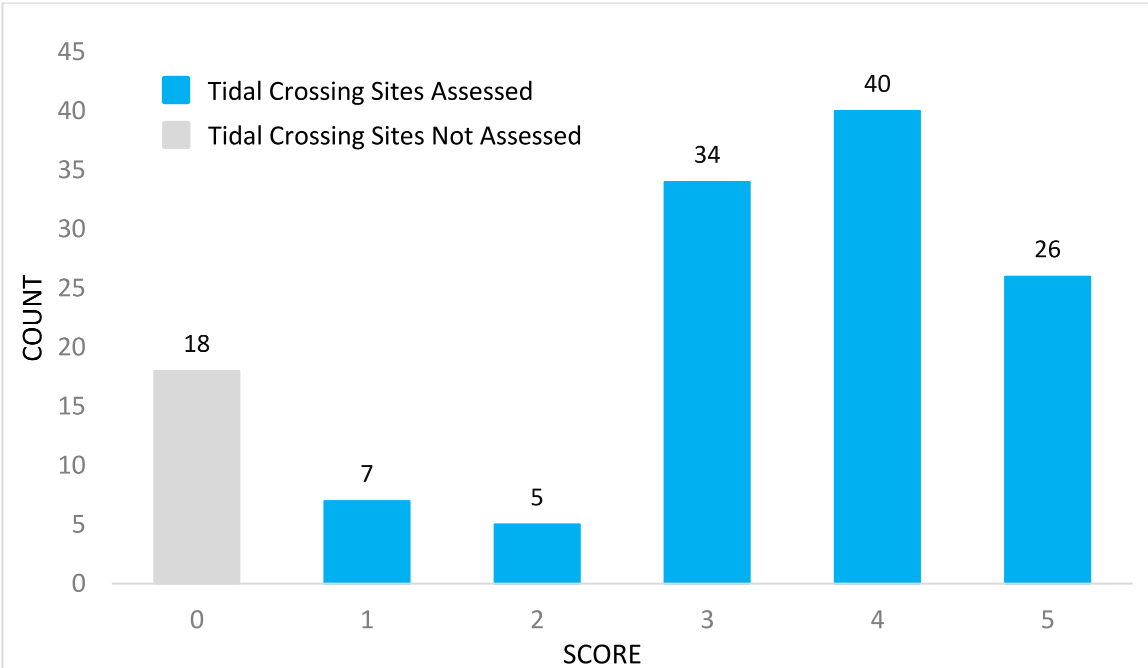


The distribution of crossing ratio scores shows that the majority of crossings (98) are undersized (scores three, four, or five) when compared to the cross-sectional width of their stream channel. Seventeen crossings restrict flows to such an extent that they create an upstream impoundment; some of these impoundments are by design whereas others are the result of an undersized structure.

Erosion Classification Score

Erosion classification is another evaluation developed by Purinton and Mountain (1996). It scores the degree that the tidal crossing causes erosion immediately upstream and/or downstream of the crossing. Erosion or scour pools are indicators that the crossing structure is undersized or incompatible with the stream system; the width of the scour pool relative to the channel width is used to characterize the degree of incompatibility. Low scores indicate the presence of limited scour, whereas high scores are the result of sites with high scour. Figure 6 illustrates the distribution of erosion classification scores.

Figure 6: Distribution of erosion classification scores.

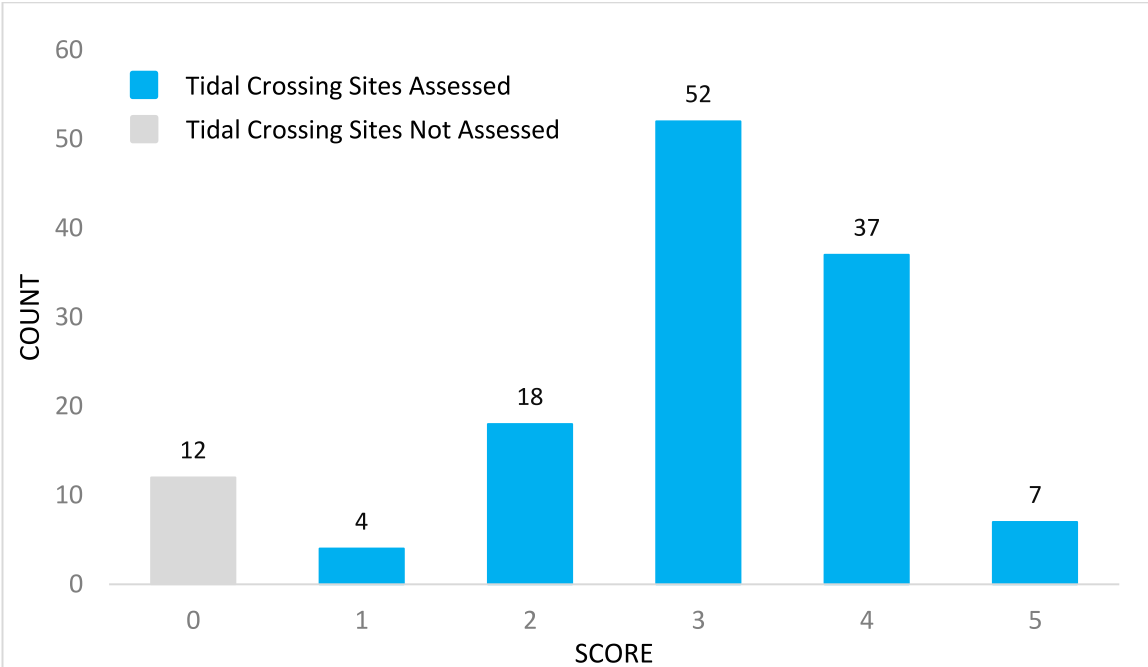


The distribution of erosion classification scores shows that the majority of crossing structures (100) are incompatible with their tidal system from an erosion standpoint (scores three, four, or five).

Tidal Restriction Overall Score

The tidal restriction overall score rolls up the three tidal restriction component scores detailed above into a single score, combining both indicators and expressions of tidal restrictions. Figure 7 illustrates the distribution of tidal restriction overall scores.

Figure 7: Distribution of tidal restriction overall scores.



The distribution of tidal restriction overall scores indicates that the majority of crossings (89) are moderately or highly restrictive to tidal flows (scores three or four, respectively). Seven sites are severe tidal restrictions (score five); many of these crossings are perched at high tide or are impounded.

4.3 Tidal Aquatic Organism Passage Score

Tidal crossings can serve as either gateways or barriers to upstream habitats for fish and other aquatic organisms. Anadromous species' complex life cycles and habitat needs rely on passage through tidal systems to access spawning and nursery habitat, as do resident estuarine fish. Fish passage, or lack thereof, at tidal crossings have much broader ecosystem implications than at a specific crossing site. Successful passage supports higher trophic levels across the land and ocean-scape, from headwaters, through estuaries, and out to the Atlantic Ocean.

Tidal aquatic organism passage is affected by multiple factors at a tidal crossing, including invert perches, flow velocities, water depth and desynchronized tidal flows—meaning that high and low tide water elevations will be delayed or out of sync. The tidal range ratio evaluation criteria consider these factors, and is therefore used to score tidal aquatic organism passage. Figure 8 illustrates the distribution of tidal aquatic organism passage scores.

Figure 8: Distribution of tidal aquatic organism passage scores.

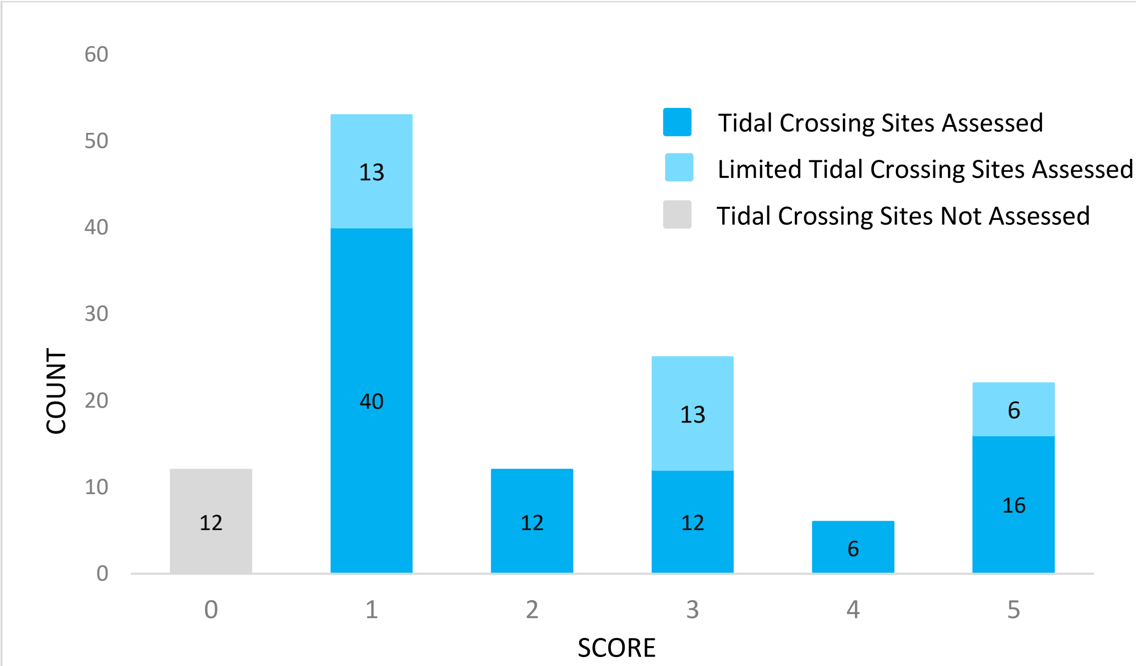


Figure 8 differentiates the results for crossings that are subject to “full tidal” (darker blue) and “limited tidal” (lighter blue) influence, as well as crossings not assessed (score of zero). Tidal aquatic organism passage scores are based on the tidal range ratio evaluation, so small differences in upstream versus downstream tidal range can score quite high using the tidal range ratio evaluation criteria in limited tidal situations. Therefore, limited tidal sites were scored differently, as described in Section 3.5 Prioritization.

Out of the full tidal crossing sites, just over 60% of crossings assessed are not significant barriers to tidal aquatic organism passage. The remaining 34 full tidal crossings indicate moderate or greater barriers. Nearly half of those are severe barriers to tidal aquatic organism passage.

Out of the 32 limited tidal crossings, 13 sites are passable (score of one) with water depths of six inches or more through the crossing structure at low tide. Six inches of water depth is a fish passage design criteria used based on spawning habitat for alewife (Pardue 1983). An additional 13 sites have less than six inches of water depth at low tide and no downstream perch. These crossings receive a score of three for not meeting the alewife design criteria. Six limited tidal crossings received a score of five, meaning they are perched on the downstream side under low tide conditions and may be impassable most of the time at these limited tidal sites.

4.4 Salt Marsh Migration Potential Score

Rising sea levels are a major threat to existing salt marshes, which are home to critically important and imperiled habitats and species that are adapted to life in these dynamic places. A significant concern is that sea level rise will outpace the rate that existing salt marshes can build in elevation.

Migration of salt marshes inland is necessary for ecologically significant assemblages of salt marsh habitats to persist under projected sea level rise scenarios. Tidally restrictive crossings reduce the ability of a salt marsh system to meet its upstream migration potential by limiting high tide inundation of salt water. This process is necessary for the conversion of upstream low-lying areas to salt-tolerant marsh habitat.

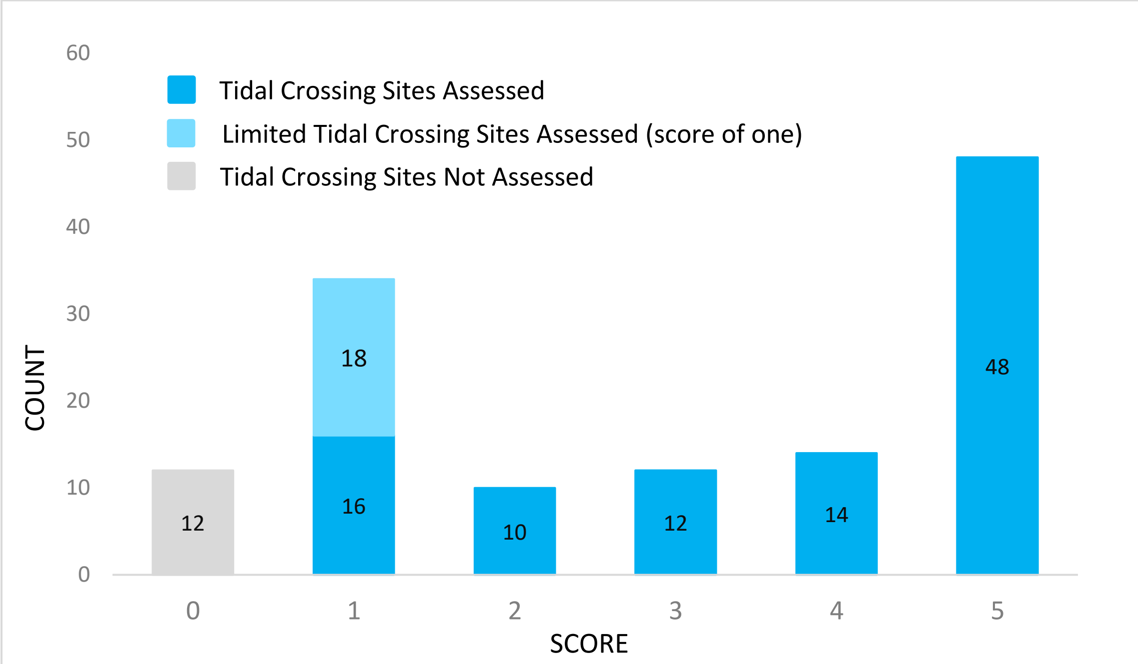
Salt marsh migration potential is scored in two different ways: (1) based on the entire upstream watershed, and (2) based on the upstream salt marsh evaluation unit or catchment — that is, the upstream watershed area before the next upstream tidal crossing, if present. The results for these two scoring approaches are described below.

To minimize confusion between the upstream watershed and upstream evaluation unit scores, only the upstream watershed score is presented on the NH Coastal Viewer. However, both scores are presented on the Tidal Crossing Summary Sheets (Appendix D), in the Crossing Scores Table (Appendix E), and are available for download from ArcGIS Online.

Upstream Watershed Score

The salt marsh migration potential — upstream watershed score, considers the marsh migration potential of the entire upstream watershed above a tidal crossing, despite upstream crossings or restrictions. Figure 9 illustrates the distribution of the upstream watershed scores for salt marsh migration potential.

Figure 9: Distribution of salt marsh migration potential scores for the upstream watershed.



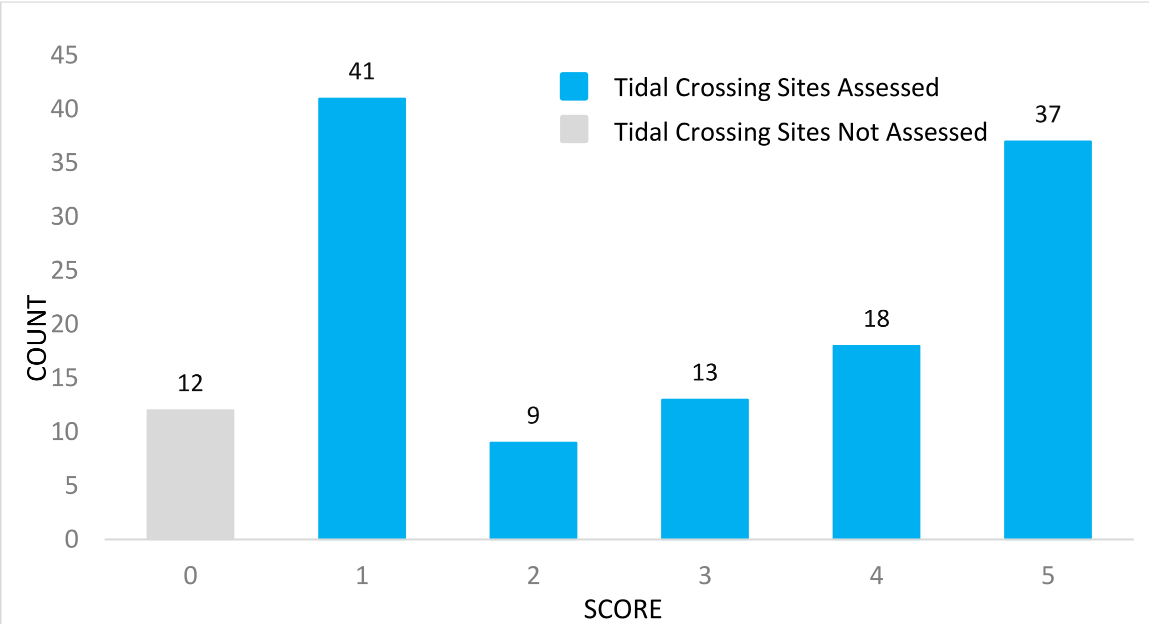
The distribution of salt marsh migration potential — upstream watershed scores shows that the majority of crossings (62) are situated in a marsh system with high or very high potential for inland migration (scores of four or five, respectively). A score of five indicates salt marsh migration potential of greater than 10 acres; a score of four indicates five to 10 acres of migration potential. Not surprisingly, 18 "limited tidal" crossings offer little salt marsh migration opportunity because they are relatively high in the tidal system.

It is especially informative to evaluate a crossing's salt marsh migration potential in combination with its overall tidal restriction score. A crossing with high salt marsh migration potential that is unrestricted will likely enable salt marsh migration as-is in the near-term. A crossing that is both highly restrictive and offers high salt marsh migration potential is a much higher priority to enable upstream salt marsh expansion.

Upstream Evaluation Unit Score

The salt marsh migration potential — upstream evaluation unit score, considers the marsh migration potential of the upstream evaluation unit or catchment — that is, the upstream watershed area before the next upstream tidal crossing, if present. If no upstream tidal crossings are present, then the scores for the upstream watershed and upstream evaluation unit are the same. The upstream evaluation unit score is a more nuanced analysis that allows resource managers and restoration planners to consider crossing specific marsh migration potential relative to upstream and downstream crossings. This information is useful to understand the marsh migration potential from a watershed approach (e.g. addressing a series of in-line tidally restrictive crossings) and to understand the upstream potential enabled by addressing a single tidal restriction. Figure 10 illustrates the distribution of the upstream evaluation unit scores for salt marsh migration potential.

Figure 10: Distribution of salt marsh migration potential scores for the evaluation unit.

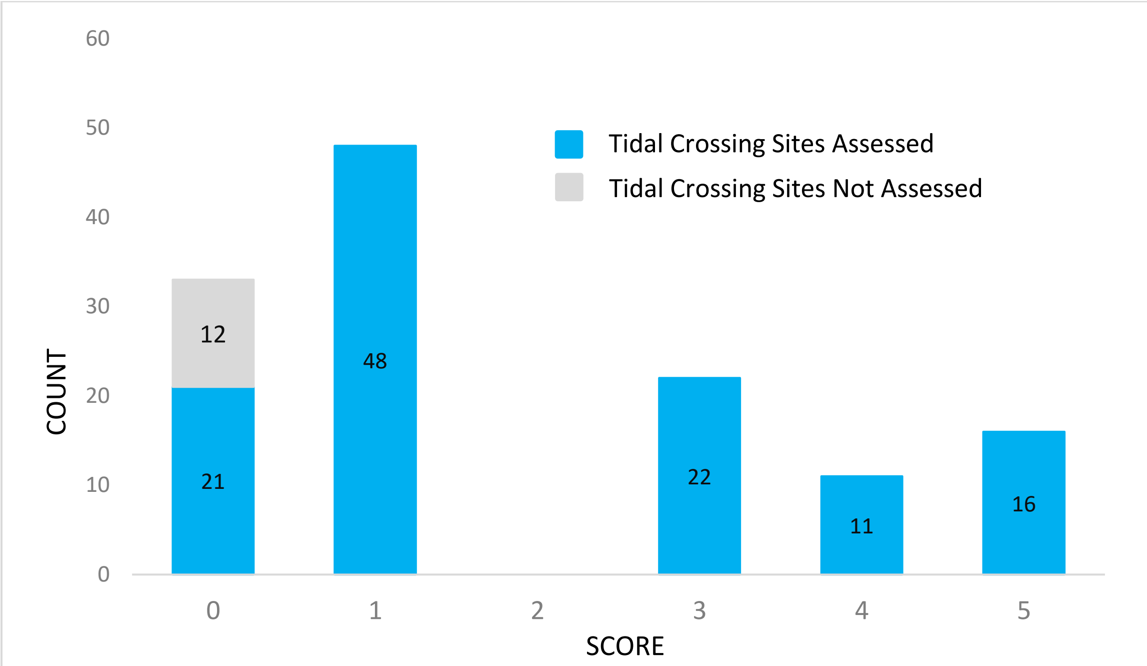


In comparing upstream watershed scores to upstream evaluation unit scores, results show a shift from higher scores to lower scores. This is because, for crossings with an upstream tidal crossing, the evaluation unit area is a smaller portion of the entire upstream watershed area, and therefore only offers that portion for marsh migration. Comparing the distribution of upstream watershed scores to upstream evaluation unit scores isn't all that informative; the upstream evaluation unit scores are developed for site-specific planning of crossings that may be considered for replacement in-series.

4.5 Vegetation Comparison Score

Wetland plants in the tidal zone have specialized adaptations to inhabit and compete in areas subject to flooding and changes in salinity. Wetland plant communities at tidal crossings are an expression of site conditions, both in terms of flooding frequency/duration and salinity. The vegetation comparison score compares the dominant upstream and downstream plant communities at each tidal crossing to understand the crossing's influence on upstream tidal flooding and salinity. Crossings with a low score indicate similar vegetation communities on both sides, whereas high scores indicate increasing divergence in the up and downstream vegetation communities. Figure 11 illustrates the distribution of the vegetation comparison scores.

Figure 11: Distribution of vegetation comparison scores.



The vegetation comparison score considers crossings with prevalent invasive species on both sides as an issue that is likely not limited to the crossing itself. There are 33 crossings that score a zero; 21 are due to invasive species while the remaining twelve were not assessed. Nearly half of the remaining assessed crossings have a score of one, meaning the crossing has a limited effect on up and downstream vegetation communities. The remaining crossings influence vegetation to varying degrees, from having moderate to severe affects (scores three through five, respectively). Note that the evaluation criteria for vegetation comparison does not assign a score of two.

4.6 Infrastructure Risk Evaluation

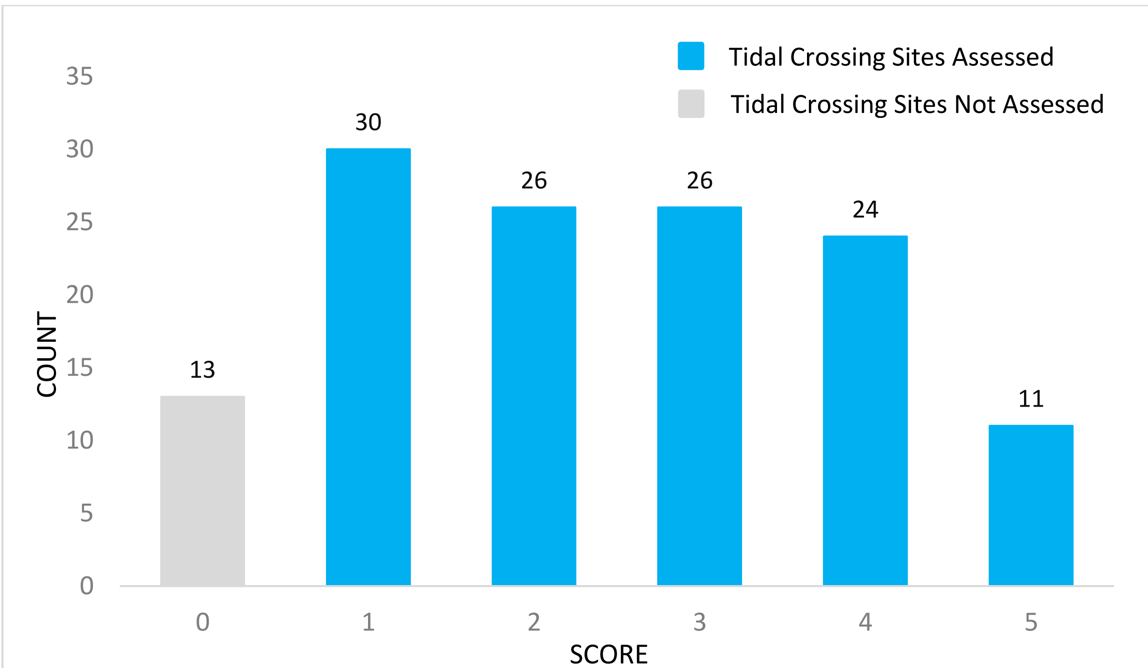
Tidal crossing infrastructure is at the front lines of coastal challenges associated with climate change, including sea level rise and more frequent and intense storm events. Our transportation infrastructure is critical to meet the needs of coastal communities, but that infrastructure is at serious risk. Much of our transportation infrastructure was not designed or constructed with sea level rise in mind. Therefore, it is important to identify tidal crossings that are at more immediate risk to prioritize their replacement, which will support a network of climate-ready transportation infrastructure.

The infrastructure risk evaluation includes two distinct scores: (1) inundation risk to the roadway and (2) inundation risk to the crossing structure. The results for each of these scores are detailed below.

Inundation Risk to the Roadway Score

The inundation risk to the roadway score evaluates the vertical distance between the highest water indicator (wrack) and the road surface. This indicates how susceptible the road is to flooding during high water events such as spring tides, king tides, or storm surges, as well as an indicator of future susceptibility with sea level rise. Figure 12 illustrates the distribution of inundation risk to the roadway score across all crossings. The Tidal Crossing Summary Sheets in Appendix D provide a score for both upstream and downstream inundation risk to the roadway, whereas Figure 12 represents only the highest of the two scores for each site.

Figure 12: Distribution of inundation risk to the roadway scores.

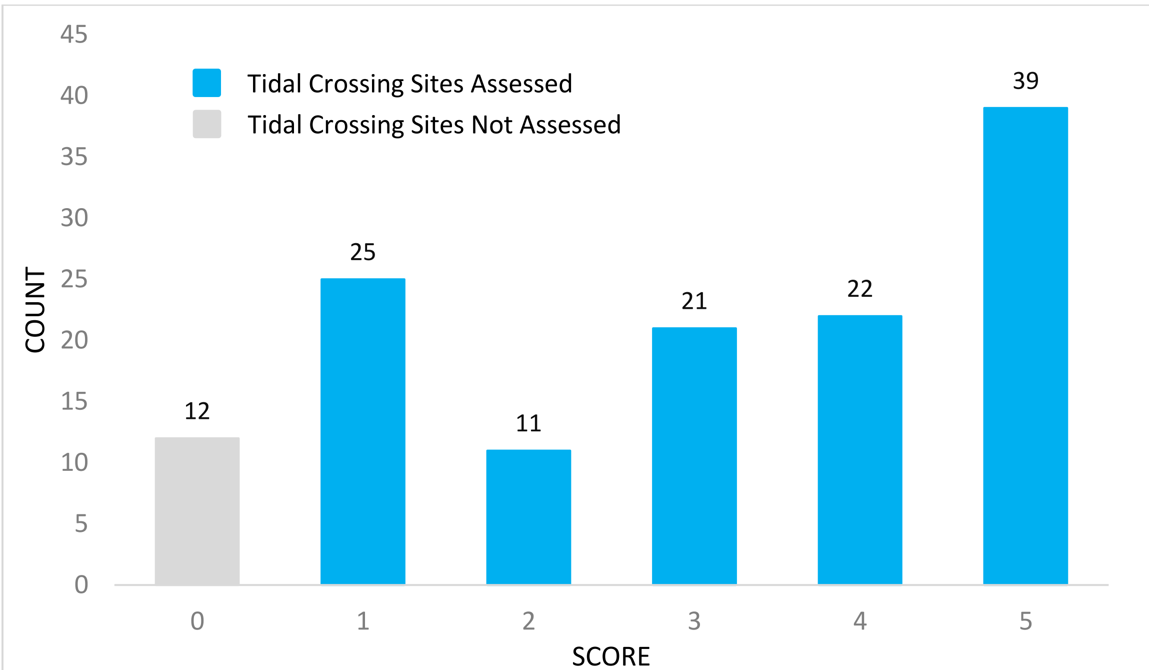


The inundation risk to the roadway scores show that only eleven crossings show signs of occasional or recent inundation (score of five). Twenty-four crossings have flood indicators within 1.5 feet of the roads surface (score of four), while an additional 26 crossings have flood indicators within three feet of the road surface. The remainder of the crossings are not likely at risk of flooding in the near future from regular high tides or high tides coincident with small storm surges (scores one and two). The inundation risk to the roadway scores will increase over time with sea level rise.

Inundation Risk to the Crossing Structure

The inundation risk to the crossing structure score evaluates headwater buildup conditions to determine the distance between the high water indicator (stain) and the ceiling of the crossing structure. A structure that is not tall enough will become completely inundated at high tide. In addition to restricting hydraulic capacity, this condition introduces high pressure on crossings that can result in vulnerabilities from scour and erosion, especially if not designed for headwater buildup. Figure 13 illustrates the distribution of inundation risk to the crossing structure score across all crossings. The Tidal Crossing Summary Sheets in Appendix D provide a score for both upstream and downstream inundation risk to the structure, whereas Figure 13 represents only the highest of the two scores for each site.

Figure 13: Distribution of inundation risk to the crossing structure scores.



The inundation risk to the crossing structure score shows that 39 crossings are inundated by high tides on a regular basis (score of five). Twenty-two crossings have high water stain indicators within one foot of the ceiling of the crossing structure (score of four). These crossings have no or limited additional capacity to convey high water events from spring tides, king tides, extreme precipitation, or storm surge. Thirty-six crossings have two or more feet of freeboard between their high water stain indicator and the ceiling of the structure (scores one and two). The inundation risk to the crossing structure scores will increase over time with sea level rise.

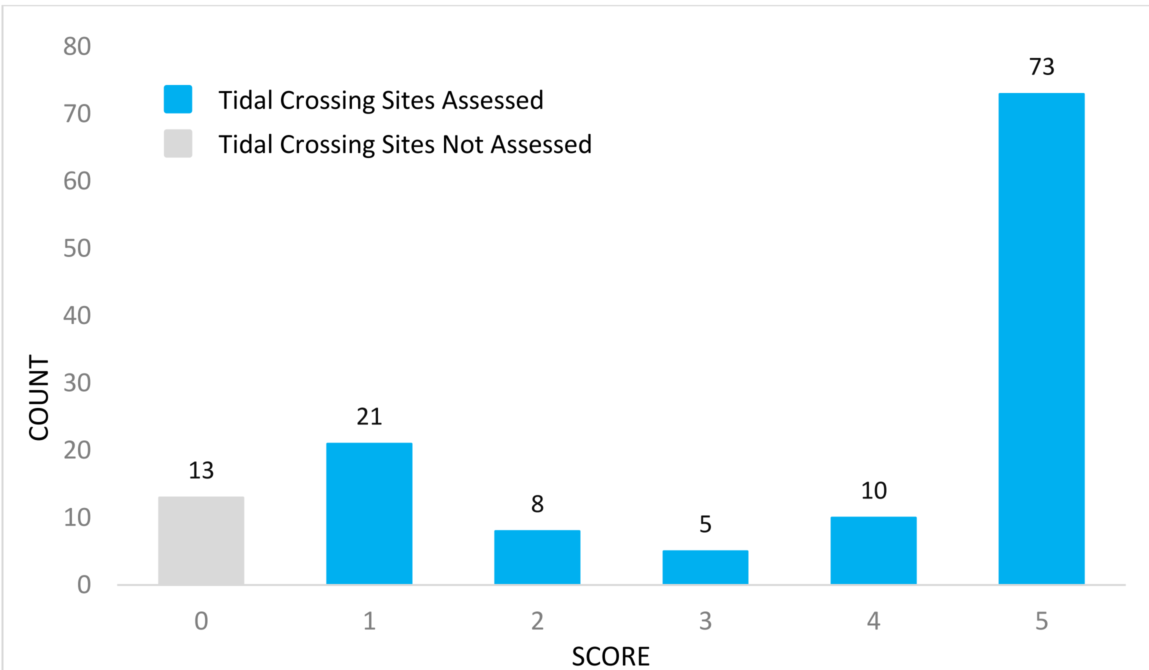
4.7 Adverse Impacts Evaluation

Careful consideration of upstream infrastructure and property susceptible to flooding is necessary in the assessment of tidal crossings — both under current conditions and accounting for rising sea levels. For example, some existing tidal crossings may serve to protect inland communities by restricting tidal flows, but may also cause more severe flooding inland because of poor drainage seaward. It is important to understand potential adverse impacts associated with replacing a tidal crossing, which informs the feasibility of restoring full or even partial upstream tidal range at some crossings.

Inundation Risk to Low-Lying Development (Non-Transportation) Score

The inundation risk to low-lying development score evaluates the number of upstream infrastructure impacts associated with 1.7 feet of SLR by 2050 (MHHW). It is important to note that the scoring scale for inundation risk to low lying development is structured to prioritize sites with high restoration opportunity. That is, crossings with low risk receive a high replacement priority/opportunity score because the feasibility of restoring full tidal range at those crossings is higher given the absence of (or limited) upstream low lying development. Figure 14 illustrates the distribution of the inundation risk to low lying development scores.

Figure 14: Inundation risk to low-lying development scores.



The inundation risk to low lying development scores show that the broad majority of tidal crossings (83) have no anticipated upstream infrastructure impacts or very limited impacts associated with a 1.7-foot SLR (scores five and four, respectively). Conversely, 21 sites have over five infrastructure impacts (score of one), which indicates low potential for restoring full tidal range.

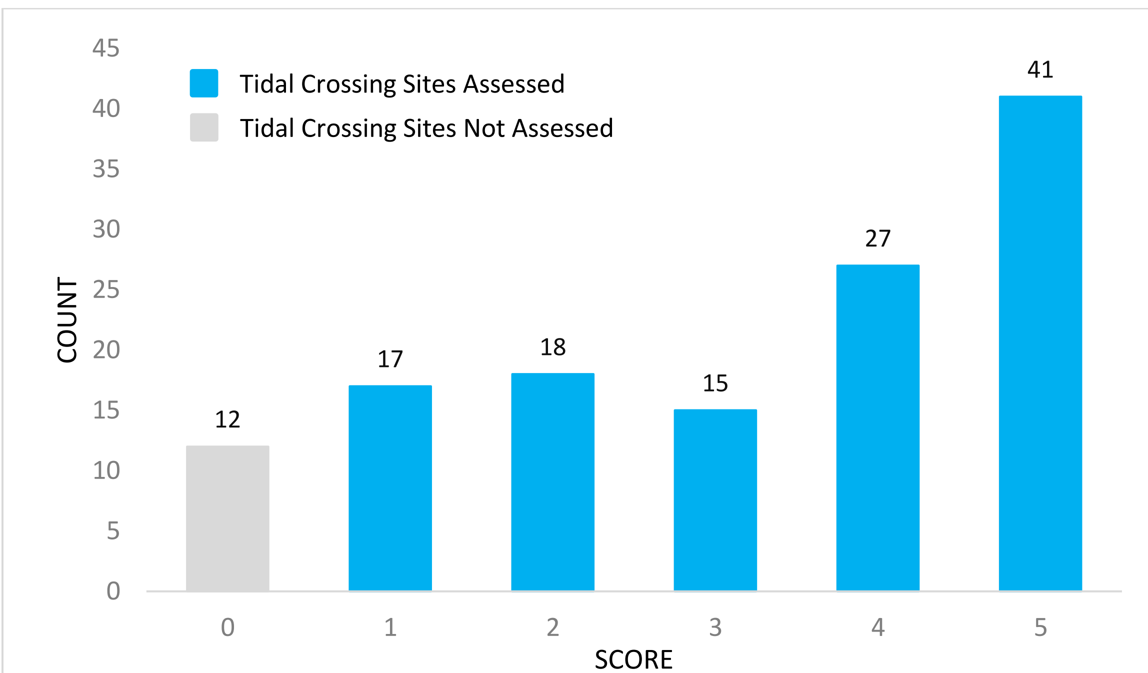
4.8 Overall Crossing Evaluations

Three overall crossing evaluation scores were developed to synthesize tidal crossing replacement priorities across many of the scores presented above. Rolled-up scores are tailored toward infrastructure management, ecological management and one overall score that prioritizes based on a combination of infrastructure and ecological management considerations. Inundation risk to low lying development is not incorporated into any of the three overall crossing evaluations — it can be used as a feasibility and management screen of the overall scores. The results of the three overall crossing scores are detailed below.

Overall Infrastructure Score

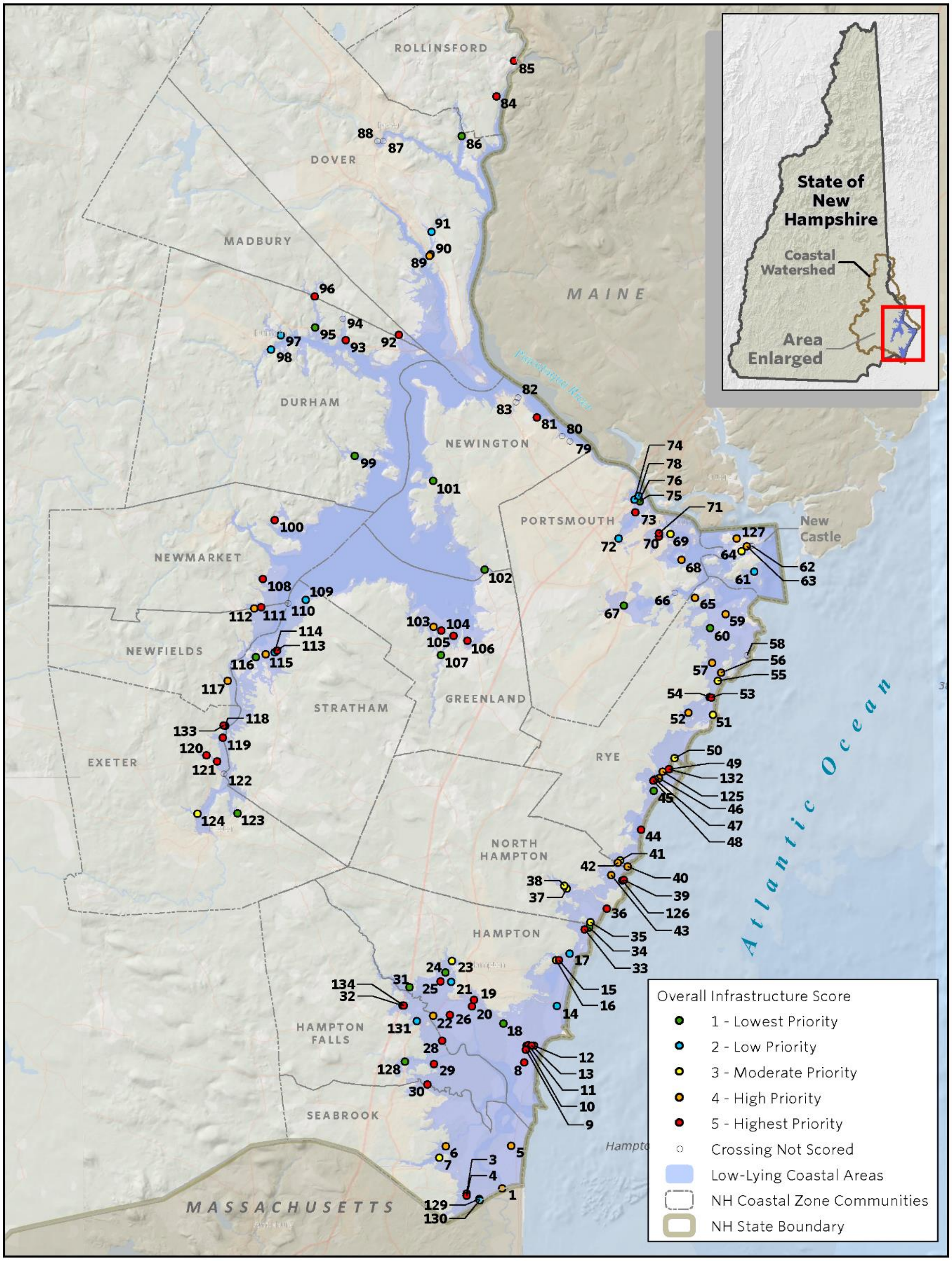
The overall infrastructure score prioritizes crossings based on increasingly poor crossing structure condition and increasing inundation risk to the roadway components. Figure 15 illustrates the distribution of the overall infrastructure risk scores.

Figure 15: Distribution of overall infrastructure scores.



The overall infrastructure scores show that when pairing structure condition and inundation risk to the roadway scores the majority of crossings (68) are at immediate or near-term risk (scores five and four, respectively). Less than 30%of crossings are currently adequate in terms of condition and inundation risk to the roadway (scores one and two). Figure 16 displays the geographic distribution of overall infrastructure scores.

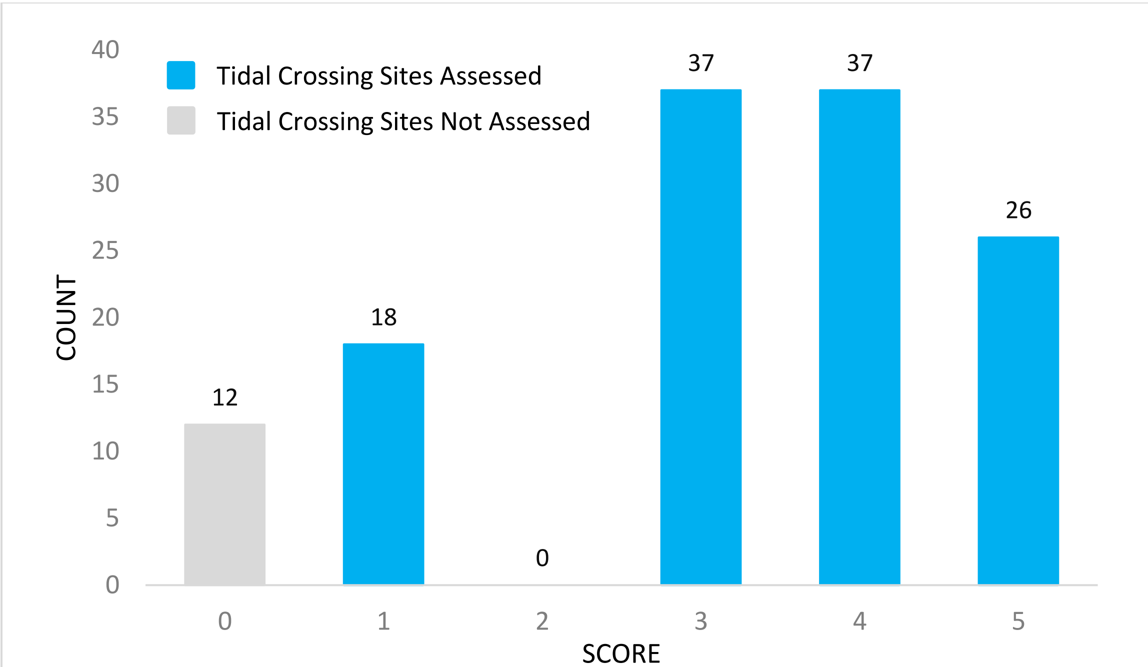
Figure 16: Geographic distribution of overall infrastructure scores.



Overall Ecological Score

The overall ecological score prioritizes crossings based on increasing ecological restoration potential for tidal restriction, tidal aquatic organism passage, salt marsh migration and vegetation. Figure 17 illustrates the distribution of the overall ecological scores.

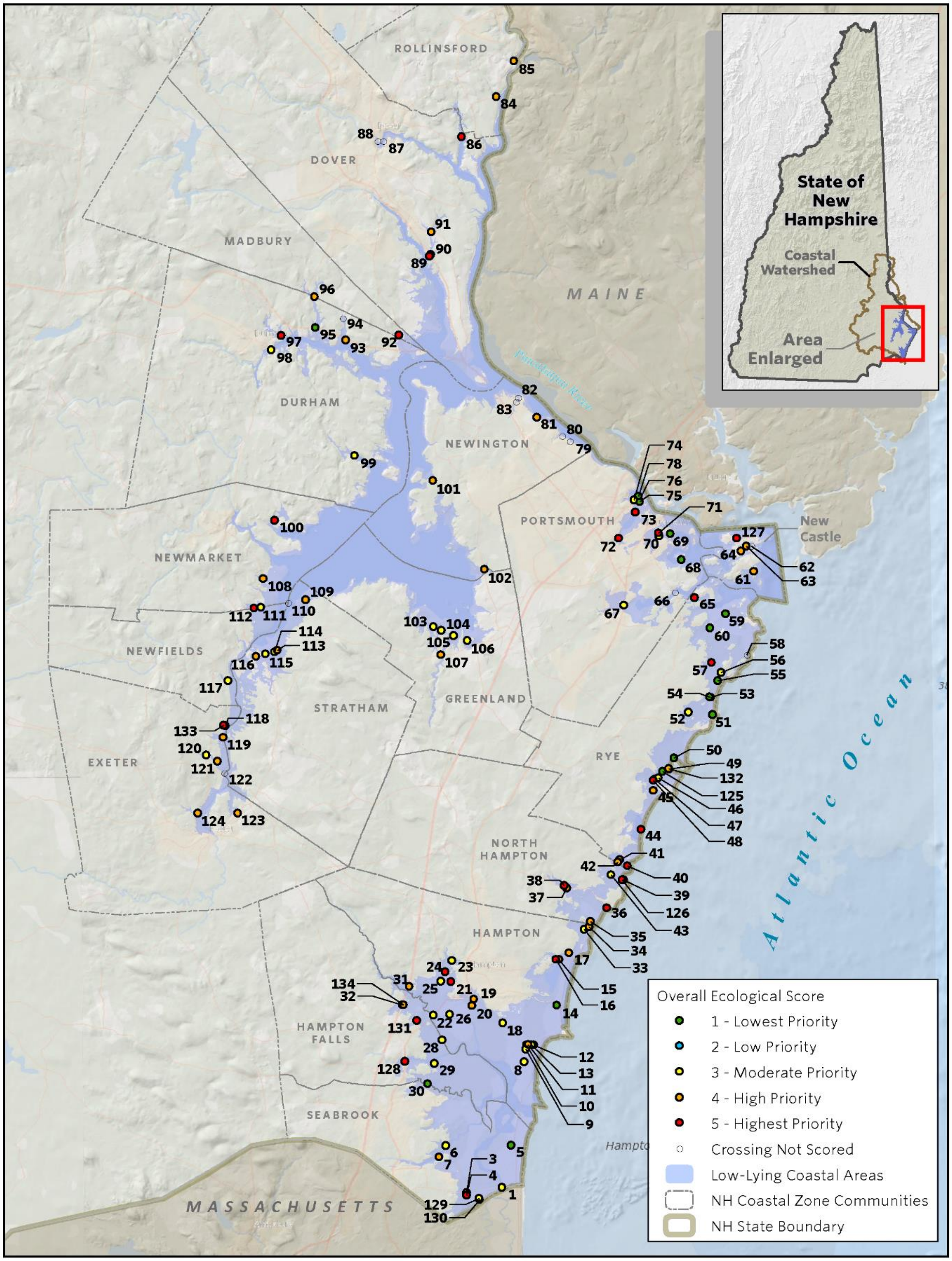
Figure 17: Distribution of overall ecological scores.



The overall ecological scores show that 37 crossings have high ecological restoration potential, and 26 crossings have very high ecological restoration potential (scores four and five, respectively). Just 18 crossing are in no need of restoration from an ecological perspective. Note that the evaluation criteria for the overall ecological score does not include a scoring category for "2." Figure 18 displays the geographic distribution of overall ecological scores.

Vegetation comparison scores of zero due to prevalent invasive species in the marsh plain on both sides of a crossing result in a minimum overall ecological score of four. Prevalent invasive species on both sides of a crossing is likely not the sole result of the crossing itself, but could be the result of numerous factors beyond the scope of this Project. However, these sites are flagged as high restoration priorities because they warrant further attention, whether independent or in conjunction with the crossing structure, to restore healthy native plant communities.

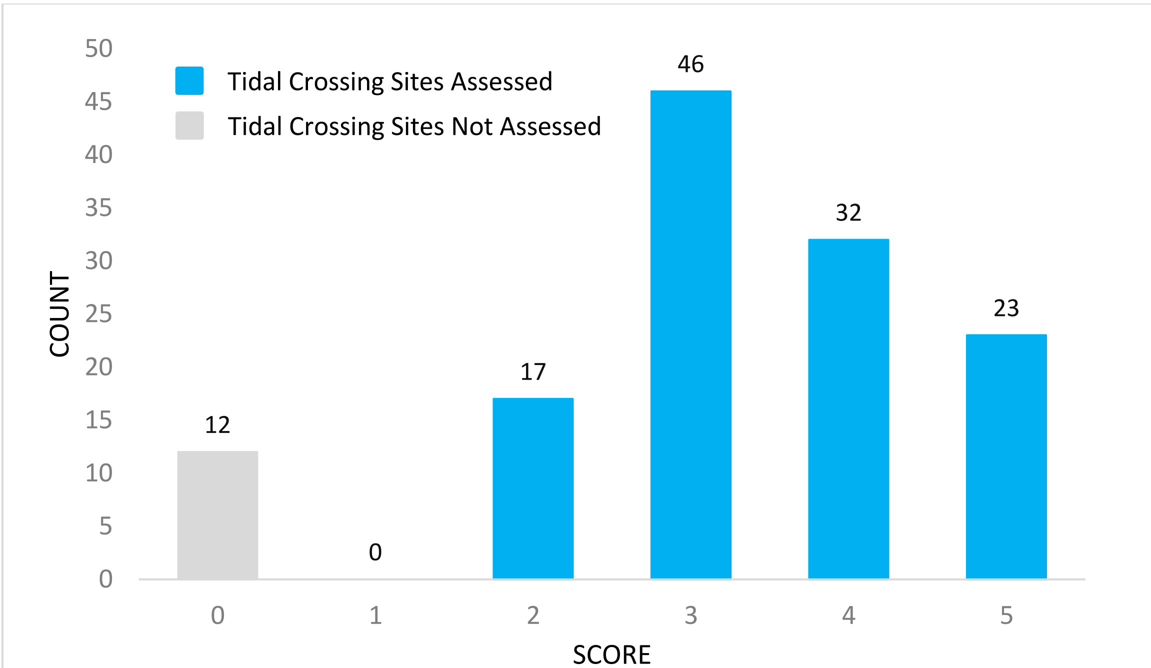
Figure 18: Geographic distribution of overall ecological scores.



Overall Combined Score

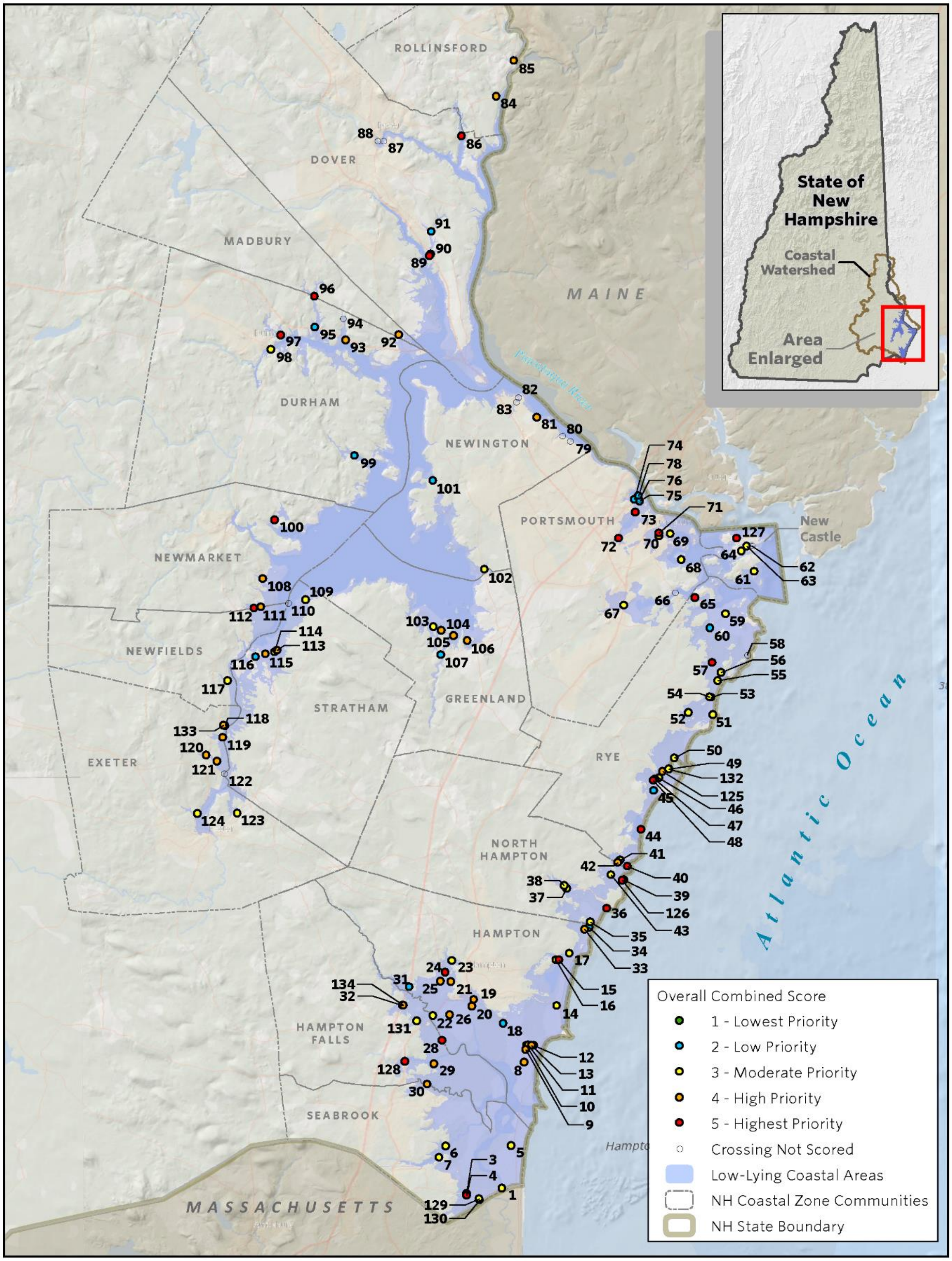
The overall combined score prioritizes crossings based on a combination of infrastructure and ecological component scores. Component scores that feed into the overall combined score includes salt marsh migration potential (upstream watershed), tidal restriction overall, vegetation evaluation, crossing condition, inundation risk to the roadway and tidal aquatic organism passage. Figure 19 illustrates the distribution of the overall combined scores.

Figure 19: Distribution of overall combined scores.



The overall combined score identifies 23 highest priority and 32 high priority crossings to be addressed (scores five and four, respectively). Seventeen crossings are currently adequate when pairing infrastructure and ecological scoring factors. Figure 20 displays the geographic distribution of overall combined scores.

Figure 20: Geographic distribution of overall combined scores.



5. DISCUSSION

Extensive data was collected and analyzed to inventory and prioritize New Hampshire's tidal crossings. Project data enables a wide range of additional analyses to further understand tidal crossings and context for their management. This section synthesizes Project results and includes examples of additional analyses that are enabled by Project data.

5.1 What is a Resilient Tidal Crossing?

The NHDES Coastal Program defines resiliency as the capacity of a community or system to proactively prepare for and promptly recover from hazardous events such as hurricanes, coastal storms and the effects of long-term SLR, rather than the ability to simply react and respond to events.

The Resilient Tidal Crossings Project was designed to understand the vulnerabilities of tidal crossing infrastructure and their effects on tidal systems. In addition to identifying tidal crossings in need of improvement or replacement, the Project also identifies tidal crossing sites that score well across the Project's multiple evaluation criteria. The most resilient tidal crossings in New Hampshire were identified through the overall combined score (see Figure 19), which identified 17 tidal crossing structures with low replacement priority scores (scores ≤ 2) and thus a high degree of resiliency.

The most resilient tidal crossings in New Hampshire share similar attributes; most notably structure type and condition. Nearly all of these sites are either bridges or box culverts and are in very good condition. In addition, the most resilient tidal crossings in New Hampshire have low inundation risk and are generally unrestrictive to tidal flows.

Figure 21. Crossing #95 at Johnson Creek on Route 4 (L), Crossing #60 at Berry's Brook on Brackett Road in Rye (R). Both crossings received low priority replacement scores for Overall Combined, demonstrating a high degree of resiliency.

Despite having sufficient vertical capacity, the majority of the most resilient crossings still have insufficient horizontal capacity. As indicated in **Section 4.2 Tidal Restriction Evaluation**, 98 assessed tidal crossings have insufficient structure opening width, which has likely resulted in severe channel scour conditions at 100 crossings. Project results also show that a site can have a tidal restriction in the form of insufficient structure width and still be resilient, especially if tidal range is not significantly affected and scour isn't compromising the structure's condition.

Restoring tidal range was the primary goal for 15 tidal crossing replacement projects proactively undertaken in New Hampshire between 1994 and 2015. Despite indicators of good tidal range and similar upstream and downstream native plant communities at restoration sites, Project results show that only one restoration site fully meets optimal infrastructure and ecological criteria (i.e. overall combined score ≤ 2). This suggests that the design considerations for restoration activities did not consider climate resiliency factors and the threats and implications of accelerated sea level rise that are considered today. Instead, restoration management objectives focused on improving tidal range, enhancing fish passage and were often constrained by balancing potential adverse impacts of restoring tidal flow. As depicted in Parsons Creek example in Figure 22, many restored crossings occur in low-lying areas near the coast where low road elevations limit tidal crossing design options. Enhancing coastal resilience at these crossings is achieved only by the costly process of raising roadway elevations to reduce inundation risks. Achieving resilience through the raising of roads is not without environmental impact; as higher road elevations will require wider road causeways that will result in a loss of tidal wetlands caused by road fill.

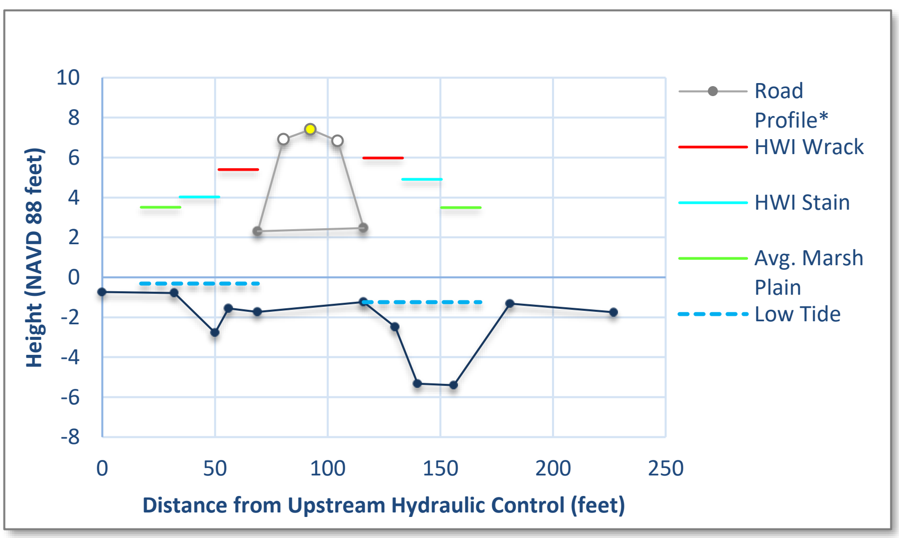
Figure 22. Crossing 54 at Parsons Creek and Wallis Road is a restoration site that received good scores for tidal range, vegetation, salt marsh migration; however, the road is very low in elevation and subject to periodic inundation and thus received high inundation risk scores.

5.2 Crossing Cross Section and Stream Longitudinal Profile

A Crossing Cross Section and Stream Longitudinal Profile was generated for each of the 118 assessed crossings based on a relative elevation survey performed at each site. A two-page Tidal Crossing Summary Sheet is provided for each crossing in Appendix D. These summary sheets include a graph that depicts the longitudinal profile of the stream through the crossing and the cross section of the road at the stream crossing as well as a table depicting raw elevation data, channel features and substrate.

The stream profile in Figure 23 represents relative elevations of the stream channel, as represented by the solid black line. The crossing cross section captures relative elevations of the crossing structure including the ceiling of the crossing structure, high water indicators, average marsh plain and road surface elevations (upstream and downstream low points and the road centerline). For the purpose of the crossing cross section, the road profile is centered over the upstream and downstream inverts for graphical purposes, and do not necessarily reflect the true configuration of the road fill slopes and roadway.

Figure 23: An example of a Crossing Cross Section and Stream Longitudinal Profile graph that depicts key elevation data collected using the New Hampshire Tidal Crossing Assessment Protocol. The table to the right of the graph corresponds to the stream longitudinal profile stations (black dots along the black line), providing information about the distance from the upstream hydraulic control, height of the feature, the feature type, and the channel substrate.



Long. Profile

Dist.	Hght.	Feat.	Sub.
0	-0.7319	HC	G
32	-0.7919	HC	C
50	-2.7819	P	C
56	-1.5619	GC	C
69	-1.7319	I	B
116	-1.2319	I	B
130	-2.4819	GC	B
140	-5.3219	P	C
156	-5.4019	P	G
181	-1.3119	HC	C
227	-1.7519	HC	G

Data from the Crossing Cross Section and Stream Longitudinal Profile are used for multiple scoring criteria (e.g. tidal range ratio, inundation risk to roadway, inundation risk to crossing structure, and tidal aquatic organism passage). Additionally, this information provides insightful context about the compatibility of a tidal crossing with the aquatic system that it conveys.

Scour Pools

Scour Pools are erosion features that indicate geomorphic incompatibilities when present immediately upstream or downstream of a tidal crossing. The erosion classification scoring criteria evaluates scour pool width (if present) relative to average channel width. Project results show that 100 of the 118 assessed sites are tidally restrictive based on this metric alone, which indicates widespread incompatibility of tidal crossings from an erosion standpoint. Scour pools generally result from increased water velocities flowing through undersized culverts or bridges. They are particularly damaging in the estuarine environment, especially to salt marsh peat, which is highly erodible and not easily restored.

Project scoring criteria do not prioritize based on scour pool depth. However, the stream longitudinal profile depicts upstream and downstream pool depths to understand the vertical dimension of channel scour. The Project team was surprised to learn that many tidal crossings exhibit deep scour pools on both sides. This suggests highly pressurized systems due to flow restrictions created by undersized crossings. At Crossing #1 in Seabrook, for example, upstream and downstream scour pool depths at low tide were greater than the field crew's 25' survey rod, demonstrating not only the effects of increased water velocities through undersized crossings but also indicating high erodibility of the unconsolidated channel substrates that are typically found in New Hampshire's tidal systems.

Channel Substrate

The data table to the right of the Crossing Cross Section and Stream Longitudinal Profile graph in Figure 23 and on the Tidal Crossing Summary Sheets provides elevation, channel feature and channel substrate information. Channel substrate (e.g. silt/clay, sand, gravel, cobble, boulder) observed in the field is not incorporated into the Project's evaluation criteria; however, it can be used to determine the compatibility of the crossing structure with the aquatic system. Undersized tidal crossings are expected to result in higher water velocities through the structure, resulting in increased channel erosion upstream and downstream of the crossing. Because smaller channel substrate particles such as, silt, sand and gravel are more susceptible to erosion, it is expected that channel substrate at tidal restrictions are dominated by larger and less mobile substrates such as cobbles and boulders. The stream profile in Figure 23 shows that the channel at the crossing inlet and outlet (feature "I") is boulder (B) dominated but the remainder of the channel is dominated by gravel (G) and cobble (C).

High Water Indicators

Another helpful aspect of the Crossing Cross Section and Stream Longitudinal Profile graphs are the high water indicators, which can inform the hydraulic performance of a tidal crossing structure. Assessed tidal crossing sites exhibit many configurations of high water indicators. Figure 23, for instance, shows that the high water indicators (wrack and stain) features are higher on the downstream side of the crossing, indicating slight buildup of water on the incoming tide. Other sites exhibit indicators of water build up on the upstream side of a crossing, indicating a restriction of seaward flows. The Tidal Crossing Site Summary Sheets (See Appendix D) present upstream and downstream scores for inundation risk to roadway and inundation risk to crossing structure, allowing data users to hone in on hydraulic compatibility with ebb and flow tides through each tidal crossing structure.

5.3 Marsh Subsidence relative to Vegetation Evaluation

One of the prominent features of salt marshes in New England is the flat plain of the high marsh (Nixon and Oviatt 1980). This plain can be impacted by hydrologic restrictions that over-drain marshes, allowing peat oxidation where carbon loss leads to subsidence (Burdick et al. 1997, Anisfeld 2012).

The Crossing Cross Section and Stream Longitudinal Profile also depicts the average marsh plain elevation on both sides of the crossing. These measurements independently average four upstream and four downstream elevations of the adjacent salt marsh plain. The purpose of collecting these marsh plain elevations is to determine if the crossing structure has a noticeable effect on marsh subsidence (i.e. loss of elevation due to oxidation of peat) or accretion (i.e. the ability of the marsh to build in elevation with sediment deposition from frequent flooding).

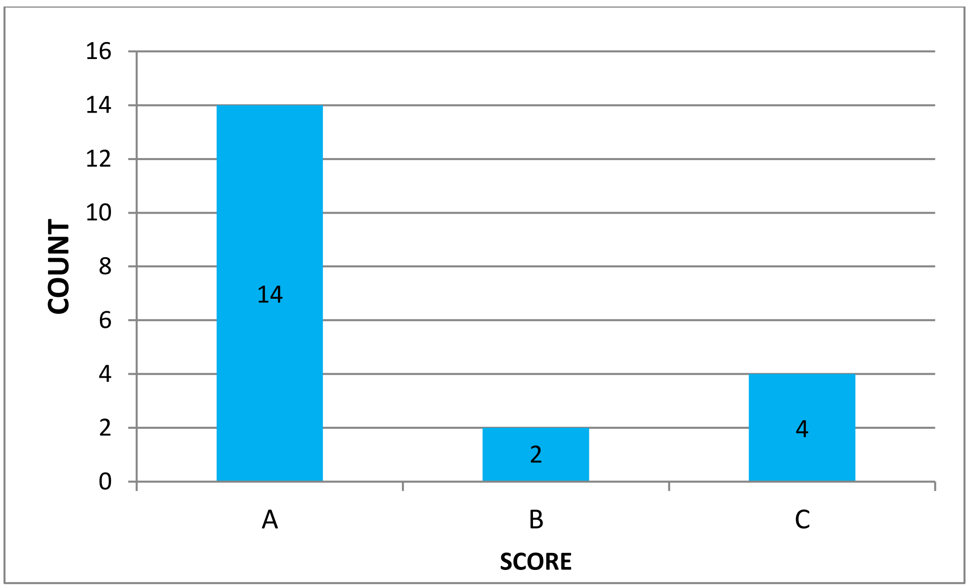
Of the 118 crossings assessed, 93 had marsh plains available to measure on both sides. Considering small amounts of elevation difference might be due to sampling variation, sites with 0.2 feet of elevation difference were removed from the analysis. A total of 20 crossings showed marsh plain elevations at least 0.2 feet lower upstream than downstream. The average amount of subsidence for these 20 crossings was only 0.39 feet. The analysis also showed that 43 tidal crossings had notably higher marsh plains upstream than downstream, 31 of which were associated with a crossing at the upper edge of the marsh or approaching the head of tide (where higher marsh plains would be expected given the topography of the land). The 20 crossings exhibiting subsidence were then analyzed, as described below, with several of our ecological assessment parameters to determine if subsidence correlates with impaired plant communities or tidal restriction.

The “Crossing ID site #” for the sites included in this subsidence analysis are: 4, 9, 10, 29, 32, 34, 35, 43, 47, 48, 54, 65, 71, 93, 99, 103, 105, 118, 121, 125.

Subsidence vs. Upstream/Downstream Plant Community

Tidal Crossing sites exhibiting upstream subsidence were compared to scores from the Project’s vegetation comparison evaluation, shown in Figure 24. Vegetation Comparison Category ‘A’ represents crossings where the plant community is the same on both sides, ‘B’ represents a slight difference in plant communities, and ‘C’ represents very different plant communities. Seventy percent of crossings with upstream subsidence have similar plant communities on both sides, while the remaining 30%of crossings express different plant communities. Subsidence sites were also compared to the presence of invasive species. Fifty percent of subsidence sites had no invasive species and the remaining half have varying degree of infestation by invasive species. Regardless of plant communities, average marsh plain elevations suggest that these 20 crossings are at greater risk of eventual collapse given that they are not maintaining elevation with their downstream marsh unit.

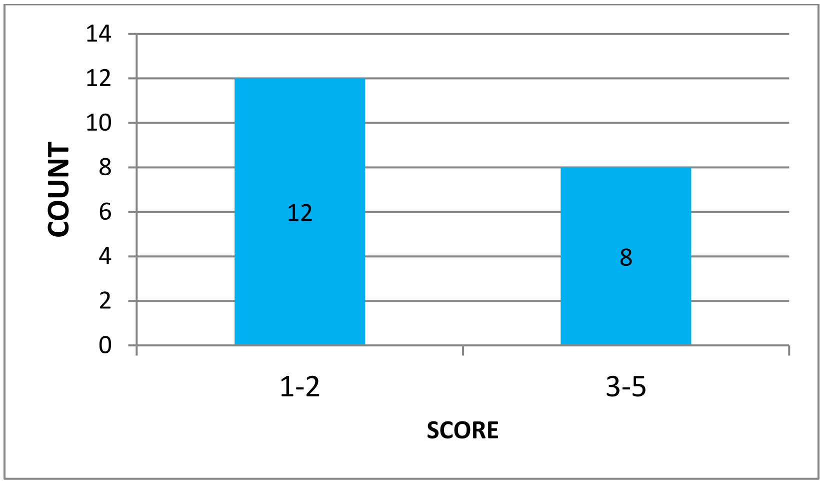
Figure 24: Comparison of crossings exhibiting subsidence to the results of the vegetation comparison evaluation. 'A' represents crossings where the plant community is the same on both sides, 'B' represents a slight difference in plant communities, and 'C' represents very different plant communities.



Subsidence vs. Tidal Range Ratio

Tidal Crossing sites exhibiting upstream subsidence were compared to the Tidal Range Ratio score, shown in Figure 25. Subsidence can be the direct result of a tidal restriction. Tidal Range Ratio Score Category "1-2" represents crossings with minimal or no tidal range difference between the up and downstream sides, category "3-5" represents moderate to severe tidal range differences. Figure 25 shows that 60% of subsidence sites have no/minimal tidal restriction and 40% of subsidence sites have moderate/severe tidal restriction.

Figure 25: Comparison of crossings exhibiting subsidence to Tidal Range Ratio score categories



Subsidence at tidal crossing sites does not appear to be strongly correlated with differences in vegetation community or a reduced tidal range ratio. Most sites with indicators of subsidence received low replacement priority scores, indicating that these sites have similar upstream /downstream plant communities and minimal tidal range issues despite exhibiting subsidence. This analysis did identify several high priority replacement sites that exhibit subsidence plus other indicators of incompatibility, including Crossing ID# 65, 99 and 118.

Project data demonstrate that measurable subsidence has occurred at 20 individual tidal crossing sites. Project data also demonstrate that subsidence of upstream marsh plain does not yet appear to be a significant natural resource management concern at tidal crossings; however, these results are based on only eight elevation readings measured adjacent to the tidal crossing. More in depth analysis of subsidence at these 20 sites would help inform possible management options at tidal crossings.

5.4 Hazard Mitigation Plans Compared to Inundation Risk to Roadway

In 2017, the New Hampshire Geological Survey compiled and digitized data from over 200 hazard mitigation plans from New Hampshire communities into an online database known as the New Hampshire Flood Hazards Geodatabase (NHFHG 2017). Tidal crossing sites identified in the NHFHG were inserted into the tidal crossing database and compared to inundation risk scores to understand alignment across both datasets. Of the 118 tidal crossings assessed, 56 are identified in a municipal hazard mitigation plan. An analysis was conducted to determine whether tidal crossings with high priority scores for inundation risk to the roadway are adequately represented in existing hazard mitigation planning documents. This analysis shows that 36 crossings in the moderate to high inundation risk categories (priority scores 3-5) are identified in a hazard mitigation plan, while 25 are not, demonstrating a potential opportunity to update hazard mitigation plans throughout out the Coastal Zone. This analysis also shows that an additional 20 crossings are identified in a hazard mitigation plan; however, received a low priority inundation risk to the roadway score. These low inundation risk sites may be in Hazard Mitigation Plans as a result of other factors beyond high tide flooding, such as flooding from the upstream watershed, flooding from an extreme storm event, or maintenance issues, among others. Road managers and planners should consider Project priority scoring for both inundation risk to roadway and inundation risk to crossing structure to inform future revisions to hazard mitigation planning documents.

6. NEXT STEPS

The Resilient Tidal Crossings Project collected, analyzed and prioritized attributes at 118 tidal crossings in New Hampshire. Priority scores allow stakeholders to evaluate crossings from a number of coastal resilience-focused management objectives to identify replacement, maintenance and/or restoration priorities and opportunities. The Project team identified the following next steps as important to leverage, implement and advance the findings of this project.

6.1 Data Sharing

A first next step is to inform stakeholders about the availability of Resilient Tidal Crossings data and priorities. Project data and results are available for public use on the NH Coastal Viewer, ArcGIS Online, and in this report. The NH Coastal Viewer is a widely used web mapping tool tailored to New Hampshire's Seacoast; access to Resilient Tidal Crossing data on the Coastal Viewer will facilitate the use of this new information by both general and technical stakeholders alike. Technical users, such as road managers, engineers and natural resource managers, can access all tidal crossing assessment parameter attributes by downloading the full Resilient Tidal Crossing database from ArcGIS Online (see section **1.1 How to Access Data**). The full tidal crossing dataset is also available upon request to the NHDES Coastal Program. Finally, all crossing scores are presented in this report in **Appendix D. Tidal Crossing Summary Sheets** and **Appendix E. Crossing Score Table**.

Conducting outreach about Project results is beyond the scope of the Resilient Tidal Crossings Project; however, the Project team identified the following recommended outreach actions to improve dissemination of Project information:

<u>Recommended Actions</u>

- Conduct direct outreach (e.g. workshops, presentations, etc.) to transportation managers and planners at the state and municipal level and among private sector engineering firms to increase understanding of Project data, particularly sites with high priority condition and inundation risk scores.

- Conduct direct outreach (e.g workshops, presentations, etc.) to conservation commissions and conservation organizations to increase understanding of Project data, particularly sites with high ecological priority scores.

- Prepare Coastal Viewer training materials to assist users navigate tidal crossing data.

6.2 Tidal Crossing Replacement

A longer term goal for the Resilient Tidal Crossings Project is to enhance coastal resilience for people and nature through the prioritized replacement of substandard tidal crossings. A key next step is to utilize Project results to queue the next set of tidal crossing replacements for coastal resilience. TNC and NHCP recently secured funding to complete full design and engineering at four to five high priority tidal crossings resulting from this assessment and prioritization effort. Identifying candidate crossings for this next phase, then working with state and/or municipal partners to start addressing management issues at those crossings is an immediate next step planned for 2019.

Recommended Actions

- Enable tidal crossing replacements by incorporating high priority tidal crossings into relevant planning documents, including but not limited to: Capital Improvement Plans, Hazard Mitigation Plans, Coastal Hazards and Adaptation Master Plans, NHDOT 10 Year Plan, NHDOT Long Range Plan.

- Link high priority sites with applicable grant funding sources for ecosystem restoration and or community resiliency.

- Work with partners to advance moderate and high priority tidal crossings through feasibility, engineering, permitting and construction.

6.3 Maintain Current Tidal Crossing Data

This Project has made a valuable investment in asset management of tidal crossings. The SADES program enabled the efficient collection and management of current tidal crossing conditions. Data from this Project enables the ability to shift from "reactive" to "proactive" management, thereby increasing the impact of infrastructure investments, as well as working toward readiness (design, engineering, permitting) for replacement of high priority tidal crossings. It is important to maintain the tidal crossing dataset going forward to take advantage of the valuable information it provides.

Recommended Action:

- Maintain and update the tidal crossing dataset for reliable long-term asset management and the ability to rapidly respond to unanticipated infrastructure needs, such as road washouts during major storms.

6.4 Tidal Crossing Design Standards

Just as there was no widely accepted assessment protocol for tidal crossings when the Project started, there are similarly no detailed and widely accepted design standards for tidal crossings. The New Hampshire Stream Crossing Guidelines (University of New Hampshire 2009) provide guidance and a regulatory framework for replacement of freshwater stream crossings, but do not address the needs and unique conditions encountered in tidal systems. Simple parameters for replacement of freshwater stream crossings such as watershed size and bankfull width are insufficient for defining the hydraulic complexity at tidal stream crossings, which must also consider site-specific tidal data, bi-directional flow, storm surge and projected SLR.

Recommended Actions

- Encourage the creation of a regional initiative to develop tidal crossing design standards with other state and federal partners across New England and the Northeast to harness professional expertize across the region and use coastal zone management planning resources efficiently.

6.5 Research

Research is necessary to enable science-based management of salt marsh. Research is more critical now than ever, as natural resource managers face significant uncertainty regarding salt marsh response to rapid SLR. Road managers and coastal engineers will also benefit from research of coastal flooding dynamics and techniques for achieving resilient coastal infrastructure. The Project database is available to researchers, natural resource professionals and engineers to advance a range of research topics to improve understanding and management at tidal crossings. The Project Team identified the following preliminary list of research topics that will improve management of tidal crossings:

Recommended Topics for Further Research:

- Investigate flooding dynamics at the tidal/freshwater interface.
- Investigate the effects of tidal crossings on salt marsh health, processes and functions and values, including but not limited to:
    - hydraulic dynamics at tidal crossings, particularly the tidal prism that is necessary to convey through each tidal crossing (under existing and potential future conditions) to achieve adequate inundation of the upstream salt marsh plain.
    - sediment dynamics, particularly the ability of salt marsh to maintain elevation relative to sea level rise.

    - native and invasive plant dynamics, particularly the effect of tidal crossings on upstream and downstream plant community.

- Monitor tidal crossing replacement projects to determine if they are achieving their specific management objectives.

6.6 Regional Transferability

The size and scale of New Hampshire's Coastal Zone is perfectly suited for a comprehensive inventory of tidal crossings, which inspired the Project Team to design and implement a field protocol that could be accomplished at 120 tidal crossings within a 4-month summer field season. While the Project was designed for specific use in New Hampshire, the Project Team was cognizant of its potential applicability elsewhere in the Gulf of Maine and perhaps throughout the US. To enable regional transferability, all Project reports, data, data management structures, scoring criteria, etc. are available through the NHDES and SADES websites.

<u>Recommended Action:</u>

- Revise New Hampshire Tidal Crossing Assessment Protocol to incorporate lessons learned from the 2018 implementation of the Protocol.

- Depending on interest/demand, use lessons learned to generate a streamlined assessment protocol that collects a limited number of assessment parameters to satisfy evaluation criteria requirements for scoring.

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Appendix F: Interpretation Guide

Category	Evaluation Criteria Description	Scoring System*
Structure Condition	A combined evaluation of multiple condition parameters (headwall, wingwall, overall structure, scour).	1 = Multiple indicators of good condition 5 = Multiple indicators of poor condition
Tidal Range Ratio	US/DS comparison of difference between high water stain indicator and low tide water elevation.	1= US/DS tidal range are similar 5= US/DS tidal range are significantly different
Crossing Ratio	Comparison of structure opening width to channel width (US/DS).	1 = Crossing and channel have similar width 5 = Channel width is significantly larger than structure width.
Erosion Classification	Comparison of channel width to the width of scour pool (US/DS)	1 = No pooling/scour 5 = Major pooling/scour
Tidal Restriction Overall	Rolled-up score that averages Tidal Range Ratio, Crossing Ratio and Erosion Classification scores.	1 = No Tidal Restriction 5 = Significant Tidal Restriction
Tidal Aquatic Organism Passage	See Tidal Range Ratio above.	See Tidal Range Ratio above
Salt Marsh Migration Potential (Evaluation Unit)	An evaluation of the amount of acreage available for salt marsh migration within the wetland unit immediately US of a crossing.	1 = Little or no migration potential 5 = Ten or more acres of migration potential
Salt Marsh Migration Potential (Watershed)	An evaluation of the total amount of acreage available for migration of salt marsh within the total US watershed.	1 = Little or no migration potential 5 = Ten or more acres of migration potential
Vegetation Comparison	US/DS comparison of vegetation community and presence of invasive species.	1 = US/DS vegetation similar & no invasives 5 = US/DS vegetation different & invasives present
Inundation Risk to Roadway	Comparison of high water wrack and road surface elevation (US/DS)	1 = Roadway at low risk of inundation 5 = Roadway at high risk of inundation
Inundation Risk to Structure	Comparison of high water stain and culvert ceiling (US/DS)	1 = Structure is at lower risk of inundation 5 = Structure is inundated on a regular basis.
Inundation Risk to Low-Lying Infrastructure**	Evaluates the risk of full tidal flow to nearby (non-transportation) development.	1 = Five or more impacts 5 = No Impacts
Overall Infrastructure	Rolled-up score combining: Structure Condition and both Inundation Risk scores.	1 = Good Condition, low Inundation Risk 5 = Poor Condition, high Inundation Risk
Overall Ecological	Rolled-up score combining: Tidal Restriction, Tidal Aquatic Organism Passage (TAOP), Salt Marsh Migration, and Vegetation.	1 = No tidal restriction, low salt marsh migration potential, full TAOP, no change to vegetation 5 = Severe tidal restriction, no TAOP, high salt marsh migration potential, change to vegetation.
Overall Combined	Rolled-up score combining: Structure Condition, Tidal Restriction, Salt Marsh Migration, Vegetation, and Inundation Risk.	1 = Good condition, limited tidal restriction, full TAOP, low salt marsh migration potential, no change to vegetation, low inundation risk. 5 = Poor condition, severe tidal restriction, No TAOP, high salt marsh migration potential, change to vegetation, high inundation risk

US: Upstream, DS: Downstream

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority

**Inundation Risk to Low Lying Infrastructure Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk.

Appendix E: Crossing Score Table

CROSSING ID	Crossing Condition Score	Tidal Range Ratio Score	Crossing Ratio Score	Erosion Classification Score	Tidal Restriction Overall Score	Tidal Aquatic Organism Passage Score	Salt Marsh Migration Potential Watershed Score	Salt Marsh Migration Potential Evaluation Unit Score	Vegetation Comparison Score	Innundation Risk to Roadway Score	Innundation Risk to Crossing Structure Score	Innundation Risk to Low-Lying Development Score	*Overall Infrastructure Score*	*Overall Ecological Score*	*Overall Combined Score*
1	1	1	5	3	3	1	5	3	1	4	3	2	4	3	3
3	1	1	4	4	3	1	5	1	3	3	5	4	3	3	3
4	4	5	5	4	5	5	5	5	1	5	5	4	5	5	5
5	2	1	5	1	2	1	1	1	1	4	3	5	4	1	3
6	2	1	3	3	2	1	4	4	3	4	2	5	4	3	3
7	1	4	3	4	4	4	2	2	0	3	3	5	3	4	3
8	5	1	5	3	3	1	1	1	1	3	5	1	5	3	4
9	5	3	5	3	4	3	2	2	1	4	5	1	5	3	4
10	1	2	5	3	3	2	3	2	1	3	5	1	3	3	3
11	5	1	4	4	3	1	3	3	5	4	5	1	5	4	4
12	2	3	3	4	3	3	1	1	3	4	4	1	4	3	3
13	4	3	3	3	3	3	2	1	3	5	4	1	5	3	4
14	2	1	3	4	3	1	5	5	1	3	3	1	2	1	3
15	5	1	4	0	3	1	5	5	5	5	5	1	5	4	5
16	3	5	3	5	4	5	1	1	0	3	3	5	3	5	3
17	2	1	1	1	1	1	5	5	0	3	5	4	2	4	3
18	1	1	4	3	3	1	5	5	3	1	1	1	1	3	2
19	5	4	4	4	4	4	1	1	4	3	4	5	5	4	4
20	4	4	4	5	4	4	4	4	1	5	5	5	5	4	4
21	2	5	4	3	4	5	1	1	4	1	2	5	2	5	4
22	2	1	4	4	3	1	5	5	1	4	2	5	4	3	3
23	3	3	1	4	3	3	1	1	3	2	3	5	3	3	3
24	1	4	3	5	4	4	5	5	0	1	3	5	1	5	5
25	5	3	4	4	4	3	5	4	3	4	5	5	5	3	4
26	5	1	4	4	3	1	5	5	1	3	3	4	5	3	4
28	5	2	5	3	3	2	5	5	1	5	5	4	5	3	5
29	5	2	3	4	3	2	5	4	1	4	2	5	5	3	4
30	5	2	5	1	3	2	5	5	1	1	5	5	5	1	4
31	1	1	1	3	2	1	5	5	5	1	1	5	1	4	2
32	2	1	1	5	2	1	1	1	3	1	5	0	2	3	2
33	5	1	5	5	4	1	4	4	3	2	5	5	5	3	4
34	1	1	1	5	2	1	1	1	0	2	2	5	1	4	2
35	1	3	3	4	3	3	5	5	0	3	5	5	3	4	3
36	1	5	3	4	4	5	5	5	1	5	5	3	5	5	5
37	3	1	4	5	3	1	2	1	0	2	1	4	3	4	3
38	3	5	4	5	5	5	2	2	1	2	1	4	3	5	3
39	2	5	5	2	4	5	5	3	1	5	5	2	5	5	5
40	2	5	5	3	4	5	5	3	1	4	5	2	4	5	5
41	3	3	5	3	4	3	4	4	5	3	3	5	3	4	3
42	4	1	5	4	3	1	4	4	0	4	5	5	4	4	4
43	4	3	4	4	4	3	3	3	3	3	4	5	4	3	3
44	2	5	5	0	5	5	5	5	1	5	3	5	5	5	5
45	1	1	1	4	2	1	4	4	4	2	4	1	1	4	2
46	4	1	4	4	3	1	5	1	3	2	4	1	4	3	3
47	1	1	2	4	2	1	5	5	1	4	4	1	4	1	3
48	5	5	4	4	4	5	5	5	1	4	4	1	5	5	5
49	2	1	4	4	3	1	5	5	1	4	1	1	4	3	3
50	1	1	3	4	3	1	5	5	1	3	1	2	3	1	3
51	1	1	2	1	1	1	5	5	1	3	1	1	3	1	3
52	1	1	1	4	2	1	4	4	3	4	4	5	4	3	3
53	1	1	2	5	3	1	5	1	1	5	4	1	5	1	3
54	1	1	1	2	1	1	5	5	1	4	4	1	4	1	3
55	1	1	3	3	2	1	1	1	1	3	4	2	3	1	3
56	1	1	3	4	3	1	3	3	3	4	4	2	4	3	3
57	2	5	5	2	4	5	5	5	5	4	4	5	4	5	5

Appendix E: Crossing Score Table

58	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*
59	1	1	1	3	2	1	5	3	1	4	1	4	4	1	3
60	1	1	4	3	3	1	5	5	1	2	1	5	1	1	2
61	2	1	5	4	3	1	5	5	0	3	5	5	2	4	3
62	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*
63	4	3	3	3	3	3	3	3	0	3	4	4	4	4	3
64	1	3	2	5	3	3	4	4	4	3	5	3	3	4	3
65	4	5	4	3	4	5	2	2	5	2	5	5	4	5	5
66	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*
67	1	3	3	3	3	3	5	5	1	2	1	3	1	3	3
68	4	1	1	1	1	1	4	4	1	*Null*	3	5	4	1	3
69	3	1	5	1	2	1	5	4	1	3	1	1	3	1	3
70	5	2	5	4	4	2	5	5	1	2	5	5	5	3	4
71	5	4	5	4	4	4	5	5	1	3	5	5	5	5	5
72	2	5	4	3	4	5	1	1	5	2	3	5	2	5	5
73	5	3	5	0	4	3	5	5	1	2	2	1	5	5	5
74	2	1	2	3	2	1	3	3	1	2	2	5	2	3	2
75	1	1	3	3	2	1	5	5	1	1	1	1	1	1	2
76	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*
78	2	1	3	3	2	1	5	5	1	1	1	1	2	1	2
79	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*
80	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*
81	5	2	3	5	3	2	1	1	5	1	5	5	5	4	4
82	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*
83	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*
84	5	3	3	3	3	3	1	1	0	1	1	5	5	4	4
85	5	3	5	4	4	3	1	1	0	1	4	5	5	4	4
86	1	5	5	0	5	5	5	5	5	1	1	5	1	5	5
87	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*
89	4	5	4	4	4	5	3	1	5	1	1	5	4	5	5
90	2	3	3	4	3	3	3	1	0	1	3	5	2	4	3
91	2	1	5	3	3	1	3	3	0	2	2	5	2	4	2
92	5	5	4	5	5	5	1	1	1	1	1	5	5	5	4
93	5	1	2	5	3	1	4	4	5	3	2	5	5	4	4
94	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*
95	1	1	3	4	3	1	5	4	1	1	1	5	1	1	2
96	5	1	5	4	3	1	2	2	4	5	1	5	5	4	5
97	2	5	5	0	5	5	5	5	0	1	5	5	2	5	5
98	2	3	3	4	3	3	1	1	1	1	1	5	2	3	3
99	1	1	4	1	2	1	4	4	3	2	1	2	1	3	2
100	5	5	5	5	5	5	1	1	5	3	3	5	5	5	5
101	1	1	5	5	4	1	1	1	0	2	5	5	1	4	2
102	1	2	4	4	3	2	1	1	4	1	1	5	1	4	3
103	4	3	4	5	4	3	2	2	1	2	3	5	4	3	3
104	5	2	5	5	4	2	1	1	3	2	4	5	5	3	4
105	5	1	3	3	2	1	4	4	3	1	1	5	5	3	4
106	5	1	4	3	3	1	1	1	3	1	5	5	5	3	4
107	1	1	1	4	2	1	3	3	4	1	1	5	1	4	2
108	5	3	5	5	4	3	1	1	3	2	4	5	5	4	4
109	2	1	5	0	3	1	5	5	4	3	4	5	2	4	3
110	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*
111	5	3	5	4	4	3	1	1	1	1	3	5	5	3	4
112	4	3	5	5	4	3	1	1	5	1	4	5	4	5	5
113	5	1	5	5	4	1	3	3	4	4	5	5	5	4	4
114	2	1	4	5	3	1	4	4	3	2	5	5	2	3	3
115	4	1	3	4	3	1	5	5	3	4	4	5	4	3	4
116	1	2	3	2	2	2	1	1	0	2	2	5	1	4	2
117	4	2	4	4	3	2	3	3	3	2	3	5	4	3	3
118	2	2	4	3	3	2	1	1	5	1	4	5	2	4	2

Appendix E: Crossing Score Table

119	5	3	4	3	3	3	1	1	0	1	5	5	5	4	4
120	5	3	3	5	4	3	1	1	1	1	2	5	5	3	4
121	5	1	4	5	3	1	1	1	0	1	5	5	5	4	4
122	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*	*Null*
123	1	3	2	3	3	3	1	1	0	1	1	5	1	4	3
124	1	1	4	3	3	1	2	2	5	3	5	5	3	4	3
125	4	1	4	3	3	1	4	4	1	4	5	5	4	1	4
126	2	5	5	2	4	5	5	5	1	4	5	2	4	5	5
127	2	5	3	4	4	5	1	1	5	4	5	4	4	5	5
128	1	5	5	3	4	5	5	5	4	2	3	5	1	5	5
129	2	3	2	4	3	3	5	5	1	2	3	3	2	3	3
130	2	2	1	5	3	2	5	5	1	2	3	3	2	1	2
131	2	5	3	5	4	5	1	1	3	3	3	5	2	5	3
132	1	4	3	3	3	4	2	2	1	5	5	5	5	4	3
133	5	5	5	3	4	5	1	1	4	1	5	5	5	5	4
134	5	3	5	5	4	3	1	1	0	3	5	5	5	4	4

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 1

Observer(s) & Organization:	TS, JB (NHDES Coastal)
Municipality:	SEABROOK
Stream Name:	Blackwater River
Road Name:	Route 286

Date:	8/13/2018	
Start Time:	7:45:00 AM	
End Time:	12:00:00 AM	
Tide Prediction	**High**	**Low**
Time:	1:34 PM	7:37 AM
Elevation:	9.7	-1.5
Tide Chart Location:	Hampton Harbor	

Crossing Condition Evaluation	Score*
Crossing Condition	1
Tidal Restriction Evaluation	
Tidal Range Ratio	1
Crossing Ratio	5
Erosion Classification	3
Tidal Restriction Overall Score	3
Tidal Aquatic Organism Passage	
Tidal Range Ratio	1
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	3
Salt Marsh Migration Potential (Wshed.)	5
Vegetation Evaluation	
Vegetation Comparison Matrix	1
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	2,4
Inun. Risk to the Crossing Structure (US, DS)	2,3
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	2

DS view toward structure

US view above structure

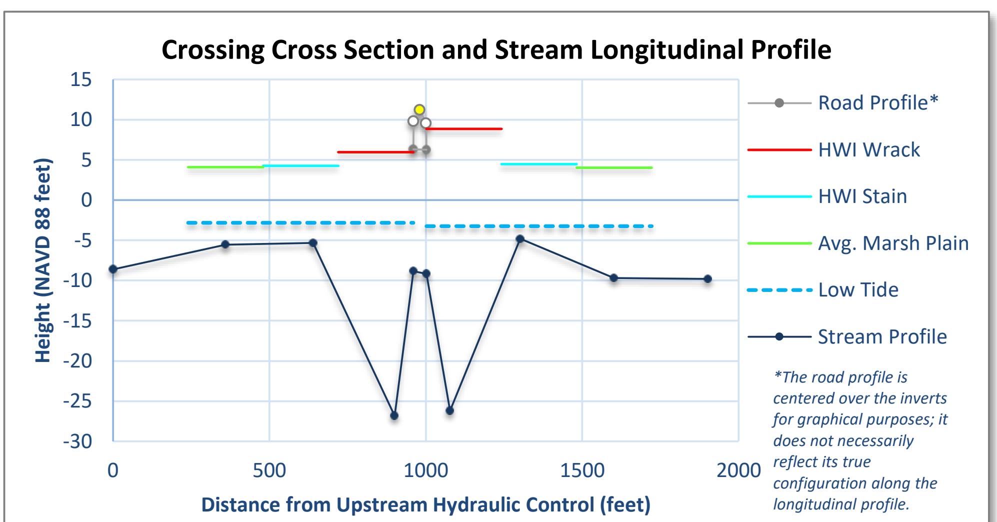
US view toward structure

DS view above structure

Overall Scores

Infrastructure	4
Ecological	3
Combined	3

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority
**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk



Long. Profile

Dist.	Hght.	Feat.	Sub.
0	-8.6323	CB	S
360	-5.5323	CB	S
640	-5.3323	HC	S
900	-26.832	P	S
960	-8.8423	I	B
1002	-9.1923	I	B
1077	-26.202	P	G
1302	-4.8023	HC	C
1602	-9.7023	P	G
1902	-9.8023	CB	C/S

Crossing Context:

N/A

Structure Characteristics:

Structure Type:	Bridge with Side Slopes and Abutments	**Date of Last Known Replacement:**	N/A
Structure Material:	Concrete		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	90	90
Dimension B^{CB}(height):	15.16	15.45
Crossing Length (Invert to Invert):	42	

Crossing Condition:	Headwall Material	Headwall Condition	Wingwall Material	Wingwall Condition	Scour at Structure	Scour Severity
Upstream	None	N/A	Rip Rap	Good	Armoring	Medium
Downstream	None	N/A	Rip Rap	Good	Armoring	Medium

Scour in Structure	Scour Severity in Structure	Road Surface Condition	Utilities at Crossing	Structure Condition Overall
None	None	Good	Gas pipeline, overhead electric, tel poles in marsh	Good

Structure Condition Comments:	N/A

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	High Salt Marsh	High Salt Marsh
Upstream Salt Marsh Migration Potential (acres):	79.35	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	Yes
Emergency Access or Evacuation Route:	Yes
History of Flooding:	1.4.2018 Road Closed due to flooding

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 3

Observer(s) & Organization:	JB (NHDES Coastal)
Municipality:	SEABROOK
Stream Name:	N/A
Road Name:	Route 286

Date:	8/10/2018	
Start Time:	4:00:00 PM	
End Time:	5:30:00 PM	
Tide Prediction	**High**	**Low**
Time:	10:11 PM	4:10 PM
Elevation:	10.2	0.0
Tide Chart Location:	Hampton Harbor	

Crossing Condition Evaluation	Score*
Crossing Condition	1
Tidal Restriction Evaluation	
Tidal Range Ratio	1
Crossing Ratio	4
Erosion Classification	4
Tidal Restriction Overall Score	3
Tidal Aquatic Organism Passage	
Tidal Range Ratio	1
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	1
Salt Marsh Migration Potential (Wshed.)	5
Vegetation Evaluation	
Vegetation Comparison Matrix	3
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	2,3
Inun. Risk to the Crossing Structure (US, DS)	5,5
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	4
Overall Scores	
Infrastructure	3
Ecological	3
Combined	3

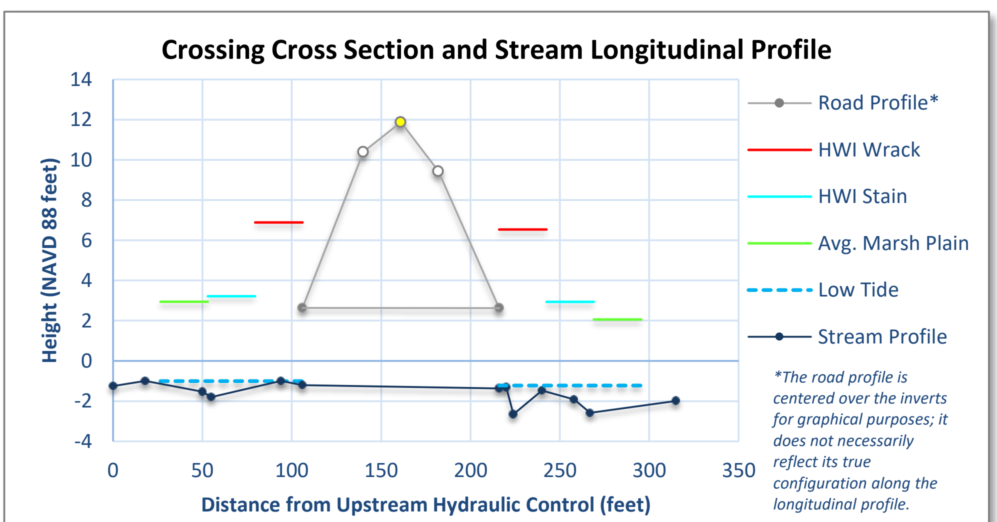
DS view toward structure

US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority
**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk



Long. Profile

Dist.	Hght.	Feat.	Sub.
0	-1.2434	HC	G
18	-0.9934	CB	G
50	-1.5334	CB	C/S
55	-1.8034	P	C/S
94	-0.9934	HC	G
106	-1.2034	I	S
216	-1.3634	I	G
220	-1.3034	GC	B
224	-2.6534	P	G
240	-1.4734	HC	C
258	-1.9234	CB	G
267	-2.5834	P	G
315	-1.9934	HC	G

Crossing Context:

N/A

Structure Characteristics:

Structure Type:	Box Culvert	**Date of Last Known Replacement:**	N/A
Structure Material:	Concrete		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	5	4
Dimension B[CB] (height):	3.95	4
Crossing Length (Invert to Invert):	110	

Crossing Condition:	Headwall Material	Headwall Condition	Wingwall Material	Wingwall Condition	Scour at Structure	Scour Severity
Upstream	Concrete	Good	Concrete	Fair	Wingwalls	Low
Downstream	Concrete	Good	Concrete	Good	Wingwalls	Low

Scour in Structure	Scour Severity in Structure	Road Surface Condition	Utilities at Crossing	Structure Condition Overall
Culvert	Low	Good	OHE	Good

Structure Condition Comments:	N/A

Ecological Assessment:

	Upstream	Downstream
Natural Community Classification:	High Salt Marsh	High Salt Marsh
Upstream Salt Marsh Migration Potential (acres):	15.81	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	No
Emergency Access or Evacuation Route:	Yes
History of Flooding:	Unknown

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 4

Observer(s) & Organization:	TS, KL (NHDES Coastal)
Municipality:	SEABROOK
Stream Name:	N/A
Road Name:	South Main St

Date:	8/9/2018	
Start Time:	3:30:00 PM	
End Time:	4:45:00 AM	
Tide Prediction	**High**	**Low**
Time:	10:11 PM	4:10 PM
Elevation:	10.2	0.0
Tide Chart Location:	Hampton Harbor	

Evaluation	Score*
Crossing Condition Evaluation	
Crossing Condition	4
Tidal Restriction Evaluation	
Tidal Range Ratio	5
Crossing Ratio	5
Erosion Classification	4
Tidal Restriction Overall Score	5
Tidal Aquatic Organism Passage	
Tidal Range Ratio	5
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	5
Salt Marsh Migration Potential (Wshed.)	5
Vegetation Evaluation	
Vegetation Comparison Matrix	1
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	4,5
Inun. Risk to the Crossing Structure (US, DS)	4,5
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	4
Overall Scores	
Infrastructure	5
Ecological	5
Combined	5

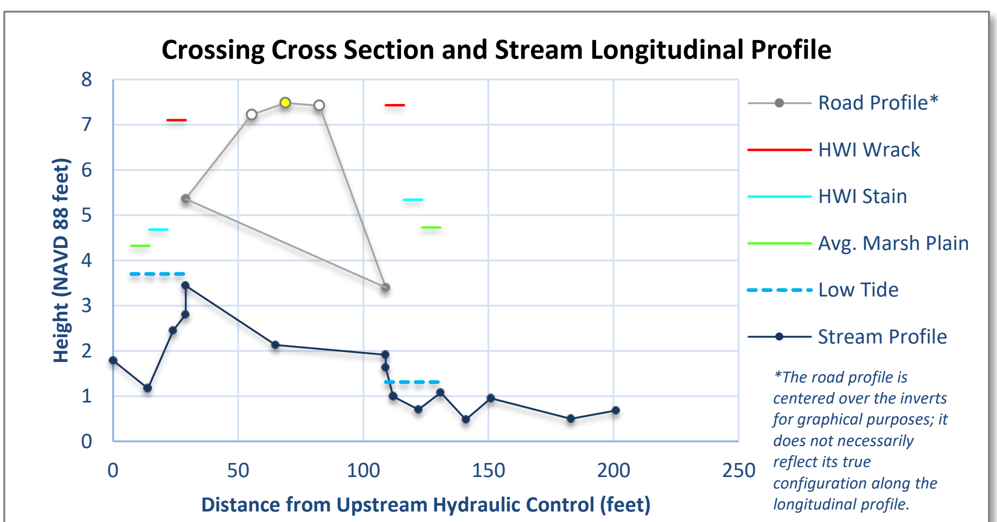
DS view toward structure

US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority
**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk



Long. Profile

Dist.	Hght.	Feat.	Sub.
0	1.7903	CB	C/S
14	1.1703	P	G
24	2.4503	CB	G
29	2.8103	CB	S
29	3.4403	I	S
65	2.1303	CB	S
109	1.9103	I	B
109	1.6303	GC	B
112	0.9903	CB	G
122	0.7003	P	G
131	1.0803	HC	G
141	0.4803	P	G
151	0.9503	HC	G
183	0.5003	CB	G
201	0.6803	HC	G

Crossing Context:

A pipe running under South Main Street in Seabrook conducts very limited tides to a small square marsh surrounded by a moat dredged at its edge which in turn is surrounded by a berm. The marsh was used to pasture horses without need for any fencing (moat) according to Sue Foote, long-time resident. The undersized crossing shows erosion, poor opportunity for organism passage and poses some risk to flooding the roadway, with an overall combined score of 5: highest priority for restoration.

Structure Characteristics:

Structure Type:	Round Culvert	**Date of Last Known Replacement:**	N/A
Structure Material:	Plastic - Smooth		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	2	1.5
Dimension B^{CB}(height):	2	1.5
Crossing Length (Invert to Invert):	80	

Crossing Condition:	Headwall Material	Headwall Condition	Wingwall Material	Wingwall Condition	Scour at Structure	Scour Severity
Upstream	Rip Rap	Poor	Rip Rap	Poor	Wingwalls	Medium
Downstream	None	N/A	Rip Rap	Fair	Culvert	Medium

Scour in Structure	Scour Severity in Structure	Road Surface Condition	Utilities at Crossing	Structure Condition Overall
None	None	Good	Overhead electric, tel pole in marsh	Fair

Structure Condition Comments:	Two separate structures connected in sewer

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	High Salt Marsh	High Salt Marsh
Upstream Salt Marsh Migration Potential (acres):	15.20	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	No
Emergency Access or Evacuation Route:	N/A
History of Flooding:	Unknown

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 5

Observer(s) & Organization:	TS, JB (NHDES Coastal)
Municipality:	SEABROOK
Stream Name:	N/A
Road Name:	Cross Beach Rd

Date:	8/6/2018	
Start Time:	1:00:00 PM	
End Time:	1:35:00 PM	
Tide Prediction	**High**	**Low**
Time:	7:10 PM	1:08 PM
Elevation:	9.1	0.6
Tide Chart Location:	Hampton Harbor	

	Score*
Crossing Condition Evaluation	
Crossing Condition	2
Tidal Restriction Evaluation	
Tidal Range Ratio	1
Crossing Ratio	5
Erosion Classification	1
Tidal Restriction Overall Score	2
Tidal Aquatic Organism Passage	
Tidal Range Ratio	1
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	1
Salt Marsh Migration Potential (Wshed.)	1
Vegetation Evaluation	
Vegetation Comparison Matrix	1
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	3,4
Inun. Risk to the Crossing Structure (US, DS)	3,3
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	5
Overall Scores	
Infrastructure	4
Ecological	1
Combined	3

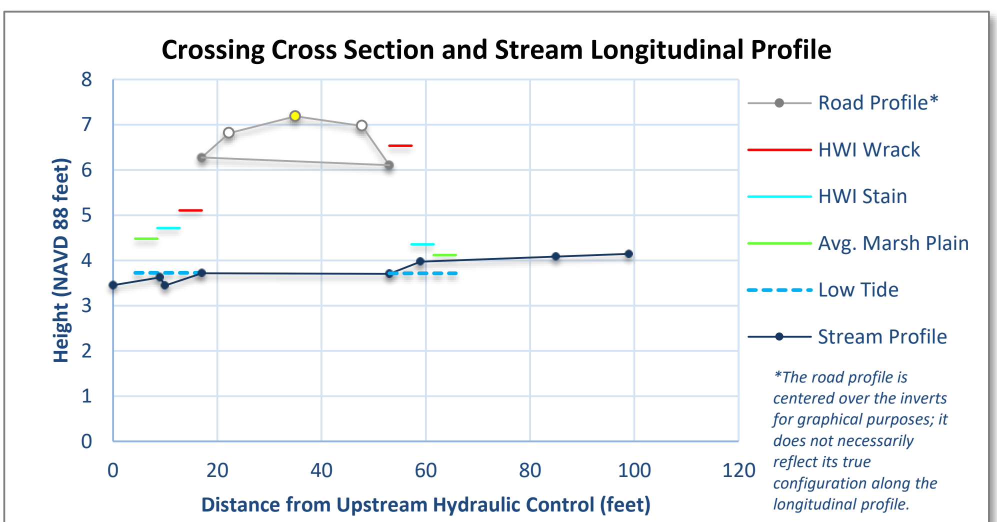
DS view toward structure

US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority
**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk



Long. Profile

Dist.	Hght.	Feat.	Sub.
0	3.455	HC	S
9	3.625	HC	C/S
10	3.445	CB	G
17	3.715	I	G
53	3.705	I	G
59	3.975	HC	G
85	4.085	CB	C/S
99	4.145	HC	C/S

Crossing Context:

N/A

Structure Characteristics:

Structure Type:	Round Culvert	**Date of Last Known Replacement:**	N/A
Structure Material:	Plastic - Smooth		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	2.5	2.5
Dimension B[CB](height):	2.5	2.5
Crossing Length (Invert to Invert):	36	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	None	N/A	Rip Rap	Fair	None	None
Downstream	None	N/A	Rip Rap	Fair	Wingwalls	Low

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
None	None	Fair	Overhead electric	Fair

Structure Condition Comments:	N/A

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	High Salt Marsh	High Salt Marsh
Upstream Salt Marsh Migration Potential (acres):	0.40	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	Yes
Emergency Access or Evacuation Route:	N/A
History of Flooding:	Road floods during storm tides

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 6

Observer(s) & Organization:	JB TS (NHDES Coastal)	**Date:**	8/15/2018		
		Start Time:	10:45:00 AM		
Municipality:	SEABROOK	**End Time:**	12:00:00 PM		
Stream Name:	Cains Brook	**Tide Prediction**		**High**	**Low**
Road Name:	Causeway St		**Time:**	4:19 PM	9:20 AM
			Elevation:	9.5	-0.9
		Tide Chart Location:		Hampton Harbor	

	Score*
Crossing Condition Evaluation	
Crossing Condition	2
Tidal Restriction Evaluation	
Tidal Range Ratio	1
Crossing Ratio	3
Erosion Classification	3
Tidal Restriction Overall Score	2
Tidal Aquatic Organism Passage	
Tidal Range Ratio	1
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	4
Salt Marsh Migration Potential (Wshed.)	4
Vegetation Evaluation	
Vegetation Comparison Matrix	3
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	3,4
Inun. Risk to the Crossing Structure (US, DS)	2,2
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	5
Overall Scores	
Infrastructure	4
Ecological	3
Combined	3

DS view toward structure

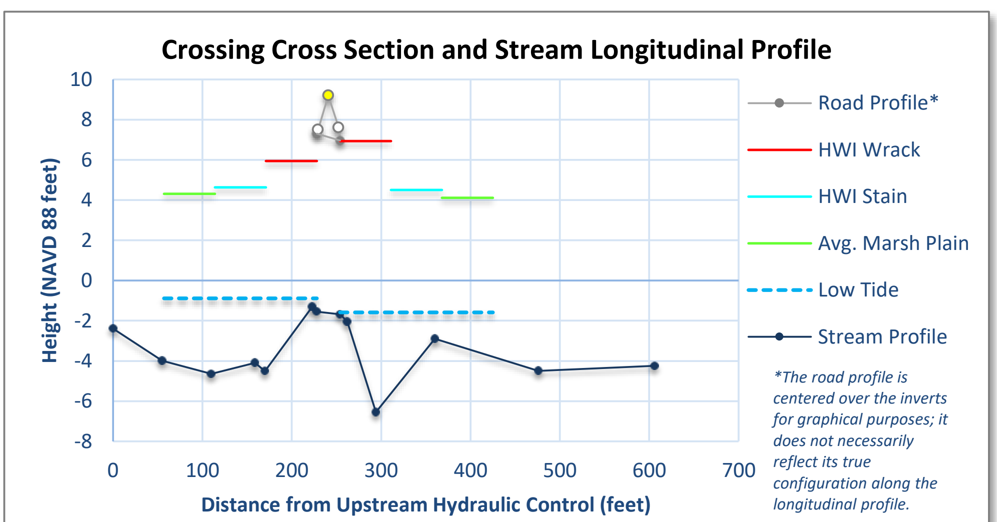
US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority

**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk



Long. Profile

Dist.	Hght.	Feat.	Sub.
0	-2.3972	HC	C/S
55	-3.9972	P	S
110	-4.6372	CB	C/S
159	-4.0972	HC	G
170	-4.5172	P	C
223	-1.3072	GC	B
228	-1.5472	I	C
254	-1.6772	I	C
262	-2.0472	GC	B
294	-6.5472	P	C
360	-2.8972	HC	G
476	-4.4972	P	C/S
606	-4.2472	HC	S

Crossing Context:

Cains Brook has two tidally influenced road crossings (crossing ID #6 and #7). The lower one is a bridge at Causeway Street where a dredged channel under the current bridge replaced a sinuous tidal creek to the south. The overall restriction score is 3, moderate priority. A combination of soil disturbance, restrictions and freshwater sources allowed common reed (*Phragmites australis* , an invasive weedy grass) to colonize the marsh on both sides of the crossing and the upstream marsh was the site of a long-term *Phragmites* control project that did not use herbicide.

Structure Characteristics:

Structure Type:	Bridge with Side Slopes and Abutments	**Date of Last Known Replacement:**	N/A
Structure Material:	Concrete		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	40	40
Dimension B[CB](height):	8.75	8.6
Crossing Length (Invert to Invert):	26	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	None	N/A	Rip Rap	Fair	Wingwalls	Low
Downstream	None	N/A	Rip Rap	Fair	Wingwalls	Low

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
None	None	Good	Sewer line parallel to rd US & DS	Fair

Structure Condition Comments:	N/A

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	High Salt Marsh	High Salt Marsh
Upstream Salt Marsh Migration Potential (acres):	8.00	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	No
Emergency Access or Evacuation Route:	N/A
History of Flooding:	Unknown

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 7

Observer(s) & Organization:	TS, KL (NHDES Coastal)
Municipality:	SEABROOK
Stream Name:	Cains Brook
Road Name:	N/A

Date:	8/8/2018	
Start Time:	3:50:00 PM	
End Time:	5:00:00 PM	
Tide Prediction	**High**	**Low**
Time:	9:11 PM	3:10 PM
Elevation:	9.8	0.3
Tide Chart Location:	Portsmouth Harbor	

Crossing Condition Evaluation	Score*
Crossing Condition	1
Tidal Restriction Evaluation	
Tidal Range Ratio	4
Crossing Ratio	3
Erosion Classification	4
Tidal Restriction Overall Score	4
Tidal Aquatic Organism Passage	
Tidal Range Ratio	4
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	2
Salt Marsh Migration Potential (Wshed.)	2
Vegetation Evaluation	
Vegetation Comparison Matrix	0
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	2,3
Inun. Risk to the Crossing Structure (US, DS)	2,3
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	5
Overall Scores	
Infrastructure	3
Ecological	4
Combined	3

DS view toward structure

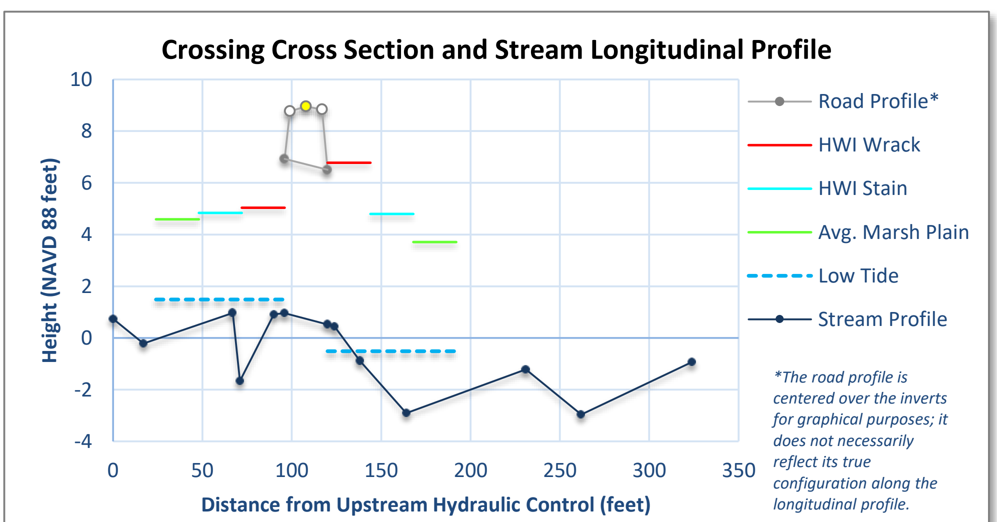
US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority

**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk



Long. Profile

Dist.	Hght.	Feat.	Sub.
0	0.7367	HC	S
17	-0.2133	P	S
67	0.9667	HC	S
71	-1.6633	P	S
90	0.9167	GC	B
96	0.9567	I	B
120	0.5267	I	B
124	0.4367	GC	B
138	-0.8833	CB	C
164	-2.9133	P	C
231	-1.2133	HC	C/S
262	-2.9633	P	C/S
324	-0.9333	HC	C/S

Crossing Context:

The upper tidal crossing at Cains Brook was restored in the mid 1990s by adding a concrete box culvert alongside the existing perched pipe, which still exists. The overall combined score is 3, moderate priority, because tides and organism passage appear to be partially restricted, there are signs of erosion and inundation risk to the structure is moderate. Above this crossing the marsh is brackish with cattail dominant and soon becomes fresh, but *Phragmites* has begun to invade this marsh (two colonies in 2016).

Structure Characteristics:

Structure Type:	Box Culvert	**Date of Last Known Replacement:**	N/A
Structure Material:	Concrete		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	10	10
Dimension B^{CB}(height):	6	6
Crossing Length (Invert to Invert):	24	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	Concrete	Good	Rip Rap	Fair	Wingwalls	Medium
Downstream	Concrete	Good	None	N/A	Armoring	Medium

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
None	None	Fair	Overhead electric. Smells of sewer.	Good

Structure Condition Comments:	N/A

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	High Salt Marsh	High Salt Marsh
Upstream Salt Marsh Migration Potential (acres):	1.64	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	No
Emergency Access or Evacuation Route:	N/A
History of Flooding:	Unknown

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 8

Observer(s) & Organization:	TS, JB (NHDES Coastal)
Municipality:	HAMPTON
Stream Name:	N/A
Road Name:	Brown Ave

Date:	7/30/2018	
Start Time:	8:00:00 AM	
End Time:	9:00:00 AM	
Tide Prediction	**High**	**Low**
Time:	2:00 PM	8:00 AM
Elevation:	8.0	0.2
Tide Chart Location:	Hampton Harbor	

	Score*
Crossing Condition Evaluation	
Crossing Condition	5
Tidal Restriction Evaluation	
Tidal Range Ratio	1
Crossing Ratio	5
Erosion Classification	3
Tidal Restriction Overall Score	3
Tidal Aquatic Organism Passage	
Tidal Range Ratio	1
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	1
Salt Marsh Migration Potential (Wshed.)	1
Vegetation Evaluation	
Vegetation Comparison Matrix	1
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	3,2
Inun. Risk to the Crossing Structure (US, DS)	5,5
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	1
Overall Scores	
Infrastructure	5
Ecological	3
Combined	4

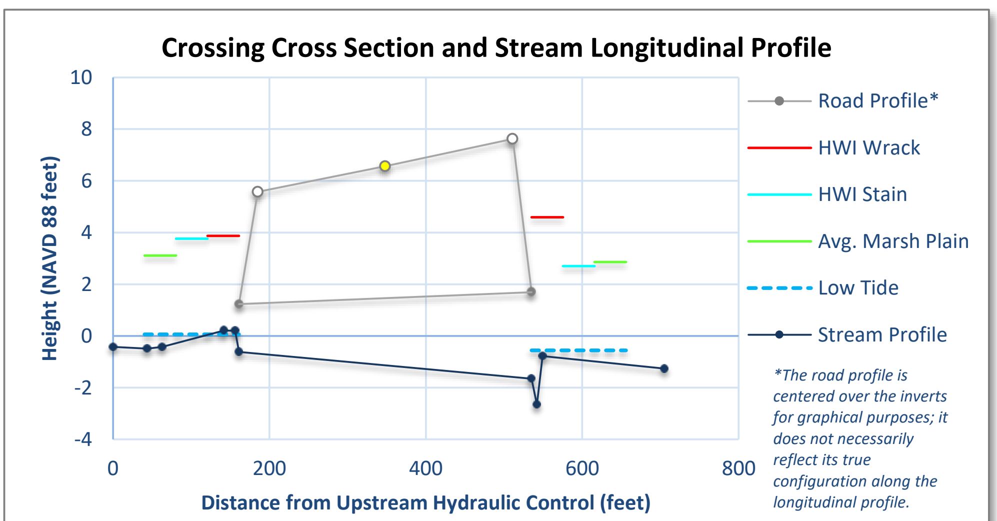
DS view toward structure

US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority
**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk

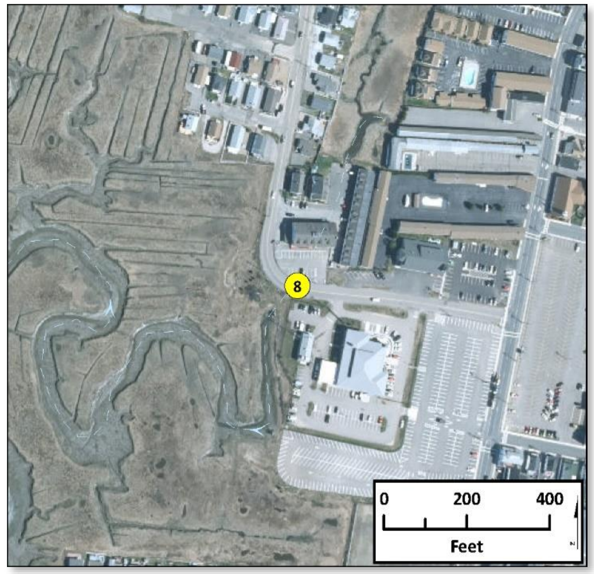


Long. Profile

Dist.	Hght.	Feat.	Sub.
0	-0.4183	HC	C/S
44	-0.4883	HC	C/S
63	-0.4183	HC	C/S
142	0.2117	HC	G
156	0.2017	GC	B
161	-0.6183	I	C
535.2	-1.6483	I	C
542.2	-2.6583	P	C
549.2	-0.7783	HC	C
705.2	-1.2583	HC	G

Crossing Context:

Brown Avenue crosses three tidal creeks (#8, 9, 10) providing tides to small marsh areas surrounded by development in Hampton. This crossing leads to the largest of the marsh areas where the upper portion has been filled for a parking lot. The tide is conducted by a 4-foot round culvert, which operates at a much lower capacity since the upstream side is crushed. The crossing condition is poor, and the culvert constricts the channel. The overall combined score is a 4, high priority for replacement.



Structure Characteristics:

Structure Type:	Round Culvert	**Date of Last Known Replacement:**	N/A
Structure Material:	Plastic - Corrugated		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	4.1	3.9
Dimension B[CB](height):	1.9	3.1
Crossing Length (Invert to Invert):	374.2	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	Concrete	Poor	None	N/A	Headwall	High
Downstream	Rip Rap	Fair	None	N/A	Headwall	Medium

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
None	None	Fair	Overhead electric	Poor

Structure Condition Comments:	Tide gate next to DS structure, see photo. US metal corrugated pipe.

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	Low Salt Marsh	High Salt Marsh
Upstream Salt Marsh Migration Potential (acres):	0.83	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	Yes
Emergency Access or Evacuation Route:	N/A
History of Flooding:	Flooded up to 1/2 foot water at time of high tide

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 9

Observer(s) & Organization:	TS, JB (NHDES Coastal)	**Date:**	7/19/2018		
Municipality:	HAMPTON	**Start Time:**	11:45:00 AM		
Stream Name:	N/A	**End Time:**	12:28:00 PM		
Road Name:	Brown Ave	**Tide Prediction**		**High**	**Low**
			Time:	5:40 PM	11:36 AM
			Elevation:	9.1	-0.2
		Tide Chart Location:	Hampton Harbor		

Crossing Condition Evaluation	Score*
Crossing Condition	5
Tidal Restriction Evaluation	
Tidal Range Ratio	3
Crossing Ratio	5
Erosion Classification	3
Tidal Restriction Overall Score	4
Tidal Aquatic Organism Passage	
Tidal Range Ratio	3
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	2
Salt Marsh Migration Potential (Wshed.)	2
Vegetation Evaluation	
Vegetation Comparison Matrix	1
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	3,4
Inun. Risk to the Crossing Structure (US, DS)	5,5
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	1
Overall Scores	
Infrastructure	5
Ecological	3
Combined	4

DS view toward structure

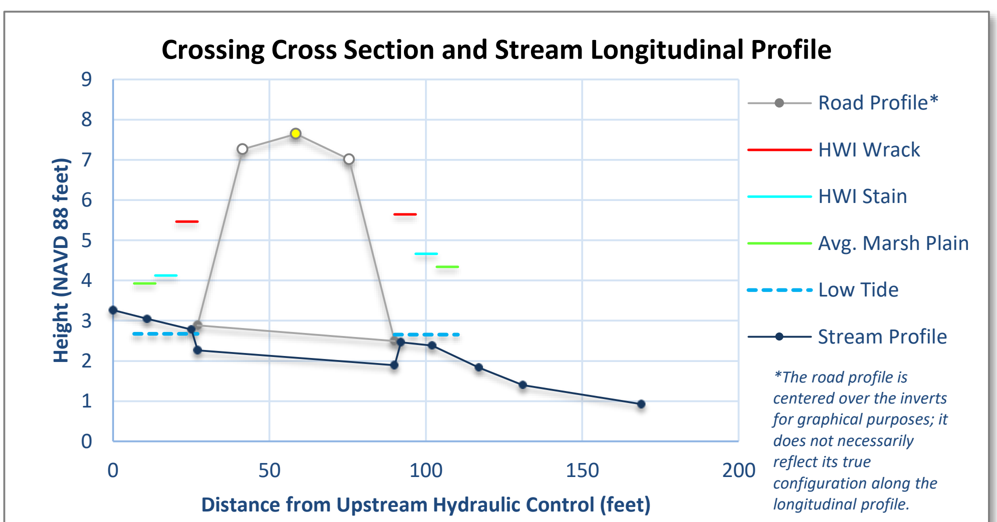
US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority

**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk



Long. Profile

Dist.	Hght.	Feat.	Sub.
0	3.2644	HC	C
11	3.0444	HC	C
25	2.7844	HC	G
27	2.2644	I	C
90	1.8944	I	C
92	2.4644	CB	G
102	2.3844	GC	G
117	1.8344	HC	G
131	1.3944	CB	G
169	0.9244	HC	G

Crossing Context:

Brown Avenue crosses three tidal creeks (#8, 9, 10) providing tides to small marsh areas surrounded by development in Hampton. This crossing leads to the smallest of the marsh areas. The crossing condition is poor, the channel is severely restricted, and the 2-foot round culvert is largely buried by sediment, further restricting the tide. The upstream marsh plain appears to have subsided about 0.4 feet. The overall combined score is 4, high priority for replacement.

Structure Characteristics:

Structure Type:	Round Culvert	**Date of Last Known Replacement:**	N/A
Structure Material:	Steel - Corrugated		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	0.8	2
Dimension B^{CB}(height):	0.4	0.4
Crossing Length (Invert to Invert):	63	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	Rip Rap	Poor	None	N/A	Headwall	Medium
Downstream	Rip Rap	Poor	None	N/A	Headwall	High

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
None	None	Fair	Overhead electric, telephone pole near bank	Poor

Structure Condition Comments:	Collapsed inlet and outlet, completely submerged

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	High Salt Marsh	High Salt Marsh
Upstream Salt Marsh Migration Potential (acres):	1.30	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	Yes
Emergency Access or Evacuation Route:	N/A
History of Flooding:	Flooded up to 1/2 foot water at time of high tide

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 10

Observer(s) & Organization:	JB, TS (NHDES Coastal)
Municipality:	HAMPTON
Stream Name:	N/A
Road Name:	Brown Ave

Date:	7/17/2018	
Start Time:	9:40:00 AM	
End Time:	10:36:00 AM	
Tide Prediction	**High**	**Low**
Time:	3:46 PM	9:45 AM
Elevation:	9.4	-1.1
Tide Chart Location:	Hampton Harbor	

	Score*
Crossing Condition Evaluation	
Crossing Condition	1
Tidal Restriction Evaluation	
Tidal Range Ratio	2
Crossing Ratio	5
Erosion Classification	3
Tidal Restriction Overall Score	3
Tidal Aquatic Organism Passage	
Tidal Range Ratio	2
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	2
Salt Marsh Migration Potential (Wshed.)	3
Vegetation Evaluation	
Vegetation Comparison Matrix	1
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	3,3
Inun. Risk to the Crossing Structure (US, DS)	5,5
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	1
Overall Scores	
Infrastructure	3
Ecological	3
Combined	3

DS view toward structure

US view above structure

US view toward structure

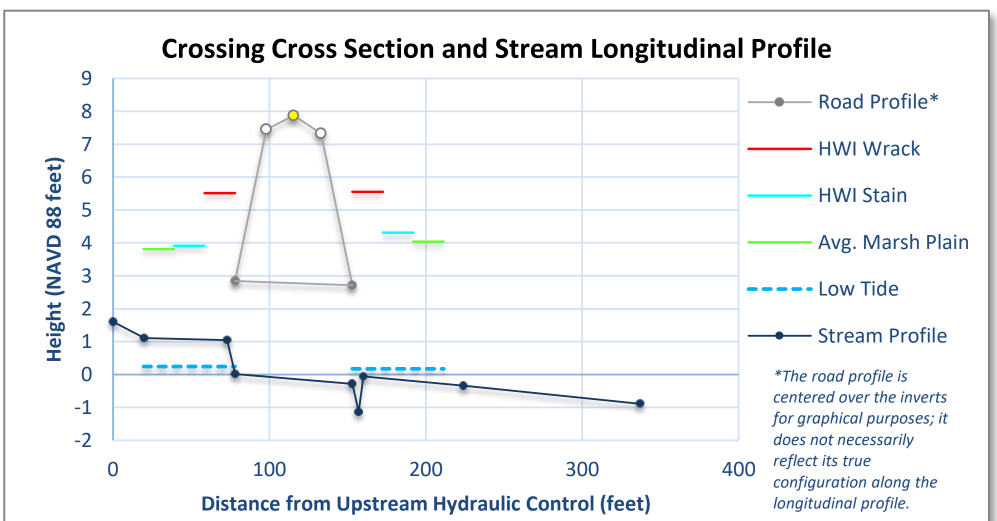
DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority

**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk

Long. Profile

Dist.	Hght.	Feat.	Sub.
0	1.604	HC	G
20	1.114	CB	G
73	1.044	GC	C
78	0.014	I	G
153	-0.286	I	G
157	-1.136	P	G
160	-0.056	HC	G
224	-0.336	HC	G
337	-0.886	HC	C/S



Crossing Context:

N/A

Structure Characteristics:

Structure Type:	Round Culvert	**Date of Last Known Replacement:**	N/A
Structure Material:	Steel - Smooth		
Tide Gate Present:	Yes		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	3	3
Dimension B[CB](height):	3	2.8
Crossing Length (Invert to Invert):	75	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	Concrete	Good	None	N/A	Headwall	Medium
Downstream	Concrete	Good	None	N/A	Culvert	Low

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
None	None	Fair	OHE US	Good

Structure Condition Comments:	N/A

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	High Salt Marsh	High Salt Marsh
Upstream Salt Marsh Migration Potential (acres):	4.73	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	Yes
Emergency Access or Evacuation Route:	N/A
History of Flooding:	Has experienced flooding during high tide events.

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 11

Observer(s) & Organization:	JB TS (NHDES Coastal)	**Date:**	7/17/2018
Municipality:	HAMPTON	**Start Time:**	10:46:00 AM
Stream Name:	N/A	**End Time:**	11:30:00 AM
Road Name:	Highland Ave		

Tide Prediction	**High**	**Low**
Time:	3:46 PM	9:45 AM
Elevation:	9.4	-1.1
Tide Chart Location:	Hampton Harbor	

	Score*
Crossing Condition Evaluation	
Crossing Condition	5
Tidal Restriction Evaluation	
Tidal Range Ratio	1
Crossing Ratio	4
Erosion Classification	4
Tidal Restriction Overall Score	3
Tidal Aquatic Organism Passage	
Tidal Range Ratio	1
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	3
Salt Marsh Migration Potential (Wshed.)	3
Vegetation Evaluation	
Vegetation Comparison Matrix	5
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	4,4
Inun. Risk to the Crossing Structure (US, DS)	4,5
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	1
Overall Scores	
Infrastructure	5
Ecological	4
Combined	4

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority
**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk

DS view toward structure

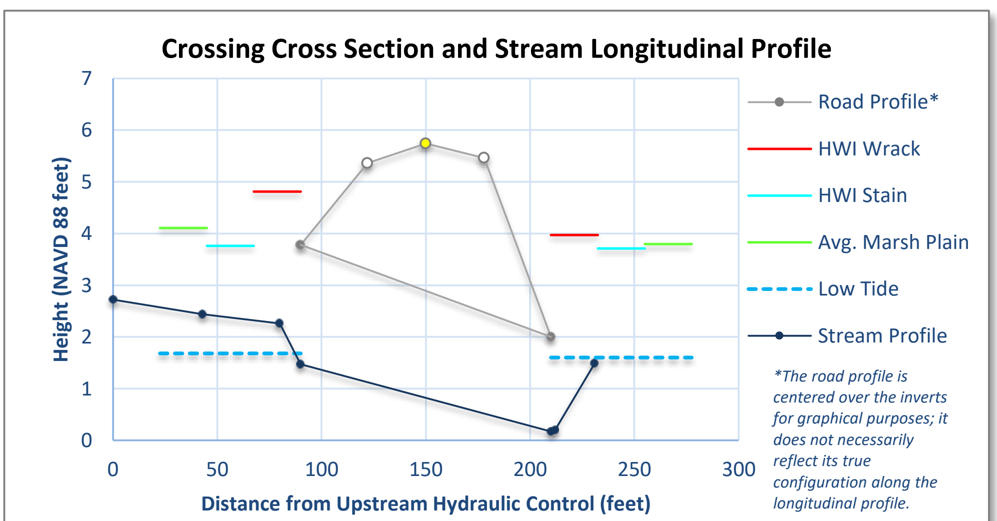
US view above structure

US view toward structure

DS view above structure

Long. Profile

Dist.	Hght.	Feat.	Sub.
0	2.7215	HC	C/S
43	2.4415	HC	C/S
80	2.2615	GC	C
90	1.4715	I	C
210	0.1715	I	C
212	0.2015	P	C
231	1.4915	HC	G



Crossing Context:

One of the small marshes in Hampton surrounded by development depends on the culvert under Highland Avenue in Hampton for its tides. The culvert is a round pipe about 3 feet in diameter, but its capacity is reduced by sediment. The crossing condition is poor, the channel is constrained with signs of erosion at the culvert. The original marsh is mostly filled by development. The overall combined score is 4, high priority for replacement.

Structure Characteristics:

Structure Type:	Round Culvert	**Date of Last Known Replacement:**	N/A
Structure Material:	Steel - Corrugated		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	3.2	3.2
Dimension B[CB](height):	2.5	1.8
Crossing Length (Invert to Invert):	120	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	Masonry	Poor	None	N/A	Culvert	Low
Downstream	Masonry	Poor	None	N/A	Headwall	Medium

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
None	None	Good	OHE. Electric meter US RR	Poor

Structure Condition Comments:	N/A

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	High Salt Marsh	High Salt Marsh
Upstream Salt Marsh Migration Potential (acres):	3.66	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	Yes
Emergency Access or Evacuation Route:	N/A
History of Flooding:	Flooded up to 1/2 foot water at time of high tide

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 12

Observer(s) & Organization:	TS, KL (NHDES Coastal)
Municipality:	HAMPTON
Stream Name:	N/A
Road Name:	Ross Ave

Date:	8/8/2018	
Start Time:	2:00:00 PM	
End Time:	2:55:00 PM	
Tide Prediction	**High**	**Low**
Time:	9:11 PM	3:10 PM
Elevation:	9.8	0.3
Tide Chart Location:	Hampton Harbor	

	Score*
Crossing Condition Evaluation	
Crossing Condition	2
Tidal Restriction Evaluation	
Tidal Range Ratio	3
Crossing Ratio	3
Erosion Classification	4
Tidal Restriction Overall Score	3
Tidal Aquatic Organism Passage	
Tidal Range Ratio	3
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	1
Salt Marsh Migration Potential (Wshed.)	1
Vegetation Evaluation	
Vegetation Comparison Matrix	3
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	4,4
Inun. Risk to the Crossing Structure (US, DS)	4,4
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	1
Overall Scores	
Infrastructure	4
Ecological	3
Combined	3

DS view toward structure

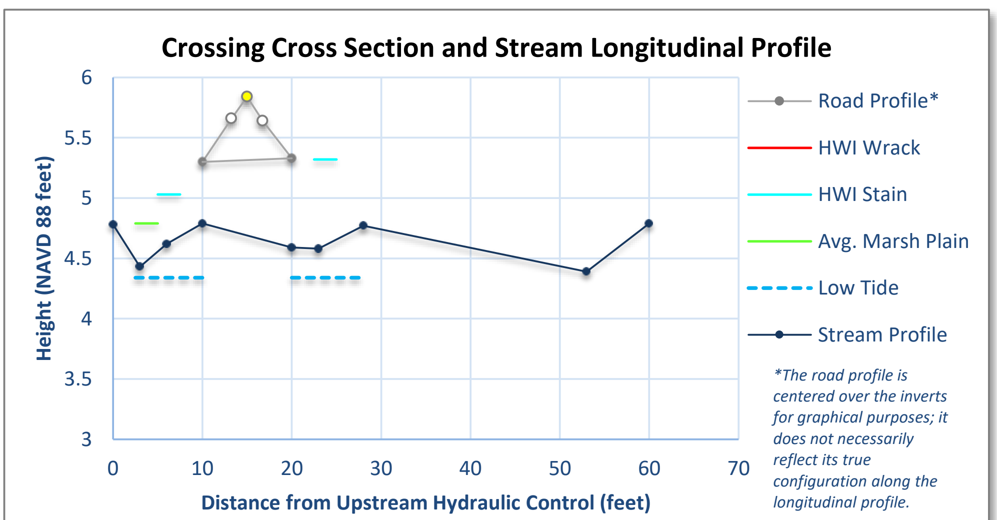
US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority

**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk



Long. Profile

Dist.	Hght.	Feat.	Sub.
0	4.7799	HC	C/S
3	4.4299	P	G
6	4.6199	HC	G
10	4.7899	I	G
20	4.5899	I	G
23	4.5799	CB	G
28	4.7699	HC	C/S
53	4.3899	CB	C/S
60	4.7899	HC	C/S

Crossing Context:

N/A

Structure Characteristics:

Structure Type:	Round Culvert	**Date of Last Known Replacement:**	N/A
Structure Material:	Other		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	1.9	1.9
Dimension B[CB] (height):	1.5	1.9
Crossing Length (Invert to Invert):	10	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	None	N/A	None	N/A	None	None
Downstream	None	N/A	None	N/A	None	None

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
None	None	N/A	Overhead electric	Fair

Structure Condition Comments:	Clay culvert

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	High Salt Marsh	High Salt Marsh
Upstream Salt Marsh Migration Potential (acres):	0.71	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	No
Emergency Access or Evacuation Route:	N/A
History of Flooding:	Area experienced 6"""""""""" flooding in March 2018.

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 13

Observer(s) & Organization:	JB TS (NHDES Coastal)
Municipality:	HAMPTON
Stream Name:	N/A
Road Name:	Church St

Date:	8/6/2018	
Start Time:	2:15:00 PM	
End Time:	3:00:00 PM	
Tide Prediction	**High**	**Low**
Time:	7:10 PM	1:08 PM
Elevation:	9.1	0.7
Tide Chart Location:	Hampton Harbor	

Crossing Condition Evaluation	Score*
Crossing Condition	4
Tidal Restriction Evaluation	
Tidal Range Ratio	3
Crossing Ratio	3
Erosion Classification	3
Tidal Restriction Overall Score	3
Tidal Aquatic Organism Passage	
Tidal Range Ratio	3
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	1
Salt Marsh Migration Potential (Wshed.)	2
Vegetation Evaluation	
Vegetation Comparison Matrix	3
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	5,4
Inun. Risk to the Crossing Structure (US, DS)	4,4
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	1
Overall Scores	
Infrastructure	5
Ecological	3
Combined	4

DS view toward structure

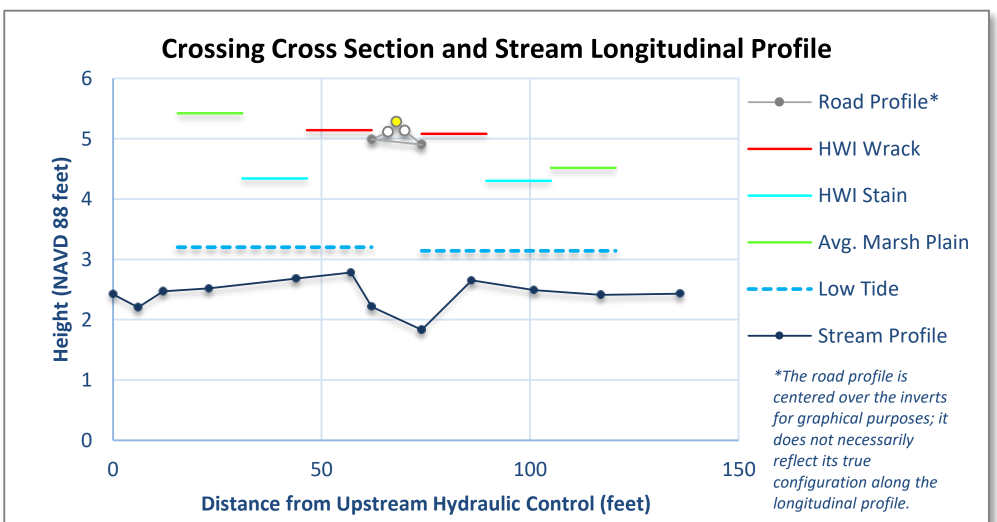
US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority

**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk



Long. Profile

Dist.	Hght.	Feat.	Sub.
0	2.4222	HC	C/S
6	2.2022	P	C/S
12	2.4722	HC	C/S
23	2.5222	CB	S
44	2.6822	HC	C/S
57	2.7822	HC	C/S
62	2.2122	I	S
74	1.8322	I	C/S
86	2.6522	HC	C/S
101	2.4922	CB	C/S
117	2.4122	CB	C/S
136	2.4322	HC	C/S

Crossing Context:

Church Street in Hampton crosses a tidal creek, providing tidal flow with a 2.5-foot round culvert. The crossing condition is fair and inundation risk to the road is high. Exotic Phragmites appears to increase above the crossing. The overall combined score is 4, high priority for replacement.

Structure Characteristics:

Structure Type:	Round Culvert	**Date of Last Known Replacement:**	N/A
Structure Material:	Other		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	2.5	2.5
Dimension B[CB](height):	1.5	2.3
Crossing Length (Invert to Invert):	12	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	None	N/A	Rip Rap	Poor	None	None
Downstream	None	N/A	None	N/A	None	None

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
None	None	N/A	US OHE	Poor

Structure Condition Comments:	Clay culvert

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	Brackish Riverbank Marsh	Brackish Riverbank Marsh
Upstream Salt Marsh Migration Potential (acres):	1.04	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	No
Emergency Access or Evacuation Route:	N/A
History of Flooding:	Area experienced 6"""""""""" flooding during March 2018.

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 14

Observer(s) & Organization:	JB TS (NHDES Coastal)
Municipality:	HAMPTON
Stream Name:	Tide Mill Creek
Road Name:	Winnacunnet Rd

Date:	7/10/2018	
Start Time:	2:50:00 PM	
End Time:	4:45:00 PM	
Tide Prediction	**High**	**Low**
Time:	9:33 PM	3:33 PM
Elevation:	9.8	0.3
Tide Chart Location:	Hampton Harbor	

Crossing Condition Evaluation	Score*
Crossing Condition	2
Tidal Restriction Evaluation	
Tidal Range Ratio	1
Crossing Ratio	3
Erosion Classification	4
Tidal Restriction Overall Score	3
Tidal Aquatic Organism Passage	
Tidal Range Ratio	1
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	5
Salt Marsh Migration Potential (Wshed.)	5
Vegetation Evaluation	
Vegetation Comparison Matrix	1
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	3,3
Inun. Risk to the Crossing Structure (US, DS)	3,2
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	1
Overall Scores	
Infrastructure	2
Ecological	1
Combined	3

DS view toward structure

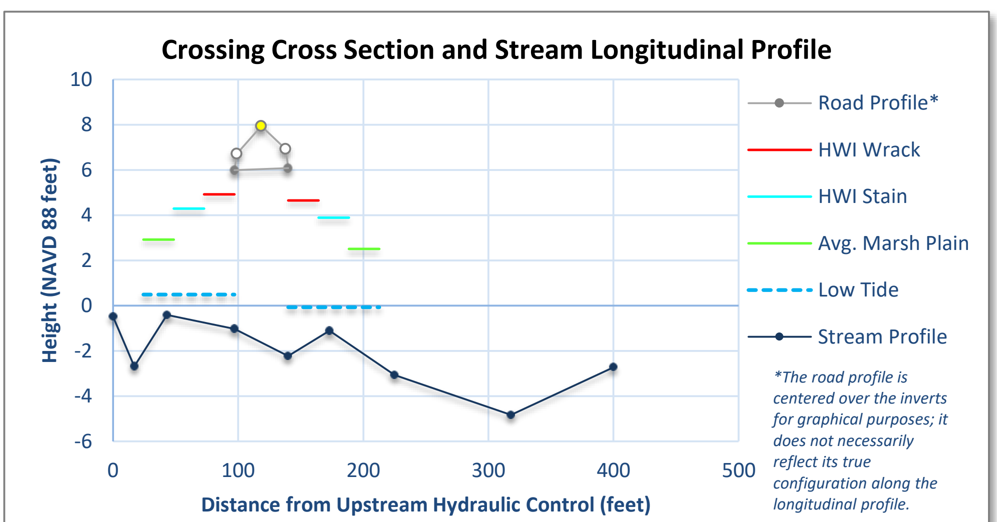
US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority

**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk



Long. Profile

Dist.	Hght.	Feat.	Sub.
0	-0.4904	HC	C
17	-2.6904	P	C/S
43	-0.4104	HC	C/S
97	-1.0304	I	C
140	-2.2204	I	C
173	-1.1104	HC	B
225	-3.0704	CB	G
318	-4.8304	P	G
400	-2.7304	HC	S

Crossing Context:

N/A

Structure Characteristics:

Structure Type:	Arch Bridge	**Date of Last Known Replacement:**	1996
Structure Material:	Concrete		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	24	24
Dimension B^{CB}(height):	7	6.4
Crossing Length (Invert to Invert):	43	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	None	N/A	Concrete	Fair	None	None
Downstream	None	N/A	Concrete	Fair	Wingwalls	Low

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
None	None	Good	Overhead electric	Good

Structure Condition Comments:	Center of DS arch not in the thalweg

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	High Salt Marsh	Low Salt Marsh
Upstream Salt Marsh Migration Potential (acres):	83.39	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	Yes
Emergency Access or Evacuation Route:	Yes
History of Flooding:	Upstream 3+' during hightide/storm events.

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 15

Observer(s) & Organization:	JB TS (NHDES Coastal)
Municipality:	HAMPTON
Stream Name:	N/A
Road Name:	High St

Date:	9/11/2018	
Start Time:	9:30:00 AM	
End Time:	10:15:00 AM	
Tide Prediction	**High**	**Low**
Time:	1:11 PM	7:15 AM
Elevation:	9.9	-1.2
Tide Chart Location:	Hampton Harbor	

Crossing Condition Evaluation	Score*
Crossing Condition	5
Tidal Restriction Evaluation	
Tidal Range Ratio	1
Crossing Ratio	4
Erosion Classification	0
Tidal Restriction Overall Score	3
Tidal Aquatic Organism Passage	
Tidal Range Ratio	1
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	5
Salt Marsh Migration Potential (Wshed.)	5
Vegetation Evaluation	
Vegetation Comparison Matrix	5
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	5,4
Inun. Risk to the Crossing Structure (US, DS)	5,5
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	1
Overall Scores	
Infrastructure	5
Ecological	4
Combined	5

DS view toward structure

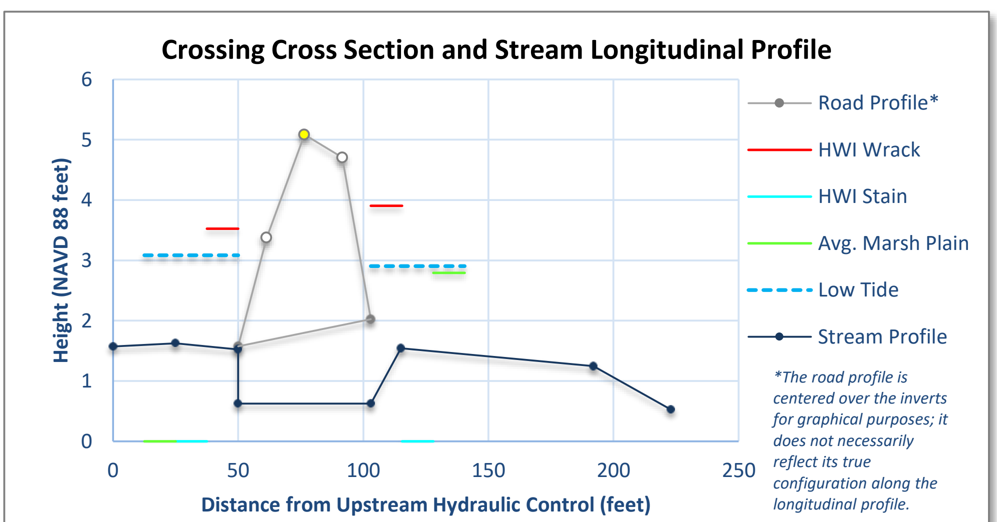
US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority

**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk

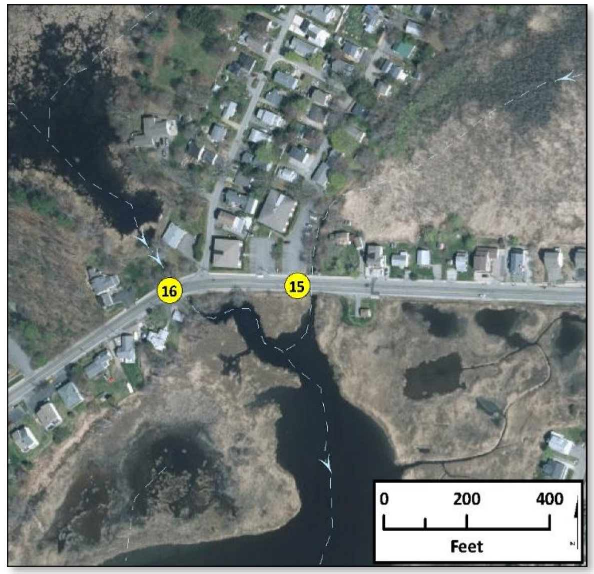


Long. Profile

Dist.	Hght.	Feat.	Sub.
0	1.5753	CB	C/S
25	1.6253	CB	C/S
50	1.5253	CB	C/S
50	0.6253	I	C/S
103	0.6253	I	C/S
115	1.5453	HC	C/S
192	1.2453	CB	C/S
223	0.5253	CB	C/S

Crossing Context:

Fresh water from wetlands to the north drain into Meadow Pond under High Street in Hampton. The undersized culvert and low-lying roadway leave the crossing underwater at low tide and make it vulnerable to flooding. The crossing condition is poor and the potential for salt marsh expansion upstream is high, leading to an overall combined score of 5, highest priority for replacement.



Structure Characteristics:

Structure Type:	Round Culvert	**Date of Last Known Replacement:**	N/A
Structure Material:	Aluminum - Corrugated		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	4	4
Dimension B[CB] (height):	2	2
Crossing Length (Invert to Invert):	53	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	None	N/A	None	N/A	None	None
Downstream	None	N/A	None	N/A	None	None

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
None	None	Good	OHE US	Poor

Structure Condition Comments:	Totally submerged and partially clogged. Two twin pipes

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	Invasive Dominant	Brackish Marsh
Upstream Salt Marsh Migration Potential (acres):	30.32	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	Yes
Emergency Access or Evacuation Route:	Yes
History of Flooding:	floods at any high tide w/ above avg rain event

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 16

Observer(s) & Organization:	JB ts (NHDES Coastal)
Municipality:	HAMPTON
Stream Name:	N/A
Road Name:	High St

Date:	9/11/2018	
Start Time:	8:30:00 AM	
End Time:	9:20:00 AM	
Tide Prediction	**High**	**Low**
Time:	1:11 PM	7:15 AM
Elevation:	9.9	-1.2
Tide Chart Location:	Hampton Harbor	

	Score*
Crossing Condition Evaluation	
Crossing Condition	3
Tidal Restriction Evaluation	
Tidal Range Ratio	5
Crossing Ratio	3
Erosion Classification	5
Tidal Restriction Overall Score	4
Tidal Aquatic Organism Passage	
Tidal Range Ratio	5
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	1
Salt Marsh Migration Potential (Wshed.)	1
Vegetation Evaluation	
Vegetation Comparison Matrix	0
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	3,2
Inun. Risk to the Crossing Structure (US, DS)	3,3
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	5
Overall Scores	
Infrastructure	3
Ecological	5
Combined	3

DS view toward structure

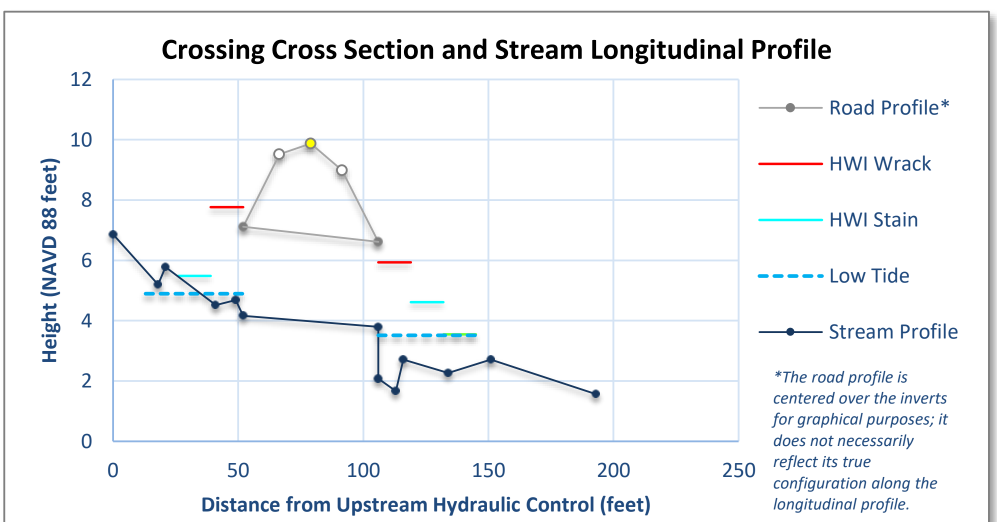
US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority

**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk



Long. Profile

Dist.	Hght.	Feat.	Sub.
0	6.8653	HC	B
18	5.1953	P	B
21	5.7853	HC	B
41	4.5153	CB	B
49	4.6853	GC	B
52	4.1653	I	B
106	3.7953	I	B
106	2.0753	CB	B
113	1.6653	P	B
116	2.7153	GC	B
134	2.2653	CB	C
151	2.7153	HC	C
193	1.5653	P	C/S

Crossing Context:

N/A

Structure Characteristics:

Structure Type:	Round Culvert	**Date of Last Known Replacement:**	N/A
Structure Material:	Plastic - Smooth		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	6	6
Dimension B[CB](height):	3	3
Crossing Length (Invert to Invert):	54	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	Dry Fit Stone	Fair	Dry Fit Stone	Fair	Wingwalls	Medium
Downstream	Dry Fit Stone	Poor	Dry Fit Stone	Fair	Wingwalls	Medium

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
None	None	Good	OHE diagonal over road	Fair

Structure Condition Comments:	Two twin culverts

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	Freshwater Stream	Brackish Marsh
Upstream Salt Marsh Migration Potential (acres):	0.00	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	Yes
Emergency Access or Evacuation Route:	Yes
History of Flooding:	floods at any high tide w/ above avg rain event

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 17

Observer(s) & Organization:	TS, JB (NHDES Coastal)
Municipality:	HAMPTON
Stream Name:	N/A
Road Name:	Cusack Rd

Date:	7/25/2018	
Start Time:	2:40:00 PM	
End Time:	3:30:00 PM	
Tide Prediction	**High**	**Low**
Time:	10:57 PM	5:00 PM
Elevation:	8.8	1.1
Tide Chart Location:	Hampton Harbor	

Crossing Condition Evaluation	Score*
Crossing Condition	2
Tidal Restriction Evaluation	
Tidal Range Ratio	1
Crossing Ratio	1
Erosion Classification	1
Tidal Restriction Overall Score	1
Tidal Aquatic Organism Passage	
Tidal Range Ratio	1
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	5
Salt Marsh Migration Potential (Wshed.)	5
Vegetation Evaluation	
Vegetation Comparison Matrix	0
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	3,3
Inun. Risk to the Crossing Structure (US, DS)	4,5
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	4
Overall Scores	
Infrastructure	2
Ecological	4
Combined	3

DS view toward structure

US view above structure

US view toward structure

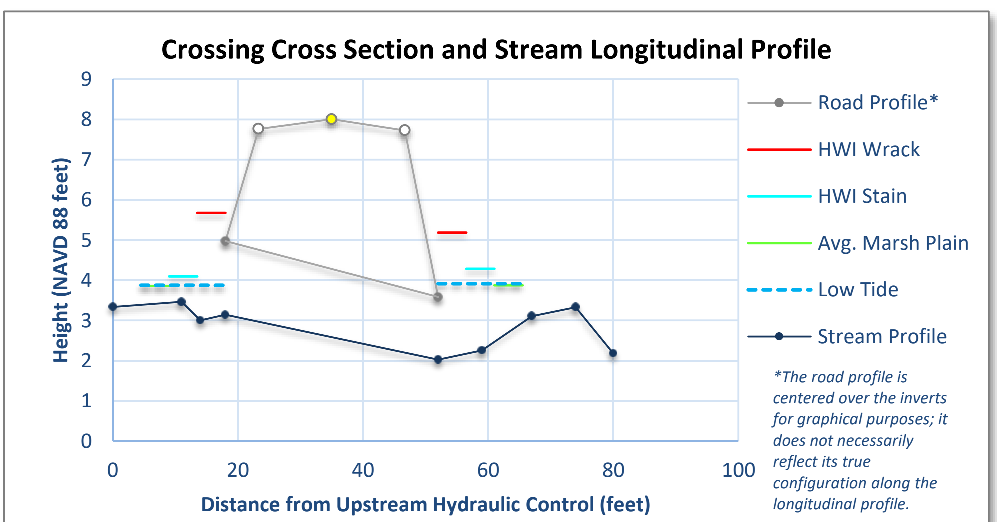
DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority

**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk

Long. Profile

Dist.	Hght.	Feat.	Sub.
0	3.3352	CB	C/S
11	3.4652	CB	C/S
14	3.0052	P	C/S
18	3.1452	I	C/S
52	2.0252	I	G
59	2.2552	P	C/S
67	3.1052	CB	C/S
74	3.3252	CB	C/S
80	2.1852	P	C/S



Crossing Context:

N/A

Structure Characteristics:

Structure Type:	Round Culvert	**Date of Last Known Replacement:**	N/A
Structure Material:	Plastic - Corrugated		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	3	3
Dimension B[CB] (height):	1.5	1.5
Crossing Length (Invert to Invert):	34	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	Concrete	Fair	None	N/A	None	None
Downstream	Concrete	Fair	None	N/A	None	None

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
None	None	Good	Overhead electric	Fair

Structure Condition Comments:	Twin culverts surveyed as one structure, completely submerged downstream

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	Freshwater Marsh	Freshwater Marsh
Upstream Salt Marsh Migration Potential (acres):	15.25	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	Yes
Emergency Access or Evacuation Route:	N/A
History of Flooding:	Culvert washed out; replaced - prone to high flows

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 18

Observer(s) & Organization:	TS, JB (NHDES Coastal)	**Date:**	8/17/2018	
Municipality:	HAMPTON	**Start Time:**	10:00:00 AM	
Stream Name:	Tide Mill Creek	**End Time:**	11:02:00 AM	
Road Name:	NH Rt 101	**Tide Prediction**	**High**	**Low**
		Time:	5:07 PM	11:05 AM
		Elevation:	9.0	0.1
		Tide Chart Location:	Hampton Harbor	

Crossing Condition Evaluation	Score*
Crossing Condition	1
Tidal Restriction Evaluation	
Tidal Range Ratio	1
Crossing Ratio	4
Erosion Classification	3
Tidal Restriction Overall Score	3
Tidal Aquatic Organism Passage	
Tidal Range Ratio	1
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	5
Salt Marsh Migration Potential (Wshed.)	5
Vegetation Evaluation	
Vegetation Comparison Matrix	3
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	1,1
Inun. Risk to the Crossing Structure (US, DS)	1,1
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	1
Overall Scores	
Infrastructure	1
Ecological	3
Combined	2

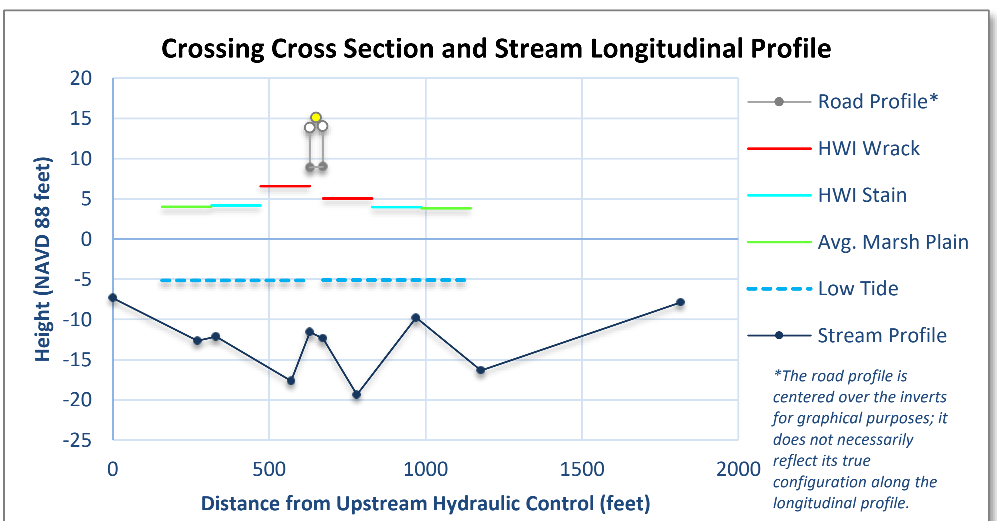
DS view toward structure

US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority
**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk



Long. Profile

Dist.	Hght.	Feat.	Sub.
0	-7.3381	HC	S
270	-12.638	P	G
330	-12.138	HC	C
570	-17.638	P	S
630	-11.558	I	B
672	-12.358	I	B
780	-19.358	P	S
970	-9.7581	HC	G
1177	-16.358	P	C/S
1816	-7.8581	HC	S

Crossing Context:

N/A

Structure Characteristics:

Structure Type:	Bridge with Side Slopes and Abutments	**Date of Last Known Replacement:**	N/A
Structure Material:	Concrete		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	117	117
Dimension B[CB](height):	20.45	21.36
Crossing Length (Invert to Invert):	42	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	None	N/A	Concrete	Good	None	None
Downstream	None	N/A	Concrete	Good	None	None

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
None	None	Fair	Overhead electric, sewer running along bridge	Good

Structure Condition Comments:	N/A

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	High Salt Marsh	High Salt Marsh
Upstream Salt Marsh Migration Potential (acres):	110.26	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	No
Emergency Access or Evacuation Route:	Yes
History of Flooding:	No

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 19

Observer(s) & Organization:	JB TS (NHDES Coastal)
Municipality:	HAMPTON
Stream Name:	N/A
Road Name:	Nh Rt 101

Date:	7/31/2018	
Start Time:	9:50:00 AM	
End Time:	11:00:00 AM	
Tide Prediction	**High**	**Low**
Time:	2:35 PM	8:39 AM
Elevation:	8.1	0.3
Tide Chart Location:	Hampton Harbor	

Crossing Condition Evaluation	Score*
Crossing Condition	5
Tidal Restriction Evaluation	
Tidal Range Ratio	4
Crossing Ratio	4
Erosion Classification	4
Tidal Restriction Overall Score	4
Tidal Aquatic Organism Passage	
Tidal Range Ratio	4
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	1
Salt Marsh Migration Potential (Wshed.)	1
Vegetation Evaluation	
Vegetation Comparison Matrix	4
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	3,3
Inun. Risk to the Crossing Structure (US, DS)	4,4
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	5
Overall Scores	
Infrastructure	5
Ecological	4
Combined	4

DS view toward structure

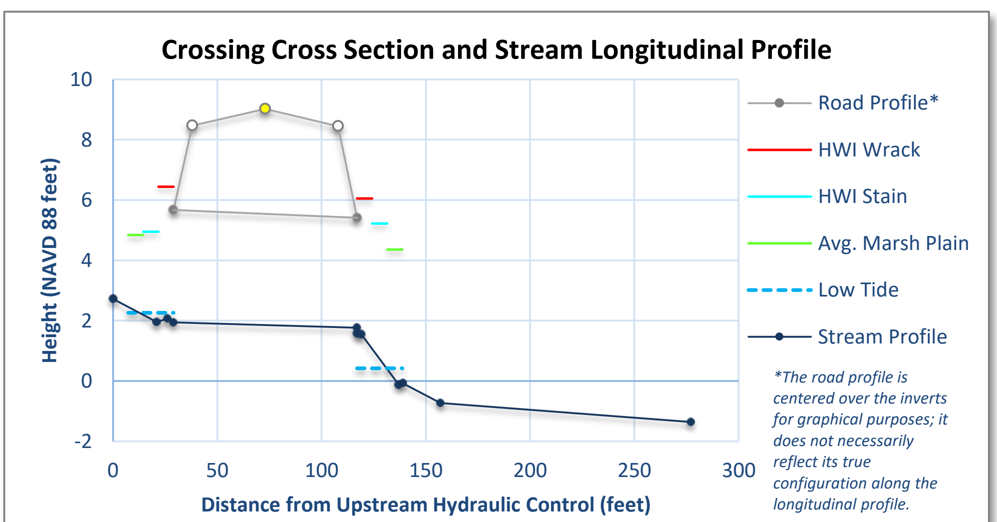
US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority

**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk



Long. Profile

Dist.	Hght.	Feat.	Sub.
0	2.7223	HC	C
21	1.9523	CB	G
26	2.0723	GC	B
29	1.9423	I	B
117	1.7723	I	B
117	1.5723	CB	B
119	1.5523	GC	B
137	-0.1277	CB	C
139	-0.0777	HC	C
157	-0.7277	P	G
277	-1.3577	HC	S

Crossing Context:

Route 101 was built at the edge of the Hampton Seabrook Estuary and a small marsh that was left upstream of the highway was provided with a 3.5-foot round concrete culvert to supply tidal flow and drainage. The crossing condition is poor, and the tidal range is muted, leading to fresher vegetation upstream of the crossing. The overall combined score is 4, a high priority for replacement of this crossing.

Structure Characteristics:

Structure Type:	Round Culvert	**Date of Last Known Replacement:**	N/A
Structure Material:	Concrete		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	3.5	3.5
Dimension B^{CB}(height):	3.5	3.5
Crossing Length (Invert to Invert):	88	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	Masonry	Poor	Masonry	Poor	Wingwalls	High
Downstream	Masonry	Poor	Rip Rap	Poor	Wingwalls	High

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
None	None	Good	None	Poor

Structure Condition Comments:	N/A

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	Brackish Marsh	High Salt Marsh
Upstream Salt Marsh Migration Potential (acres):	0.23	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	No
Emergency Access or Evacuation Route:	Yes
History of Flooding:	unknown

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 20

Observer(s) & Organization:	JB TS (NHDES Coastal)
Municipality:	HAMPTON
Stream Name:	N/A
Road Name:	Landing Rd

Date:	8/1/2018
Start Time:	10:00:00 AM
End Time:	11:00:00 AM

Tide Prediction	**High**	**Low**
Time:	3:12 PM	9:15 AM
Elevation:	8.2	0.3
Tide Chart Location:	Hampton Harbor	

Crossing Condition Evaluation	Score*
Crossing Condition	4
Tidal Restriction Evaluation	
Tidal Range Ratio	4
Crossing Ratio	4
Erosion Classification	5
Tidal Restriction Overall Score	4
Tidal Aquatic Organism Passage	
Tidal Range Ratio	4
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	4
Salt Marsh Migration Potential (Wshed.)	4
Vegetation Evaluation	
Vegetation Comparison Matrix	1
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	5,5
Inun. Risk to the Crossing Structure (US, DS)	5,5
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	5
Overall Scores	
Infrastructure	5
Ecological	4
Combined	4

DS view toward structure

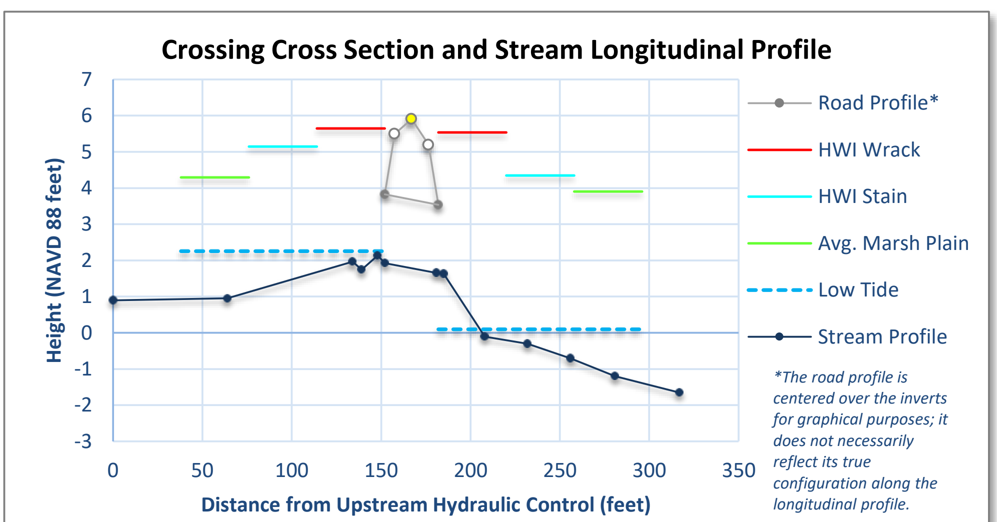
US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority

**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk



Long. Profile

Dist.	Hght.	Feat.	Sub.
0	0.8955	HC	C/S
64	0.9555	P	C/S
134	1.9655	HC	G
139	1.7455	P	G
148	2.1355	GC	C
152	1.9255	I	C
181	1.6555	I	C
185	1.6255	GC	C
208	-0.1045	CB	G
232	-0.3045	HC	G
256	-0.7045	HC	G
281	-1.2045	CB	G
317	-1.6545	HC	G

Crossing Context:

Landing Road in Hampton crosses an unnamed tidal creek with a 4 by 2-foot concrete box culvert that was installed as a tidal restoration in 2010. Tides regularly fill the undersized culvert and threaten to flood the road (and do flood the road during storms). The crossing condition is fair, inundation risk is very high and erosion is evident. In addition, the structure is perched. The overall combined score of 4 indicates this is a high priority for replacement.

Structure Characteristics:

Structure Type:	Box Culvert	**Date of Last Known Replacement:**	2010
Structure Material:	Concrete		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	4	4
Dimension B[CB](height):	2	2
Crossing Length (Invert to Invert):	30	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	Rip Rap	Fair	Rip Rap	Fair	Wingwalls	Medium
Downstream	Rip Rap	Poor	Rip Rap	Poor	Headwall	Medium

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
Culvert	Low	Good	OHE DS and US in marsh	Fair

Structure Condition Comments:	N/A

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	High Salt Marsh	High Salt Marsh
Upstream Salt Marsh Migration Potential (acres):	5.67	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	No
Emergency Access or Evacuation Route:	N/A
History of Flooding:	unknown

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 21

Observer(s) & Organization:	JB TS (NHDES Coastal)
Municipality:	HAMPTON
Stream Name:	N/A
Road Name:	Drakeside Rd

Date:	7/19/2018	
Start Time:	12:45:00 PM	
End Time:	1:40:00 PM	
Tide Prediction	**High**	**Low**
Time:	5:40 PM	11:36 AM
Elevation:	9.1	-0.2
Tide Chart Location:	Hampton Harbor	

Crossing Condition Evaluation	Score*
Crossing Condition	2
Tidal Restriction Evaluation	
Tidal Range Ratio	5
Crossing Ratio	4
Erosion Classification	3
Tidal Restriction Overall Score	4
Tidal Aquatic Organism Passage	
Tidal Range Ratio	5
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	1
Salt Marsh Migration Potential (Wshed.)	1
Vegetation Evaluation	
Vegetation Comparison Matrix	4
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	1,1
Inun. Risk to the Crossing Structure (US, DS)	2,2
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	5
Overall Scores	
Infrastructure	2
Ecological	5
Combined	4

DS view toward structure

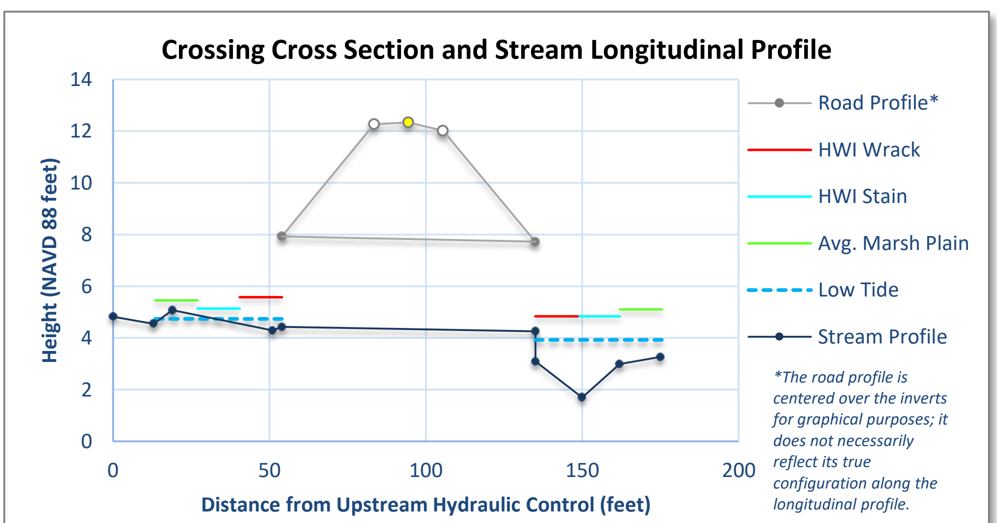
US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority

**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk

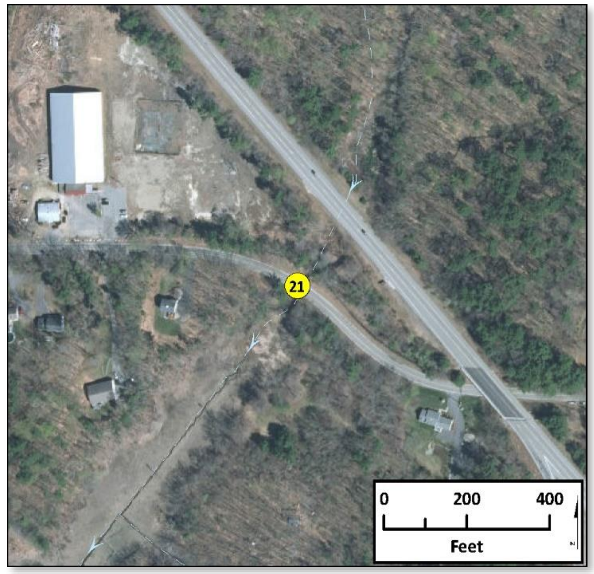


Long. Profile

Dist.	Hght.	Feat.	Sub.
0	4.826	HC	C
13	4.546	P	C
19	5.076	HC	G
51	4.296	P	G
54	4.426	I	C
135	4.256	I	C
135	3.096	CB	C
150	1.696	P	C/S
162	2.986	HC	C/S
175	3.266	HC	C/S

Crossing Context:

A 3.5-foot round concrete culvert under Drakeside Road drains a small wetland and its freshwater sources that were disrupted by the construction of Route 101. The longitudinal profile and water height indicators show the system is perched, impounding water upstream and preventing all but the highest tides from passing upstream, interfering with organism passage and influencing the upstream vegetation. The overall combined score is 4 for this culvert, indicating a high priority for replacement.



Structure Characteristics:

Structure Type:	Round Culvert	**Date of Last Known Replacement:**	N/A
Structure Material:	Concrete		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	3.5	3.5
Dimension B^{CB}(height):	3.5	3.5
Crossing Length (Invert to Invert):	81	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	Masonry	Fair	Masonry	Fair	Wingwalls	Low
Downstream	Masonry	Good	Masonry	Fair	Culvert	Low

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
None	None	Good	OHE US	Good

Structure Condition Comments:	N/A

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	Freshwater Stream	Brackish Riverbank Marsh
Upstream Salt Marsh Migration Potential (acres):	0.00	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	No
Emergency Access or Evacuation Route:	N/A
History of Flooding:	Unknown

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 22

Observer(s) & Organization:	JB TS (NHDES Coastal)
Municipality:	HAMPTON
Stream Name:	Taylor River
Road Name:	Lafayette Rd

Date:	8/16/2018	
Start Time:	9:45:00 AM	
End Time:	10:46:00 AM	
Tide Prediction	**High**	**Low**
Time:	4:12 PM	10:12 AM
Elevation:	9.3	-0.4
Tide Chart Location:	Hampton Harbor	

Crossing Condition Evaluation	Score*
Crossing Condition	2
Tidal Restriction Evaluation	
Tidal Range Ratio	1
Crossing Ratio	4
Erosion Classification	4
Tidal Restriction Overall Score	3
Tidal Aquatic Organism Passage	
Tidal Range Ratio	1
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	5
Salt Marsh Migration Potential (Wshed.)	5
Vegetation Evaluation	
Vegetation Comparison Matrix	1
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	3,4
Inun. Risk to the Crossing Structure (US, DS)	2,1
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	5
Overall Scores	
Infrastructure	4
Ecological	3
Combined	3

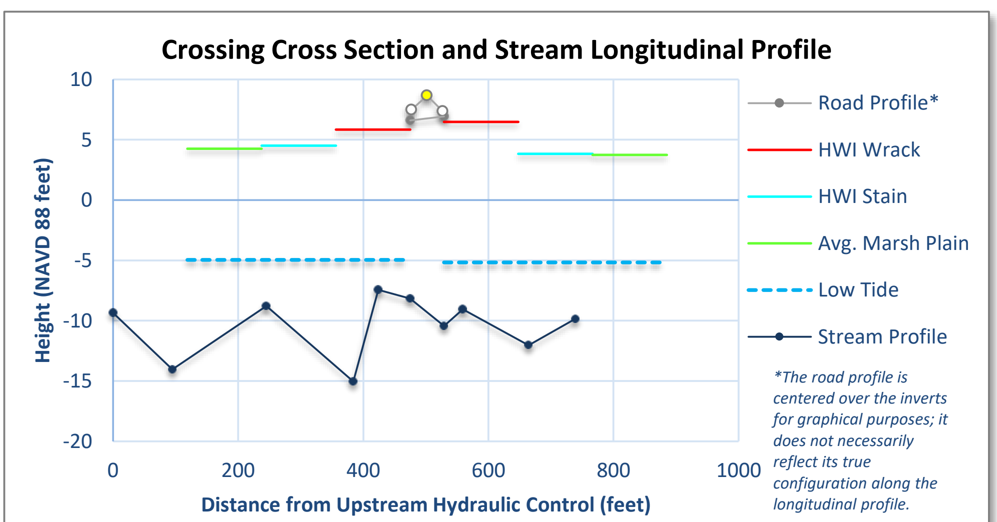
DS view toward structure

US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority
**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk



Long. Profile

Dist.	Hght.	Feat.	Sub.
0	-9.3386	HC	C/S
95	-14.039	P	C/S
245	-8.7886	HC	G
384	-15.039	P	C
424	-7.4386	GC	G
475	-8.1686	I	B
529	-10.439	I	B
559	-9.0586	HC	C
664	-12.039	P	C
739	-9.8386	HC	G

Crossing Context:

N/A

Structure Characteristics:

Structure Type:	Bridge with Abutments	**Date of Last Known Replacement:**	N/A
Structure Material:	Concrete		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	30	30
Dimension B[CB](height):	15	16.7
Crossing Length (Invert to Invert):	54	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	None	N/A	Concrete	Fair	Wingwalls	Low
Downstream	None	N/A	Rip Rap	Good	Wingwalls	Low

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
Abutment	Medium	Good	DS OHE	Fair

Structure Condition Comments:	Some cracks inside structure RL

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	High Salt Marsh	High Salt Marsh
Upstream Salt Marsh Migration Potential (acres):	137.43	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	Yes
Emergency Access or Evacuation Route:	Yes
History of Flooding:	Water rises from very high/storm tides

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 23

Observer(s) & Organization:	TS, JB (NHDES Coastal)
Municipality:	HAMPTON
Stream Name:	N/A
Road Name:	Merrill Industrial Dr

Date:	7/9/2018	
Start Time:	4:00:00 PM	
End Time:	5:24:00 PM	
Tide Prediction	**High**	**Low**
Time:	8:38 PM	2:36 PM
Elevation:	9.4	0.5
Tide Chart Location:	Hampton Harbor	

Crossing Condition Evaluation	Score*
Crossing Condition	3
Tidal Restriction Evaluation	
Tidal Range Ratio	3
Crossing Ratio	1
Erosion Classification	4
Tidal Restriction Overall Score	3
Tidal Aquatic Organism Passage	
Tidal Range Ratio	3
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	1
Salt Marsh Migration Potential (Wshed.)	1
Vegetation Evaluation	
Vegetation Comparison Matrix	3
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	2,2
Inun. Risk to the Crossing Structure (US, DS)	3,3
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	5
Overall Scores	
Infrastructure	3
Ecological	3
Combined	3

DS view toward structure

US view above structure

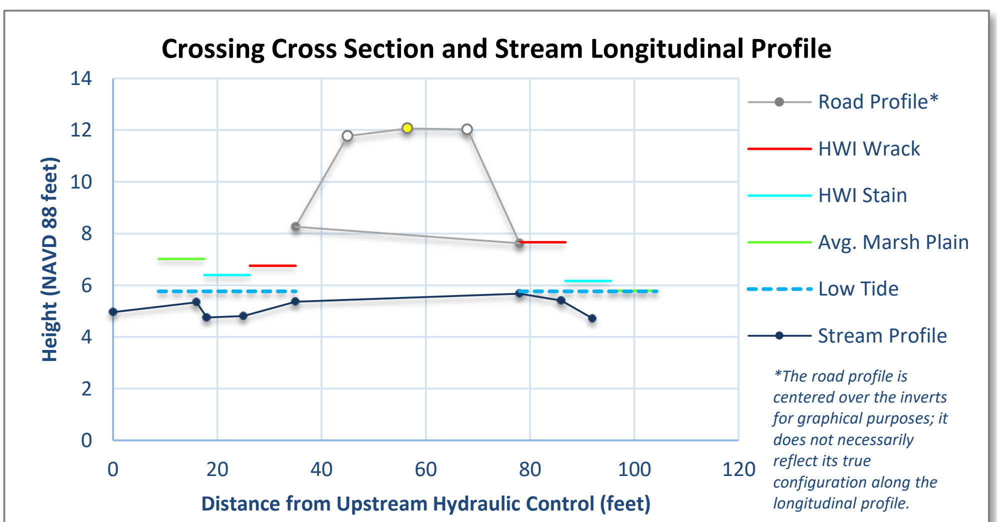
US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority
**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk

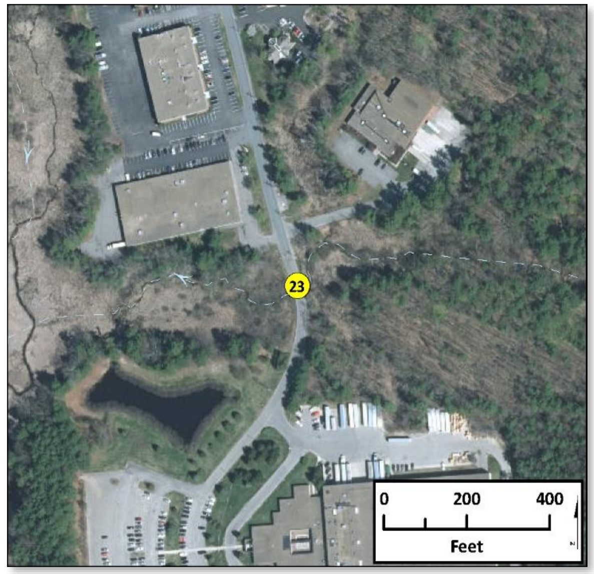
Long. Profile

Dist.	Hght.	Feat.	Sub.
0	4.9536	HC	S
16	5.3436	CB	S
18	4.7536	P	S
25	4.8136	HC	S
35	5.3636	I	C
78	5.6736	I	S
86	5.4036	HC	S
92	4.7136	HC	S



Crossing Context:

N/A



Structure Characteristics:

Structure Type:	Embedded Round Culvert	**Date of Last Known Replacement:**	N/A
Structure Material:	Concrete		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	6.8	6.6
Dimension B[CB] (height):	3.1	1.9
Crossing Length (Invert to Invert):	43	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	Rip Rap	Poor	None	N/A	Culvert	Low
Downstream	None	N/A	None	N/A	Culvert	Low

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
Channel	Medium	Good		Good

Structure Condition Comments:	Two twin culverts, measured as one

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	Freshwater Stream	Freshwater Stream
Upstream Salt Marsh Migration Potential (acres):	0.00	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	No
Emergency Access or Evacuation Route:	N/A
History of Flooding:	unknown

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 24

Observer(s) & Organization:	JB TS (NHDES Coastal)
Municipality:	HAMPTON
Stream Name:	Drakes River
Road Name:	Nh Rt 101

Date:	7/30/2018	
Start Time:	9:20:00 AM	
End Time:	10:45:00 AM	
Tide Prediction	**High**	**Low**
Time:	2:00 PM	8:05 AM
Elevation:	8.0	0.2
Tide Chart Location:	Hampton Harbor	

	Score*
Crossing Condition Evaluation	
Crossing Condition	1
Tidal Restriction Evaluation	
Tidal Range Ratio	4
Crossing Ratio	3
Erosion Classification	5
Tidal Restriction Overall Score	4
Tidal Aquatic Organism Passage	
Tidal Range Ratio	4
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	5
Salt Marsh Migration Potential (Wshed.)	5
Vegetation Evaluation	
Vegetation Comparison Matrix	0
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	1,1
Inun. Risk to the Crossing Structure (US, DS)	3,3
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	5
Overall Scores	
Infrastructure	1
Ecological	5
Combined	5

DS view toward structure

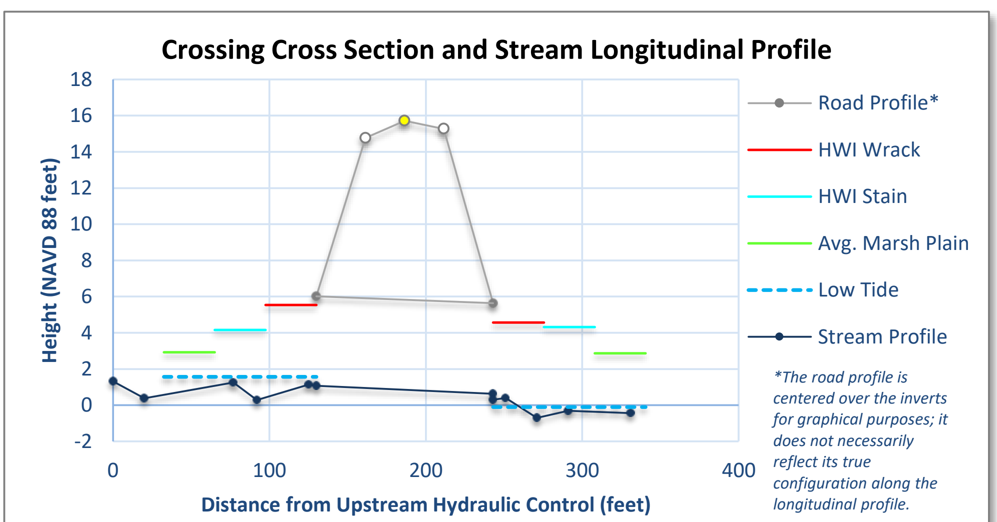
US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority

**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk



Long. Profile

Dist.	Hght.	Feat.	Sub.
0	1.3152	HC	G
20	0.3752	P	G
77	1.2552	HC	G
92	0.2752	P	G
125	1.1452	GC	C
130	1.0752	I	C
243	0.6352	I	C
243.1	0.3052	CB	C
251	0.4052	GC	C
271	-0.7048	P	C
291	-0.3148	HC	G
331	-0.4348	HC	G

Crossing Context:

The upper crossing of Drakes River passes under Route 101 for over 100 feet and is a large concrete pipe alongside a rectangular culvert encased as a pair in concrete. The high water stain on the culvert structure indicates there is some tidal restriction and the culvert slope is about a foot and the low tide is more than 18 inches higher upstream, indicating impoundment. Along with high erosion, the perch (improperly high elevation of the culvert) leads to an overall combined score of 5: highest priority for replacement.

Structure Characteristics:

Structure Type:	Round Culvert	**Date of Last Known Replacement:**	N/A
Structure Material:	Concrete		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	10	10
Dimension B[CB](height):	5	5
Crossing Length (Invert to Invert):	113	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	Concrete	Good	Concrete	Good	None	None
Downstream	Concrete	Good	Concrete	Good	None	None

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
None	None	Good	None	Good

Structure Condition Comments:	Twin culverts surveyed as one structure. Box at inlet/outlet converts to round culvert

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	Brackish Riverbank Marsh	High Salt Marsh
Upstream Salt Marsh Migration Potential (acres):	11.66	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	No
Emergency Access or Evacuation Route:	Yes
History of Flooding:	unknown

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 25

Observer(s) & Organization:	Burdick, Steckler, Flanagan, Lucey, Glode (TNC)
Municipality:	HAMPTON
Stream Name:	Drakes River
Road Name:	Drakeside Rd

Date:	5/30/2017	
Start Time:	9:36:00 AM	
End Time:	1:00:00 PM	
Tide Prediction	**High**	**Low**
Time:	4:10 PM	10:07 AM
Elevation:	9.0	-1.0
Tide Chart Location:	Hampton Harbor	

Crossing Condition Evaluation	Score*
Crossing Condition	5
Tidal Restriction Evaluation	
Tidal Range Ratio	3
Crossing Ratio	4
Erosion Classification	4
Tidal Restriction Overall Score	4
Tidal Aquatic Organism Passage	
Tidal Range Ratio	3
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	4
Salt Marsh Migration Potential (Wshed.)	5
Vegetation Evaluation	
Vegetation Comparison Matrix	3
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	3,4
Inun. Risk to the Crossing Structure (US, DS)	5,5
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	5
Overall Scores	
Infrastructure	5
Ecological	3
Combined	4

DS view toward structure

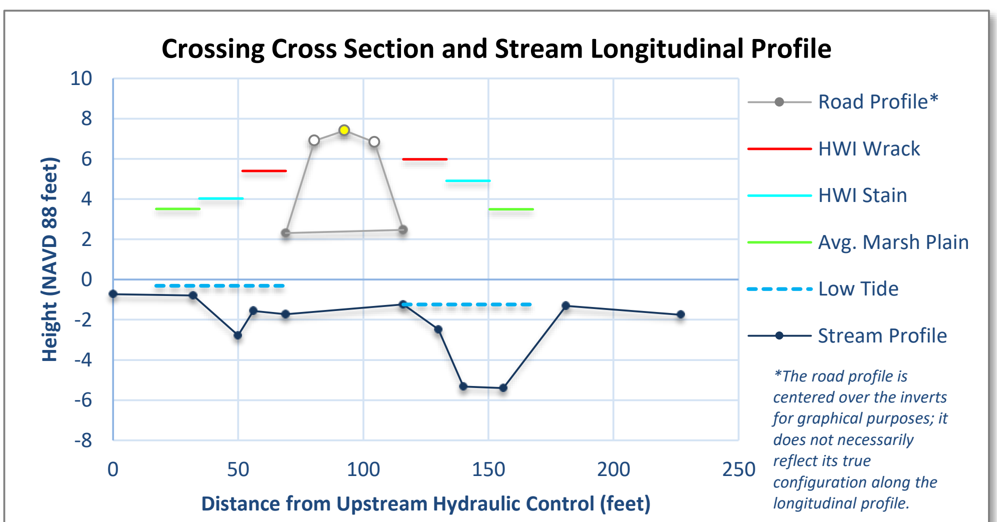
US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority

**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk



Long. Profile

Dist.	Hght.	Feat.	Sub.
0	-0.7319	HC	G
32	-0.7919	HC	C
50	-2.7819	P	C
56	-1.5619	GC	C
69	-1.7319	I	B
116	-1.2319	I	B
130	-2.4819	GC	B
140	-5.3219	P	C
156	-5.4019	P	G
181	-1.3119	HC	C
227	-1.7519	HC	G

Crossing Context:

The lower tidal crossing of Drakes River passes under Drakeside Road through a 4 by 8 concrete culvert in Hampton. Despite restoration in 1996 tides are still restricted, with an overall combined score of 4 (high priority for replacement). This is due to reduced tidal range, interference with organism passage and poor crossing condition. *Phragmites* , which was overrunning the site in the mid-1990s, remains a visible feature in the marsh.

Structure Characteristics:

Structure Type:	Box Culvert	**Date of Last Known Replacement:**	1996
Structure Material:	Concrete		
Tide Gate Present:	Yes		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	8	8
Dimension B^{CB}(height):	4	3.7
Crossing Length (Invert to Invert):	47	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	Other	Poor	Rip Rap	Fair	Headwall	High
Downstream	Other	Fair	Rip Rap	Fair	Headwall	High

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
None	None	Poor	Telephone pole on US side	Fair

Structure Condition Comments:	N/A

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	Low Salt Marsh	Low Salt Marsh
Upstream Salt Marsh Migration Potential (acres):	21.48	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	No
Emergency Access or Evacuation Route:	N/A
History of Flooding:	Uknown

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 26

Observer(s) & Organization:	TS, JB (NHDES Coastal)	**Date:**	8/15/2018	
Municipality:	HAMPTON	**Start Time:**	9:20:00 AM	
Stream Name:	Taylor River	**End Time:**	10:00:00 AM	
Road Name:	N/A	**Tide Prediction**	**High**	**Low**
		Time:	4:19 PM	9:20 AM
		Elevation:	9.5	-0.9
		Tide Chart Location:	Hampton Harbor	

Crossing Condition Evaluation	Score*
Crossing Condition	5
Tidal Restriction Evaluation	
Tidal Range Ratio	1
Crossing Ratio	4
Erosion Classification	4
Tidal Restriction Overall Score	3
Tidal Aquatic Organism Passage	
Tidal Range Ratio	1
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	5
Salt Marsh Migration Potential (Wshed.)	5
Vegetation Evaluation	
Vegetation Comparison Matrix	1
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	2,3
Inun. Risk to the Crossing Structure (US, DS)	3,3
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	4
Overall Scores	
Infrastructure	5
Ecological	3
Combined	4

DS view toward structure

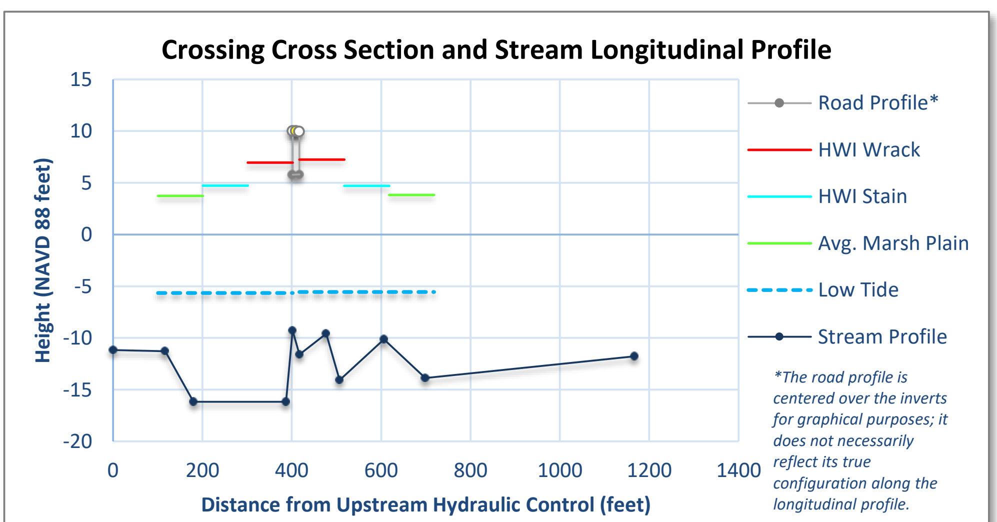
US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority

**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk



Long. Profile

Dist.	Hght.	Feat.	Sub.
0	-11.173	HC	S
117	-11.273	HC	C/S
180	-16.173	P	C/S
387	-16.173	CB	C
402	-9.2734	I	B
417	-11.613	I	S
477	-9.5734	CB	C
507	-14.073	P	C
606	-10.123	HC	C
699	-13.873	P	C/S
1167	-11.773	HC	C/S

Crossing Context:

A railroad trestle crossing the Taylor River creates a constriction, approximately 60 by 16 feet in size, in the largest tributary to the Estuary. This is one of four tidal river crossings by the abandoned railroad bed that bisect Hampton Seabrook Estuary (the others are 28, 29 and 30) where tides are large (> 10 feet) and flows are huge. The crossing condition is rated poor and the potential for salt marsh migration in the upstream watershed is high. With an overall combined score of 4, this ranking indicates high priority for replacement or removal.

Structure Characteristics:

Structure Type:	Bridge with Side Slopes and Abutments	**Date of Last Known Replacement:**	N/A
Structure Material:	Steel - Smooth		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	58	59
Dimension B^{CB}(height):	15.4	16.8
Crossing Length (Invert to Invert):	15	

Crossing Condition:	Headwall Material	Headwall Condition	Wingwall Material	Wingwall Condition	Scour at Structure	Scour Severity
Upstream	None	N/A	Dry Fit Stone	Poor	Wingwalls	Medium
Downstream	None	N/A	Dry Fit Stone	Poor	Wingwalls	None

Scour in Structure	Scour Severity in Structure	Road Surface Condition	Utilities at Crossing	Structure Condition Overall
None	None	N/A	Overhead electric, tel poles in marsh	Poor

Structure Condition Comments:	Bridge is rusting out, rail logs rotted

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	High Salt Marsh	High Salt Marsh
Upstream Salt Marsh Migration Potential (acres):	149.30	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	Yes
Emergency Access or Evacuation Route:	N/A
History of Flooding:	Water rises as a result of very high/ storm tides

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 28

Observer(s) & Organization:	JB TS (NHDES Coastal)	**Date:**	8/17/2018	
Municipality:	HAMPTON FALLS	**Start Time:**	11:00:00 AM	
Stream Name:	Hampton Falls River	**End Time:**	12:00:00 PM	
Road Name:	N/A	**Tide Prediction**	**High**	**Low**
		Time:	5:07 PM	11:05 AM
		Elevation:	9.0	0.1
		Tide Chart Location:	Hampton Harbor	

	Score*
Crossing Condition Evaluation	
Crossing Condition	5
Tidal Restriction Evaluation	
Tidal Range Ratio	2
Crossing Ratio	5
Erosion Classification	3
Tidal Restriction Overall Score	3
Tidal Aquatic Organism Passage	
Tidal Range Ratio	2
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	5
Salt Marsh Migration Potential (Wshed.)	5
Vegetation Evaluation	
Vegetation Comparison Matrix	1
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	5,4
Inun. Risk to the Crossing Structure (US, DS)	5,4
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	4
Overall Scores	
Infrastructure	5
Ecological	3
Combined	5

DS view toward structure

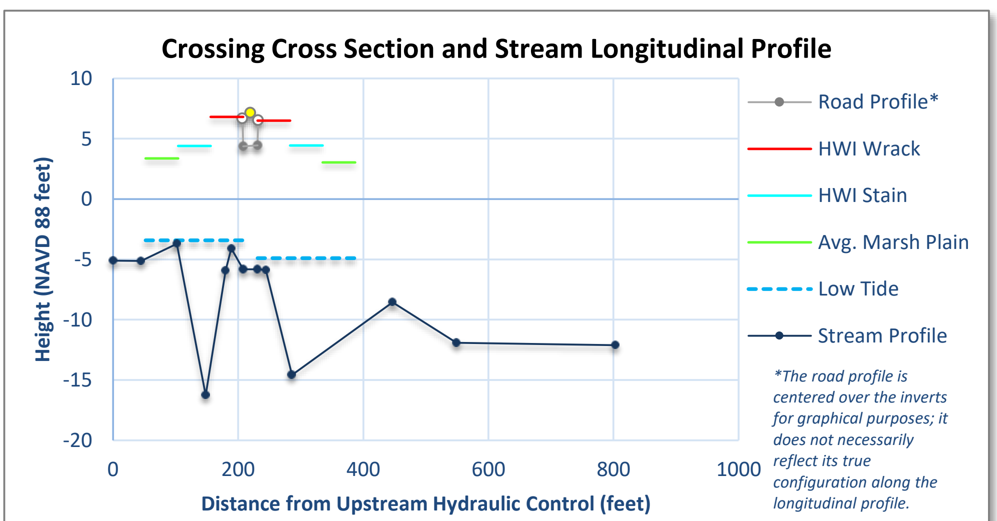
US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority

**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk



Long. Profile

Dist.	Hght.	Feat.	Sub.
0	-5.0978	HC	G
45	-5.1378	CB	G
102	-3.7078	HC	Shell
148	-16.268	P	S
180	-5.9178	CB	C
189	-4.0978	GC	C
208	-5.8178	I	C
231	-5.8178	I	B
244	-5.8678	CB	B
286	-14.568	P	C/S
447	-8.5678	HC	S
549	-11.918	P	S
803	-12.118	CB	C/S

Crossing Context:

One of four tidal river crossings by the abandoned railroad bed that bisect Hampton Seabrook Estuary, this old granite bridge carries the flow of a major tidal creek. Despite its large size (16 feet by 10 feet), it constricts flow as shown by the very large plunge pools on either side of the crossing. The crossing condition is poor with high inundation risk and salt marsh migration potential in the upstream watershed, leading to an overall combined score of 5: highest priority for replacement (or removal).

Structure Characteristics:

Structure Type:	Bridge with Abutments	**Date of Last Known Replacement:**	N/A
Structure Material:	Stone		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	16.5	15.7
Dimension B^{CB}(height):	11	10.2
Crossing Length (Invert to Invert):	23	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	None	N/A	Dry Fit Stone	Poor	Wingwalls	High
Downstream	None	N/A	Dry Fit Stone	Fair	Abutment	High

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
Abutment	High	N/A	OHE wires from power plant.	Poor

Structure Condition Comments:	Rusting out I beams. Stones falling out of structure

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	High Salt Marsh	High Salt Marsh
Upstream Salt Marsh Migration Potential (acres):	26.46	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	No
Emergency Access or Evacuation Route:	N/A
History of Flooding:	Unknown

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 29

Observer(s) & Organization:	JB TS (NHDES Coastal)
Municipality:	HAMPTON FALLS
Stream Name:	Hampton Falls River
Road Name:	N/A

Date:	7/3/2018	
Start Time:	9:33:00 AM	
End Time:	11:06:00 AM	
Tide Prediction	**High**	**Low**
Time:	3:48 PM	9:49 AM
Elevation:	7.9	0.5
Tide Chart Location:	Hampton Harbor	

Crossing Condition Evaluation	Score*
Crossing Condition	5
Tidal Restriction Evaluation	
Tidal Range Ratio	2
Crossing Ratio	3
Erosion Classification	4
Tidal Restriction Overall Score	3
Tidal Aquatic Organism Passage	
Tidal Range Ratio	2
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	4
Salt Marsh Migration Potential (Wshed.)	5
Vegetation Evaluation	
Vegetation Comparison Matrix	1
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	4,3
Inun. Risk to the Crossing Structure (US, DS)	2,2
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	5
Overall Scores	
Infrastructure	5
Ecological	3
Combined	4

DS view toward structure

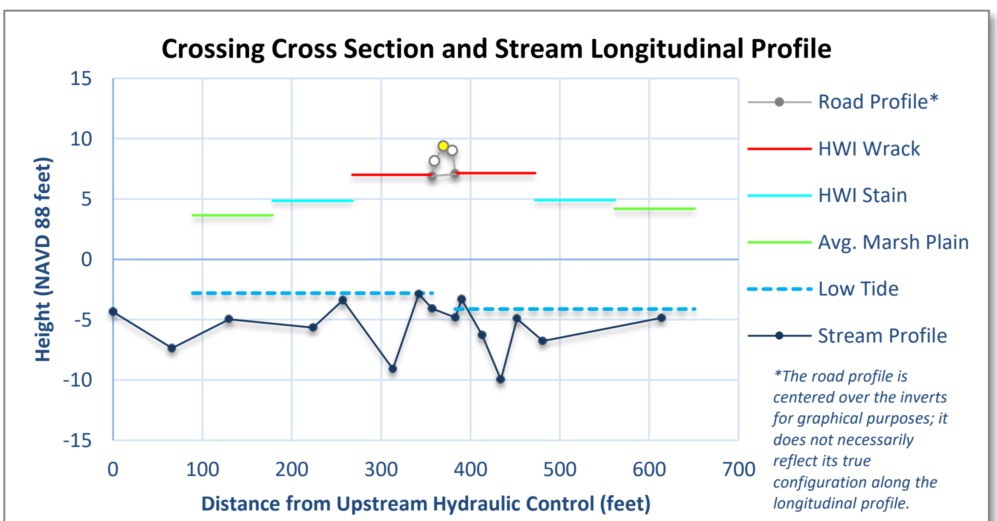
US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority

**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk



Long. Profile

Dist.	Hght.	Feat.	Sub.
0	-4.3468	HC	S
66	-7.3468	P	S
130	-4.9768	HC	S
224	-5.6468	CB	S
257	-3.3968	HC	S
313	-9.0768	P	S
342	-2.8668	GC	B
357	-4.0868	I	C
383	-4.8168	I	C
390	-3.3168	GC	B
413	-6.2668	CB	C
434	-9.9768	P	C
452	-4.9068	HC	C
481	-6.7568	P	G
614	-4.8468	HC	G

Crossing Context:

The granite structure conducts the Hampton Falls River, one of four tidal river crossings by the abandoned railroad bed that bisect Hampton Seabrook Estuary. The high water wrack line indicates tides in excess of 10 feet are not uncommon here and the large 27 foot by 11.5-foot structure is still shown to restrict tides by the 5 to 7-foot-deep plunge pools and over six inches of subsidence of the upstream marsh plain. The overall combined score of 4, high priority, is largely due to the poor structural condition of the crossing. Like crossings 26 and 28, this supports an abandoned railroad and could be removed.

Structure Characteristics:

Structure Type:	Bridge with Abutments	**Date of Last Known Replacement:**	N/A
Structure Material:	Stone		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	27	27
Dimension B[CB](height):	11.45	11.57
Crossing Length (Invert to Invert):	26	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	None	N/A	Masonry	Fair	Abutment	High
Downstream	None	N/A	Masonry	Poor	Culvert	High

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
Culvert	High	N/A	OHE	Poor

Structure Condition Comments:	Masonry missing mortar. Shifting stones. Support stumps exposed underneath structure

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	High Salt Marsh	High Salt Marsh
Upstream Salt Marsh Migration Potential (acres):	19.43	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	No
Emergency Access or Evacuation Route:	N/A
History of Flooding:	Unknown

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 30

Observer(s) & Organization:	TS, JB (NHDES Coastal)
Municipality:	HAMPTON FALLS
Stream Name:	Browns River
Road Name:	N/A

Date:	8/16/2018	
Start Time:	11:10:00 AM	
End Time:	1:00:00 PM	
Tide Prediction	**High**	**Low**
Time:	4:12 PM	10:12 AM
Elevation:	9.3	-0.4
Tide Chart Location:	Hampton Harbor	

Crossing Condition Evaluation	Score*
Crossing Condition	5
Tidal Restriction Evaluation	
Tidal Range Ratio	2
Crossing Ratio	5
Erosion Classification	1
Tidal Restriction Overall Score	3
Tidal Aquatic Organism Passage	
Tidal Range Ratio	2
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	5
Salt Marsh Migration Potential (Wshed.)	5
Vegetation Evaluation	
Vegetation Comparison Matrix	1
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	1,1
Inun. Risk to the Crossing Structure (US, DS)	5,5
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	5
Overall Scores	
Infrastructure	5
Ecological	1
Combined	4

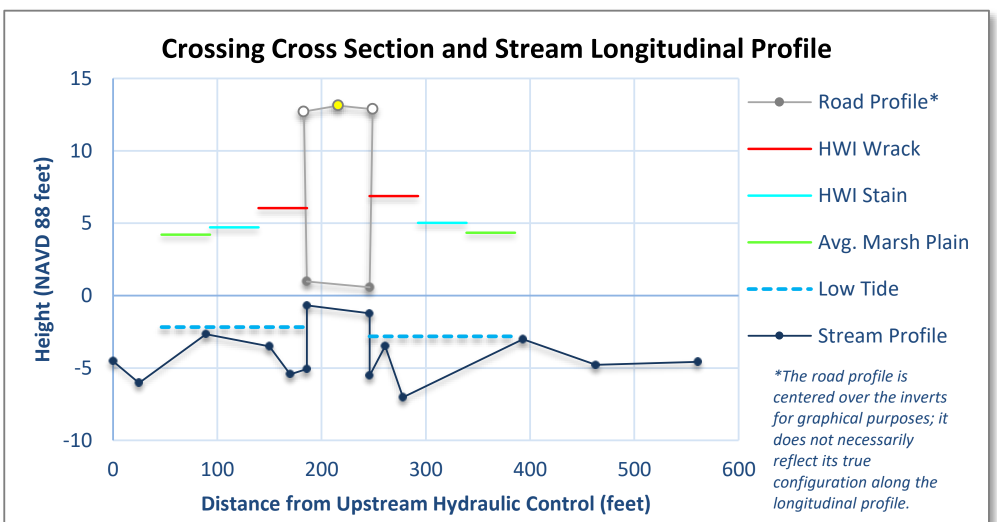
DS view toward structure

US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority
**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk



Long. Profile

Dist.	Hght.	Feat.	Sub.
0	-4.5266	HC	C/S
25	-6.0466	P	C/S
89	-2.6666	HC	G
150	-3.5066	CB	S
170	-5.4466	P	S
186	-5.0766	I	B
186	-0.6766	I	C
246	-1.2166	I	B
246	-5.5166	I	B
261	-3.4966	GC	B
278	-7.0266	P	G
393	-3.0066	HC	G
463	-4.7866	P	C/S
561	-4.5766	HC	C/S

Crossing Context:

The crossing at Brown's River was under an inactive rail line and the 48-inch dimeter culvert was too small and perched too high, leading to tidal restriction and upstream marsh subsidence (about 5 inches) and invasion of exotic Phragmites. In addition, the ebb flow led to a greatly eroded channel, which is still evident (high crossing ratio score). In 2005, tidal flow was enhanced by the addition of a 4 by 6-foot culvert placed lower in the intertidal zone to support organism passage and reduce the tidal restriction. Although the marsh surface measurements were limited, the survey team found that the subsidence had decreased to only 1.5 inches in 2018. Despite the added benefits from the additional culvert, the crossing condition is poor, and the entire structure is regularly overfilled by tides, leading to an overall combined score of 4: high priority for replacement.

Structure Characteristics:

Structure Type:	Box Culvert	**Date of Last Known Replacement:**	2005
Structure Material:	Concrete		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	8	8
Dimension B[CB] (height):	6	6
Crossing Length (Invert to Invert):	60	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	Concrete	Good	Rip Rap	Fair	None	None
Downstream	Concrete	Fair	Rip Rap	Good	Headwall	Medium

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
Culvert	Low	N/A	Nuclear plant	Fair

Structure Condition Comments:	Cracking at headwall/wingwall DS

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	High Salt Marsh	High Salt Marsh
Upstream Salt Marsh Migration Potential (acres):	15.81	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	No
Emergency Access or Evacuation Route:	N/A
History of Flooding:	Unknown

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 31

Observer(s) & Organization:	JB, KL (NHDES Coastal)
Municipality:	HAMPTON
Stream Name:	Taylor River
Road Name:	Interstate 95 N

Date:	10/1/2018	
Start Time:	9:30:00 AM	
End Time:	12:00:00 PM	
Tide Prediction	**High**	**Low**
Time:	4:26 PM	10:29 AM
Elevation:	9.1	0.7
Tide Chart Location:	Portsmouth Harbor	

Crossing Condition Evaluation	Score*
Crossing Condition	1
Tidal Restriction Evaluation	
Tidal Range Ratio	1
Crossing Ratio	1
Erosion Classification	3
Tidal Restriction Overall Score	2
Tidal Aquatic Organism Passage	
Tidal Range Ratio	1
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	5
Salt Marsh Migration Potential (Wshed.)	5
Vegetation Evaluation	
Vegetation Comparison Matrix	5
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	0,1
Inun. Risk to the Crossing Structure (US, DS)	1,1
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	5
Overall Scores	
Infrastructure	1
Ecological	4
Combined	2

DS view toward structure

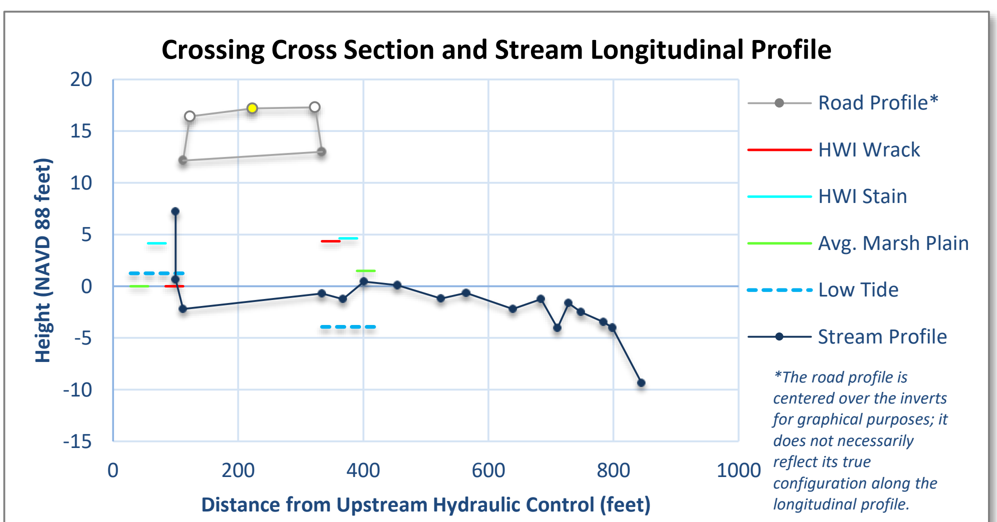
US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority

**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk

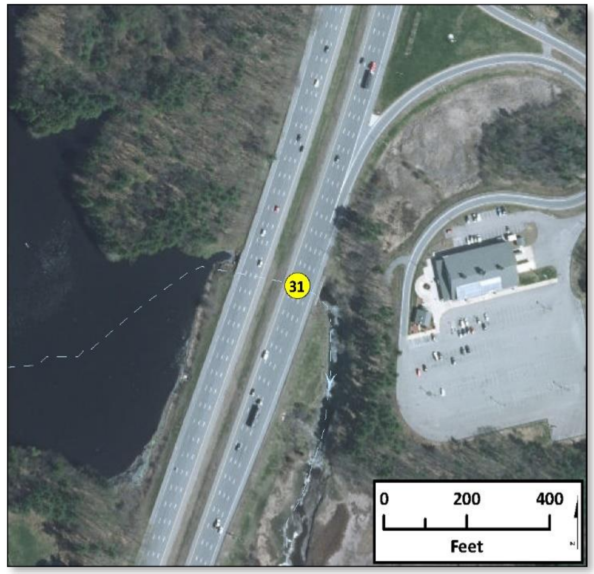


Long. Profile

Dist.	Hght.	Feat.	Sub.
100	7.2116	HC	N/A
100	0.6516	CB	B
112	-2.1984	I	B
334.24	-0.6884	I	C/S
367.24	-1.2484	P	C/S
401.24	0.4516	HC	C
454.24	0.1016	HC	G
524.24	-1.1984	P	C
564.24	-0.6484	HC	G
639.24	-2.1984	P	G
684.24	-1.2484	HC	C
710.24	-4.0484	P	B
728.24	-1.6584	HC	B
748.24	-2.5284	HC	B
784.24	-3.4784	HC	S
798.24	-4.0184	CB	C/S
845.24	-9.3984	CB	C/S

Crossing Context:

N/A



Structure Characteristics:

Structure Type:	Bridge with Side Slopes and Abutments	**Date of Last Known Replacement:**	N/A
Structure Material:	Concrete		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	72	72
Dimension B^{CB}(height):	14.11	13.73
Crossing Length (Invert to Invert):	222	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	None	N/A	None	N/A	None	None
Downstream	None	N/A	None	N/A	None	None

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
None	None	Good	None	Good

Structure Condition Comments:	N/A

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	Freshwater Marsh	Brackish Riverbank Marsh
Upstream Salt Marsh Migration Potential (acres):	46.47	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	Yes
Emergency Access or Evacuation Route:	Yes
History of Flooding:	US flooding in '06 and '09 prior to being updated

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 32

Observer(s) & Organization:	JB (NHDES Coastal)
Municipality:	HAMPTON FALLS
Stream Name:	N/A
Road Name:	Interstate 95 N

Date:	10/16/2018	
Start Time:	10:05:00 AM	
End Time:	12:00:00 PM	
Tide Prediction	**High**	**Low**
Time:	5:28 AM	11:42 AM
Elevation:	7.5	1.7
Tide Chart Location:	Hampton Harbor	

Crossing Condition Evaluation	Score*
Crossing Condition	2
Tidal Restriction Evaluation	
Tidal Range Ratio	1
Crossing Ratio	1
Erosion Classification	5
Tidal Restriction Overall Score	2
Tidal Aquatic Organism Passage	
Tidal Range Ratio	1
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	1
Salt Marsh Migration Potential (Wshed.)	1
Vegetation Evaluation	
Vegetation Comparison Matrix	3
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	1,1
Inun. Risk to the Crossing Structure (US, DS)	5,5
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	0
Overall Scores	
Infrastructure	2
Ecological	3
Combined	2

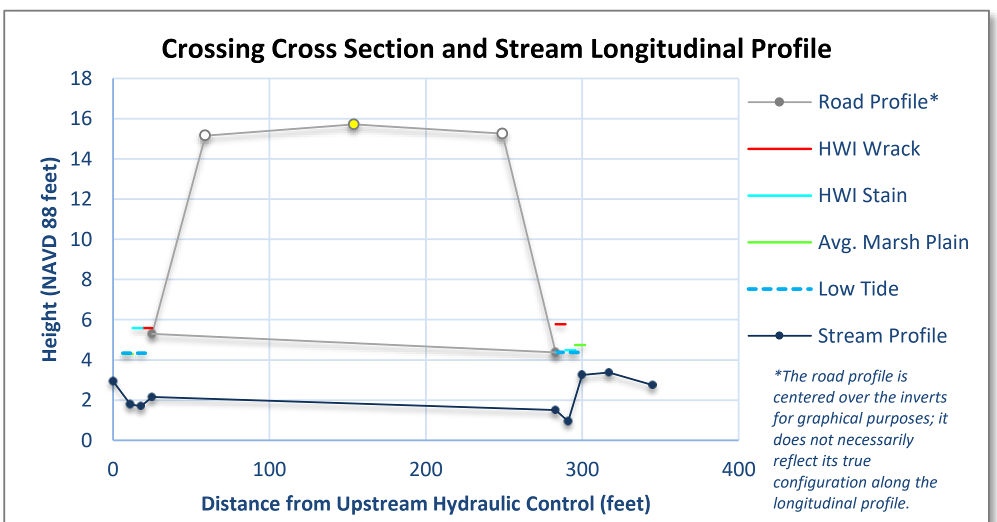
DS view toward structure

US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority
**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk

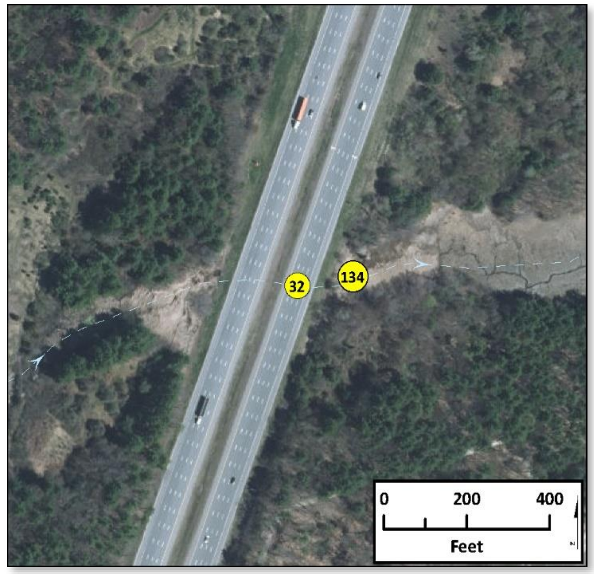


Long. Profile

Dist.	Hght.	Feat.	Sub.
0	2.9452	CB	C/S
11	1.7852	HC	C/S
18	1.7052	CB	B
25	2.1552	I	B
283	1.5052	I	C/S
291	0.9452	P	C/S
300	3.2552	HC	C/S
317	3.3752	CB	C/S
345	2.7452	I	C/S

Crossing Context:

N/A



Structure Characteristics:

Structure Type:	Round Culvert	**Date of Last Known Replacement:**	N/A
Structure Material:	Concrete		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	5.8	5.8
Dimension B[CB](height):	2.9	2.9
Crossing Length (Invert to Invert):	258	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	Masonry	Fair	Masonry	Fair	Wingwalls	Low
Downstream	Masonry	Fair	Masonry	Fair	None	None

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
None	None	Good	None	Fair

Structure Condition Comments:	N/A

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	Invasive Dominant	Invasive Dominant
Upstream Salt Marsh Migration Potential (acres):	0.00	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	No
Emergency Access or Evacuation Route:	Yes
History of Flooding:	unknown

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 33

Observer(s) & Organization:	TS, TM (NHDES Coastal)
Municipality:	HAMPTON
Stream Name:	N/A
Road Name:	Huckleberry Ln

Date:	7/16/2018	
Start Time:	8:00:00 AM	
End Time:	9:40:00 AM	
Tide Prediction	**High**	**Low**
Time:	2:50 PM	8:50 AM
Elevation:	9.5	-1.4
Tide Chart Location:	Hampton Harbor	

Crossing Condition Evaluation	Score*
Crossing Condition	5
Tidal Restriction Evaluation	
Tidal Range Ratio	1
Crossing Ratio	5
Erosion Classification	5
Tidal Restriction Overall Score	4
Tidal Aquatic Organism Passage	
Tidal Range Ratio	1
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	4
Salt Marsh Migration Potential (Wshed.)	4
Vegetation Evaluation	
Vegetation Comparison Matrix	3
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	2,2
Inun. Risk to the Crossing Structure (US, DS)	5,5
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	5
Overall Scores	
Infrastructure	5
Ecological	3
Combined	4

DS view toward structure

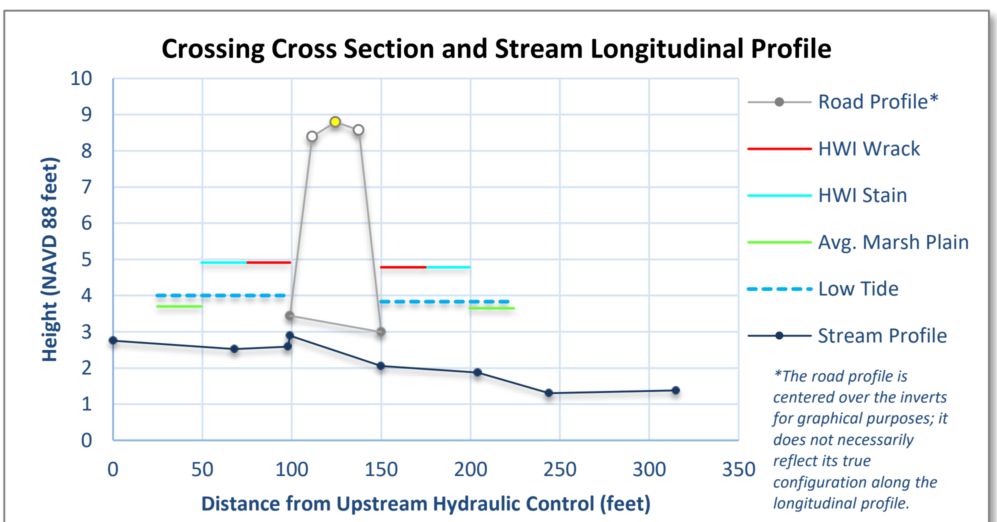
US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority

**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk



Long. Profile

Dist.	Hght.	Feat.	Sub.
0	2.7527	HC	S
68	2.5227	HC	C/S
98	2.5927	P	C/S
99	2.8927	I	C/S
150	2.0527	I	G
204	1.8727	P	C/S
244	1.3027	HC	C/S
315	1.3827	HC	C/S

Crossing Context:

Huckleberry Lane crosses an unnamed tributary to the Little River and the tidal flow is supported by three small pipes that are underwater most of the time. The downstream area is eroded to a wider creek and erosion classification at the crossing is high for both upstream and downstream, leading to an overall combined score of 4, high priority for replacement.

Structure Characteristics:

Structure Type:	Round Culvert	**Date of Last Known Replacement:**	N/A
Structure Material:	Plastic - Smooth		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	3.6	3.6
Dimension B^{CB}(height):	1.1	1.2
Crossing Length (Invert to Invert):	51	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	Rip Rap	Poor	None	N/A	None	None
Downstream	Rip Rap	Poor	None	N/A	None	None

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
None	None	Fair	Overhead electric	Poor

Structure Condition Comments:	Tree culverts, surveyed as one, completely submerged

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	Low Salt Marsh	Low Salt Marsh
Upstream Salt Marsh Migration Potential (acres):	7.88	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	No
Emergency Access or Evacuation Route:	N/A
History of Flooding:	unknown

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 34

Observer(s) & Organization:	JB TS (NHDES Coastal)
Municipality:	HAMPTON
Stream Name:	N/A
Road Name:	Ocean Blvd

Date:	7/31/2018
Start Time:	8:30:00 AM
End Time:	9:43:00 AM

Tide Prediction	**High**	**Low**
Time:	2:35 PM	8:39 AM
Elevation:	8.1	0.3
Tide Chart Location:	Hampton Harbor	

Crossing Condition Evaluation	Score*
Crossing Condition	1
Tidal Restriction Evaluation	
Tidal Range Ratio	1
Crossing Ratio	1
Erosion Classification	5
Tidal Restriction Overall Score	2
Tidal Aquatic Organism Passage	
Tidal Range Ratio	1
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	1
Salt Marsh Migration Potential (Wshed.)	1
Vegetation Evaluation	
Vegetation Comparison Matrix	0
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	2,2
Inun. Risk to the Crossing Structure (US, DS)	2,2
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	5

Overall Scores

Infrastructure	1
Ecological	4
Combined	2

DS view toward structure

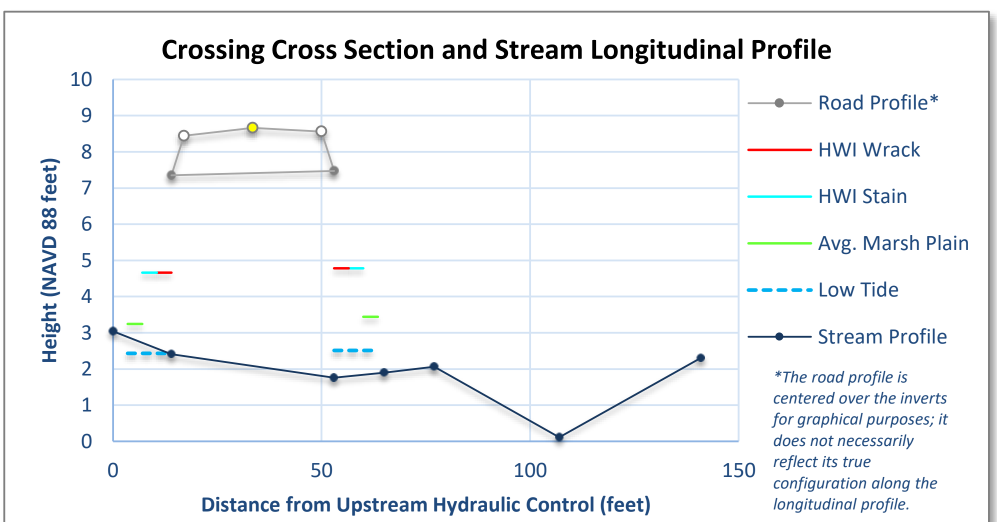
US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority

**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk



Long. Profile

Dist.	Hght.	Feat.	Sub.
0	3.0414	CB	C/S
14	2.4114	I	C/S
53	1.7614	I	C/S
65	1.9014	HC	C/S
77	2.0614	HC	C/S
107	0.1114	P	C/S
141	2.3114	HC	C/S

Crossing Context:

N/A

Structure Characteristics:

Structure Type:	Box Culvert	**Date of Last Known Replacement:**	N/A
Structure Material:	Concrete		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	8.85	8.77
Dimension B^{CB}(height):	4.91	5.71
Crossing Length (Invert to Invert):	39	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	None	N/A	Concrete	Good		
Downstream	None	N/A	Concrete	Good	None	None

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
None	None	Fair	Overhead electric	Good

Structure Condition Comments:	N/A

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	Invasive Dominant	Low Salt Marsh
Upstream Salt Marsh Migration Potential (acres):	0.00	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	Yes
Emergency Access or Evacuation Route:	N/A
History of Flooding:	'11 minor flooding. prone to high flows.

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 35

Observer(s) & Organization:	JB TS (NHDES Coastal)
Municipality:	NORTH HAMPTON
Stream Name:	Little River
Road Name:	Appledore Ave

Date:	7/9/2018	
Start Time:	2:24:00 PM	
End Time:	3:32:00 PM	
Tide Prediction	**High**	**Low**
Time:	8:38 PM	2:36 PM
Elevation:	9.4	0.5
Tide Chart Location:	Hampton Harbor	

Crossing Condition Evaluation	Score*
Crossing Condition	1
Tidal Restriction Evaluation	
Tidal Range Ratio	3
Crossing Ratio	3
Erosion Classification	4
Tidal Restriction Overall Score	3
Tidal Aquatic Organism Passage	
Tidal Range Ratio	3
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	5
Salt Marsh Migration Potential (Wshed.)	5
Vegetation Evaluation	
Vegetation Comparison Matrix	0
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	3,3
Inun. Risk to the Crossing Structure (US, DS)	5,5
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	5

Overall Scores

Infrastructure	3
Ecological	4
Combined	3

DS view toward structure

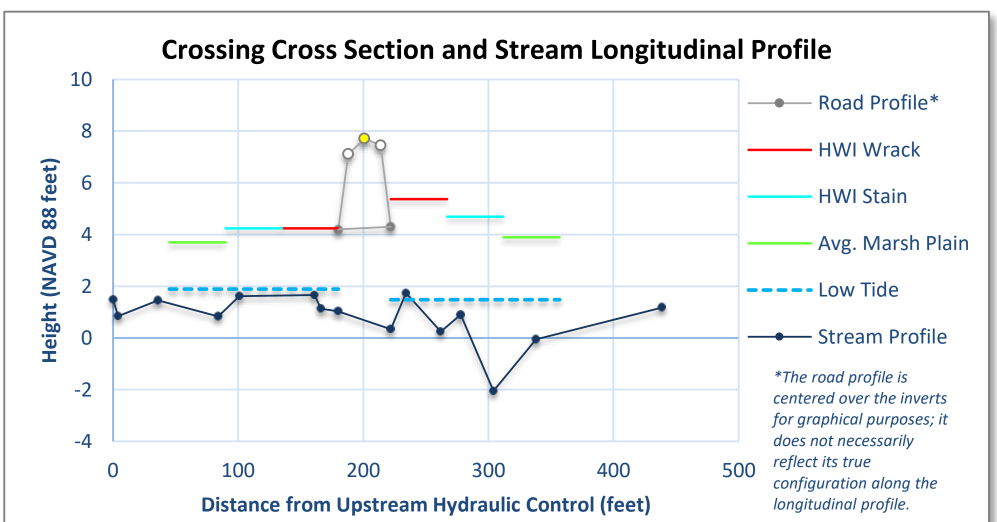
US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority

**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk



Long. Profile

Dist.	Hght.	Feat.	Sub.
0	1.48	HC	S
4	0.84	P	S
36	1.46	HC	S
84	0.83	P	S
101	1.61	HC	S
161	1.66	HC	S
166	1.13	CB	S
180	1.03	I	G
222	0.34	I	C
234	1.74	GC	C
262	0.25	P	G
278	0.9	HC	G
304	-2.05	P	G
338	-0.05	HC	S
439	1.18	HC	S

Crossing Context:

Appledore Avenue crosses creek running north to the Little River and the original structure was replaced in 1999 with a 4 by 8-foot box culvert to allow unrestricted tides to flow upstream. The overall combined score of 3 shows a moderate priority for replacement, largely based on crossing ratios and signs of erosion, some of which may remain from the previous structure. More information can be found for this and the Little River restoration in 2000 on the NRCS website:

https://www.nrcs.usda.gov/wps/portal/nrcs/detail/nh/technical/?cid=nrcs144p2_015688

Structure Characteristics:

Structure Type:	Box Culvert	**Date of Last Known Replacement:**	2001
Structure Material:	Concrete		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	8	8
Dimension B^{CB}(height):	3.3	4
Crossing Length (Invert to Invert):	42	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	Concrete	Good	Rip Rap	Fair	Wingwalls	Medium
Downstream	Concrete	Good	Rip Rap	Fair	Wingwalls	Medium

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
None	None	Fair	OHE DS	Good

Structure Condition Comments:	N/A

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	High Salt Marsh	High Salt Marsh
Upstream Salt Marsh Migration Potential (acres):	21.80	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	No
Emergency Access or Evacuation Route:	N/A
History of Flooding:	Prior to replacement

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 36

Observer(s) & Organization:	JB TS. (NHDES Coastal)
Municipality:	NORTH HAMPTON
Stream Name:	N/A
Road Name:	Ocean Blvd

Date:	7/11/2018	
Start Time:	3:30:00 PM	
End Time:	5:10:00 PM	
Tide Prediction	**High**	**Low**
Time:	10:28 PM	2:29 PM
Elevation:	10.2	0.0
Tide Chart Location:	Hampton Harbor	

Crossing Condition Evaluation	Score*
Crossing Condition	1
Tidal Restriction Evaluation	
Tidal Range Ratio	5
Crossing Ratio	3
Erosion Classification	4
Tidal Restriction Overall Score	4
Tidal Aquatic Organism Passage	
Tidal Range Ratio	5
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	5
Salt Marsh Migration Potential (Wshed.)	5
Vegetation Evaluation	
Vegetation Comparison Matrix	1
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	4,5
Inun. Risk to the Crossing Structure (US, DS)	5,5
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	3
Overall Scores	
Infrastructure	5
Ecological	5
Combined	5

DS view toward structure

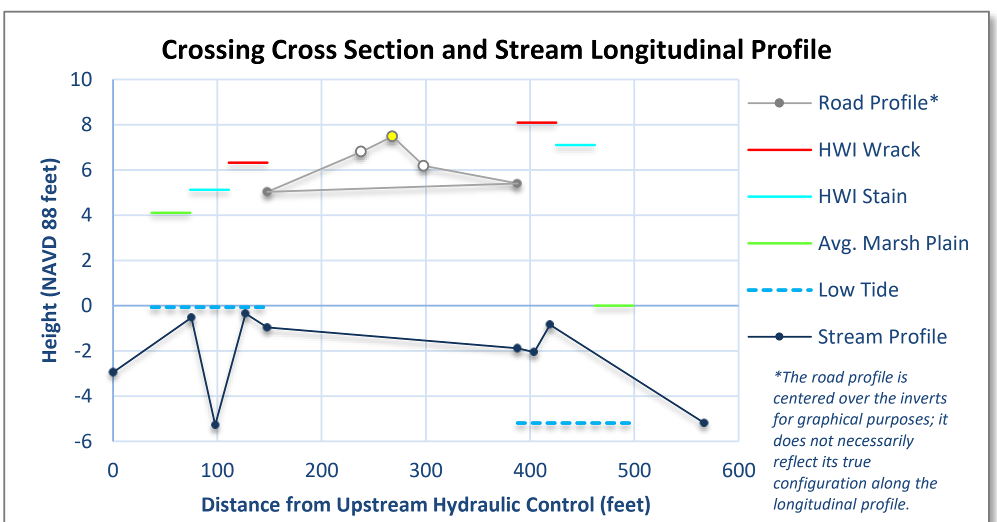
US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority

**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk



Long. Profile

Dist.	Hght.	Feat.	Sub.
0	-2.9497	HC	G
75	-0.5297	HC	G
98	-5.2797	P	S
127	-0.3497	GC	C
148	-0.9597	I	B
388	-1.8897	I	C
404	-2.0497	P	C
419	-0.8397	HC	B
567	-5.1897	HC	C

Crossing Context:

Little River once flowed into the ocean through an inlet south of Appledore Road, but with the construction of Route 1A and the 'trunk' that drained the marsh system (once measured at 193 acres) at its north end, the inlet variably closed which led to dynamic shifts in water levels and marsh degradation. The trunk was drained by a 4-foot round pipe and was woefully inadequate to support tidal flow into the marsh. It was replaced by two 6 by 12-foot culverts, side by side, in 2000. The disparity of the up and downstream highwater stains shows the top two feet of regular high tides are still prevented from flooding the marsh, signs of strong erosion are found upstream and the crossing is likely to be inundated by storms. The overall combined score is 5: highest priority. It should be stated the culvert size chosen in 2000 was recognized not to be able to conduct the full tidal flow but was selected as a more economical solution than a larger bridge. More information can be found for the Little River restoration on the NRCS website:

https://www.nrcs.usda.gov/wps/portal/nrcs/detail/nh/technical/?cid=nrcs144p2_015688

and the NHDES website:

https://www.des.nh.gov/organization/divisions/water/wmb/coastal/restoration/saltmarsh_restoration.htm

Structure Characteristics:

Structure Type:	Box Culvert	**Date of Last Known Replacement:**	2000
Structure Material:	Concrete		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	24	24
Dimension B[CB](height):	6	6
Crossing Length (Invert to Invert):	240	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	None	N/A	Rip Rap	Good	None	None
Downstream	None	N/A	Rip Rap	Good	None	None

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
None	None	Good	OHE. Poles in marsh US	Good

Structure Condition Comments:	Two twin box culverts, surveyed as one structure

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	High Salt Marsh	Sparsely Vegetated Intertidal Habitat
Upstream Salt Marsh Migration Potential (acres):	73.63	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	Yes
Emergency Access or Evacuation Route:	N/A
History of Flooding:	Past flooding has occurred.

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 37

Observer(s) & Organization:	TS, JB (NHDES Coastal)
Municipality:	NORTH HAMPTON
Stream Name:	Little River
Road Name:	Atlantic Ave

Date:	6/25/2018	
Start Time:	3:58:00 PM	
End Time:	6:19:00 PM	
Tide Prediction	**High**	**Low**
Time:	10:38 PM	4:40 PM
Elevation:	9.1	0.8
Tide Chart Location:	Hampton Harbor	

Crossing Condition Evaluation	Score*
Crossing Condition	3
Tidal Restriction Evaluation	
Tidal Range Ratio	1
Crossing Ratio	4
Erosion Classification	5
Tidal Restriction Overall Score	3
Tidal Aquatic Organism Passage	
Tidal Range Ratio	1
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	1
Salt Marsh Migration Potential (Wshed.)	2
Vegetation Evaluation	
Vegetation Comparison Matrix	0
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	2,2
Inun. Risk to the Crossing Structure (US, DS)	1,1
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	4
Overall Scores	
Infrastructure	3
Ecological	4
Combined	3

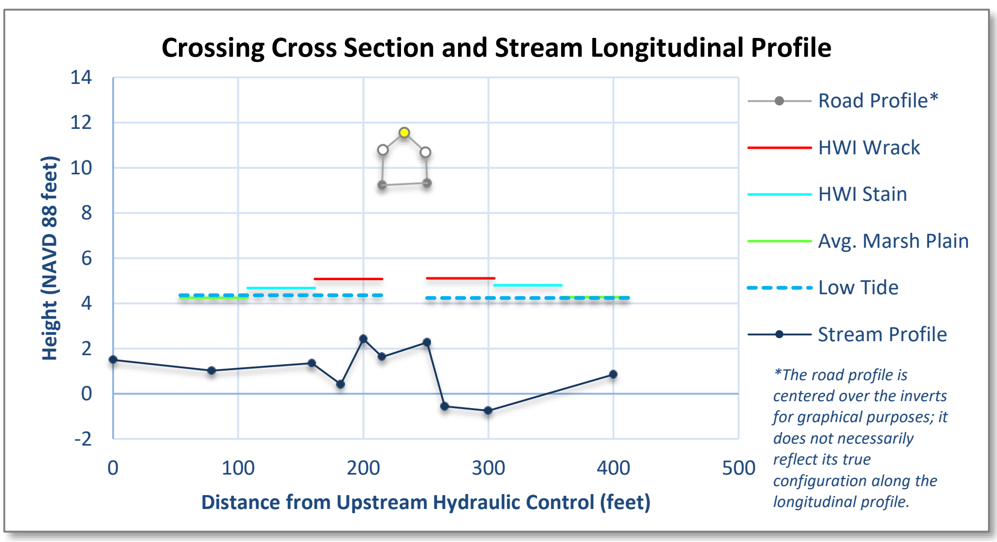
DS view toward structure

US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority
**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk



Long. Profile

Dist.	Hght.	Feat.	Sub.
0	1.4986	HC	C/S
79	1.0286	P	C/S
159	1.3486	HC	C/S
182	0.4186	P	G
200	2.4186	GC	C
215	1.6286	I	C
251	2.2786	I	C
265	-0.5514	P	C
300	-0.7514	HC	C/S
400	0.8586	HC	C/S

Crossing Context:

N/A

Structure Characteristics:

Structure Type:	Box Culvert	**Date of Last Known Replacement:**	N/A
Structure Material:	Concrete		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	7.72	8.8
Dimension B[CB] (height):	7.69	7.2
Crossing Length (Invert to Invert):	36	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	Concrete	Good	Concrete	Fair	Culvert	High
Downstream	Concrete	Good	Concrete	Fair	None	None

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
Culvert	Low	Fair	Overhead electric, sewer line downstream headwall	Fair

Structure Condition Comments:	N/A

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	Brackish Riverbank Marsh	Brackish Riverbank Marsh
Upstream Salt Marsh Migration Potential (acres):	1.03	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	No
Emergency Access or Evacuation Route:	Yes
History of Flooding:	Unknown

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 38

Observer(s) & Organization:	TS, JB (NHDES Coastal)
Municipality:	NORTH HAMPTON
Stream Name:	Little River
Road Name:	Woodland Rd

Date:	7/3/2018	
Start Time:	11:45:00 AM	
End Time:	1:00:00 PM	
Tide Prediction	**High**	**Low**
Time:	3:48 PM	9:49 AM
Elevation:	7.9	0.5
Tide Chart Location:	Hampton Harbor	

Crossing Condition Evaluation	Score*
Crossing Condition	3
Tidal Restriction Evaluation	
Tidal Range Ratio	5
Crossing Ratio	4
Erosion Classification	5
Tidal Restriction Overall Score	5
Tidal Aquatic Organism Passage	
Tidal Range Ratio	5
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	2
Salt Marsh Migration Potential (Wshed.)	2
Vegetation Evaluation	
Vegetation Comparison Matrix	1
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	2,2
Inun. Risk to the Crossing Structure (US, DS)	1,1
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	4

Overall Scores

Infrastructure	3
Ecological	5
Combined	3

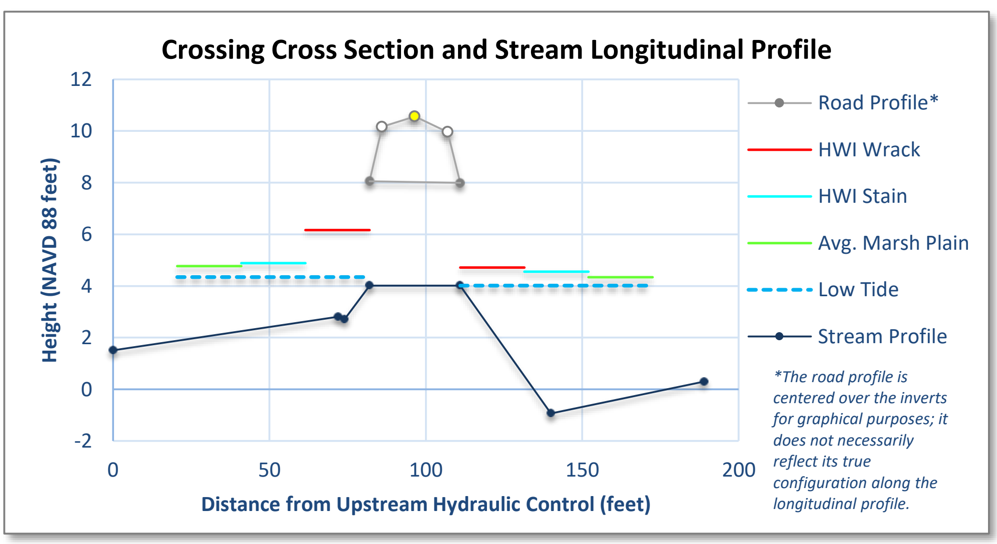
DS view toward structure

US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority
**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk



Long. Profile

Dist.	Hght.	Feat.	Sub.
0	1.5143	HC	C/S
72	2.8143	HC	G
74	2.7143	P	G
82	4.0143	I	C
111	4.0143	I	C
140	-0.9357	P	B
189	0.3043	HC	G

Crossing Context:

N/A

Structure Characteristics:

Structure Type:	Box Culvert	**Date of Last Known Replacement:**	N/A
Structure Material:	Concrete		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	8	8
Dimension B[CB](height):	4	4
Crossing Length (Invert to Invert):	29	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	Concrete	Good	Rip Rap	Poor	Wingwalls	Medium
Downstream	Concrete	Good	Concrete	Good	Wingwalls	Low

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
None	None	Good	Overhead electric	Good

Structure Condition Comments:	N/A

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	Freshwater Swamp	Freshwater Swamp
Upstream Salt Marsh Migration Potential (acres):	1.03	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	Yes
Emergency Access or Evacuation Route:	N/A
History of Flooding:	Past flooding with potential for erosion

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 39

Observer(s) & Organization:	TS, JB, PS, KL (NHDES Coastal)
Municipality:	NORTH HAMPTON
Stream Name:	Chapel Brook
Road Name:	Ocean Blvd

Date:	7/20/2018	
Start Time:	11:45:00 AM	
End Time:	1:44:00 PM	
Tide Prediction	**High**	**Low**
Time:	6:38 PM	12:34 PM
Elevation:	8.9	0.3
Tide Chart Location:	Hampton Harbor	

	Score*
Crossing Condition Evaluation	
Crossing Condition	2
Tidal Restriction Evaluation	
Tidal Range Ratio	5
Crossing Ratio	5
Erosion Classification	2
Tidal Restriction Overall Score	4
Tidal Aquatic Organism Passage	
Tidal Range Ratio	5
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	3
Salt Marsh Migration Potential (Wshed.)	5
Vegetation Evaluation	
Vegetation Comparison Matrix	1
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	1,5
Inun. Risk to the Crossing Structure (US, DS)	4,5
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	2
Overall Scores	
Infrastructure	5
Ecological	5
Combined	5

DS view toward structure

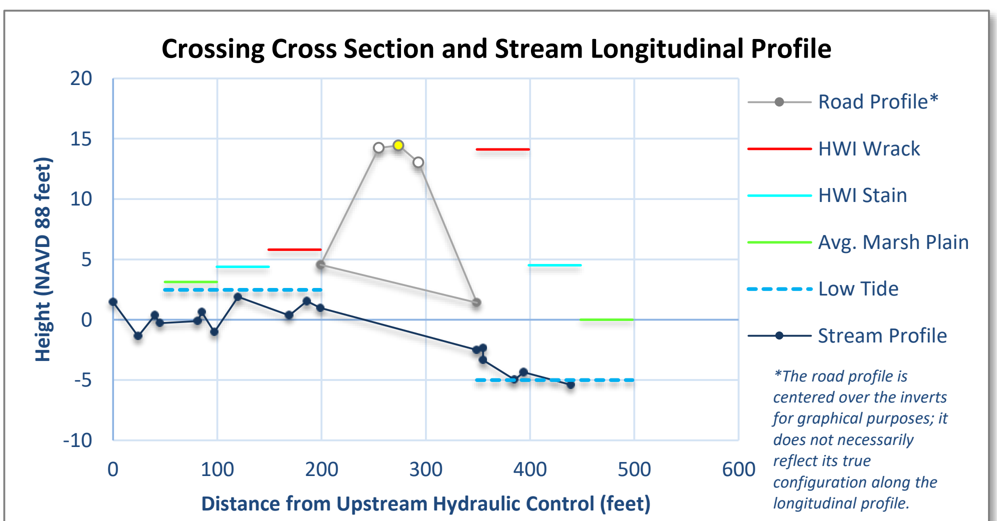
US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority

**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk



Long. Profile

Dist.	Hght.	Feat.	Sub.
0	1.4657	HC	G
24	-1.3643	P	C
40	0.3657	GC	B
45	-0.2743	I	B
81	-0.1043	I	B
85	0.6357	GC	B
97	-1.0143	P	S
120	1.8957	HC	S
169	0.3557	P	G
186	1.5357	GC	C
199	0.9657	I	C
349	-2.4943	I	B
355	-2.3443	GC	B
355	-3.3443	CB	B
385	-4.9843	P	G
394	-4.3543	HC	B
439	-5.3943	HC	B

Crossing Context:

Tidal flow supporting the salt marsh at Philbrick's Pond has been restricted by the trolley berm of the early 1900s as well as Route 1A (reported here). A recent investigation into the hydrodynamic flows and how they may be restored to rejuvenate the degraded salt marsh showed that the small clay pipe under the trolley berm was intact, but restricted tides, while the culvert under Route 1A was less restrictive (CMA Engineers 2018). The overall combined score of 4 indicates high priority for replacement.

Structure Characteristics:

Structure Type:	Box Culvert	**Date of Last Known Replacement:**	N/A
Structure Material:	Stone		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	5	4
Dimension B^{CB}(height):	4	4
Crossing Length (Invert to Invert):	150	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	Masonry	Fair	Rip Rap	Fair	Wingwalls	Medium
Downstream	Rip Rap	Fair	None	N/A	None	None

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
None	None	Fair	Overhead electric	Fair

Structure Condition Comments:	Converts to concrete pipe halfway downstream

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	Low Salt Marsh	Sparsely Vegetated Intertidal Habitat
Upstream Salt Marsh Migration Potential (acres):	34.64	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	No
Emergency Access or Evacuation Route:	Yes
History of Flooding:	flooding due to trolly line restriction

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 40

Observer(s) & Organization:	JB TS (NHDES Coastal)
Municipality:	RYE
Stream Name:	N/A
Road Name:	Ocean Blvd

Date:	7/24/2018	
Start Time:	3:10:00 PM	
End Time:	4:00:00 PM	
Tide Prediction	**High**	**Low**
Time:	10:13 PM	4:15 PM
Elevation:	8.8	1.2
Tide Chart Location:	Hampton Harbor	

Crossing Condition Evaluation	Score*
Crossing Condition	2
Tidal Restriction Evaluation	
Tidal Range Ratio	5
Crossing Ratio	5
Erosion Classification	3
Tidal Restriction Overall Score	4
Tidal Aquatic Organism Passage	
Tidal Range Ratio	5
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	3
Salt Marsh Migration Potential (Wshed.)	5
Vegetation Evaluation	
Vegetation Comparison Matrix	1
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	1,4
Inun. Risk to the Crossing Structure (US, DS)	5,5
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	2
Overall Scores	
Infrastructure	4
Ecological	5
Combined	5

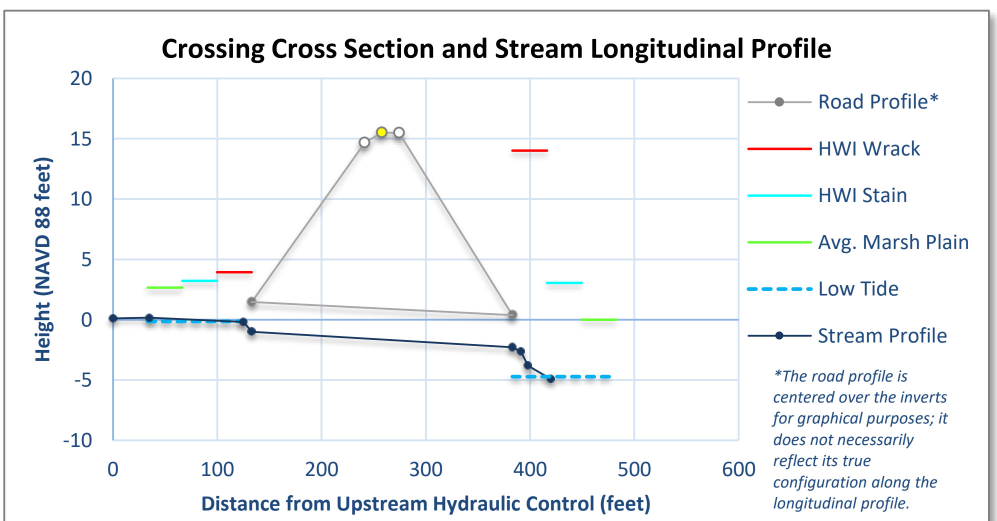
DS view toward structure

US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority
**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk



Long. Profile

Dist.	Hght.	Feat.	Sub.
0	0.1184	HC	C/S
35	0.1684	HC	G
125	-0.1816	GC	G
133	-1.0116	I	C
383	-2.2816	I	B
391	-2.6316	HC	B
398	-3.8016	CB	B
420	-4.9216	HC	C

Crossing Context:

The inlet to Bass Beach Marsh is crossed by Route 1A (Ocean Boulevard) that uses a 2.4-foot circular culvert that is over 250 feet in length to conduct the tides. Although the marsh is perched about 5 feet above the downstream low tide, the culvert still restricts the upper portion of the tide as evidenced by the high crossing ratio. The marsh is being invaded by exotic common reed. The overall combined score of 5 indicates highest priority for replacement.

Structure Characteristics:

Structure Type:	Round Culvert	**Date of Last Known Replacement:**	N/A
Structure Material:	Plastic - Smooth		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	2.4	2.4
Dimension B[CB](height):	2.4	2.4
Crossing Length (Invert to Invert):	250	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	Dry Fit Stone	Fair	None	N/A	Headwall	Medium
Downstream	None	N/A	None	N/A	None	None

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
None	None	Fair	None	Fair

Structure Condition Comments:	Large boulder blocking DS outlet. Restricting flow and AOP.

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	Low Salt Marsh	Sparsely Vegetated Intertidal Habitat
Upstream Salt Marsh Migration Potential (acres):	11.66	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	Yes
Emergency Access or Evacuation Route:	Yes
History of Flooding:	culvert gets clogged, floods during heavy rain.

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 41

Observer(s) & Organization:	JB TS (NHDES Coastal)
Municipality:	RYE
Stream Name:	N/A
Road Name:	Causeway Rd

Date:	7/6/2018	
Start Time:	12:30:00 PM	
End Time:	1:00:00 PM	
Tide Prediction	**High**	**Low**
Time:	6:08 PM	11:42 AM
Elevation:	7.8	0.7
Tide Chart Location:	Portsmouth Harbor	

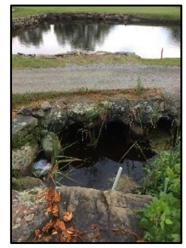
Crossing Condition Evaluation	Score*
Crossing Condition	3
Tidal Restriction Evaluation	
Tidal Range Ratio	3
Crossing Ratio	5
Erosion Classification	3
Tidal Restriction Overall Score	4
Tidal Aquatic Organism Passage	
Tidal Range Ratio	3
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	4
Salt Marsh Migration Potential (Wshed.)	4
Vegetation Evaluation	
Vegetation Comparison Matrix	5
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	3,3
Inun. Risk to the Crossing Structure (US, DS)	3,3
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	5

Overall Scores

Infrastructure	3
Ecological	4
Combined	3

DS view toward structure

US view above structure



US view toward structure

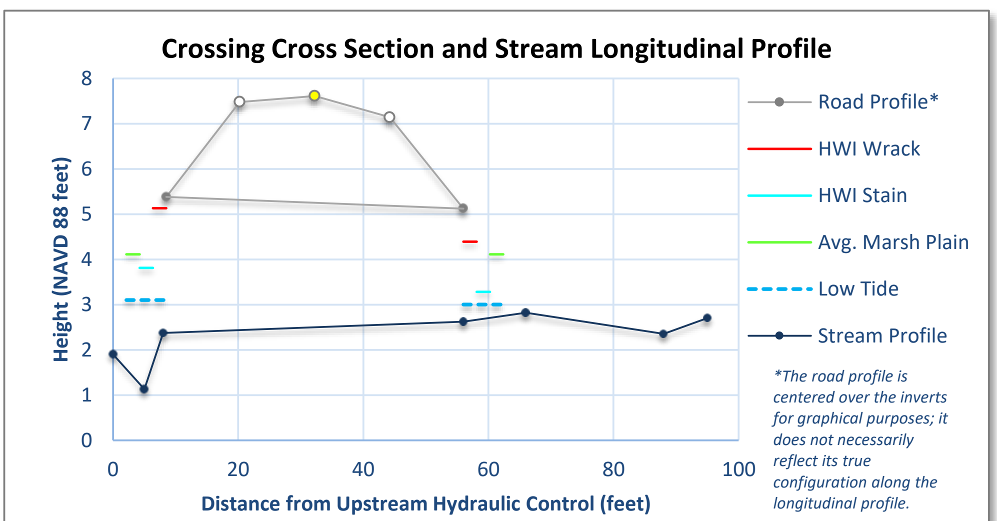
DS view above structure

Long. Profile

Dist.	Hght.	Feat.	Sub.
0	1.9015	CB	C/S
5	1.1315	P	C/S
8	2.3715	I	C/S
56	2.6215	I	S
66	2.8215	HC	G
88	2.3515	P	C/S
95	2.7015	HC	C/S

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority

**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk



Crossing Context:

N/A

Structure Characteristics:

Structure Type:	Round Culvert	**Date of Last Known Replacement:**	N/A
Structure Material:	Plastic - Smooth		
Tide Gate Present:	Yes		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	2.7	2.8
Dimension B^{CB}(height):	2.7	2.5
Crossing Length (Invert to Invert):	47.5	

Crossing Condition:	Headwall Material	Headwall Condition	Wingwall Material	Wingwall Condition	Scour at Structure	Scour Severity
Upstream	Dry Fit Stone	Good	Dry Fit Stone	Good	None	None
Downstream	Masonry	Poor	None	N/A	Headwall	Medium

Scour in Structure	Scour Severity in Structure	Road Surface Condition	Utilities at Crossing	Structure Condition Overall
None	None	Good	OHE US	Fair

Structure Condition Comments:	US well taken care of. DS neglected and overrun with invasives. Minimal observed flow likely due to tide gate.

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	Brackish Marsh	Invasive Dominant
Upstream Salt Marsh Migration Potential (acres):	8.37	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	No
Emergency Access or Evacuation Route:	N/A
History of Flooding:	unknown

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 42

Observer(s) & Organization:	TS, JB (NHDES Coastal)
Municipality:	NORTH HAMPTON
Stream Name:	N/A
Road Name:	Old Locke Rd

Date:	7/18/2018	
Start Time:	10:45:00 AM	
End Time:	11:35:00 AM	
Tide Prediction	**High**	**Low**
Time:	4:43 PM	10:40 AM
Elevation:	9.3	-0.7
Tide Chart Location:	Hampton Harbor	

Crossing Condition Evaluation	Score*
Crossing Condition	4
Tidal Restriction Evaluation	
Tidal Range Ratio	1
Crossing Ratio	5
Erosion Classification	4
Tidal Restriction Overall Score	3
Tidal Aquatic Organism Passage	
Tidal Range Ratio	1
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	4
Salt Marsh Migration Potential (Wshed.)	4
Vegetation Evaluation	
Vegetation Comparison Matrix	4
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	4,4
Inun. Risk to the Crossing Structure (US, DS)	5,5
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	5

DS view toward structure

US view above structure

US view toward structure

DS view above structure

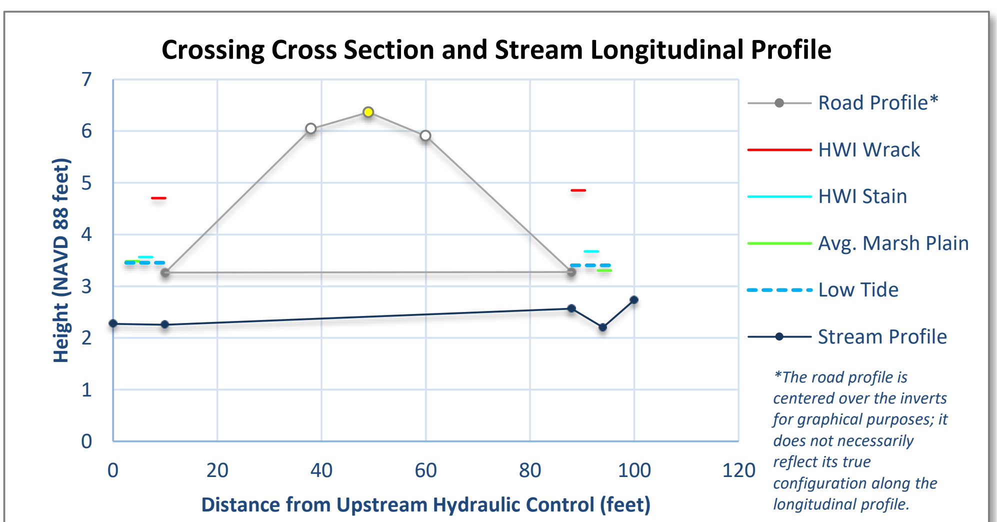
Overall Scores

Infrastructure	4
Ecological	4
Combined	4

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority
**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk

Long. Profile

Dist.	Hght.	Feat.	Sub.
0	2.2748	CB	C/S
10	2.2548	I	S
88	2.5648	I	S
94	2.2048	P	G
100	2.7348	CB	S



Crossing Context:

A small culvert (1-foot round pipe) runs from the golf course, under Old Locke Road and into the upper portion of Philbrick's Pond. The overall combined score for restriction is 4, high priority, because of erosion and inundation risk to road and the undersized culvert is submerged even at low tide.

Structure Characteristics:

Structure Type:	Round Culvert	**Date of Last Known Replacement:**	N/A
Structure Material:	Concrete		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	1	2.5
Dimension B^{CB}(height):	1	0.9
Crossing Length (Invert to Invert):	78	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	Dry Fit Stone	Fair	Dry Fit Stone	Fair	None	None
Downstream	Dry Fit Stone	Poor	None	N/A	None	None

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
None	None	Fair	Overhead electric	Poor

Structure Condition Comments:	Culvert flooded both sides, no culvert DS, open "box" where pipe should be

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	Freshwater Marsh	Brackish Marsh
Upstream Salt Marsh Migration Potential (acres):	5.00	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	Yes
Emergency Access or Evacuation Route:	N/A
History of Flooding:	flood prone, culvert in need of repair or replace

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 43

Observer(s) & Organization:	JB TS (NHDES Coastal)
Municipality:	NORTH HAMPTON
Stream Name:	N/A
Road Name:	Old Locke Rd

Date:	7/25/2018	
Start Time:	3:44:00 PM	
End Time:	4:20:00 PM	
Tide Prediction	**High**	**Low**
Time:	10:57 PM	5:00 PM
Elevation:	8.8	1.1
Tide Chart Location:	Hampton Harbor	

Crossing Condition Evaluation	Score*
Crossing Condition	4
Tidal Restriction Evaluation	
Tidal Range Ratio	3
Crossing Ratio	4
Erosion Classification	4
Tidal Restriction Overall Score	4
Tidal Aquatic Organism Passage	
Tidal Range Ratio	3
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	3
Salt Marsh Migration Potential (Wshed.)	3
Vegetation Evaluation	
Vegetation Comparison Matrix	3
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	3,3
Inun. Risk to the Crossing Structure (US, DS)	4,4
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	5
Overall Scores	
Infrastructure	4
Ecological	3
Combined	3

DS view toward structure

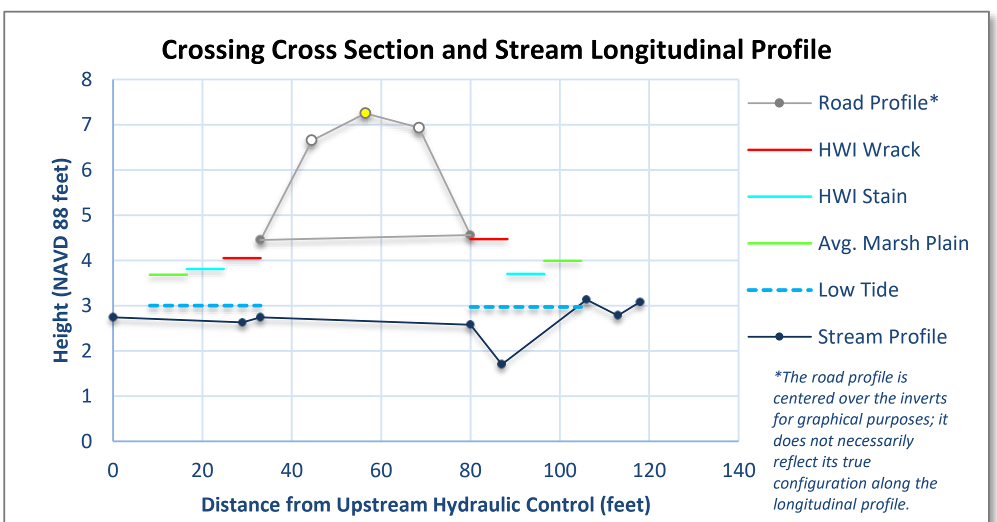
US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority

**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk



Long. Profile

Dist.	Hght.	Feat.	Sub.
0	2.7407	HC	C/S
29	2.6307	CB	C/S
33	2.7407	I	C/S
80	2.5807	I	G
87	1.7007	P	S
106	3.1307	HC	G
113	2.7807	CB	S
118	3.0807	HC	S

Crossing Context:

An unnamed creek under Old Locke Road conducts brackish tides to and from Philbrick's Pond through a 2-foot round culvert, but it serves mostly as upland drainage to the Pond. It has an overall combined score of 3, moderate priority, because of signs of erosion, crossing condition and potential ecological impacts.

Structure Characteristics:

Structure Type:	Round Culvert	**Date of Last Known Replacement:**	N/A
Structure Material:	Stone		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	2.2	2
Dimension B[CB] (height):	1.6	2
Crossing Length (Invert to Invert):	47	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	Dry Fit Stone	Poor	None	N/A	None	None
Downstream	Dry Fit Stone	Poor	None	N/A	None	None

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
None	None	Good	US OHE	Fair

Structure Condition Comments:	Slightly squashed inlet. Loose granite on US Headwall

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	Freshwater Swamp	Brackish Riverbank Marsh
Upstream Salt Marsh Migration Potential (acres):	4.59	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	Yes
Emergency Access or Evacuation Route:	N/A
History of Flooding:	Past flooding reported. culvert damaged.

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 44

Observer(s) & Organization:	JB PS (NHDES Coastal)
Municipality:	RYE
Stream Name:	Bailey Brook
Road Name:	Ocean Blvd

Date:	6/19/2018	
Start Time:	10:00:00 AM	
End Time:	12:05:00 PM	
Tide Prediction	**High**	**Low**
Time:	12:00 AM	10:49 AM
Elevation:	0.0	0.0
Tide Chart Location:	Portsmouth Harbor	

	Score*
Crossing Condition Evaluation	
Crossing Condition	2
Tidal Restriction Evaluation	
Tidal Range Ratio	5
Crossing Ratio	5
Erosion Classification	0
Tidal Restriction Overall Score	5
Tidal Aquatic Organism Passage	
Tidal Range Ratio	5
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	5
Salt Marsh Migration Potential (Wshed.)	5
Vegetation Evaluation	
Vegetation Comparison Matrix	1
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	2,5
Inun. Risk to the Crossing Structure (US, DS)	3,3
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	5
Overall Scores	
Infrastructure	5
Ecological	5
Combined	5

DS view toward structure

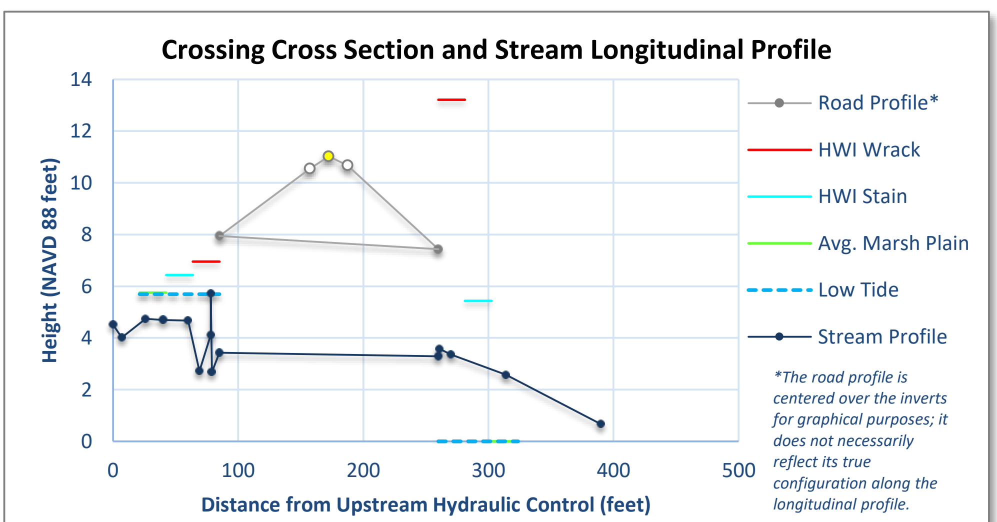
US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority

**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk



Long. Profile

Dist.	Hght.	Feat.	Sub.
0	4.5136	HC	S
7	4.0136	P	S
26	4.7436	HC	S
40	4.6936	CB	S
60	4.6736	HC	S
69	2.7136	P	G
78	4.1136	CB	G
78	5.7136	GC	N/A
79	2.6836	GC	N/A
85	3.4336	I	G
260	3.2936	I	S
261	3.5736	HC	G
270	3.3536	CB	S
314	2.5736	CB	S
390	0.6636	GC	S

Crossing Context:

The inlet to Eel Pond is controlled by a double 4 by 4-foot cement culvert running under Route 1A in Rye. The tides are prevented from entering by two sets of stop logs at the downstream end, which is perched above a beach facing the Atlantic Ocean. Stoplogs are removed seasonally to release freshwater and a limited flow of salt water enters the pond. Recognizing the current policy of maintaining a low-salinity pond and surrounding marsh, the overall combined score for the crossing is 5, highest priority for consideration of replacement.

Structure Characteristics:

Structure Type:	Round Culvert	**Date of Last Known Replacement:**	N/A
Structure Material:	Concrete		
Tide Gate Present:	Yes		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	4	4
Dimension B[CB] (height):	4	4
Crossing Length (Invert to Invert):	175	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	Concrete	Good	Concrete	Good	None	None
Downstream	Concrete	Fair	Concrete	Fair	None	None

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
None	None	Good	N/A	Fair

Structure Condition Comments:	Twin 48"""" c pipes. DS blocked by stop logs. US one side blocked by sheet. One side grated.

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	Coastal Salt Pond Marsh/Meadow	Sparsely Vegetated Intertidal Habitat
Upstream Salt Marsh Migration Potential (acres):	43.90	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	Yes
Emergency Access or Evacuation Route:	Yes
History of Flooding:	floods regularaly under high/king tide condtions

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 45

Observer(s) & Organization:	KL, ts (NHDES Coastal)
Municipality:	RYE
Stream Name:	N/A
Road Name:	Ocean Blvd

Date:	6/19/2018	
Start Time:	9:50:00 AM	
End Time:	11:30:00 AM	
Tide Prediction	**High**	**Low**
Time:	3:15 PM	10:48 AM
Elevation:	8.5	-0.6
Tide Chart Location:	Portsmouth Harbor	

Crossing Condition Evaluation	Score*
Crossing Condition	1
Tidal Restriction Evaluation	
Tidal Range Ratio	1
Crossing Ratio	1
Erosion Classification	4
Tidal Restriction Overall Score	2
Tidal Aquatic Organism Passage	
Tidal Range Ratio	1
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	4
Salt Marsh Migration Potential (Wshed.)	4
Vegetation Evaluation	
Vegetation Comparison Matrix	4
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	2,2
Inun. Risk to the Crossing Structure (US, DS)	4,4
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	1
Overall Scores	
Infrastructure	1
Ecological	4
Combined	2

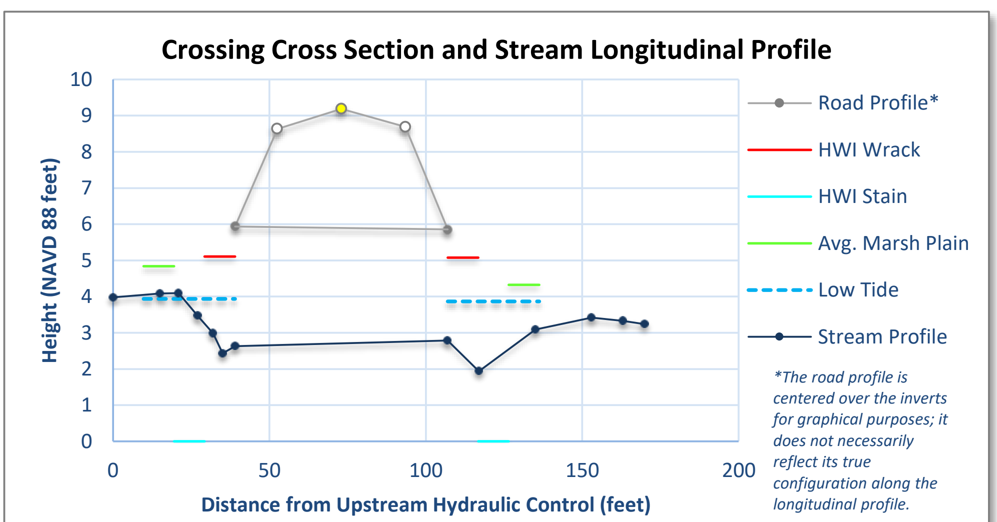
DS view toward structure

US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority
**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk



Long. Profile

Dist.	Hght.	Feat.	Sub.
0	3.9764	HC	C/S
15	4.0864	CB	C/S
21	4.0964	HC	C/S
27	3.4664	HC	C/S
32	2.9864	HC	C/S
35	2.4364	P	C/S
39	2.6264	I	C/S
107	2.7864	I	C/S
117	1.9364	P	C/S
135	3.0864	HC	C/S
153	3.4164	HC	C/S
163	3.3264	CB	C/S
170	3.2364	HC	C/S

Crossing Context:

The southernmost upper reach of the salt marsh at Rye Harbor passes back under Route 1A into a brackish marsh surrounded by a residential neighborhood. A pair of 3-foot round culverts recently replaced or fortified conducts the tide. Although erosion is evident upstream and downstream of the culverts, restriction appears minor and the overall combined score is 2: low priority.

Structure Characteristics:

Structure Type:	Round Culvert	**Date of Last Known Replacement:**	N/A
Structure Material:	Plastic - Smooth		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	6	6
Dimension B[CB](height):	3	3
Crossing Length (Invert to Invert):	68	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	Rip Rap	Good	Rip Rap	Good	None	None
Downstream	Rip Rap	Good	Rip Rap	Good	None	None

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
None	None	Good	Overhead electric	Good

Structure Condition Comments:	New culvert. Replaced 2018

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	High Salt Marsh	High Salt Marsh
Upstream Salt Marsh Migration Potential (acres):	9.37	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	Yes
Emergency Access or Evacuation Route:	Yes
History of Flooding:	flooding in surrounding area prior to replacement

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 46

Observer(s) & Organization:	JB TS KL (NHDES Coastal)
Municipality:	RYE
Stream Name:	N/A
Road Name:	Ocean Blvd

Date:	5/25/2018	
Start Time:	1:30:00 PM	
End Time:	4:30:00 AM	
Tide Prediction	**High**	**Low**
Time:	9:35 AM	2:47 AM
Elevation:	8.7	0.3
Tide Chart Location:	Portsmouth Harbor	

Crossing Condition Evaluation	Score*
Crossing Condition	4
Tidal Restriction Evaluation	
Tidal Range Ratio	1
Crossing Ratio	4
Erosion Classification	4
Tidal Restriction Overall Score	3
Tidal Aquatic Organism Passage	
Tidal Range Ratio	1
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	1
Salt Marsh Migration Potential (Wshed.)	5
Vegetation Evaluation	
Vegetation Comparison Matrix	3
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	2,2
Inun. Risk to the Crossing Structure (US, DS)	4,3
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	1

DS view toward structure

US view above structure

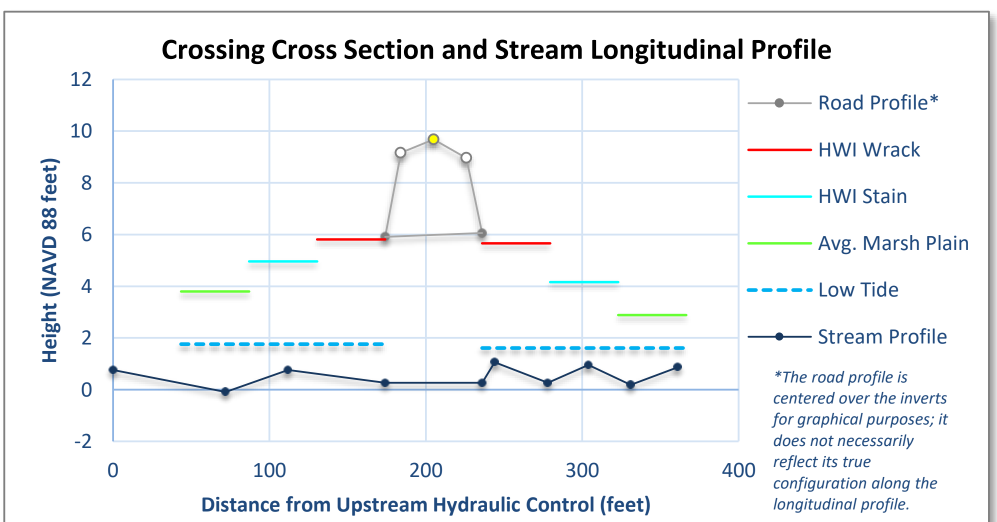
US view toward structure

DS view above structure

Overall Scores

Infrastructure	4
Ecological	3
Combined	3

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority
**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk

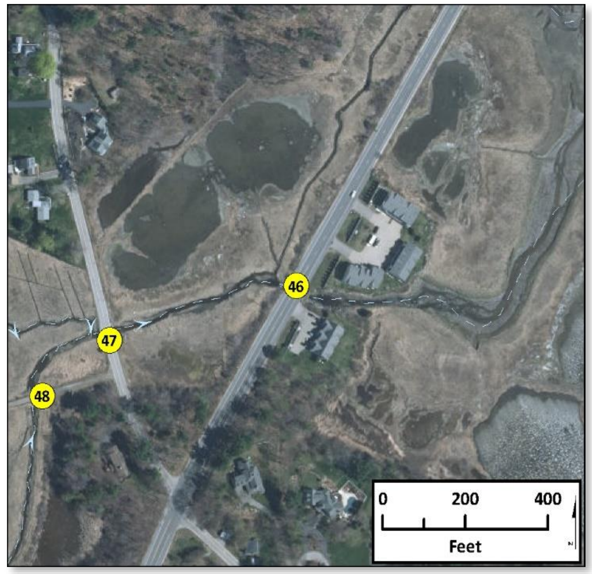


Long. Profile

Dist.	Hght.	Feat.	Sub.
0	0.76	HC	C/S
72	-0.09	P	C/S
112	0.76	HC	S
174	0.26	I	G
236	0.26	I	G
244	1.06	GC	C
278	0.26	P	G
304	0.96	HC	G
331	0.19	P	G
361	0.86	HC	G

Crossing Context:

One of two crossings of Rye Harbor Marsh as it passes across Route 1A from east to west, this branch conducts the tide to the Locke Road area through an old granite structure capped by concrete. The unfavorable crossing ratio and high erosion indicators lead to a moderate priority for replacement, with an overall combined score of 3. Tidal restriction here influences three more crossings upstream that limit flow to a significant marsh area.



Structure Characteristics:

Structure Type:	Bridge with Abutments	**Date of Last Known Replacement:**	N/A
Structure Material:	Stone		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	3.9	4
Dimension B[CB] (height):	5.35	5.9
Crossing Length (Invert to Invert):	62	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	Concrete	Good	Masonry	Good	Wingwalls	Medium
Downstream	Concrete	Good	Masonry	Poor	Wingwalls	Medium

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
None	None	Good	Ohe US	Poor

Structure Condition Comments:	20 inch section of masonry collapse in structure

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	High Salt Marsh	Low Salt Marsh
Upstream Salt Marsh Migration Potential (acres):	36.40	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	Yes
Emergency Access or Evacuation Route:	Yes
History of Flooding:	higher tides flood US Marsh. 6" harbor rd 1/4/18

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 47

Observer(s) & Organization:	PS KL JB TS DB JG (NHDES Coastal)
Municipality:	RYE
Stream Name:	N/A
Road Name:	Locke Rd

Date:	5/31/2018	
Start Time:	7:30:00 AM	
End Time:	11:22:00 AM	
Tide Prediction	**High**	**Low**
Time:	1:47 PM	7:28 AM
Elevation:	7.7	-0.1
Tide Chart Location:	Portsmouth Harbor	

Crossing Condition Evaluation	Score*
Crossing Condition	1
Tidal Restriction Evaluation	
Tidal Range Ratio	1
Crossing Ratio	2
Erosion Classification	4
Tidal Restriction Overall Score	2
Tidal Aquatic Organism Passage	
Tidal Range Ratio	1
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	5
Salt Marsh Migration Potential (Wshed.)	5
Vegetation Evaluation	
Vegetation Comparison Matrix	1
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	4,4
Inun. Risk to the Crossing Structure (US, DS)	4,4
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	1
Overall Scores	
Infrastructure	4
Ecological	1
Combined	3

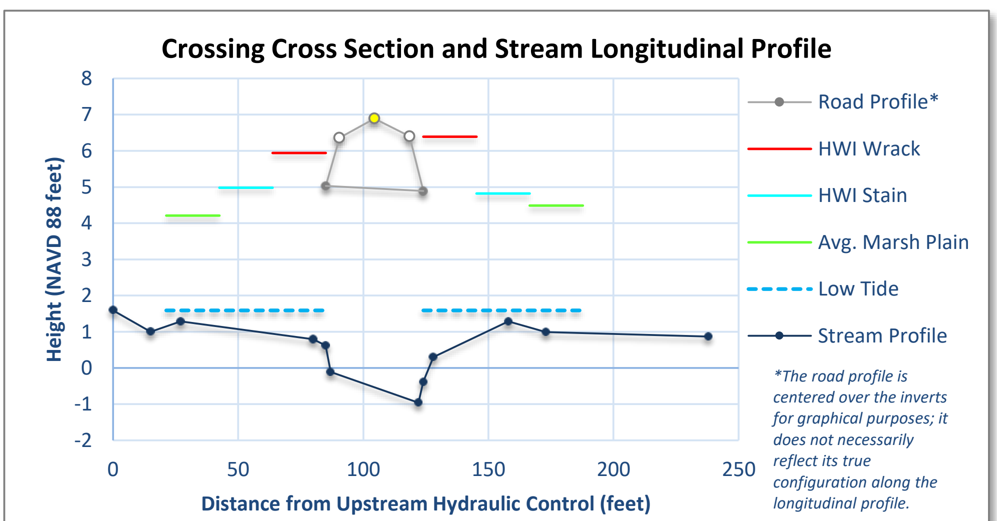
DS view toward structure

US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority
**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk

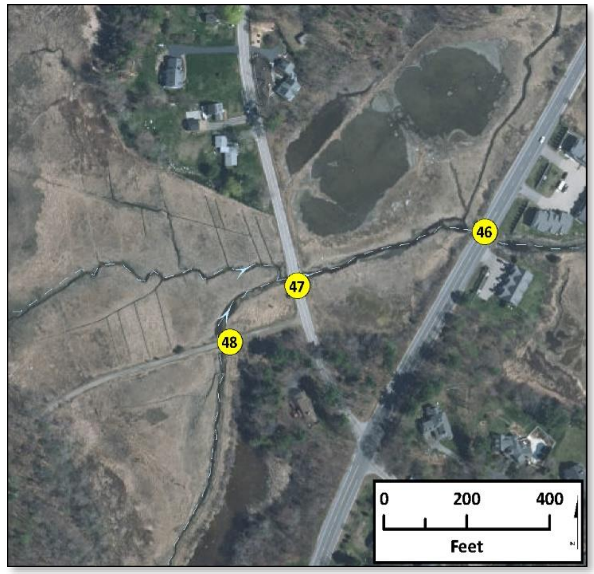


Long. Profile

Dist.	Hght.	Feat.	Sub.
0	1.5901	US HC	S
15	1.0001	US HC	S
27	1.2901	US HC	S
80	0.7901	US P	S
85	0.6201	US I	S
87	-0.1099	US P	G
122	-0.9599	DS P	S
124	-0.3799	DS I	S
128	0.3001	DS P	S
158	1.2901	DS HC	S
173	0.9901	DS P	S
238	0.8701	DS HC	G

Crossing Context:

The main tidal creek that conducts the tides to all marsh areas west of Locke Road passes through a 5 by 9 foot box culvert. In 1996 the Town of Rye replaced a smaller culvert here and on the upstream drive (#48, private). however, the high water stain indicates the culvert capacity is regularly exceeded, signs of erosion were evident and the flooding risk to the structure and roadway is high. The overall score for this crossing is 3, indicating moderate priority for replacement.



Structure Characteristics:

Structure Type:	Box Culvert	**Date of Last Known Replacement:**	1997
Structure Material:	Concrete		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	9	9
Dimension B[CB](height):	4.86	5.94
Crossing Length (Invert to Invert):	39	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	Concrete	Good	Rip Rap	Fair	None	None
Downstream	Concrete	Good	Rip Rap	Good	Wingwalls	Medium

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
None	None	Fair	Overhead electric	Fair

Structure Condition Comments:	N/A

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	High Salt Marsh	High Salt Marsh
Upstream Salt Marsh Migration Potential (acres):	35.71	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	Yes
Emergency Access or Evacuation Route:	N/A
History of Flooding:	prone during very high tides when marsh floods.

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 48

Observer(s) & Organization:	JB TS (NHDES Coastal)
Municipality:	RYE
Stream Name:	N/A
Road Name:	DRIVEWAY

Date:	6/18/2018	
Start Time:	9:31:00 AM	
End Time:	10:30:00 AM	
Tide Prediction	**High**	**Low**
Time:	4:15 PM	9:49 AM
Elevation:	8.7	-1.0
Tide Chart Location:	Portsmouth Harbor	

	Score*
Crossing Condition Evaluation	
Crossing Condition	5
Tidal Restriction Evaluation	
Tidal Range Ratio	5
Crossing Ratio	4
Erosion Classification	4
Tidal Restriction Overall Score	4
Tidal Aquatic Organism Passage	
Tidal Range Ratio	5
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	5
Salt Marsh Migration Potential (Wshed.)	5
Vegetation Evaluation	
Vegetation Comparison Matrix	1
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	4,4
Inun. Risk to the Crossing Structure (US, DS)	3,4
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	1
Overall Scores	
Infrastructure	5
Ecological	5
Combined	5

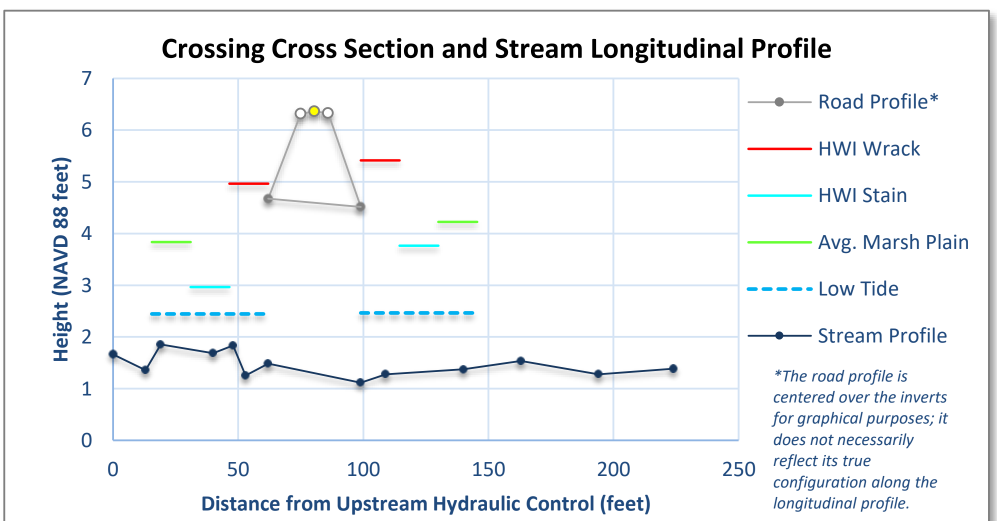
DS view toward structure

US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority
**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk

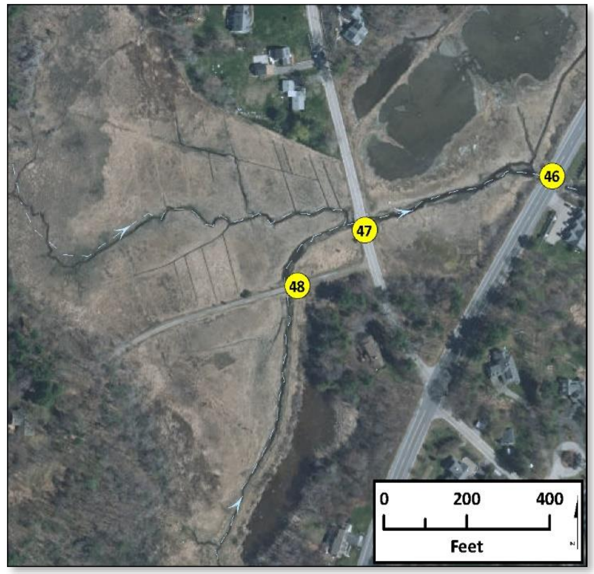


Long. Profile

Dist.	Hght.	Feat.	Sub.
0	1.6648	HC	C/S
13	1.3548	P	S
19	1.8548	HC	C/S
40	1.6848	CB	C/S
48	1.8348	HC	G
53	1.2548	P	G
62	1.4848	I	G
99	1.1148	I	G
109	1.2748	P	G
140	1.3748	HC	C/S
163	1.5348	P	C/S
194	1.2748	HC	C/S
224	1.3848	HC	S

Crossing Context:

The culvert under this private drive was replaced circa 1996, with a round 4-foot culvert, but the effective cross-sectional area has been reduced by sediment fill or crushing. The observations of poor crossing condition, erosion, flood risk and high water stain all suggest this crossing severely restricts tidal flow and is in need of an upgrade. The overall combined score is 5, highest priority for replacement.



Structure Characteristics:

Structure Type:	Round Culvert	**Date of Last Known Replacement:**	1995
Structure Material:	Steel - Corrugated		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	4	4.2
Dimension B[CB](height):	3.3	3.4
Crossing Length (Invert to Invert):	37	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	Rip Rap	Poor	Rip Rap	Fair	Culvert	High
Downstream	Rip Rap	Poor	Rip Rap	Fair	Culvert	High

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
Culvert	High	Good	OHE	Poor

Structure Condition Comments:	US Severe wing wall scour, DS moderate wing wall scour

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	High Salt Marsh	High Salt Marsh
Upstream Salt Marsh Migration Potential (acres):	24.28	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	Yes
Emergency Access or Evacuation Route:	N/A
History of Flooding:	Prone during high tide events when DS marsh floods

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 49

Observer(s) & Organization:	Lucey, Burdick, Becker, Flanagan (TNC)
Municipality:	RYE
Stream Name:	N/A
Road Name:	Harbor Rd

Date:	8/11/2016	
Start Time:	12:30:00 PM	
End Time:	3:20:00 PM	
Tide Prediction	**High**	**Low**
Time:	12:00 AM	12:27 PM
Elevation:	0.0	0.0
Tide Chart Location:	Hampton Harbor	

Crossing Condition Evaluation	Score*
Crossing Condition	2
Tidal Restriction Evaluation	
Tidal Range Ratio	1
Crossing Ratio	4
Erosion Classification	4
Tidal Restriction Overall Score	3
Tidal Aquatic Organism Passage	
Tidal Range Ratio	1
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	5
Salt Marsh Migration Potential (Wshed.)	5
Vegetation Evaluation	
Vegetation Comparison Matrix	1
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	2,4
Inun. Risk to the Crossing Structure (US, DS)	1,1
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	1
Overall Scores	
Infrastructure	4
Ecological	3
Combined	3

DS view toward structure

US view above structure

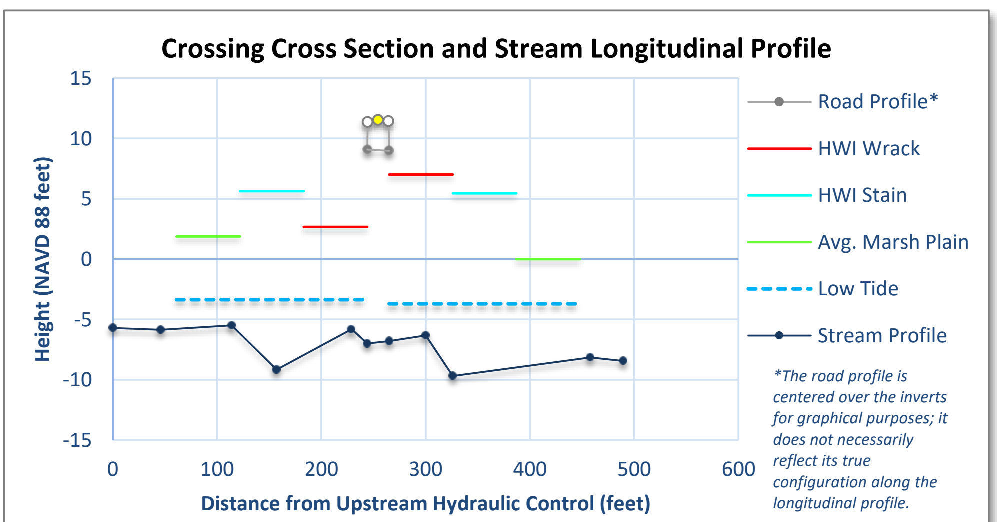
US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority
**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk

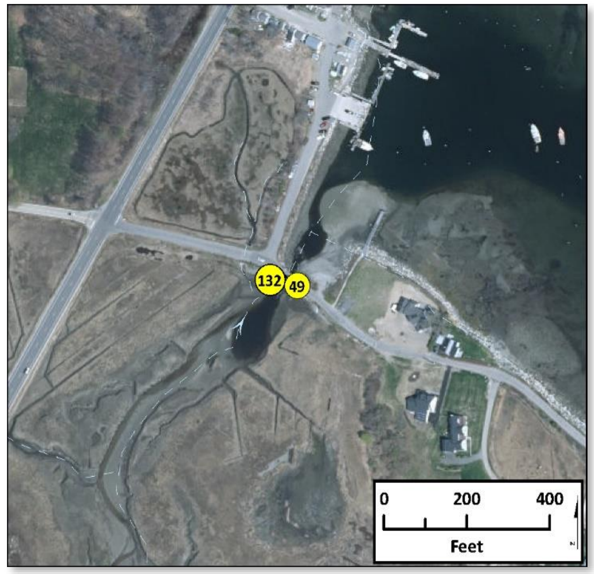
Long. Profile

Dist.	Hght.	Feat.	Sub.
0	-5.7043	HC	S
46	-5.8543	P	S
114	-5.4843	HC	S
157	-9.1543	P	S
229	-5.8043	GC	Shell
244	-6.9943	I	B
265	-6.7943	I	B
300	-6.3143	GC	B
326	-9.6843	P	C
458	-8.1543	HC	C
490	-8.4543	CB	C



Crossing Context:

The bridge on Harbor Road conducts all the tidal waters into Rye Harbor Marsh, which is extensive. It is wide (19 feet) and tall (13 feet) and does not appear to restrict the tide, though there is a large erosional pool on the upstream side. It has an overall combined priority of 3 (moderate) for replacement.



Structure Characteristics:

Structure Type:	Bridge with Abutments	**Date of Last Known Replacement:**	N/A
Structure Material:	Steel - Corrugated		
Tide Gate Present:	Yes		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	18.8	18.9
Dimension B^{CB}(height):	0	0
Crossing Length (Invert to Invert):	21	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	None	N/A			None	None
Downstream	None	N/A			None	None

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
			None	

Structure Condition Comments:	Underside of bridge deck spalling, road surface jo

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	High Salt Marsh	
Upstream Salt Marsh Migration Potential (acres):	61.01	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	Yes
Emergency Access or Evacuation Route:	N/A
History of Flooding:	6" over road on 1/4/18

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 50

Observer(s) & Organization:	JB TS (NHDES Coastal)
Municipality:	RYE
Stream Name:	N/A
Road Name:	Ocean Blvd

Date:	8/2/2018	
Start Time:	8:50:00 AM	
End Time:	10:35:00 AM	
Tide Prediction	**High**	**Low**
Time:	3:39 PM	9:38 AM
Elevation:	7.8	0.4
Tide Chart Location:	Portsmouth Harbor	

	Score*
Crossing Condition Evaluation	
Crossing Condition	1
Tidal Restriction Evaluation	
Tidal Range Ratio	1
Crossing Ratio	3
Erosion Classification	4
Tidal Restriction Overall Score	3
Tidal Aquatic Organism Passage	
Tidal Range Ratio	1
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	5
Salt Marsh Migration Potential (Wshed.)	5
Vegetation Evaluation	
Vegetation Comparison Matrix	1
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	3,2
Inun. Risk to the Crossing Structure (US, DS)	1,1
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	2
Overall Scores	
Infrastructure	3
Ecological	1
Combined	3

DS view toward structure

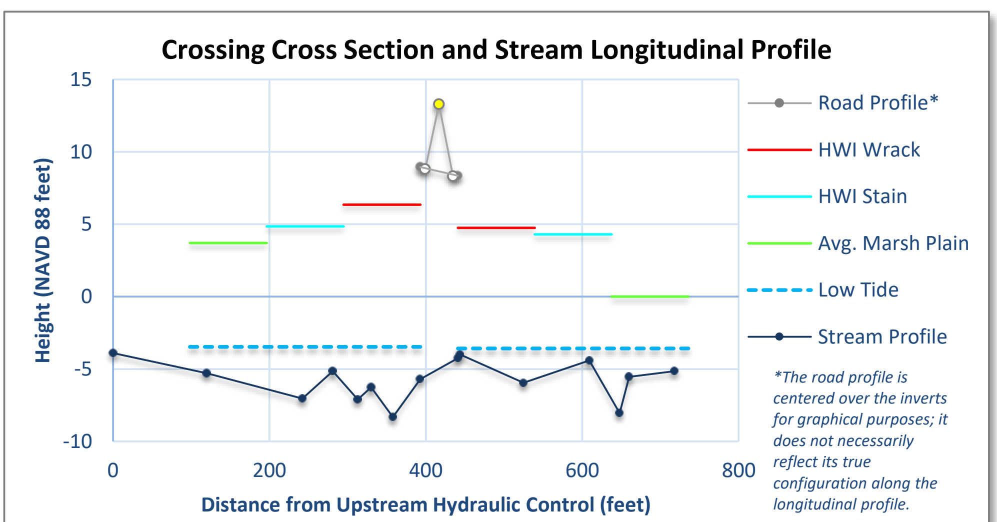
US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority

**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk



Long. Profile

Dist.	Hght.	Feat.	Sub.
0	-3.9026	HC	S
120	-5.3026	CB	G
242	-7.0526	P	C/S
281	-5.1526	HC	C
313	-7.1026	P	S
330	-6.2526	CB	C
358	-8.3226	P	C
393	-5.7026	I	C
441	-4.2526	I	G
444	-4.0026	GC	B
525	-5.9526	P	C
609	-4.4026	HC	B
648	-8.0526	P	G
660	-5.5526	CB	G
718	-5.1526	HC	G

Crossing Context:

This crossing is a large bridge on Route 1A over a man-made inlet that supplies all of Awcomin Marsh with tides. The original inlet along with large portions of the marsh was filled in 1941 and 1962 when Rye Harbor was dredged. In the 1990s and 2000s several projects were undertaken to remove dredge spoil and restore hydrology to the marsh, which had been overrun with common reed. The overall combined score is 3, indicating moderate priority for replacement because of erosion on the upstream side. Information on the restoration actions can be found at: https://www.des.nh.gov/organization/divisions/water/wmb/coastal/restoration/saltmarsh_restoration.htm

Structure Characteristics:

Structure Type:	Bridge with Side Slopes and Abutments	**Date of Last Known Replacement:**	N/A
Structure Material:	Concrete		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	88	88
Dimension B[CB] (height):	14.05	12.9
Crossing Length (Invert to Invert):	48	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	None	N/A	Concrete	Good	None	None
Downstream	None	N/A	Concrete	Good	None	None

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
None	None	Good	OHE US	Good

Structure Condition Comments:	N/A

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	High Salt Marsh	Sparsely Vegetated Intertidal Habitat
Upstream Salt Marsh Migration Potential (acres):	38.71	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	Yes
Emergency Access or Evacuation Route:	Yes
History of Flooding:	Flooding in harbour and some in US marsh

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 51

Observer(s) & Organization:	JB SS (NHDES Coastal)
Municipality:	RYE
Stream Name:	N/A
Road Name:	Ocean Blvd

Date:	8/22/2018	
Start Time:	3:00:00 PM	
End Time:	5:05:00 PM	
Tide Prediction	**High**	**Low**
Time:	9:53 PM	3:32 PM
Elevation:	8.0	1.3
Tide Chart Location:	Portsmouth Harbor	

Crossing Condition Evaluation	Score*
Crossing Condition	1
Tidal Restriction Evaluation	
Tidal Range Ratio	1
Crossing Ratio	2
Erosion Classification	1
Tidal Restriction Overall Score	1
Tidal Aquatic Organism Passage	
Tidal Range Ratio	1
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	5
Salt Marsh Migration Potential (Wshed.)	5
Vegetation Evaluation	
Vegetation Comparison Matrix	1
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	3,2
Inun. Risk to the Crossing Structure (US, DS)	1,1
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	1
Overall Scores	
Infrastructure	3
Ecological	1
Combined	3

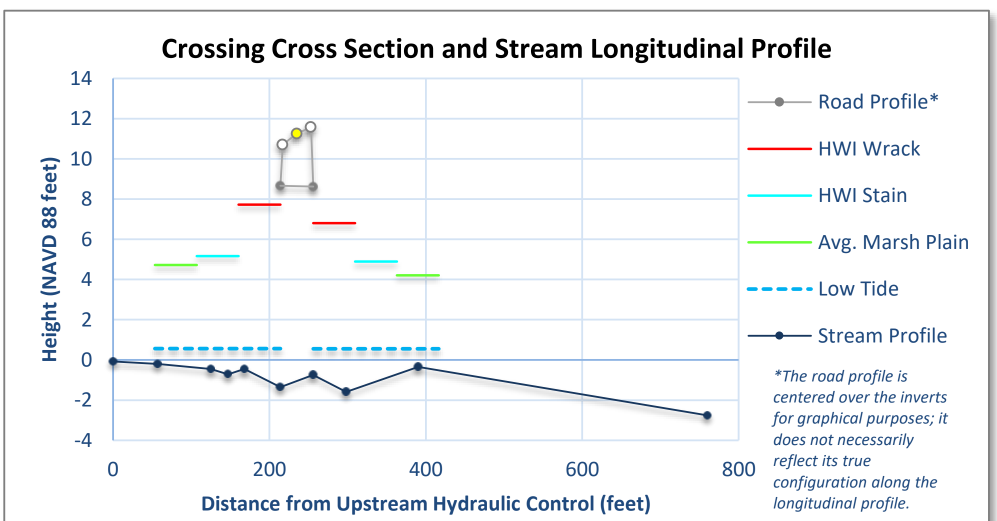
DS view toward structure

US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority
**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk



Long. Profile

Dist.	Hght.	Feat.	Sub.
0	-0.0767	HC	S
57	-0.1967	CB	S
125	-0.4467	HC	S
147	-0.7167	P	S
168	-0.4567	HC	S
214	-1.3567	I	S
256	-0.7467	I	B
298	-1.5967	P	C
390	-0.3467	HC	G
760	-2.7567	HC	G

Crossing Context:

N/A

Structure Characteristics:

Structure Type:	Bridge with Abutments	**Date of Last Known Replacement:**	N/A
Structure Material:	Stone		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	40	40
Dimension B[CB] (height):	10	9.6
Crossing Length (Invert to Invert):	42	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	None	N/A	None	N/A	None	None
Downstream	None	N/A	None	N/A	None	None

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
Abutment	Low	Good	OHE RR	Good

Structure Condition Comments:	N/A

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	High Salt Marsh	Low Salt Marsh
Upstream Salt Marsh Migration Potential (acres):	166.05	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	No
Emergency Access or Evacuation Route:	Yes
History of Flooding:	unknown

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 52

Observer(s) & Organization:	TS, JB (NHDES Coastal)
Municipality:	RYE
Stream Name:	N/A
Road Name:	Brackett Rd

Date:	6/15/2018	
Start Time:	6:34:00 AM	
End Time:	7:28:00 AM	
Tide Prediction	**High**	**Low**
Time:	1:25 PM	7:07 AM
Elevation:	8.7	-1.4
Tide Chart Location:	Portsmouth Harbor	

Crossing Condition Evaluation	Score*
Crossing Condition	1
Tidal Restriction Evaluation	
Tidal Range Ratio	1
Crossing Ratio	1
Erosion Classification	4
Tidal Restriction Overall Score	2
Tidal Aquatic Organism Passage	
Tidal Range Ratio	1
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	4
Salt Marsh Migration Potential (Wshed.)	4
Vegetation Evaluation	
Vegetation Comparison Matrix	3
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	4,4
Inun. Risk to the Crossing Structure (US, DS)	4,4
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	5
Overall Scores	
Infrastructure	4
Ecological	3
Combined	3

DS view toward structure

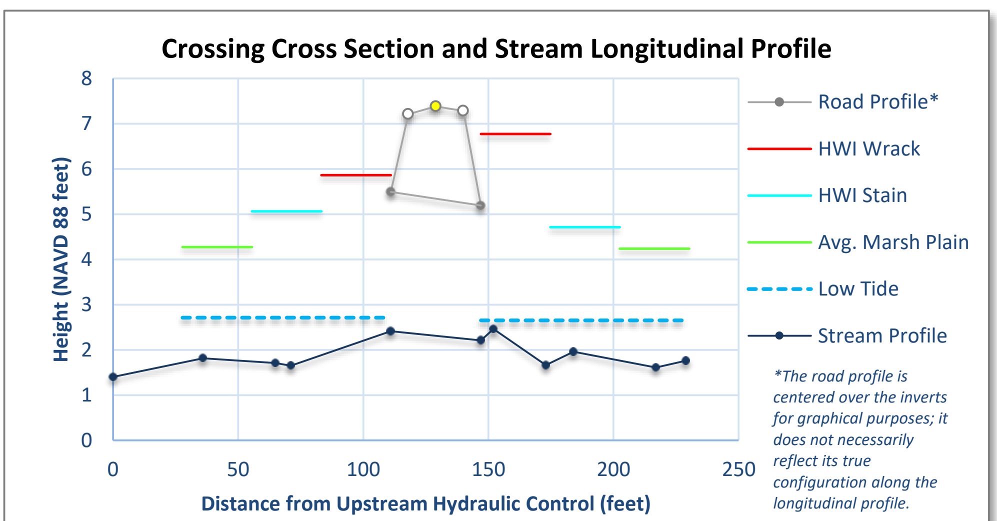
US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority

**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk

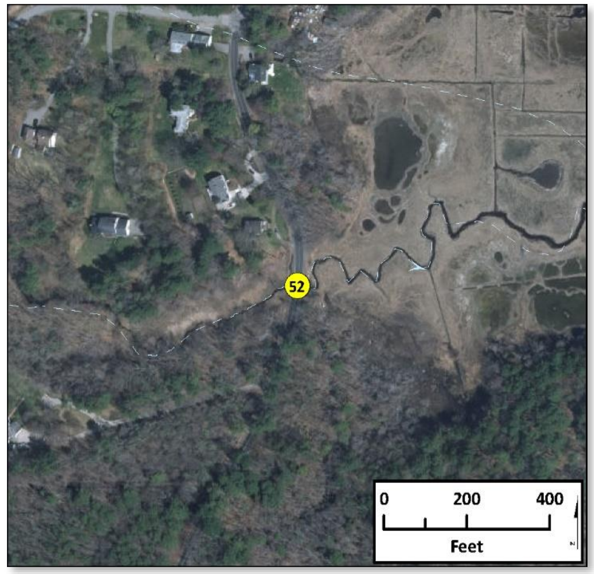


Long. Profile

Dist.	Hght.	Feat.	Sub.
0	1.4019	HC	C/S
36	1.8119	CB	C/S
65	1.7119	HC	S
71	1.6519	P	S
111	2.4119	I	G
147	2.2119	I	S
152	2.4619	GC	C
173	1.6619	P	C
184	1.9619	HC	G
217	1.6119	P	C
229	1.7619	HC	C

Crossing Context:

N/A



Structure Characteristics:

Structure Type:	Box Culvert	**Date of Last Known Replacement:**	N/A
Structure Material:	Concrete		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	6	6
Dimension B^{CB}(height):	3	3
Crossing Length (Invert to Invert):	36	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	Concrete	Good	Rip Rap	Good	Wingwalls	Low
Downstream	Concrete	Good	Rip Rap	Good	Wingwalls	Low

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
None	None	Good	Overhead electric	Good

Structure Condition Comments:	N/A

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	High Salt Marsh	High Salt Marsh
Upstream Salt Marsh Migration Potential (acres):	5.04	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	Yes
Emergency Access or Evacuation Route:	N/A
History of Flooding:	Road sometimes flooded from tidal influence

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 53

Observer(s) & Organization:	TS, NY TNC (NHDES Coastal)
Municipality:	RYE
Stream Name:	N/A
Road Name:	Wallis Rd

Date:	6/6/2018	
Start Time:	10:28:00 AM	
End Time:	1:31:00 PM	
Tide Prediction	**High**	**Low**
Time:	6:05 PM	11:38 AM
Elevation:	7.3	0.9
Tide Chart Location:	Portsmouth Harbor	

Crossing Condition Evaluation	Score*
Crossing Condition	1
Tidal Restriction Evaluation	
Tidal Range Ratio	1
Crossing Ratio	2
Erosion Classification	5
Tidal Restriction Overall Score	3
Tidal Aquatic Organism Passage	
Tidal Range Ratio	1
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	0
Salt Marsh Migration Potential (Wshed.)	5
Vegetation Evaluation	
Vegetation Comparison Matrix	1
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	4,5
Inun. Risk to the Crossing Structure (US, DS)	4,3
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	1
Overall Scores	
Infrastructure	5
Ecological	1
Combined	3

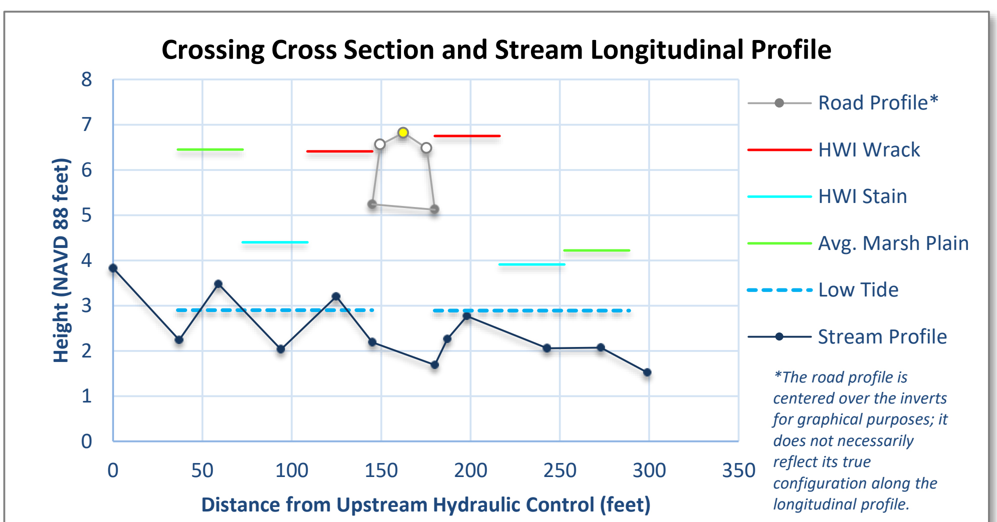
DS view toward structure

US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority
**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk



Long. Profile

Dist.	Hght.	Feat.	Sub.
0	3.8302	HC	C/S
37	2.2402	P	C/S
59	3.4802	HC	C/S
94	2.0302	P	C/S
125	3.2002	GC	C
145	2.1902	I	C
180	1.6902	I	G
187	2.2602	P	G
198	2.7702	HC	C/S
243	2.0602	P	C/S
273	2.0702	HC	C/S
299	1.5202	P	C/S

Crossing Context:

The Parsons Creek Marsh has an inlet under Route 1A and the north branch of the main tidal creek passes under Wallis Road where a 4 by 10-foot box culvert was installed by the Town of Rye in 1998 to relieve the previous tidal restriction. This eastern crossing (western crossing is #54) conducts minor amounts of tidal flow and is partially filled with sediment but becomes important for higher and storm tides. It has an overall combined score replacement priority of moderate: 3, mostly due to high flooding risk. Information on restoration can be found at: https://www.des.nh.gov/organization/divisions/water/wmb/coastal/restoration/saltmarsh_restoration.htm

Structure Characteristics:

Structure Type:	Box Culvert	**Date of Last Known Replacement:**	N/A
Structure Material:	Concrete		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	9.17	9.91
Dimension B^CB (height):	3.14	3.43
Crossing Length (Invert to Invert):	35	

Crossing Condition:	Headwall Material	Headwall Condition	Wingwall Material	Wingwall Condition	Scour at Structure	Scour Severity
Upstream	Concrete	Good	Rip Rap	Good	None	None
Downstream	Concrete	Good	Rip Rap	Good	None	None

Scour in Structure	Scour Severity in Structure	Road Surface Condition	Utilities at Crossing	Structure Condition Overall
None	None	Good	Powerlines	Good

Structure Condition Comments:	N/A

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	High Salt Marsh	High Salt Marsh
Upstream Salt Marsh Migration Potential (acres):	128.43	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	Yes
Emergency Access or Evacuation Route:	Yes
History of Flooding:	king tide causes prolonged highwater. flood 1/4/18

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 54

Observer(s) & Organization:	JB PS SM (NHDES Coastal)
Municipality:	RYE
Stream Name:	N/A
Road Name:	Wallis Rd

Date:	6/6/2018	
Start Time:	10:30:00 AM	
End Time:	1:36:00 AM	
Tide Prediction	**High**	**Low**
Time:	12:00 AM	11:38 AM
Elevation:	7.3	0.9
Tide Chart Location:	Portsmouth Harbor	

Crossing Condition Evaluation	Score*
Crossing Condition	1
Tidal Restriction Evaluation	
Tidal Range Ratio	1
Crossing Ratio	1
Erosion Classification	2
Tidal Restriction Overall Score	1
Tidal Aquatic Organism Passage	
Tidal Range Ratio	1
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	5
Salt Marsh Migration Potential (Wshed.)	5
Vegetation Evaluation	
Vegetation Comparison Matrix	1
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	4,4
Inun. Risk to the Crossing Structure (US, DS)	3,4
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	1

Overall Scores

Infrastructure	4
Ecological	1
Combined	3

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority
**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk

DS view toward structure

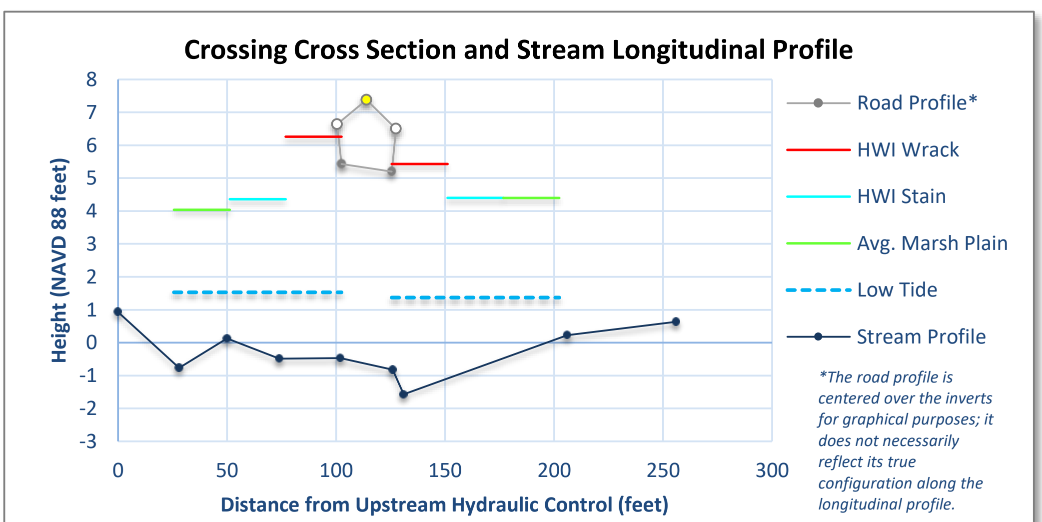
US view above structure

US view toward structure

DS view above structure

Long. Profile

Dist.	Hght.	Feat.	Sub.
0	0.9299	HC	S
28	-0.7701	P	S
50	0.1299	HC	G
74	-0.4901	P	S
102	-0.4701	I	C
126	-0.8201	I	S
131	-1.5701	P	S
206	0.2299	HC	S
256	0.6299	HC	S



Crossing Context:

The Parsons Creek Marsh has an inlet under Route 1A and the north branch of the main tidal creek passes under Wallis Road where two 6 by 12-foot box culverts were installed by the Town of Rye in 1998 to relieve the previous tidal restriction. This is the western crossing (eastern crossing is #53) that conducts most of the tidal flow, but it shows little evidence of erosion. It has an overall combined score of 3, indicating moderate replacement priority, only because the road is vulnerable to inundation.Information on restoration can be found at: https://www.des.nh.gov/organization/divisions/water/wmb/coastal/restoration/saltmarsh_restoration.htm

Structure Characteristics:

Structure Type:	Box Culvert	**Date of Last Known Replacement:**	1998
Structure Material:	Concrete		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	24	24
Dimension B[CB] (height):	6	6
Crossing Length (Invert to Invert):	23	

Crossing Condition:	Headwall Material	Headwall Condition	Wingwall Material	Wingwall Condition	Scour at Structure	Scour Severity
Upstream	Concrete	Good	Rip Rap	Good	None	None
Downstream	Concrete	Good	Rip Rap	Good	None	None

Scour in Structure	Scour Severity in Structure	Road Surface Condition	Utilities at Crossing	Structure Condition Overall
None	None	Fair	OHE	Good

Structure Condition Comments:	Twin 12 ft box culverts assessed as one structure

Ecological Assessment:

	Upstream	Downstream
Natural Community Classification:	High Salt Marsh	High Salt Marsh
Upstream Salt Marsh Migration Potential (acres):	128.43	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	Yes
Emergency Access or Evacuation Route:	Yes
History of Flooding:	king tide causes prolonged highwater. flood 1/4/18

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 55

Observer(s) & Organization:	JB TS (NHDES Coastal)
Municipality:	RYE
Stream Name:	N/A
Road Name:	Ocean Blvd

Date:	6/11/2018	
Start Time:	2:04:00 PM	
End Time:	4:07:00 PM	
Tide Prediction	**High**	**Low**
Time:	10:11 PM	3:49 PM
Elevation:	9.1	0.3
Tide Chart Location:	Portsmouth Harbor	

Crossing Condition Evaluation	Score*
Crossing Condition	1
Tidal Restriction Evaluation	
Tidal Range Ratio	1
Crossing Ratio	3
Erosion Classification	3
Tidal Restriction Overall Score	2
Tidal Aquatic Organism Passage	
Tidal Range Ratio	1
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	1
Salt Marsh Migration Potential (Wshed.)	1
Vegetation Evaluation	
Vegetation Comparison Matrix	1
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	3,2
Inun. Risk to the Crossing Structure (US, DS)	3,4
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	2
Overall Scores	
Infrastructure	3
Ecological	1
Combined	3

DS view toward structure

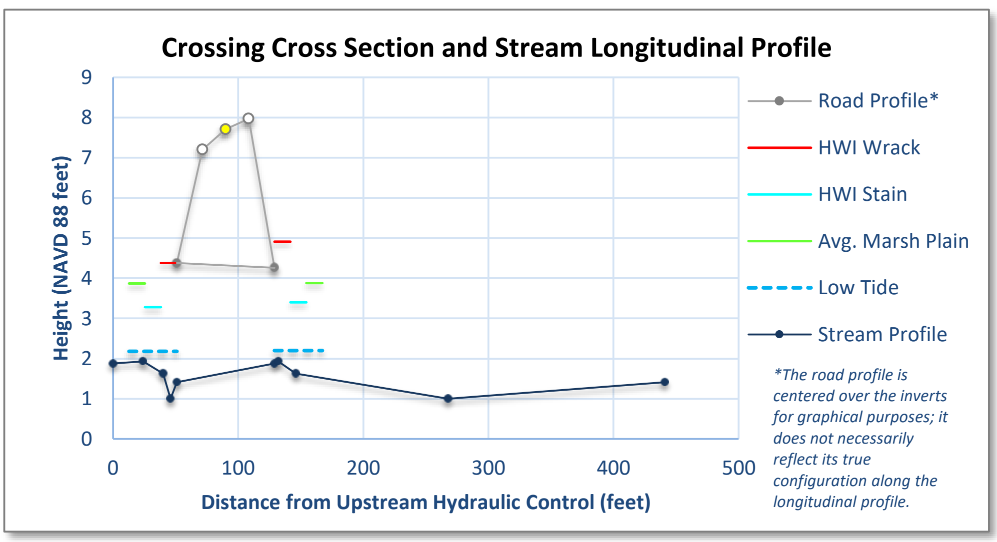
US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority

**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk



Long. Profile

Dist.	Hght.	Feat.	Sub.
0	1.88	HC	C/S
24	1.93	HC	C/S
40	1.63	CB	C/S
46	1	P	C/S
51	1.41	I	C/S
129	1.88	HC	C/S
132	1.93	HC	C/S
146	1.63	CB	C/S
268	1	P	C/S
441	1.41	I	C/S

Crossing Context:

A small portion of the Parsons Creek Marsh is crossed again by Route 1A and extends eastward up to the private residences on the barrier beach. In 1999 a 3 foot round corrugated metal pipe was replaced with a 3 by 6-foot concrete box culvert by the Town of Rye. The current restriction, if any, appears to be minor and the overall combined score is 3, moderate priority for replacement. Information on the 1999 restoration can be found at: https://www.des.nh.gov/organization/divisions/water/wmb/coastal/restoration/saltmarsh_restoration.htm

Structure Characteristics:

Structure Type:	Box Culvert	**Date of Last Known Replacement:**	1999
Structure Material:	Concrete		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	6	6
Dimension B[CB] (height):	3.1	3.1
Crossing Length (Invert to Invert):	78	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	Concrete	Good	None	N/A	None	None
Downstream	Concrete	Good	Rip Rap	Good	None	None

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
None	None	Good	None	Good

Structure Condition Comments:	N/A

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	High Salt Marsh	High Salt Marsh
Upstream Salt Marsh Migration Potential (acres):	0.44	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	No
Emergency Access or Evacuation Route:	Yes
History of Flooding:	Flooding along this portion of 1A

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 56

Observer(s) & Organization:	TS,JB (NHDES Coastal)
Municipality:	RYE
Stream Name:	N/A
Road Name:	Marsh Rd

Date:	6/8/2018	
Start Time:	12:01:00 PM	
End Time:	1:48:00 PM	
Tide Prediction	**High**	**Low**
Time:	7:44 PM	1:17 AM
Elevation:	7.8	1.4
Tide Chart Location:	Portsmouth Harbor	

	Score*
Crossing Condition Evaluation	
Crossing Condition	1
Tidal Restriction Evaluation	
Tidal Range Ratio	1
Crossing Ratio	3
Erosion Classification	4
Tidal Restriction Overall Score	3
Tidal Aquatic Organism Passage	
Tidal Range Ratio	1
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	3
Salt Marsh Migration Potential (Wshed.)	3
Vegetation Evaluation	
Vegetation Comparison Matrix	3
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	4,4
Inun. Risk to the Crossing Structure (US, DS)	4,4
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	2
Overall Scores	
Infrastructure	4
Ecological	3
Combined	3

DS view toward structure

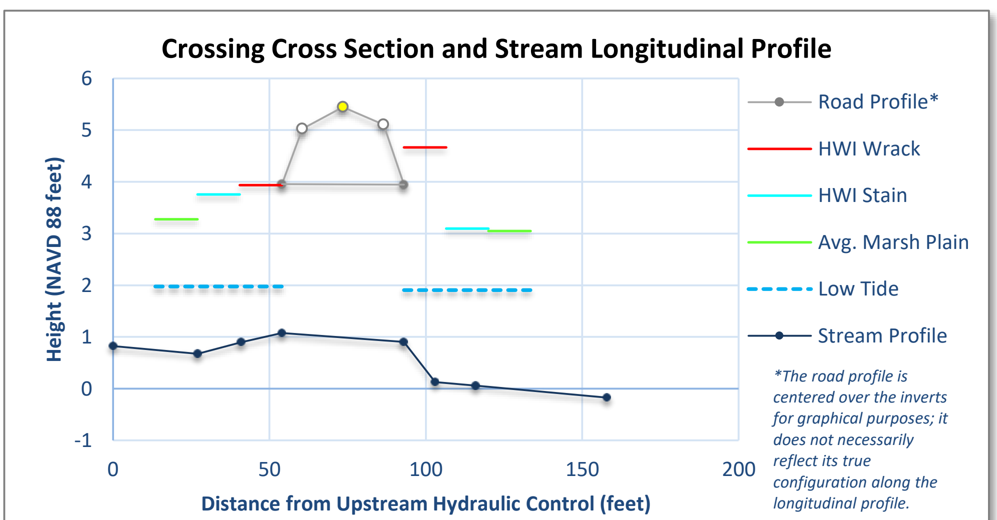
US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority

**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk



Long. Profile

Dist.	Hght.	Feat.	Sub.
0	0.8262	HC	C/S
27	0.6762	CB	C/S
41	0.8962	P	C/S
54	1.0762	I	G
93	0.9062	I	G
103	0.1262	P	C/S
116	0.0562	CB	C/S
158	-0.1738	CB	C/S

Crossing Context:

N/A

Structure Characteristics:

Structure Type:	Box Culvert	**Date of Last Known Replacement:**	N/A
Structure Material:	Concrete		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	5	5
Dimension B[CB] (height):	3	3
Crossing Length (Invert to Invert):	39	

Crossing Condition:	Headwall Material	Headwall Condition	Wingwall Material	Wingwall Condition	Scour at Structure	Scour Severity
Upstream	Concrete	Good	Dry Fit Stone	Good	Wingwalls	Low
Downstream	Concrete	Good	Rip Rap	Good	None	None

Scour in Structure	Scour Severity in Structure	Road Surface Condition	Utilities at Crossing	Structure Condition Overall
None	None	Good	Overhead electric	Good

Structure Condition Comments:	N/A

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	High Salt Marsh	High Salt Marsh
Upstream Salt Marsh Migration Potential (acres):	3.73	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	No
Emergency Access or Evacuation Route:	Yes
History of Flooding:	unknown

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 57

Observer(s) & Organization:	JB TS (NHDES Coastal)	**Date:**	6/7/2018	
Municipality:	RYE	**Start Time:**	11:30:00 AM	
Stream Name:	N/A	**End Time:**	1:26:00 PM	
Road Name:	Parsons Rd			

Tide Prediction	**High**	**Low**
Time:	6:54 PM	12:26 PM
Elevation:	7.5	0.9
Tide Chart Location:	Portsmouth Harbor	

Crossing Condition Evaluation	Score*
Crossing Condition	2
Tidal Restriction Evaluation	
Tidal Range Ratio	5
Crossing Ratio	5
Erosion Classification	2
Tidal Restriction Overall Score	4
Tidal Aquatic Organism Passage	
Tidal Range Ratio	5
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	5
Salt Marsh Migration Potential (Wshed.)	5
Vegetation Evaluation	
Vegetation Comparison Matrix	5
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	4,3
Inun. Risk to the Crossing Structure (US, DS)	4,3
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	5
Overall Scores	
Infrastructure	4
Ecological	5
Combined	5

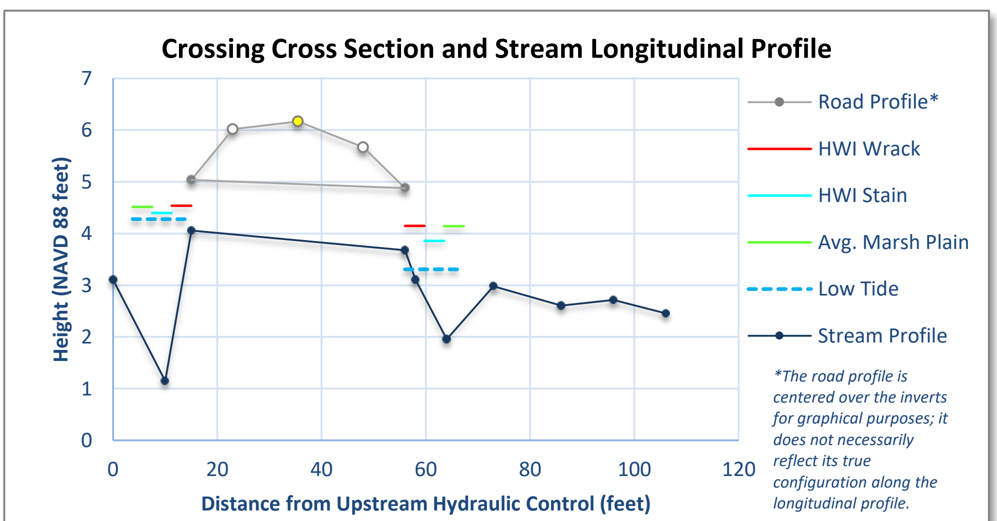
DS view toward structure

US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority
**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk

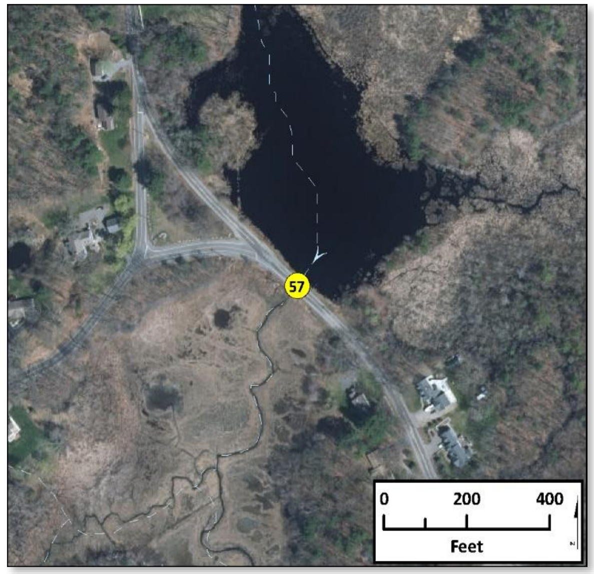


Long. Profile

Dist.	Hght.	Feat.	Sub.
0	3.108	CB	C/S
10	1.148	P	C/S
15	4.058	I	C/S
56	3.678	I	C
58	3.108	GC	C
64	1.958	P	G
73	2.978	HC	C/S
86	2.608	P	C/S
96	2.718	HC	S
106	2.458	CB	S

Crossing Context:

The upper section of Parsons Creek Marsh drains from a freshwater impoundment caused by an undersized crossing (1-foot diameter pipe) running under Parsons Road in Rye. Although the crossing condition is good, the undersized pipe results in a poor crossing ratio, restricted tidal range, poor organism passage and an impediment to salt marsh migration. The result is a fresh to brackish pond rather than a continuation of the salt marsh that is found below Parsons Road. The overall combined score is a 5, indicating highest priority for replacement.



Structure Characteristics:

Structure Type:	Round Culvert	**Date of Last Known Replacement:**	N/A
Structure Material:	Plastic - Corrugated		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	1	1
Dimension B[CB](height):	1	1
Crossing Length (Invert to Invert):	41	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	None	N/A	None	N/A	None	None
Downstream	None	N/A	Rip Rap	Fair	Culvert	Medium

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
None	None	Good	OHE. Utility box DS RR	Fair

Structure Condition Comments:	Scour at wingwalls

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	Brackish Marsh	High Salt Marsh
Upstream Salt Marsh Migration Potential (acres):	100.68	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	No
Emergency Access or Evacuation Route:	Yes
History of Flooding:	unknown

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 59

Observer(s) & Organization:	JB TS (NHDES Coastal)
Municipality:	RYE
Stream Name:	Berrys Brook
Road Name:	Pioneer Rd

Date:	7/5/2018	
Start Time:	10:40:00 AM	
End Time:	12:30:00 PM	
Tide Prediction	**High**	**Low**
Time:	5:21 PM	10:56 AM
Elevation:	7.6	0.6
Tide Chart Location:	Portsmouth Harbor	

Crossing Condition Evaluation	Score*
Crossing Condition	1
Tidal Restriction Evaluation	
Tidal Range Ratio	1
Crossing Ratio	1
Erosion Classification	3
Tidal Restriction Overall Score	2
Tidal Aquatic Organism Passage	
Tidal Range Ratio	1
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	3
Salt Marsh Migration Potential (Wshed.)	5
Vegetation Evaluation	
Vegetation Comparison Matrix	1
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	4,4
Inun. Risk to the Crossing Structure (US, DS)	1,1
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	4
Overall Scores	
Infrastructure	4
Ecological	1
Combined	3

DS view toward structure

US view above structure

US view toward structure

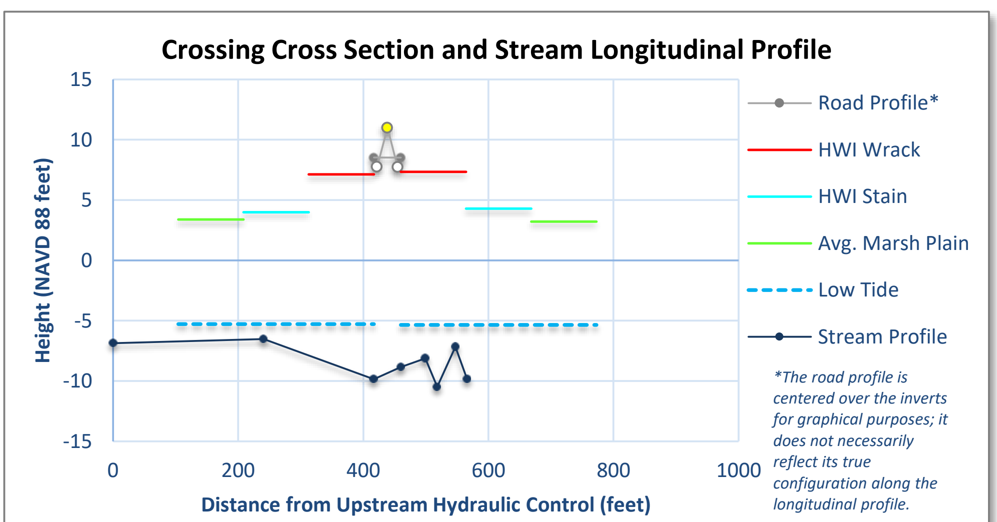
DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority

**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk

Long. Profile

Dist.	Hght.	Feat.	Sub.
0	-6.8592	HC	S
241	-6.5192	HC	S
417	-9.8492	I	S
460	-8.8392	I	G
499	-8.1292	HC	C
518	-10.479	P	G
547	-7.1492	HC	C
566	-9.8492	CB	C



Crossing Context:

N/A

Structure Characteristics:

Structure Type:	Bridge with Abutments	**Date of Last Known Replacement:**	N/A
Structure Material:	Wood		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	153	153
Dimension B[CB] (height):	19.02	17.84
Crossing Length (Invert to Invert):	43	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	None	N/A	None	N/A	None	None
Downstream	None	N/A	None	N/A	None	None

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
None	None	Good	OHE DS	Good

Structure Condition Comments:	Wood ceiling. Concrete abutments. Metal pillars.

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	High Salt Marsh	High Salt Marsh
Upstream Salt Marsh Migration Potential (acres):	153.86	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	No
Emergency Access or Evacuation Route:	Yes
History of Flooding:	No

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 60

Observer(s) & Organization:	TS, JB (NHDES Coastal)
Municipality:	RYE
Stream Name:	Berrys Brook
Road Name:	Brackett Rd

Date:	6/12/2018	
Start Time:	3:30:00 PM	
End Time:	5:12:00 PM	
Tide Prediction	**High**	**Low**
Time:	12:00 AM	12:00 AM
Elevation:	0.0	0.0
Tide Chart Location:	Portsmouth Harbor	

Crossing Condition Evaluation	Score*
Crossing Condition	1
Tidal Restriction Evaluation	
Tidal Range Ratio	1
Crossing Ratio	4
Erosion Classification	3
Tidal Restriction Overall Score	3
Tidal Aquatic Organism Passage	
Tidal Range Ratio	1
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	5
Salt Marsh Migration Potential (Wshed.)	5
Vegetation Evaluation	
Vegetation Comparison Matrix	1
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	2,2
Inun. Risk to the Crossing Structure (US, DS)	1,1
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	5
Overall Scores	
Infrastructure	1
Ecological	1
Combined	2

DS view toward structure

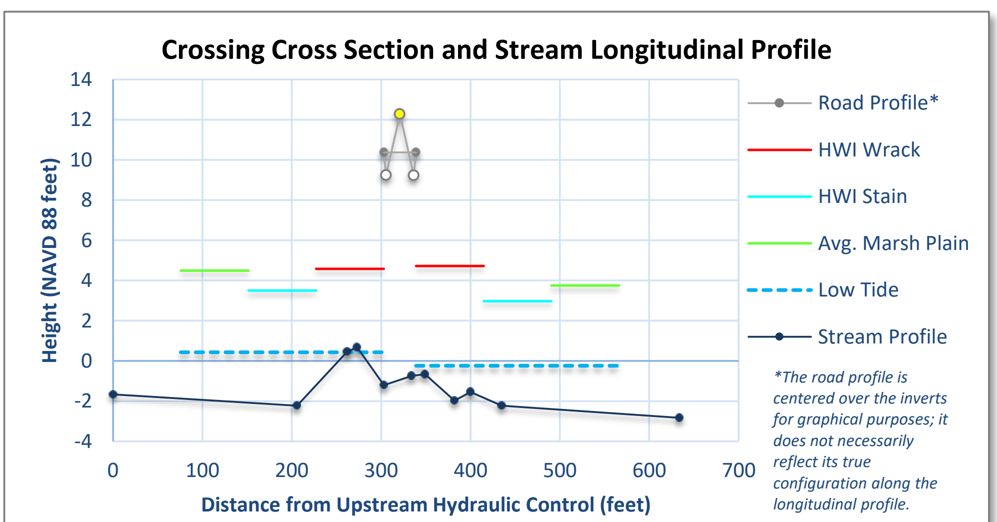
US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority

**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk



Long. Profile

Dist.	Hght.	Feat.	Sub.
0	-1.6597	HC	C/S
206	-2.2297	P	G
262	0.4703	CB	C
273	0.6703	GC	B
303	-1.1997	I	C
334	-0.7497	I	G
349	-0.6597	GC	G
382	-1.9697	P	G
400	-1.5497	HC	G
435	-2.2197	P	G
634	-2.8297	HC	G

Crossing Context:

N/A

Structure Characteristics:

Structure Type:	Bridge with Abutments	**Date of Last Known Replacement:**	N/A
Structure Material:	Concrete		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	31.35	31.5
Dimension B[CB](height):	11.5	11.75
Crossing Length (Invert to Invert):	36	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	None	N/A	Rip Rap	Good	None	None
Downstream	None	N/A	Rip Rap	Good	None	None

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
None	None	Good	Overhead electric	Good

Structure Condition Comments:	N/A

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	High Salt Marsh	High Salt Marsh
Upstream Salt Marsh Migration Potential (acres):	21.97	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	Yes
Emergency Access or Evacuation Route:	Yes
History of Flooding:	Flooding on Brackett Rd and 1A

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 61

Observer(s) & Organization:	TS, JB (NHDES Coastal)
Municipality:	NEW CASTLE
Stream Name:	N/A
Road Name:	Wild Rose Ln

Date:	6/1/2018	
Start Time:	8:00:00 AM	
End Time:	9:31:00 AM	
Tide Prediction	**High**	**Low**
Time:	2:26 PM	8:07 AM
Elevation:	7.6	1.2
Tide Chart Location:	Portsmouth Harbor	

	Score*
Crossing Condition Evaluation	
Crossing Condition	2
Tidal Restriction Evaluation	
Tidal Range Ratio	1
Crossing Ratio	5
Erosion Classification	4
Tidal Restriction Overall Score	3
Tidal Aquatic Organism Passage	
Tidal Range Ratio	1
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	5
Salt Marsh Migration Potential (Wshed.)	5
Vegetation Evaluation	
Vegetation Comparison Matrix	0
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	3,3
Inun. Risk to the Crossing Structure (US, DS)	5,5
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	5
Overall Scores	
Infrastructure	2
Ecological	4
Combined	3

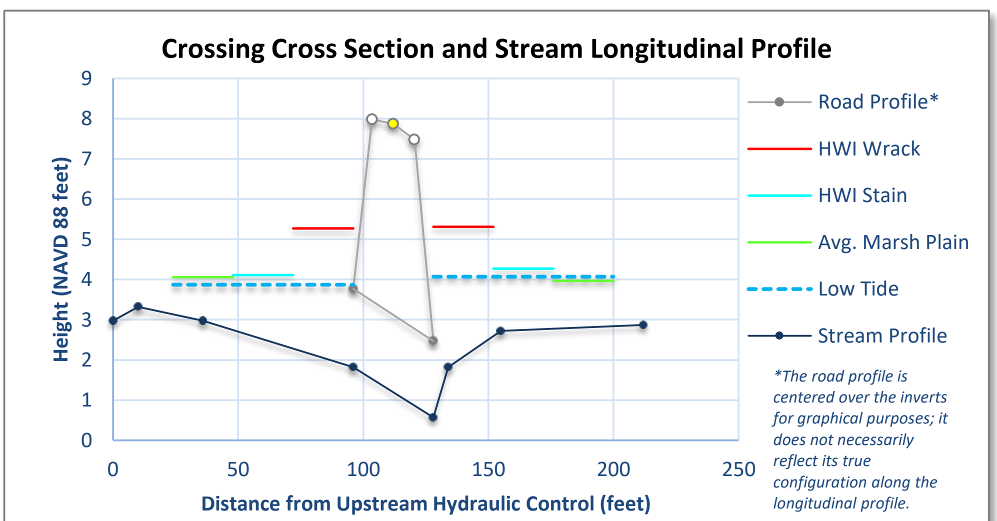
DS view toward structure

US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority
**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk



Long. Profile

Dist.	Hght.	Feat.	Sub.
0	2.9701	US HC	C/S
10	3.3201	US HC	C/S
36	2.9701	US P	C/S
96	1.8201	US I	C/S
128	0.5701	DS I	C/S
134	1.8201	DS P	C/S
155	2.7201	DS HC	C/S
212	2.8701	DS HC	C/S

Crossing Context:

A small back-barrier wetland landward of Fort Stark has a central ditch that is crossed by Wild Rose Lane and has a 3-foot round culvert. The wetland appears fresh to brackish, with exotic common reed and cattail, and is cut off from tidal flooding by gravel barrier beaches to the east and south. The crossing is an undersized culvert that is continually and entirely under water. It has an overall combined score of 3, indicating moderate priority for replacement.

Structure Characteristics:

Structure Type:	Round Culvert	**Date of Last Known Replacement:**	N/A
Structure Material:	Concrete		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	3	3
Dimension B[CB](height):	3	3
Crossing Length (Invert to Invert):	32	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	Masonry	Fair	Masonry	Fair	None	None
Downstream	Masonry	Fair	Masonry	Fair	None	None

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
None	None	Fair	Overhead electric	Fair

Structure Condition Comments:	Structure completely flooded. Difficult to get structure measurements

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	Invasive Dominant	Invasive Dominant
Upstream Salt Marsh Migration Potential (acres):	13.66	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	No
Emergency Access or Evacuation Route:	N/A
History of Flooding:	unknown

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 63

Observer(s) & Organization:	JB TS (NHDES Coastal)
Municipality:	NEW CASTLE
Stream Name:	N/A
Road Name:	Pit Ln

Date:	6/5/2018	
Start Time:	9:26:00 AM	
End Time:	10:17:00 AM	
Tide Prediction	**High**	**Low**
Time:	5:18 PM	10:52 AM
Elevation:	7.2	1.6
Tide Chart Location:	Portsmouth Harbor	

Crossing Condition Evaluation	Score*
Crossing Condition	4
Tidal Restriction Evaluation	
Tidal Range Ratio	3
Crossing Ratio	3
Erosion Classification	3
Tidal Restriction Overall Score	3
Tidal Aquatic Organism Passage	
Tidal Range Ratio	3
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	3
Salt Marsh Migration Potential (Wshed.)	3
Vegetation Evaluation	
Vegetation Comparison Matrix	0
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	3,3
Inun. Risk to the Crossing Structure (US, DS)	4,4
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	4
Overall Scores	
Infrastructure	4
Ecological	4
Combined	3

DS view toward structure

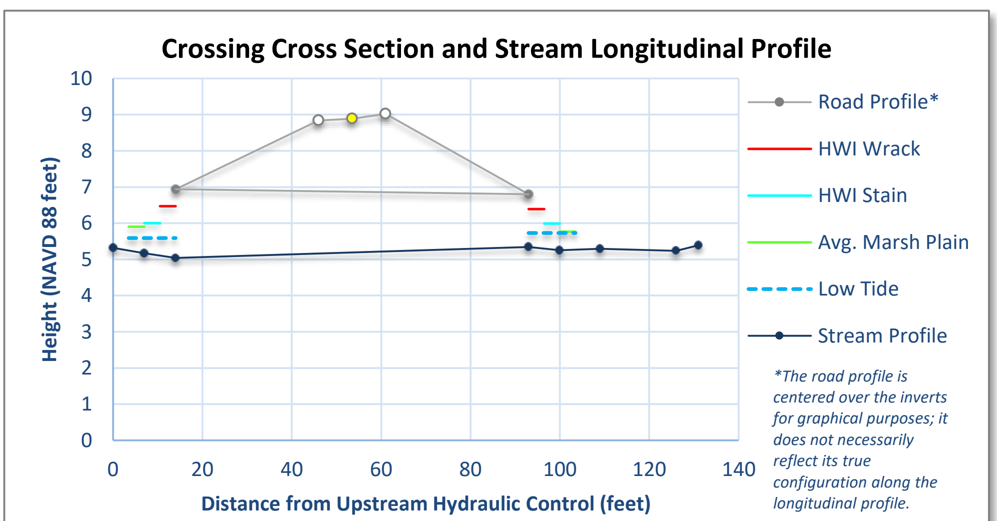
US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority

**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk



Long. Profile

Dist.	Hght.	Feat.	Sub.
0	5.3201	HC	C/S
7	5.1701	P	C/S
14	5.0401	I	C/S
93	5.3401	I	C/S
100	5.2501	P	C/S
109	5.2901	HC	C/S
126	5.2401	P	C/S
131	5.3901	HC	C/S

Crossing Context:

N/A

Structure Characteristics:

Structure Type:	Round Culvert	**Date of Last Known Replacement:**	N/A
Structure Material:	Steel - Corrugated		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	2	2
Dimension B[CB](height):	1.9	1.7
Crossing Length (Invert to Invert):	79	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	None	N/A	None	N/A	None	None
Downstream	Dry Fit Stone	Fair	None	N/A	None	None

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
None	None	Good	Utility box and OHE DS	Poor

Structure Condition Comments:	Bottom of culvert rusted out. Water flow under culvert. No observed flow during assessment.

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	Freshwater Marsh	Freshwater Marsh
Upstream Salt Marsh Migration Potential (acres):	4.82	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	No
Emergency Access or Evacuation Route:	N/A
History of Flooding:	unknown

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 64

Observer(s) & Organization:	TS, JB (NHDES Coastal)
Municipality:	NEW CASTLE
Stream Name:	N/A
Road Name:	Quarterdeck Ln

Date:	6/5/2018	
Start Time:	10:36:00 AM	
End Time:	11:50:00 AM	
Tide Prediction	**High**	**Low**
Time:	5:18 PM	10:52 AM
Elevation:	7.2	1.6
Tide Chart Location:	Portsmouth Harbor	

Crossing Condition Evaluation	Score*
Crossing Condition	1
Tidal Restriction Evaluation	
Tidal Range Ratio	3
Crossing Ratio	2
Erosion Classification	5
Tidal Restriction Overall Score	3
Tidal Aquatic Organism Passage	
Tidal Range Ratio	3
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	4
Salt Marsh Migration Potential (Wshed.)	4
Vegetation Evaluation	
Vegetation Comparison Matrix	4
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	2,3
Inun. Risk to the Crossing Structure (US, DS)	5,4
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	3
Overall Scores	
Infrastructure	3
Ecological	4
Combined	3

DS view toward structure

US view above structure

US view toward structure

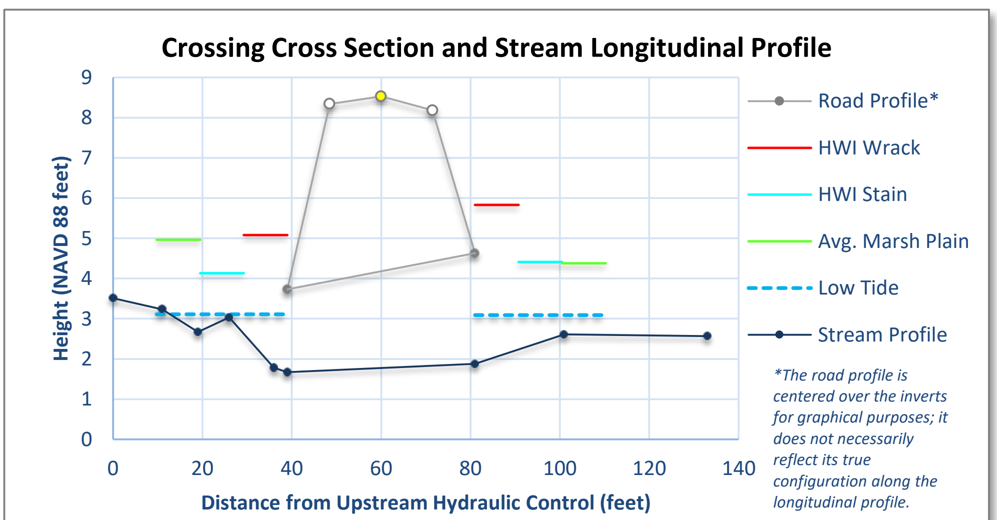
DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority

**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk

Long. Profile

Dist.	Hght.	Feat.	Sub.
0	3.5102	HC	C/S
11	3.2302	HC	C/S
19	2.6702	P	C/S
26	3.0302	HC	C/S
36	1.7802	P	C/S
39	1.6702	I	C/S
81	1.8802	I	C/S
101	2.6102	HC	C/S
133	2.5702	HC	C/S



Crossing Context:

A small marsh extends west of Lavenger Creek in New Castle and its tidal creek runs under Quarterdeck Lane through a concrete box culvert 4 feet wide by 3 feet tall. This culvert replaced a 3-foot pipe in 2008 that was restricting flow and impounding water. Although the crossing condition is very good, erosion is evident, the tidal flow appear restricted and tides regularly overfill the culvert. The upstream marsh is cattail while the downstream marsh is dominated by salt marsh grasses. The overall combined score is 3, indicating moderate priority for replacement.

Structure Characteristics:

Structure Type:	Box Culvert	**Date of Last Known Replacement:**	2008
Structure Material:	Concrete		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	4	4
Dimension B^{CB}(height):	3	3
Crossing Length (Invert to Invert):	42	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	Dry Fit Stone	Good	Dry Fit Stone	Good	None	None
Downstream	Dry Fit Stone	Good	Dry Fit Stone	Good	None	None

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
None	None	Good	Sewer, overhead electric	Good

Structure Condition Comments:	N/A

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	Freshwater Marsh	High Salt Marsh
Upstream Salt Marsh Migration Potential (acres):	8.51	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	Yes
Emergency Access or Evacuation Route:	N/A
History of Flooding:	flooding from heavyrain/storm surge

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 65

Observer(s) & Organization:	TS, JB (NHDES Coastal)
Municipality:	RYE
Stream Name:	N/A
Road Name:	N/A

Date:	6/20/2018	
Start Time:	11:10:00 AM	
End Time:	11:52:00 AM	
Tide Prediction	**High**	**Low**
Time:	6:16 PM	11:47 AM
Elevation:	8.5	-0.3
Tide Chart Location:	Portsmouth Harbor	

Crossing Condition Evaluation	Score*
Crossing Condition	4
Tidal Restriction Evaluation	
Tidal Range Ratio	5
Crossing Ratio	4
Erosion Classification	3
Tidal Restriction Overall Score	4
Tidal Aquatic Organism Passage	
Tidal Range Ratio	5
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	2
Salt Marsh Migration Potential (Wshed.)	2
Vegetation Evaluation	
Vegetation Comparison Matrix	5
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	2,2
Inun. Risk to the Crossing Structure (US, DS)	5,5
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	5
Overall Scores	
Infrastructure	4
Ecological	5
Combined	5

DS view toward structure

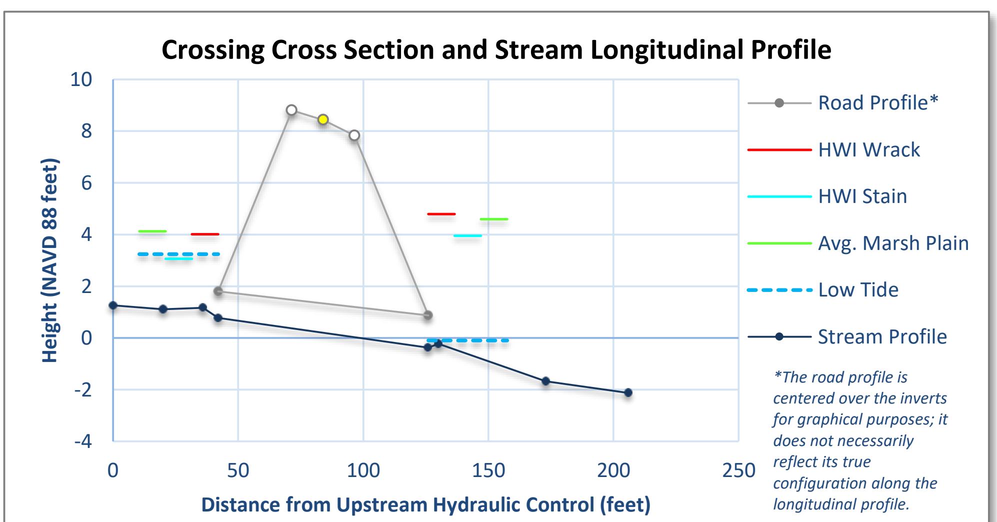
US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority

**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk



Long. Profile

Dist.	Hght.	Feat.	Sub.
0	1.2618	HC	S
20	1.1118	HC	G
36	1.1718	GC	G
42	0.7718	I	G
126	-0.3782	I	G
130	-0.2282	HC	G
173	-1.6782	HC	G
206	-2.1282	HC	G

Crossing Context:

The tiny culvert that runs under Route 1B is a 1-foot diameter pipe that restricts tides from Sagamore Creek to a small upstream marsh. The tidal range is restricted and erosion occurs on the upstream side, but an intensive study found that mummichogs (salt marsh minnows) regularly navigated the culvert (Eberhardt et al. 2011). It has an overall combined score of 5, indicating highest priority for replacement. The high water stain suggests that an immediate expansion of salt marsh would be supported by a larger culvert. The link for cited text can be found below:
https://scholars.unh.edu/jel/36/

Structure Characteristics:

Structure Type:	Round Culvert	**Date of Last Known Replacement:**	N/A
Structure Material:	Concrete		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	1	1
Dimension B[CB] **(height):**	1	1
Crossing Length (Invert to Invert):	84	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	None	Poor	None	N/A	Culvert	Medium
Downstream	None	N/A	None	N/A	Culvert	Low

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
None	None	Good	OHE at crossing US and utility pole DS RR	Poor

Structure Condition Comments:	Culvert chipped at invert both sides.

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	High Salt Marsh	Sparsely Vegetated Intertidal Habitat
Upstream Salt Marsh Migration Potential (acres):	1.03	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	No
Emergency Access or Evacuation Route:	Yes
History of Flooding:	unknown

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 67

Observer(s) & Organization:	TS, JB (NHDES Coastal)
Municipality:	PORTSMOUTH
Stream Name:	Sagamore Creek
Road Name:	Lafayette Rd

Date:	7/2/2018	
Start Time:	8:45:00 AM	
End Time:	10:30:00 AM	
Tide Prediction	**High**	**Low**
Time:	3:17 PM	8:56 AM
Elevation:	7.4	0.4
Tide Chart Location:	Portsmouth Harbor	

Crossing Condition Evaluation	Score*
Crossing Condition	1
Tidal Restriction Evaluation	
Tidal Range Ratio	3
Crossing Ratio	3
Erosion Classification	3
Tidal Restriction Overall Score	3
Tidal Aquatic Organism Passage	
Tidal Range Ratio	3
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	5
Salt Marsh Migration Potential (Wshed.)	5
Vegetation Evaluation	
Vegetation Comparison Matrix	1
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	2,2
Inun. Risk to the Crossing Structure (US, DS)	1,1
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	3

DS view toward structure

US view above structure

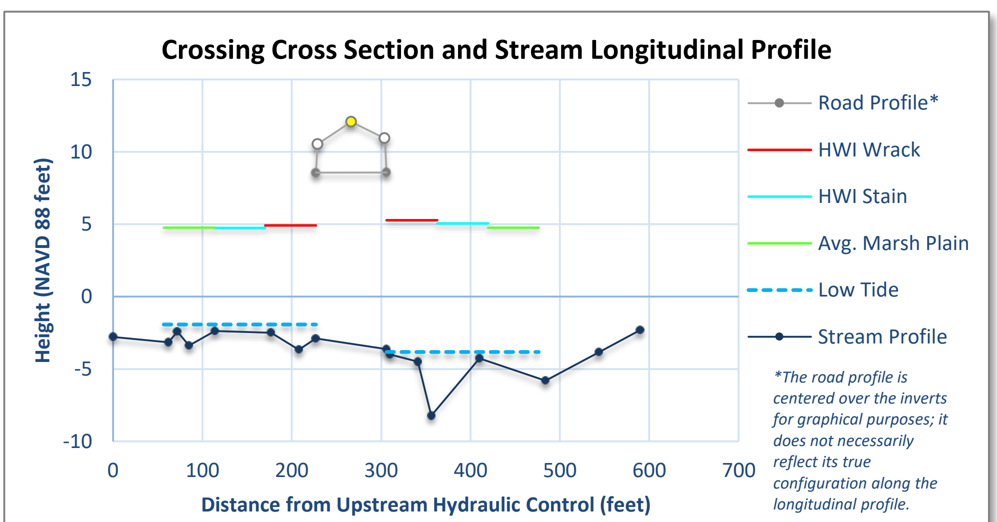
US view toward structure

DS view above structure

Overall Scores

Infrastructure	1
Ecological	3
Combined	3

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority
**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk



Long. Profile

Dist.	Hght.	Feat.	Sub.
0	-2.7965	HC	C
62	-3.1665	P	C
72	-2.4265	HC	C
85	-3.3765	P	C
114	-2.3765	HC	C
177	-2.4965	CB	G
208	-3.6765	P	G
227	-2.8865	I	C
306	-3.6365	I	C
310	-4.0065	CB	S
341	-4.4865	CB	C
356	-8.2265	P	G
410	-4.2765	HC	G
484	-5.8165	P	G
544	-3.8465	HC	G
590	-2.3065	CB	C

Crossing Context:

N/A

Structure Characteristics:

Structure Type:	Bridge with Abutments	**Date of Last Known Replacement:**	N/A
Structure Material:	Concrete		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	39.2	39.3
Dimension B[CB](height):	11.03	11.93
Crossing Length (Invert to Invert):	79	

Crossing Condition:	Headwall Material	Headwall Condition	Wingwall Material	Wingwall Condition	Scour at Structure	Scour Severity
Upstream	None	N/A	Rip Rap	Good	None	None
Downstream	None	N/A	Rip Rap	Good	None	None

Scour in Structure	Scour Severity in Structure	Road Surface Condition	Utilities at Crossing	Structure Condition Overall
None	None	Good	Overhead electric	Good

Structure Condition Comments:	May be bridge with abutments and side slopes, took C and D measurement (see photo 5)

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	High Salt Marsh	High Salt Marsh
Upstream Salt Marsh Migration Potential (acres):	13.37	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	Yes
Emergency Access or Evacuation Route:	Yes
History of Flooding:	flooding of adjacent business parking lot

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 68

Observer(s) & Organization:	TS, JB, KL (NHDES Coastal)
Municipality:	PORTSMOUTH
Stream Name:	0
Road Name:	Belle Isle Rd

Date:	9/13/2018	
Start Time:	8:57:00 AM	
End Time:	10:30:00 AM	
Tide Prediction	**High**	**Low**
Time:	2:56 AM	8:36 AM
Elevation:	9.0	-0.5
Tide Chart Location:	Portsmouth Harbor	

Crossing Condition Evaluation	Score*
Crossing Condition	4
Tidal Restriction Evaluation	
Tidal Range Ratio	1
Crossing Ratio	1
Erosion Classification	1
Tidal Restriction Overall Score	1
Tidal Aquatic Organism Passage	
Tidal Range Ratio	1
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	4
Salt Marsh Migration Potential (Wshed.)	4
Vegetation Evaluation	
Vegetation Comparison Matrix	1
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	Null,Null
Inun. Risk to the Crossing Structure (US, DS)	3,2
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	5

DS view toward structure

US view above structure

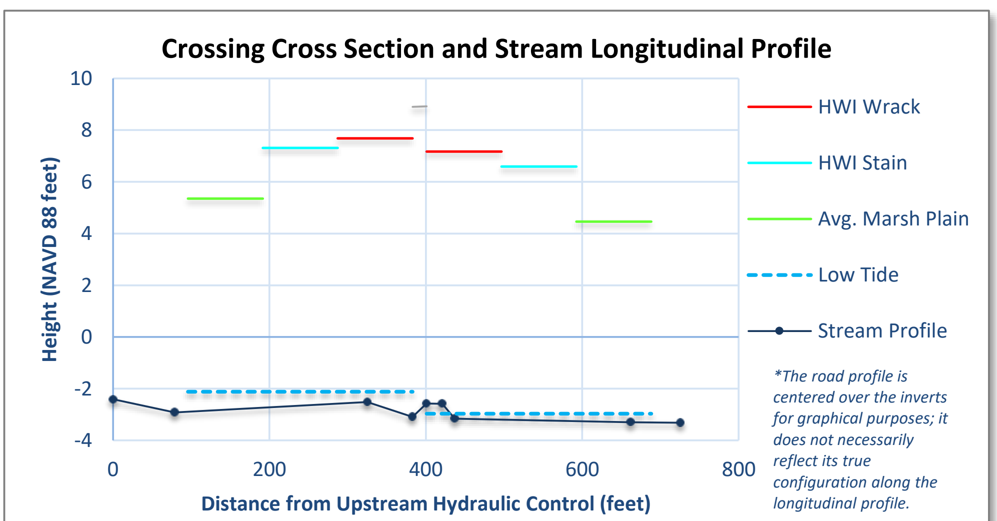
US view toward structure

DS view above structure

Overall Scores

Infrastructure	4
Ecological	1
Combined	3

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority
**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk



Long. Profile

Dist.	Hght.	Feat.	Sub.
0	-2.4086	HC	C/S
79	-2.9186	CB	Shell
325	-2.5186	GC	Shell
383	-3.0986	I	Shell
401	-2.5786	I	Shell
421	-2.5886	GC	Shell
437	-3.1586	CB	Shell
662	-3.2986	HC	S
726	-3.3186	CB	S

Crossing Context:

N/A

Structure Characteristics:

Structure Type:	Bridge with Side Slopes and Abutments	**Date of Last Known Replacement:**	N/A
Structure Material:	Steel - Smooth		
Tide Gate Present:	Yes		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	91	91
Dimension B^{CB}(height):	12	11.5
Crossing Length (Invert to Invert):	18	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	None	N/A	Concrete	Poor	Wingwalls	Medium
Downstream	None	N/A	Concrete	Poor	Wingwalls	Medium

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
Abutment	Medium	N/A	None	Fair

Structure Condition Comments:	N/A

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	Sparsely Vegetated Intertidal Habitat	Sparsely Vegetated Intertidal Habitat
Upstream Salt Marsh Migration Potential (acres):	9.35	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	No
Emergency Access or Evacuation Route:	N/A
History of Flooding:	unknown

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 69

Observer(s) & Organization:	JB TS (NHDES Coastal)
Municipality:	PORTSMOUTH
Stream Name:	South mill pond
Road Name:	Marcy St

Date:	9/4/2018	
Start Time:	12:30:00 PM	
End Time:	1:40:00 PM	
Tide Prediction	**High**	**Low**
Time:	6:55 PM	12:31 PM
Elevation:	8.6	0.7
Tide Chart Location:	Portsmouth Harbor	

Crossing Condition Evaluation	Score*
Crossing Condition	3
Tidal Restriction Evaluation	
Tidal Range Ratio	1
Crossing Ratio	5
Erosion Classification	1
Tidal Restriction Overall Score	2
Tidal Aquatic Organism Passage	
Tidal Range Ratio	1
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	4
Salt Marsh Migration Potential (Wshed.)	5
Vegetation Evaluation	
Vegetation Comparison Matrix	1
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	2,3
Inun. Risk to the Crossing Structure (US, DS)	1,1
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	1
Overall Scores	
Infrastructure	3
Ecological	1
Combined	3

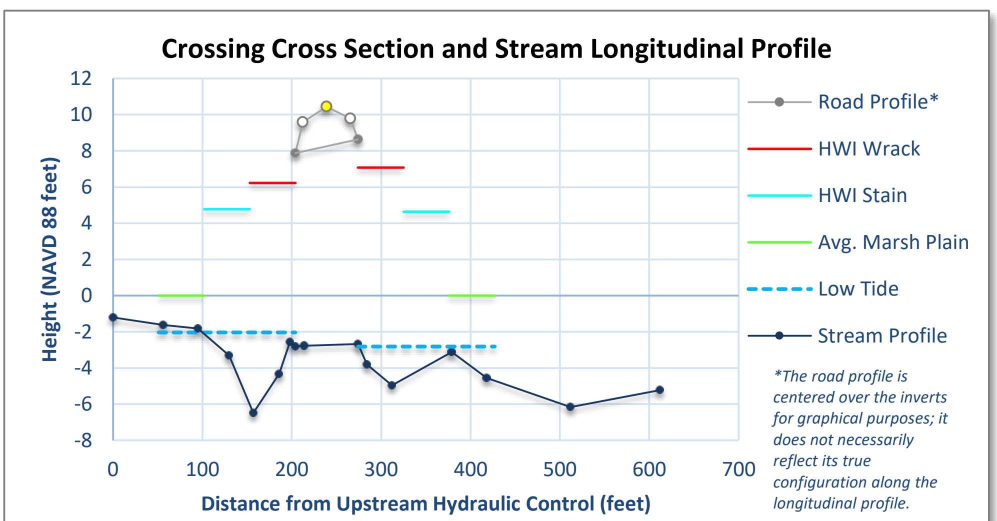
DS view toward structure

US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority
**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk



Long. Profile

Dist.	Hght.	Feat.	Sub.
0	-1.2069	HC	G
56	-1.6269	CB	G
95	-1.8169	HC	G
130	-3.3169	CB	C
157	-6.4869	P	C
186	-4.3169	CB	B
198	-2.5669	GC	B
204	-2.8169	I	B
214	-2.7669	CB	Shell
274	-2.6669	I	Shell
284	-3.8069	CB	Shell
312	-4.9669	P	G
379	-3.1169	HC	C
418	-4.5469	CB	G
512	-6.1669	P	G
612	-5.2169	HC	C

Crossing Context:

The crossing over the inlet to South Mill Pond at Marcy Street is a tide gate that was regularly closed before 2000 on occasions when combined sewer overflows (CSO) produced a stench. The closures resulted anoxia in the water and death of aquatic animals, but policy change with restoration of shellfish and salt marsh coupled with sewer upgrades and reductions in CSO events has allowed the gate to remain open (McDermott et al. 2005). This crossing has an overall combined score of 3, indicating moderate priority for replacement. The link for cited text can be found below:
https://scholars.unh.edu/jel/33/

Structure Characteristics:

Structure Type:	Box Culvert	**Date of Last Known Replacement:**	N/A
Structure Material:	Concrete		
Tide Gate Present:	Yes		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	20	20
Dimension B[CB](height):	10.95	11.35
Crossing Length (Invert to Invert):	70	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	Concrete	Good	Concrete	Good	None	None
Downstream	Concrete	Good	Concrete	Good	None	None

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
None	None	Fair	Gas line, sewer line, other pipes. E mtr, OHE	Good

Structure Condition Comments:	US Dim C is tide gate opening.

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	Sparsely Vegetated Intertidal Habitat	Sparsely Vegetated Intertidal Habitat
Upstream Salt Marsh Migration Potential (acres):	27.82	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	Yes
Emergency Access or Evacuation Route:	Yes
History of Flooding:	identified as past, present, and future hazard

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 70

Observer(s) & Organization:	JB TS (NHDES Coastal)	**Date:**	6/21/2018	
Municipality:	PORTSMOUTH	**Start Time:**	12:14:00 PM	
Stream Name:	N/A	**End Time:**	1:00:00 PM	
Road Name:	Junkins Ave	**Tide Prediction**	**High**	**Low**
		Time:	5:16 PM	12:48 PM
		Elevation:	8.5	0.0
		Tide Chart Location:	Portsmouth Harbor	

Crossing Condition Evaluation	Score*
Crossing Condition	5
Tidal Restriction Evaluation	
Tidal Range Ratio	2
Crossing Ratio	5
Erosion Classification	4
Tidal Restriction Overall Score	4
Tidal Aquatic Organism Passage	
Tidal Range Ratio	2
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	5
Salt Marsh Migration Potential (Wshed.)	5
Vegetation Evaluation	
Vegetation Comparison Matrix	1
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	2,2
Inun. Risk to the Crossing Structure (US, DS)	5,5
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	5
Overall Scores	
Infrastructure	5
Ecological	3
Combined	4

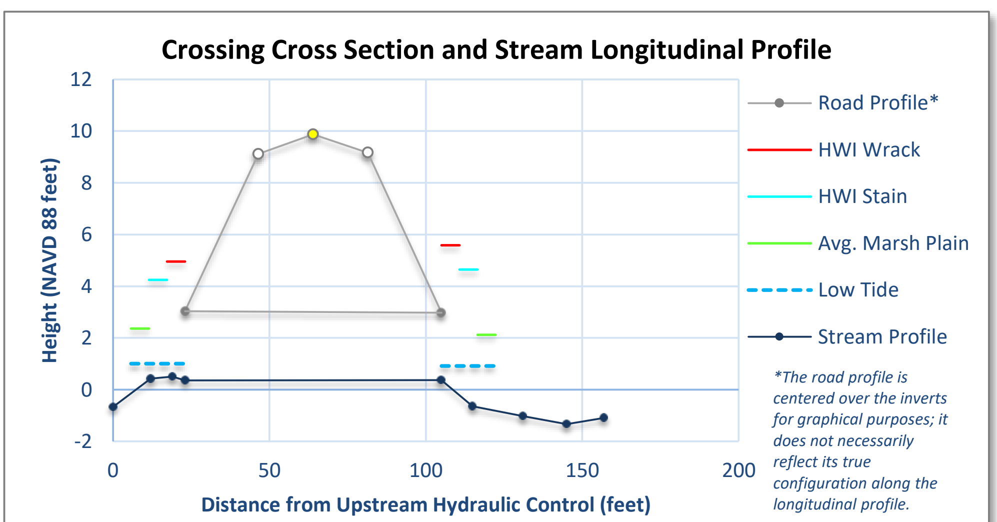
DS view toward structure

US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority
**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk

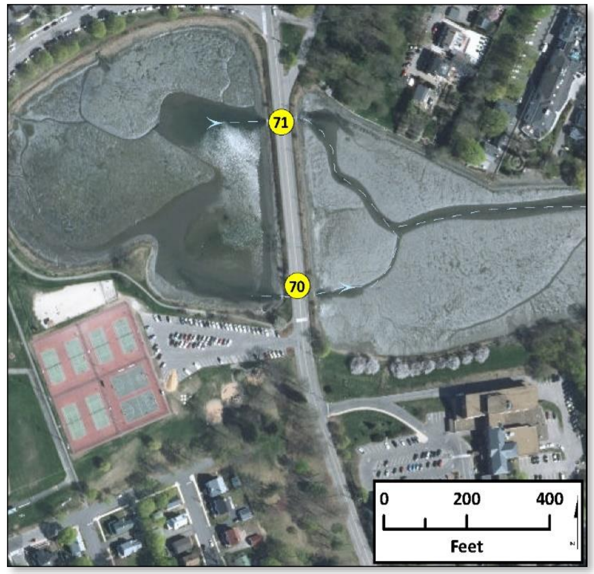


Long. Profile

Dist.	Hght.	Feat.	Sub.
0	-0.6647	P	G
12	0.4253	CB	C
19	0.5053	HC	C
23	0.3553	I	C
105	0.3653	I	Shell
115	-0.6447	CB	G
131	-1.0247	HC	G
145	-1.3347	P	G
157	-1.0947	HC	C/S

Crossing Context:

The crossing on Junkins Avenue provides tides to the inner portion of South Mill Pond through a pair of 3 by 8-foot concrete box culverts (#71 is the other culvert). Salt marsh and shellfish have been restored in parts of the pond following opening of the tide gate (see crossing #69), but erosion and tidal restriction indicate replacement is needed. The crossing has an overall combined score of 4, indicating high priority for replacement.



Structure Characteristics:

Structure Type:	Box Culvert	**Date of Last Known Replacement:**	N/A
Structure Material:	Concrete		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	8	8
Dimension B[CB](height):	2.8	2.6
Crossing Length (Invert to Invert):	82	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	None	N/A	None	N/A	Culvert	Medium
Downstream	None	N/A	None	N/A	Culvert	Medium

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
Culvert	Medium	Fair	OHE	Poor

Structure Condition Comments:	Concrete falling off structure. Exposed rebar DS

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	Sparsely Vegetated Intertidal Habitat	Sparsely Vegetated Intertidal Habitat
Upstream Salt Marsh Migration Potential (acres):	18.93	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	Yes
Emergency Access or Evacuation Route:	N/A
History of Flooding:	Past and future hazard

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 71

Observer(s) & Organization:	TS, JB (NHDES Coastal)
Municipality:	PORTSMOUTH
Stream Name:	N/A
Road Name:	Junkins Ave

Date:	6/21/2018	
Start Time:	1:22:00 PM	
End Time:	2:30:00 PM	
Tide Prediction	**High**	**Low**
Time:	7:16 PM	12:48 PM
Elevation:	8.5	0.0
Tide Chart Location:	Portsmouth Harbor	

Crossing Condition Evaluation	Score*
Crossing Condition	5
Tidal Restriction Evaluation	
Tidal Range Ratio	4
Crossing Ratio	5
Erosion Classification	4
Tidal Restriction Overall Score	4
Tidal Aquatic Organism Passage	
Tidal Range Ratio	4
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	5
Salt Marsh Migration Potential (Wshed.)	5
Vegetation Evaluation	
Vegetation Comparison Matrix	1
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	3,3
Inun. Risk to the Crossing Structure (US, DS)	5,5
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	5
Overall Scores	
Infrastructure	5
Ecological	5
Combined	5

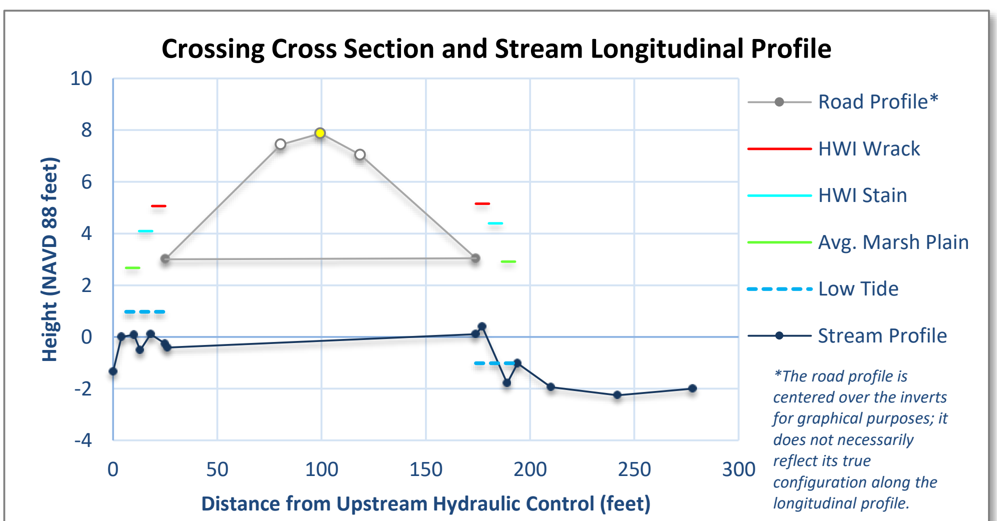
DS view toward structure

US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority
**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk

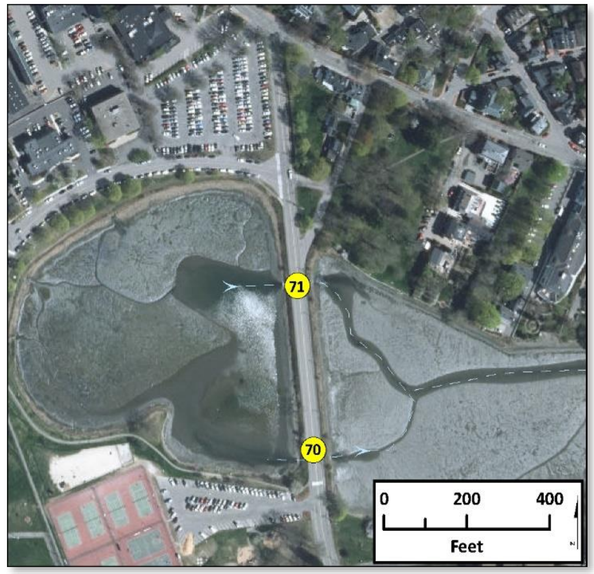


Long. Profile

Dist.	Hght.	Feat.	Sub.
0	-1.346	P	S
4	0.004	HC	G
10	0.084	CB	C
13	-0.516	P	G
18	0.104	HC	G
25	-0.266	I	C
26	-0.406	CB	G
174	0.104	I	Shell
177	0.404	GC	B
189	-1.796	P	G
194	-1.016	HC	B
210	-1.946	CB	G
242	-2.256	P	G
278	-1.996	HC	C/S

Crossing Context:

The crossing on Junkins Avenue provides tides to the inner portion of South Mill Pond through a pair of 3 by 8-foot concrete box culverts (#70 is the other culvert). This culvert appears to be partially filled with sediment (cobble sized). Salt marsh and shellfish have been restored in parts of the pond following opening of the tide gate (see crossing #69), but erosion and tidal restriction indicate replacement is needed. The crossing has an overall combined score of 5, indicating highest priority for replacement.



Structure Characteristics:

Structure Type:	Box Culvert	**Date of Last Known Replacement:**	N/A
Structure Material:	Concrete		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	8	8
Dimension B[CB] (height):	3.2	2.85
Crossing Length (Invert to Invert):	149	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	None	N/A	None	N/A	Culvert	Medium
Downstream	None	N/A	None	N/A	Culvert	Low

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
Culvert	Medium	Fair	Overhead electric	Poor

Structure Condition Comments:	N/A

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	Sparsely Vegetated Intertidal Habitat	Sparsely Vegetated Intertidal Habitat
Upstream Salt Marsh Migration Potential (acres):	18.93	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	Yes
Emergency Access or Evacuation Route:	N/A
History of Flooding:	past and future hazard

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 72

Observer(s) & Organization:	JB TS (NHDES Coastal)
Municipality:	PORTSMOUTH
Stream Name:	Hodgson Brook
Road Name:	Bartlett St

Date:	7/23/2018	
Start Time:	1:30:00 PM	
End Time:	3:22:00 PM	
Tide Prediction	**High**	**Low**
Time:	9:33 PM	3:09 PM
Elevation:	8.3	1.0
Tide Chart Location:	Portsmouth Harbor	

Crossing Condition Evaluation	Score*
Crossing Condition	2
Tidal Restriction Evaluation	
Tidal Range Ratio	5
Crossing Ratio	4
Erosion Classification	3
Tidal Restriction Overall Score	4
Tidal Aquatic Organism Passage	
Tidal Range Ratio	5
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	1
Salt Marsh Migration Potential (Wshed.)	1
Vegetation Evaluation	
Vegetation Comparison Matrix	5
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	2,2
Inun. Risk to the Crossing Structure (US, DS)	1,3
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	5
Overall Scores	
Infrastructure	2
Ecological	5
Combined	5

DS view toward structure

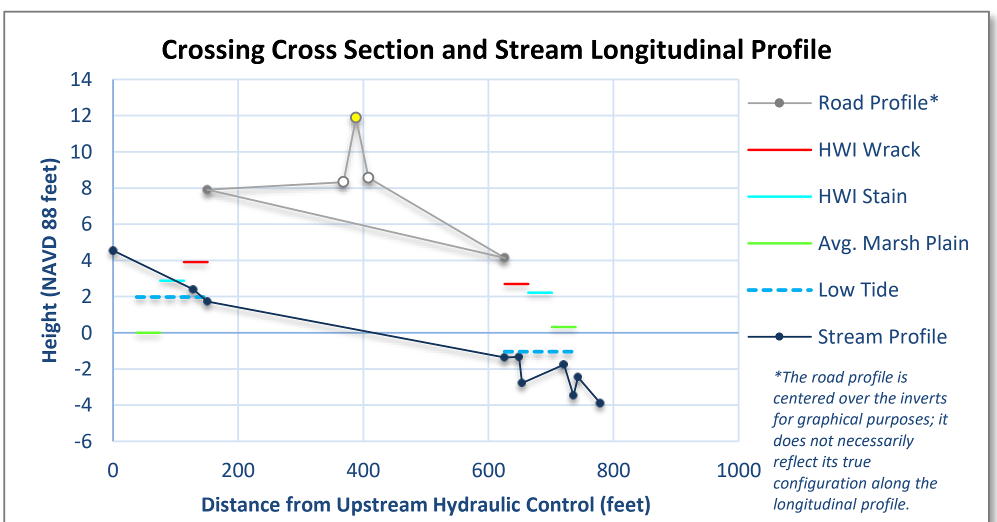
US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority

**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk

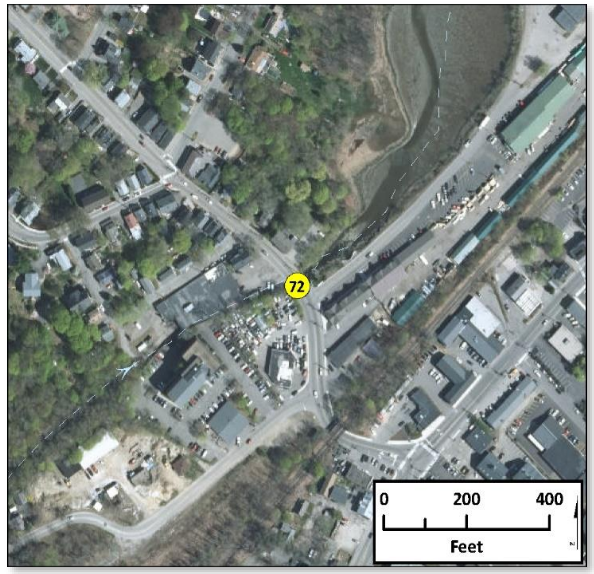


Long. Profile

Dist.	Hght.	Feat.	Sub.
0	4.5466	HC	B
128	2.4066	HC	B
151	1.7266	I	B
626	-1.3634	I	B
649	-1.3334	GC	B
654	-2.7734	P	C
721	-1.7634	HC	C
736	-3.4634	P	C
743	-2.4534	HC	C
779	-3.8934	CB	C

Crossing Context:

Bartlett Street and upstream development covers Hodgson Brook almost 500 linear feet: from an artificially straightened freshwater stream to the southern terminus of North Mill Pond, which is a salt water pond. Spring tides can push salt water into the stream, but the gradient rises more than three feet over the length of the structure and upstream tides are, for the most part, fresh. The overall combined score for replacement is 5, highest priority, due to restriction in tidal range, stream width and erosion.



Structure Characteristics:

Structure Type:	Box Culvert	**Date of Last Known Replacement:**	N/A
Structure Material:	Concrete		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	11.28	9
Dimension B[CB](height):	6.4	5.45
Crossing Length (Invert to Invert):	475	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	Concrete	Good	Metal	Fair	Wingwalls	Low
Downstream	Dry Fit Stone	Fair	Dry Fit Stone	Fair	Wingwalls	Low

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
Culvert	Low	Good	DS sewer line parallel to road. DS OHE	Good

Structure Condition Comments:	N/A

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	Freshwater Stream	Sparsely Vegetated Intertidal Habitat
Upstream Salt Marsh Migration Potential (acres):	0.00	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	Yes
Emergency Access or Evacuation Route:	Yes
History of Flooding:	River right area prone to flooding

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 73

Observer(s) & Organization:	TS, JB (NHDES Coastal)
Municipality:	PORTSMOUTH
Stream Name:	N/A
Road Name:	Maplewood Ave

Date:	9/5/2018	
Start Time:	1:24:00 PM	
End Time:	2:30:00 PM	
Tide Prediction	**High**	**Low**
Time:	2:07 PM	7:48 AM
Elevation:	9.3	-0.9
Tide Chart Location:	Portsmouth Harbor	

Crossing Condition Evaluation	Score*
Crossing Condition	5
Tidal Restriction Evaluation	
Tidal Range Ratio	3
Crossing Ratio	5
Erosion Classification	0
Tidal Restriction Overall Score	4
Tidal Aquatic Organism Passage	
Tidal Range Ratio	3
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	5
Salt Marsh Migration Potential (Wshed.)	5
Vegetation Evaluation	
Vegetation Comparison Matrix	1
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	2,2
Inun. Risk to the Crossing Structure (US, DS)	2,2
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	1
Overall Scores	
Infrastructure	5
Ecological	5
Combined	5

DS view toward structure

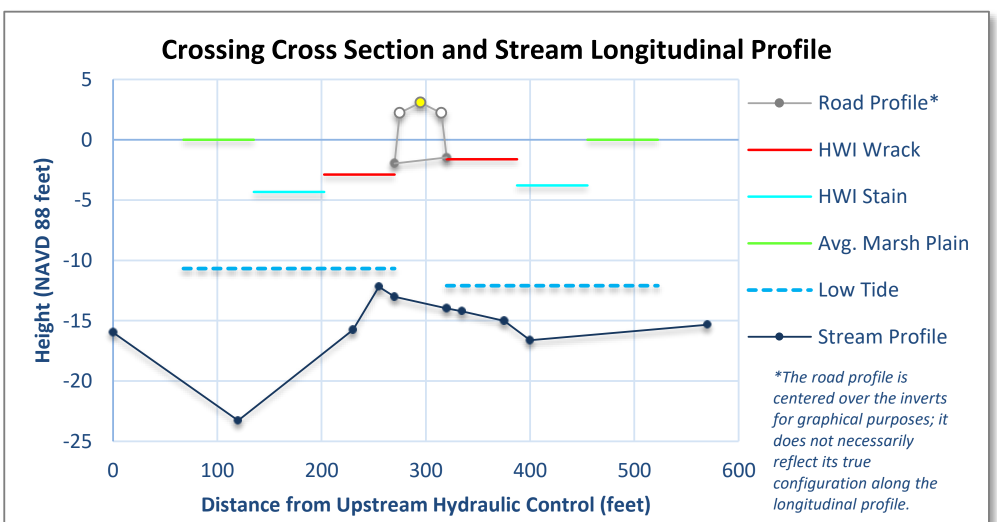
US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority

**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk

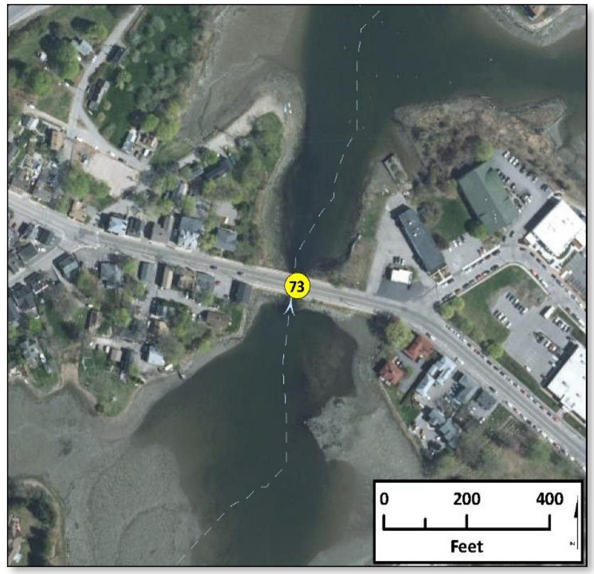


Long. Profile

Dist.	Hght.	Feat.	Sub.
0	-15.966	HC	G
120	-23.276	P	C
230	-15.766	CB	B
255	-12.186	GC	B
270	-13.006	I	B
320	-13.966	I	B
335	-14.226	GC	B
375	-15.026	CB	C
400	-16.626	P	C
570	-15.326	CB	C

Crossing Context:

The bridge on Maplewood Avenue conducts all the tides to the North Mill Pond through a large arch (about 12 by 25 feet) supported by courses of granite blocks. A tide gate that resulted in a non-tidal fresh pond was destroyed in a truck accident on the road in the 1950s. The crossing is very old and is in need of repair; it restricts larger tides. Although almost all of the shoreline has been filled, little in the way of new structures or infrastructure has been built so inundation risk to development is small. The overall combined score is a 5: highest priority for replacement.



Structure Characteristics:

Structure Type:	Arch Bridge	**Date of Last Known Replacement:**	N/A
Structure Material:	Steel - Corrugated		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	25	25
Dimension B^{CB}(height):	11.3	13
Crossing Length (Invert to Invert):	50	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	None	N/A	Masonry	Fair	Wingwalls	Medium
Downstream	None	N/A	Masonry	Poor	Wingwalls	High

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
Abutment	Medium	Fair	Overhead electric, sewer/water through crossing	Poor

Structure Condition Comments:	Sewer pipe running under crossing, severe spalling and loss of material for DS wingwall

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	Sparsely Vegetated Intertidal Habitat	Sparsely Vegetated Intertidal Habitat
Upstream Salt Marsh Migration Potential (acres):	37.76	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	Yes
Emergency Access or Evacuation Route:	Yes
History of Flooding:	No

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 74

Observer(s) & Organization:	JB TS (NHDES Coastal)
Municipality:	PORTSMOUTH
Stream Name:	N/A
Road Name:	N/A

Date:	8/14/2018	
Start Time:	8:35:00 AM	
End Time:	10:00:00 AM	
Tide Prediction	**High**	**Low**
Time:	2:35 PM	8:13 AM
Elevation:	9.1	-1.2
Tide Chart Location:	Portsmouth Harbor	

Crossing Condition Evaluation	Score*
Crossing Condition	2
Tidal Restriction Evaluation	
Tidal Range Ratio	1
Crossing Ratio	2
Erosion Classification	3
Tidal Restriction Overall Score	2
Tidal Aquatic Organism Passage	
Tidal Range Ratio	1
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	3
Salt Marsh Migration Potential (Wshed.)	3
Vegetation Evaluation	
Vegetation Comparison Matrix	1
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	2,2
Inun. Risk to the Crossing Structure (US, DS)	2,2
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	5
Overall Scores	
Infrastructure	2
Ecological	3
Combined	2

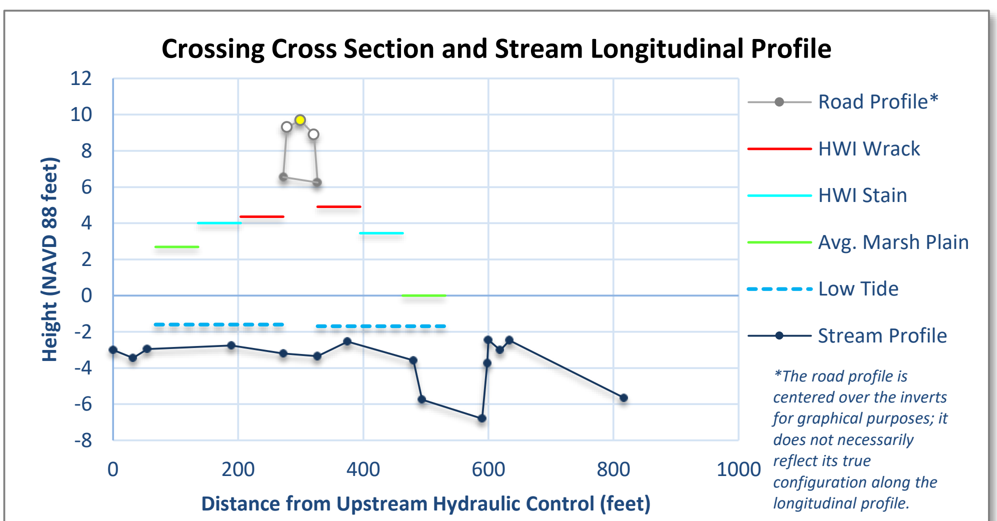
DS view toward structure

US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority
**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk



Long. Profile

Dist.	Hght.	Feat.	Sub.
0	-3.0015	HC	G
32	-3.4515	P	G
55	-2.9515	HC	G
189	-2.7515	HC	G
272	-3.2015	I	C
327	-3.3515	I	C
375	-2.5515	HC	G
480	-3.5815	CB	C
494	-5.7515	P	C/S
590	-6.8015	CB	C
598	-3.7515	CB	C
600	-2.4515	HC	C
619	-3.0215	CB	C
634	-2.4815	HC	G
817	-5.6515	HC	C

Crossing Context:

This crossing was built for access to the Albacore Sub Museum and conducts tides through a rip-rap canal into a small intertidal embayment formed by the construction of Market Street Extension. The canal had a sill that created a subtidal salt pond with the intention to reduce odors from undocumented sewage. In the 1990s the sill was removed and sewage sources were identified and corrected. The crossing does not impede flow and the structure is in good shape, leading to an overall combined score of 2, indicating low priority for replacement.

Structure Characteristics:

Structure Type:	Bridge with Side Slopes and Abutments	**Date of Last Known Replacement:**	N/A
Structure Material:	Concrete		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	42	42
Dimension B[CB](height):	9.4	9.5
Crossing Length (Invert to Invert):	55	

Crossing Condition:	Headwall Material	Headwall Condition	Wingwall Material	Wingwall Condition	Scour at Structure	Scour Severity
Upstream	None	N/A	Concrete	Fair	None	None
Downstream	None	N/A	Concrete	Fair	None	None

Scour in Structure	Scour Severity in Structure	Road Surface Condition	Utilities at Crossing	Structure Condition Overall
None	None	Good	OHE. Pump station	Good

Structure Condition Comments:	Old retaining wall/dam coming into DS channel from banks

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	Sparsely Vegetated Intertidal Habitat	Sparsely Vegetated Intertidal Habitat
Upstream Salt Marsh Migration Potential (acres):	4.31	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	No
Emergency Access or Evacuation Route:	N/A
History of Flooding:	No

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 75

Observer(s) & Organization:	TS, JB (NHDES Coastal)
Municipality:	PORTSMOUTH
Stream Name:	N/A
Road Name:	Market St

Date:	8/7/2018	
Start Time:	2:10:00 PM	
End Time:	2:45:00 PM	
Tide Prediction	**High**	**Low**
Time:	8:18 PM	1:53 PM
Elevation:	8.9	0.5
Tide Chart Location:	Portsmouth Harbor	

Crossing Condition Evaluation	Score*
Crossing Condition	1
Tidal Restriction Evaluation	
Tidal Range Ratio	1
Crossing Ratio	3
Erosion Classification	3
Tidal Restriction Overall Score	2
Tidal Aquatic Organism Passage	
Tidal Range Ratio	1
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	5
Salt Marsh Migration Potential (Wshed.)	5
Vegetation Evaluation	
Vegetation Comparison Matrix	1
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	1,1
Inun. Risk to the Crossing Structure (US, DS)	1,1
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	1
Overall Scores	
Infrastructure	1
Ecological	1
Combined	2

DS view toward structure

US view above structure

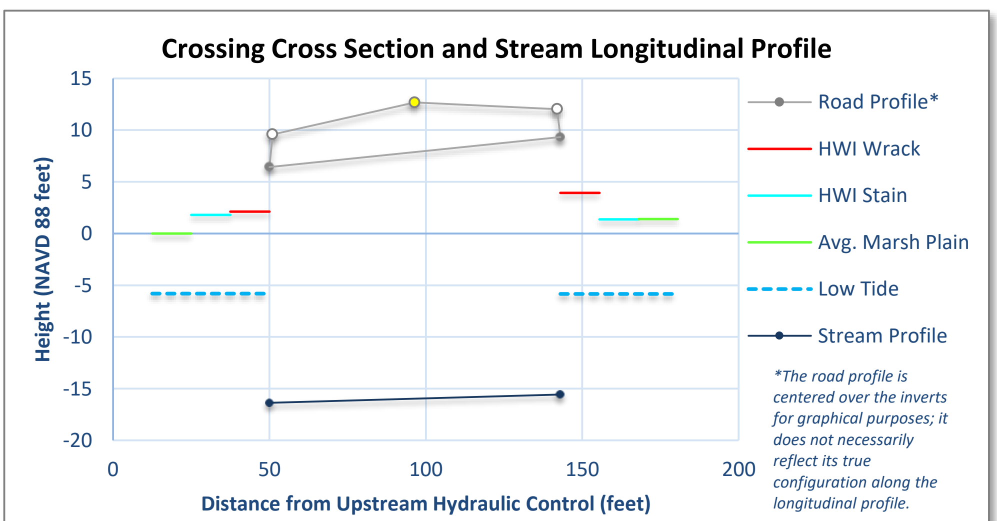
US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority
**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk

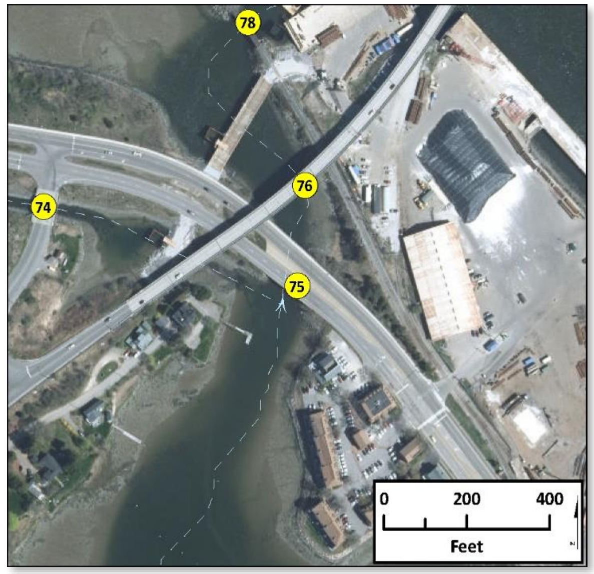
Long. Profile

Dist.	Hght.	Feat.	Sub.
50	-16.37	I	B
143	-15.57	I	B



Crossing Context:

Market Street Extension is built over the inlet to the North Mill Pond system and the crossing is very large (23 by 130 feet) that carries the tides without restriction. The structure is in very good shape and the overall combined score is 2, low priority for replacement.



Structure Characteristics:

Structure Type:	Bridge with Side Slopes and Abutments	**Date of Last Known Replacement:**	N/A
Structure Material:	Concrete		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	129	132
Dimension B^{CB}(height):	22.8	24.9
Crossing Length (Invert to Invert):	93	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	None	N/A	Rip Rap	Good	None	None
Downstream	None	N/A	Rip Rap	Good	None	None

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
None	None	Good	Overhead electric	Good

Structure Condition Comments:	N/A

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	Sparsely Vegetated Intertidal Habitat	Sparsely Vegetated Intertidal Habitat
Upstream Salt Marsh Migration Potential (acres):	53.01	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	No
Emergency Access or Evacuation Route:	Yes
History of Flooding:	No

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 78

Observer(s) & Organization:	TS, JB (NHDES Coastal)
Municipality:	PORTSMOUTH
Stream Name:	N/A
Road Name:	N/A

Date:	8/7/2018	
Start Time:	1:30:00 PM	
End Time:	2:00:00 PM	
Tide Prediction	**High**	**Low**
Time:	8:18 PM	1:53 PM
Elevation:	8.9	0.5
Tide Chart Location:	Portsmouth Harbor	

Crossing Condition Evaluation	Score*
Crossing Condition	2
Tidal Restriction Evaluation	
Tidal Range Ratio	1
Crossing Ratio	3
Erosion Classification	3
Tidal Restriction Overall Score	2
Tidal Aquatic Organism Passage	
Tidal Range Ratio	1
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	5
Salt Marsh Migration Potential (Wshed.)	5
Vegetation Evaluation	
Vegetation Comparison Matrix	1
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	1,1
Inun. Risk to the Crossing Structure (US, DS)	1,1
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	1

DS view toward structure

US view above structure

US view toward structure

DS view above structure

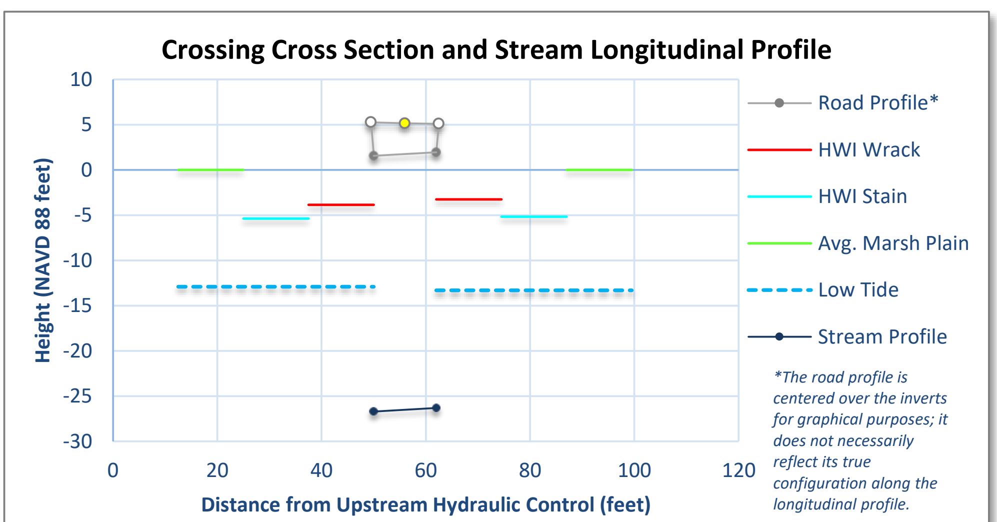
Overall Scores

Infrastructure	2
Ecological	1
Combined	2

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority
**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk

Long. Profile

Dist.	Hght.	Feat.	Sub.
50	-26.709	I	B
62	-26.309	I	B



Crossing Context:

This is the railroad bridge for a spur line that was built out upon Cutts Cove to connect a gypsum plant that makes wallboard. The crossing is somewhat restrictive in that it increases current speed through the opening, but it likely doesn't affect high tides upstream of the 96-foot span. The overall combined score is 2, indicating low priority for replacement.

Structure Characteristics:

Structure Type:	Bridge with Side Slopes	**Date of Last Known Replacement:**	N/A
Structure Material:	Wood		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	96	96
Dimension B[CB](height):	28.25	28
Crossing Length (Invert to Invert):	12	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	None	N/A	Rip Rap	Fair	None	None
Downstream	None	N/A	Rip Rap	Fair	None	None

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
None	None	N/A	None	Fair

Structure Condition Comments:	N/A

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	Sparsely Vegetated Intertidal Habitat	Sparsely Vegetated Intertidal Habitat
Upstream Salt Marsh Migration Potential (acres):	66.26	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	No
Emergency Access or Evacuation Route:	N/A
History of Flooding:	Unknown

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 81

Observer(s) & Organization:	JB kl (NHDES Coastal)
Municipality:	NEWINGTON
Stream Name:	N/A
Road Name:	N/A

Date:	10/15/2018	
Start Time:	12:04:00 PM	
End Time:	1:30:00 PM	
Tide Prediction	**High**	**Low**
Time:	4:49 PM	10:31 AM
Elevation:	7.8	1.3
Tide Chart Location:	Portsmouth Harbor	

Crossing Condition Evaluation	Score*
Crossing Condition	5
Tidal Restriction Evaluation	
Tidal Range Ratio	2
Crossing Ratio	3
Erosion Classification	5
Tidal Restriction Overall Score	3
Tidal Aquatic Organism Passage	
Tidal Range Ratio	2
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	1
Salt Marsh Migration Potential (Wshed.)	1
Vegetation Evaluation	
Vegetation Comparison Matrix	5
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	0,1
Inun. Risk to the Crossing Structure (US, DS)	5,5
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	5
Overall Scores	
Infrastructure	5
Ecological	4
Combined	4

DS view toward structure

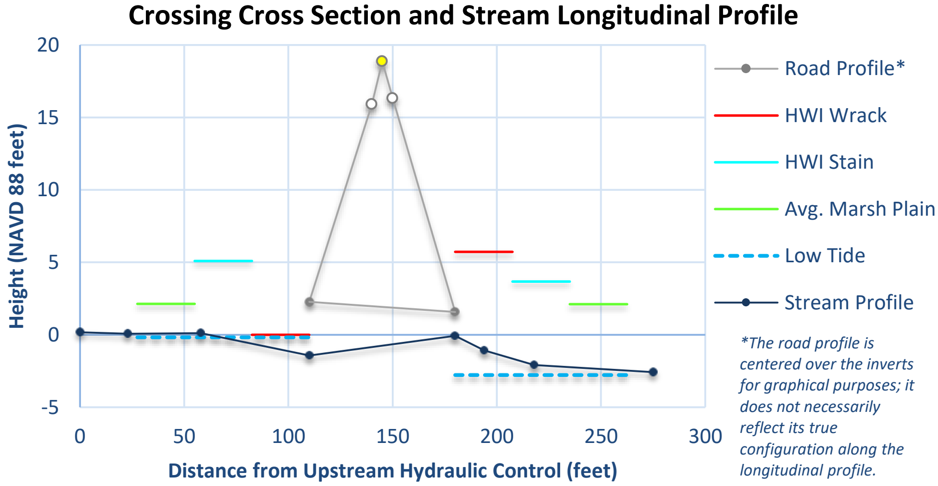
US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority
**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk

Crossing Cross Section and Stream Longitudinal Profile



Long. Profile

Dist.	Hght.	Feat.	Sub.
0	0.1748	HC	C/S
23	0.0748	P	C/S
58	0.1248	HC	C/S
110	-1.4252	I	C/S
180	-0.0752	I	C/S
194	-1.0752	HC	C
218	-2.0752	CB	G
275	-2.5752	CB	C/S

Crossing Context:

An unnamed tidal creek supplying a salt marsh with tidal flow is crossed by Boston and Maine Corporation rail line by a 3-foot-wide by 4-foot-tall granite culvert that connects the wetland to the Piscataqua River. The crossing condition is poor, erosion is evident, and the entire culvert is underwater on a daily basis. In addition, the culvert is perched and the upstream plant community is different. All these deficiencies and vulnerabilities make this a high priority for replacement with an overall combined score of 4.

Structure Characteristics:

Structure Type:	Box Culvert	**Date of Last Known Replacement:**	N/A
Structure Material:	Stone		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	3	3
Dimension B[CB](height):	3.7	2.2
Crossing Length (Invert to Invert):	70	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	Dry Fit Stone	Poor	None	N/A	Headwall	High
Downstream	Dry Fit Stone	Poor	None	N/A	Culvert	High

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
Culvert	High	N/A	None	Poor

Structure Condition Comments:	Highly scoured. DS structure destroyed

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	Low Salt Marsh	Sparsely Vegetated Intertidal Habitat
Upstream Salt Marsh Migration Potential (acres):	0.02	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	No
Emergency Access or Evacuation Route:	N/A
History of Flooding:	damaged culvert

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 84

Observer(s) & Organization:	TS, JB ()
Municipality:	ROLLINSFORD
Stream Name:	Sligo Brook
Road Name:	Sligo Rd

Date:	6/7/2018	
Start Time:	2:20:00 PM	
End Time:	4:24:00 PM	
Tide Prediction	**High**	**Low**
Time:	8:26 PM	2:07 PM
Elevation:	6.7	1.2
Tide Chart Location:	Salmon Falls River	

Crossing Condition Evaluation	Score*
Crossing Condition	5
Tidal Restriction Evaluation	
Tidal Range Ratio	3
Crossing Ratio	3
Erosion Classification	3
Tidal Restriction Overall Score	3
Tidal Aquatic Organism Passage	
Tidal Range Ratio	3
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	1
Salt Marsh Migration Potential (Wshed.)	1
Vegetation Evaluation	
Vegetation Comparison Matrix	0
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	1,1
Inun. Risk to the Crossing Structure (US, DS)	1,1
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	5
Overall Scores	
Infrastructure	5
Ecological	4
Combined	4

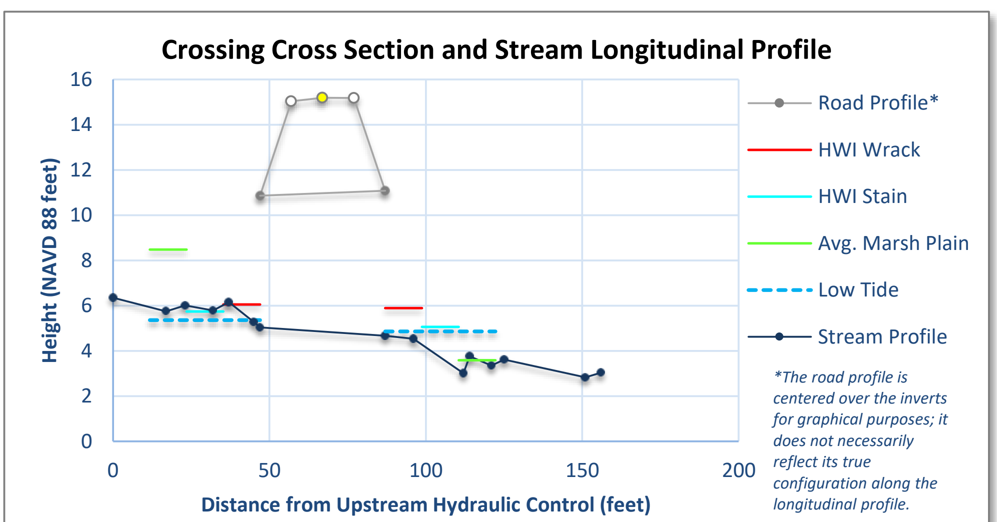
DS view toward structure

US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority
**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk

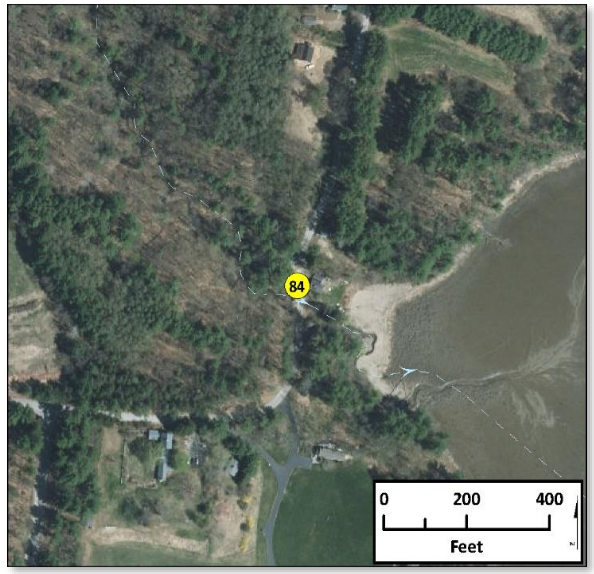


Long. Profile

Dist.	Hght.	Feat.	Sub.
0	6.3503	HC	S
17	5.7403	P	S
23	6.0103	HC	S
32	5.7903	P	C
37	6.1503	HC	C
45	5.2703	GC	C
47	5.0403	I	C
87	4.6703	I	S
96	4.5403	HC	C
112	3.0103	P	S
114	3.7603	GC	B
121	3.3503	P	S
125	3.6203	HC	C
151	2.8303	P	S
156	3.0303	GC	C

Crossing Context:

Sligo Road in Rollinsford crosses the Sligo Brook and provides drainage through a 6 by 6-foot stone culvert with a crossing condition rated as poor. The potential for tidal flow through a restored culvert is low until sea level rise occurs because the crossing is perched at the head of tide. The overall combined score is 4: high priority for replacement.



Structure Characteristics:

Structure Type:	Box Culvert	**Date of Last Known Replacement:**	N/A
Structure Material:	Stone		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	6.4	6.11
Dimension B[CB] (height):	6.11	5.9
Crossing Length (Invert to Invert):	40	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	Dry Fit Stone	Poor	Rip Rap	Poor	Wingwalls	High
Downstream	Dry Fit Stone	Fair	Dry Fit Stone	Fair	Wingwalls	Medium

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
Culvert	High	Fair	OHE	Poor

Structure Condition Comments:	N/A

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	Freshwater Stream	Freshwater Stream
Upstream Salt Marsh Migration Potential (acres):	0.00	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	No
Emergency Access or Evacuation Route:	N/A
History of Flooding:	Unknown

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 85

Observer(s) & Organization:	TS, JB (NHDES Coastal)	**Date:**	6/1/2018	
Municipality:	ROLLINSFORD	**Start Time:**	10:10:00 AM	
Stream Name:	N/A	**End Time:**	12:00:00 PM	
Road Name:	Sligo Rd	**Tide Prediction**	**High**	**Low**
		Time:	3:37 PM	9:17 AM
		Elevation:	6.1	1.0
		Tide Chart Location:	Dover Point	

Crossing Condition Evaluation	Score*
Crossing Condition	5
Tidal Restriction Evaluation	
Tidal Range Ratio	3
Crossing Ratio	5
Erosion Classification	4
Tidal Restriction Overall Score	4
Tidal Aquatic Organism Passage	
Tidal Range Ratio	3
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	1
Salt Marsh Migration Potential (Wshed.)	1
Vegetation Evaluation	
Vegetation Comparison Matrix	0
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	1,1
Inun. Risk to the Crossing Structure (US, DS)	3,4
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	5

DS view toward structure

US view above structure

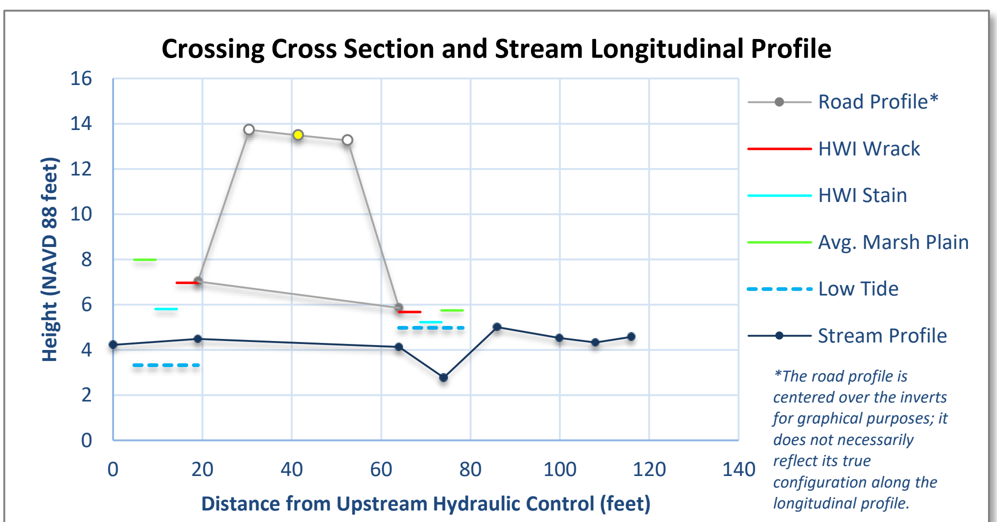
US view toward structure

DS view above structure

Overall Scores

Infrastructure	5
Ecological	4
Combined	4

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority
**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk



Long. Profile

Dist.	Hght.	Feat.	Sub.
0	4.2243	US HC	C/S
19	4.4843	US I	G
64	4.1243	DS I	G
74	2.7743	DS P	G
86	5.0043	DS HC	S
100	4.5243	DS HC	S
108	4.3243	DS P	S
116	4.5743	DS HC	S

Crossing Context:

Sligo Road crosses an unnamed creek just north of crossing #84 through a 6 by 2-foot stone culvert. The crossing condition is poor with erosion and tidal restriction observed, including a plunge pool downstream and an impoundment upstream. The overall combined score is 4: high priority for replacement. The roadway was washed out in 2011 and a pipe was added above the failing culvert to prevent another washout, highlighting the need for replacement.

Structure Characteristics:

Structure Type:	Box Culvert	**Date of Last Known Replacement:**	N/A
Structure Material:	Stone		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	6	3.5
Dimension B[CB] (height):	2	1.8
Crossing Length (Invert to Invert):	45	

Crossing Condition:	Headwall Material	Headwall Condition	Wingwall Material	Wingwall Condition	Scour at Structure	Scour Severity
Upstream	Dry Fit Stone	Poor	Dry Fit Stone	Fair	None	None
Downstream	Dry Fit Stone	Poor	None	N/A	None	None

Scour in Structure	Scour Severity in Structure	Road Surface Condition	Utilities at Crossing	Structure Condition Overall
None	None	Fair	OHE	Poor

Structure Condition Comments:	N/A

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	Freshwater Marsh	Freshwater Marsh
Upstream Salt Marsh Migration Potential (acres):	0.00	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	Yes
Emergency Access or Evacuation Route:	N/A
History of Flooding:	culvert washed out in '11. Since been upgraded.

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 86

Observer(s) & Organization:	TS, Jab (NHDES Coastal)
Municipality:	DOVER
Stream Name:	Fresh Creek
Road Name:	Atlantic Ave

Date:	6/5/2018	
Start Time:	12:20:00 PM	
End Time:	3:50:00 PM	
Tide Prediction	**High**	**Low**
Time:	6:42 PM	12:26 PM
Elevation:	6.4	0.6
Tide Chart Location:	Salmon Falls River	

Crossing Condition Evaluation	Score*
Crossing Condition	1
Tidal Restriction Evaluation	
Tidal Range Ratio	5
Crossing Ratio	5
Erosion Classification	0
Tidal Restriction Overall Score	5
Tidal Aquatic Organism Passage	
Tidal Range Ratio	5
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	5
Salt Marsh Migration Potential (Wshed.)	5
Vegetation Evaluation	
Vegetation Comparison Matrix	5
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	1,1
Inun. Risk to the Crossing Structure (US, DS)	1,1
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	5

DS view toward structure

US view above structure

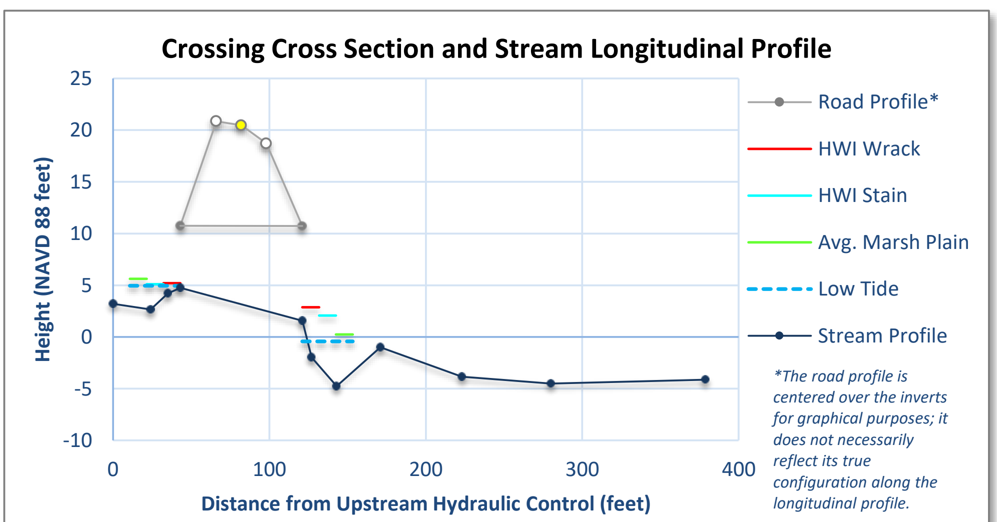
US view toward structure

DS view above structure

Overall Scores

Infrastructure	1
Ecological	5
Combined	5

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority
**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk



Long. Profile

Dist.	Hght.	Feat.	Sub.
0	3.2002	HC	G
24	2.6702	P	G
35	4.2102	GC	B
43	4.7502	I	B
121	1.5702	I	B
127	-1.9798	GC	B
143	-4.7598	P	B
171	-0.9898	GC	B
223	-3.8598	HC	B
280	-4.5098	P	B
379	-4.1298	HC	C/S

Crossing Context:

The crossing over Fresh Creek is a 6 by 20-foot culvert that is relatively new and in good shape, but it is perched just above the high water line. The overall combined score is a 5, highest priority for replacement because it cuts off the entire watershed from tidal waters and prevents organism passage, including anadromous fish. It has been considered as a possible restoration site.

Structure Characteristics:

Structure Type:	Box Culvert	**Date of Last Known Replacement:**	N/A
Structure Material:	Concrete		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	20	20
Dimension B^{CB}(height):	6	6
Crossing Length (Invert to Invert):	78	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	Concrete	Good	Rip Rap	Fair	Culvert	Low
Downstream	Concrete	Good	Rip Rap	Good	Culvert	Low

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
Culvert	Low	Good	OHE	Good

Structure Condition Comments:	Good shape

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	Freshwater Stream	Sparsely Vegetated Intertidal Habitat
Upstream Salt Marsh Migration Potential (acres):	18.73	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	No
Emergency Access or Evacuation Route:	N/A
History of Flooding:	post replacement flooding unknown

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 89

Observer(s) & Organization:	TS, JB (NHDES Coastal)
Municipality:	DOVER
Stream Name:	Varney Brook
Road Name:	Spur Rd

Date:	6/8/2018	
Start Time:	2:20:00 PM	
End Time:	4:10:00 PM	
Tide Prediction	**High**	**Low**
Time:	8:55 PM	2:27 PM
Elevation:	6.4	0.7
Tide Chart Location:	Dover Point	

Crossing Condition Evaluation	Score*
Crossing Condition	4
Tidal Restriction Evaluation	
Tidal Range Ratio	5
Crossing Ratio	4
Erosion Classification	4
Tidal Restriction Overall Score	4
Tidal Aquatic Organism Passage	
Tidal Range Ratio	5
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	1
Salt Marsh Migration Potential (Wshed.)	3
Vegetation Evaluation	
Vegetation Comparison Matrix	5
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	1,1
Inun. Risk to the Crossing Structure (US, DS)	1,1
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	5
Overall Scores	
Infrastructure	4
Ecological	5
Combined	5

DS view toward structure

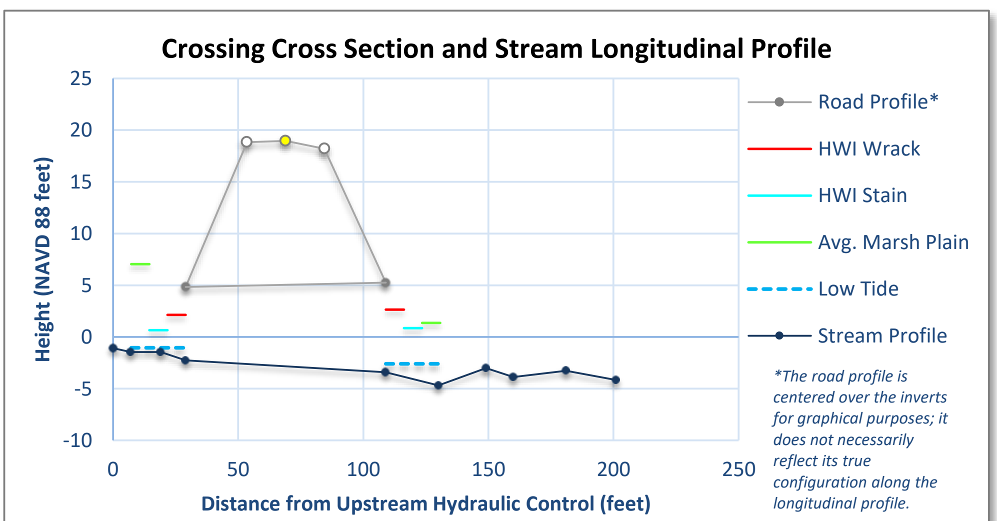
US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority

**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk



Long. Profile

Dist.	Hght.	Feat.	Sub.
0	-1.0867	HC	G
7	-1.4667	P	G
19	-1.4467	GC	C
29	-2.2667	I	C
109	-3.4067	I	C
130	-4.6867	P	C
149	-3.0167	CB	C
160	-3.8667	P	C
181	-3.2767	HC	G
201	-4.1567	P	C/S
237	-3.8067	CB	C/S

Crossing Context:

Spur road in Dover crosses Varney Brook with a 7 by 8-foot granite culvert. Just 80 feet upstream of this crossing Route 16 crosses the Brook (#90) with double 6-foot diameter round culverts. The upstream area is heavily shaded and is not likely to support tidal marsh plants. The overall combined score for this crossing is 5, highest priority for replacement based upon crossing conditions, erosion and tidal restriction.

Structure Characteristics:

Structure Type:	Bridge with Abutments	**Date of Last Known Replacement:**	N/A
Structure Material:	Stone		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	7.2	7.1
Dimension B^{CB}(height):	7.03	8.65
Crossing Length (Invert to Invert):	80	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	Dry Fit Stone	Good	Dry Fit Stone	Poor	Wingwalls	Low
Downstream	Dry Fit Stone	Fair	Dry Fit Stone	Poor	Wingwalls	Medium

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
Abutment	Medium	Fair	OHE and US sewer line	Fair

Structure Condition Comments:	Overall not bad. Collapsing wing walls.

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	Brackish Riverbank Marsh	Sparsely Vegetated Intertidal Habitat
Upstream Salt Marsh Migration Potential (acres):	4.59	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	Yes
Emergency Access or Evacuation Route:	N/A
History of Flooding:	Past flooding has occurred

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 90

Observer(s) & Organization:	TS, JB (NHDES Coastal)
Municipality:	DOVER
Stream Name:	Varney Brook
Road Name:	Spaulding Tpke N

Date:	8/2/2018	
Start Time:	11:15:00 AM	
End Time:	1:05:00 PM	
Tide Prediction	**High**	**Low**
Time:	5:10 PM	10:48 AM
Elevation:	6.4	0.3
Tide Chart Location:	Dover Point	

Crossing Condition Evaluation	Score*
Crossing Condition	2
Tidal Restriction Evaluation	
Tidal Range Ratio	3
Crossing Ratio	3
Erosion Classification	4
Tidal Restriction Overall Score	3
Tidal Aquatic Organism Passage	
Tidal Range Ratio	3
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	1
Salt Marsh Migration Potential (Wshed.)	3
Vegetation Evaluation	
Vegetation Comparison Matrix	0
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	1,1
Inun. Risk to the Crossing Structure (US, DS)	2,3
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	5

Overall Scores

Infrastructure	2
Ecological	4
Combined	3

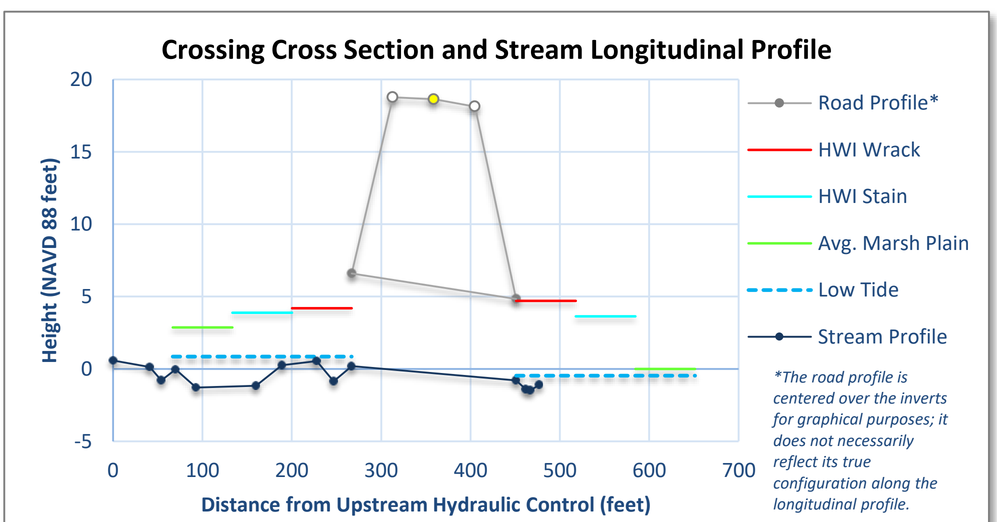
* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority
**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk

DS view toward structure

US view above structure

US view toward structure

DS view above structure



Long. Profile

Dist.	Hght.	Feat.	Sub.
0	0.5852	HC	C/S
41	0.1452	CB	C/S
54	-0.7948	P	G
70	-0.0248	HC	B
93	-1.2848	P	G
160	-1.1548	CB	S
189	0.2652	HC	G
228	0.5552	HC	B
247	-0.8448	P	G
267	0.2052	I	C
451	-0.7948	I	B
462	-1.4148	P	C
467	-1.4748	HC	B
477	-1.1048	HC	B

Crossing Context:

N/A

Structure Characteristics:

Structure Type:	Round Culvert	**Date of Last Known Replacement:**	N/A
Structure Material:	Plastic - Smooth		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	5.85	6
Dimension B[CB](height):	6.02	5.58
Crossing Length (Invert to Invert):	184	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	Dry Fit Stone	Fair	Dry Fit Stone	Fair	Armoring	Medium
Downstream	Dry Fit Stone	Fair	Dry Fit Stone	Fair	Armoring	Medium

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
None	None	Good	Sewer, runs through crossing	Fair

Structure Condition Comments:	Outer/old structure rotting, inner new culvert okay

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	Low Salt Marsh	Sparsely Vegetated Intertidal Habitat
Upstream Salt Marsh Migration Potential (acres):	4.59	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	Yes
Emergency Access or Evacuation Route:	N/A
History of Flooding:	Past flooding has occurred

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 91

Observer(s) & Organization:	TS, JB (NHDES Coastal)
Municipality:	DOVER
Stream Name:	Varney Brook
Road Name:	Dover Point Rd

Date:	6/18/2018	
Start Time:	11:15:00 AM	
End Time:	12:30:00 PM	
Tide Prediction	**High**	**Low**
Time:	5:26 PM	10:59 AM
Elevation:	7.0	-0.8
Tide Chart Location:	Dover Point	

Crossing Condition Evaluation	Score*
Crossing Condition	2
Tidal Restriction Evaluation	
Tidal Range Ratio	1
Crossing Ratio	5
Erosion Classification	3
Tidal Restriction Overall Score	3
Tidal Aquatic Organism Passage	
Tidal Range Ratio	1
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	3
Salt Marsh Migration Potential (Wshed.)	3
Vegetation Evaluation	
Vegetation Comparison Matrix	0
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	2,2
Inun. Risk to the Crossing Structure (US, DS)	1,2
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	5
Overall Scores	
Infrastructure	2
Ecological	4
Combined	2

DS view toward structure

US view above structure

US view toward structure

DS view above structure

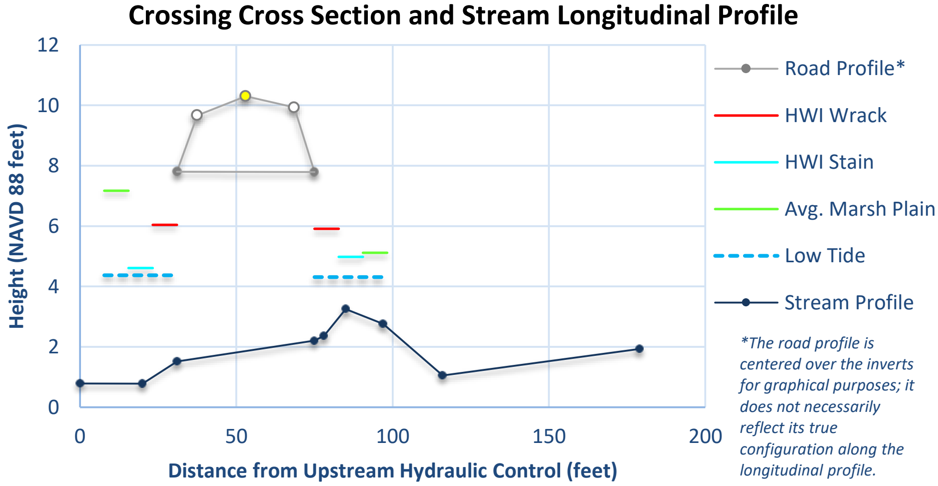
* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority

**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk

Long. Profile

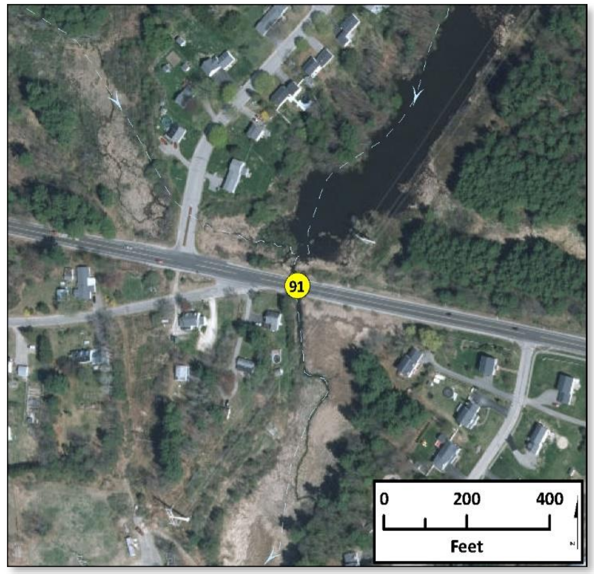
Dist.	Hght.	Feat.	Sub.
0	0.7918	HC	G
20	0.7818	P	C
31	1.5218	I	G
75	2.2118	I	C
78	2.3618	P	G
85	3.2518	CB	C
97	2.7618	HC	C
116	1.0518	P	G
179	1.9318	HC	S

Crossing Cross Section and Stream Longitudinal Profile



Crossing Context:

N/A



Structure Characteristics:

Structure Type:	Bridge with Abutments	**Date of Last Known Replacement:**	N/A
Structure Material:	Concrete		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	9.35	8.8
Dimension B^{CB}(height):	6.5	5.55
Crossing Length (Invert to Invert):	44	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	None	N/A	Dry Fit Stone	Fair	Footer	Low
Downstream	None	N/A	Concrete	Good	Footer	Low

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
Footer	Medium	Fair	Overhead electric, pipe upstream over crossing	Fair

Structure Condition Comments:	N/A

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	Freshwater Marsh	Brackish Riverbank Marsh
Upstream Salt Marsh Migration Potential (acres):	3.99	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	Yes
Emergency Access or Evacuation Route:	N/A
History of Flooding:	Past flooding has occurred.

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 92

Observer(s) & Organization:	TS (NHDES Coastal)	**Date:**	7/16/2018	
Municipality:	MADBURY	**Start Time:**	10:20:00 AM	
Stream Name:	N/A	**End Time:**	11:26:00 AM	
Road Name:	Piscataqua Bridge Rd	**Tide Prediction**	**High**	**Low**
		Time:	4:09 PM	9:45 AM
		Elevation:	7.3	-1.1
		Tide Chart Location:	Dover Point	

Crossing Condition Evaluation	Score*
Crossing Condition	5
Tidal Restriction Evaluation	
Tidal Range Ratio	5
Crossing Ratio	4
Erosion Classification	5
Tidal Restriction Overall Score	5
Tidal Aquatic Organism Passage	
Tidal Range Ratio	5
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	1
Salt Marsh Migration Potential (Wshed.)	1
Vegetation Evaluation	
Vegetation Comparison Matrix	1
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	1,1
Inun. Risk to the Crossing Structure (US, DS)	1,1
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	5
Overall Scores	
Infrastructure	5
Ecological	5
Combined	4

DS view toward structure

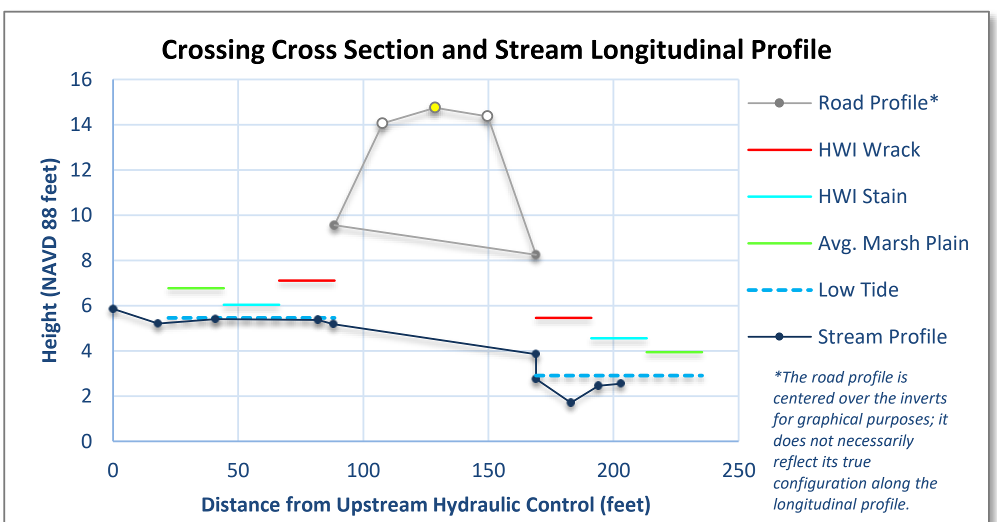
US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority

**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk



Long. Profile

Dist.	Hght.	Feat.	Sub.
0	5.8574	HC	G
18	5.2074	P	C/S
41	5.4074	HC	S
82	5.3674	GC	C
88	5.1874	I	G
169	3.8574	I	C
169	2.7574	CB	C
183	1.7074	P	S
194	2.4574	HC	C
203	2.5474	HC	C
214	1.8574	P	C
242	2.3274	HC	C

Crossing Context:

N/A

Structure Characteristics:

Structure Type:	Round Culvert	**Date of Last Known Replacement:**	N/A
Structure Material:	Steel - Corrugated		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	4.4	4.5
Dimension B[CB] (height):	4.4	4.3
Crossing Length (Invert to Invert):	80.5	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	None	N/A	Concrete	Poor	Culvert	Low
Downstream	Dry Fit Stone	Poor	Dry Fit Stone	Poor	Culvert	Low

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
None	None	Good	Overhead electric	Fair

Structure Condition Comments:	N/A

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	Freshwater Stream	Freshwater Stream
Upstream Salt Marsh Migration Potential (acres):	0.00	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	No
Emergency Access or Evacuation Route:	N/A
History of Flooding:	Unknown

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 93

Observer(s) & Organization:	TS,JB (NHDES Coastal)
Municipality:	DURHAM
Stream Name:	Bunker Creek
Road Name:	Piscataqua Rd

Date:	8/3/2018	
Start Time:	10:00:00 AM	
End Time:	11:45:00 AM	
Tide Prediction	**High**	**Low**
Time:	5:53 PM	11:29 AM
Elevation:	6.5	0.4
Tide Chart Location:	Dover Point	

Crossing Condition Evaluation	Score*
Crossing Condition	5
Tidal Restriction Evaluation	
Tidal Range Ratio	1
Crossing Ratio	2
Erosion Classification	5
Tidal Restriction Overall Score	3
Tidal Aquatic Organism Passage	
Tidal Range Ratio	1
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	4
Salt Marsh Migration Potential (Wshed.)	4
Vegetation Evaluation	
Vegetation Comparison Matrix	5
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	3,3
Inun. Risk to the Crossing Structure (US, DS)	1,2
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	5
Overall Scores	
Infrastructure	5
Ecological	4
Combined	4

DS view toward structure

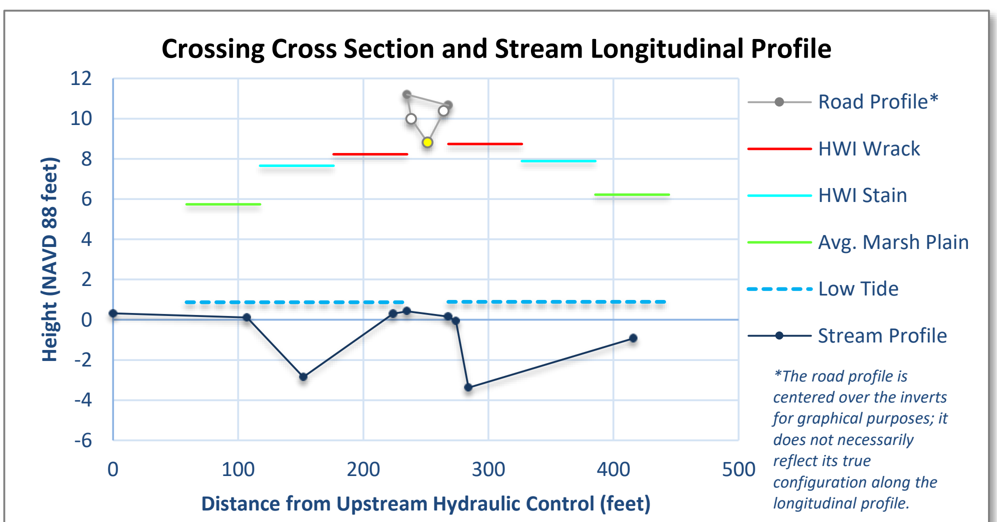
US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority

**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk



Long. Profile

Dist.	Hght.	Feat.	Sub.
0	0.3191	HC	C/S
107	0.1091	HC	C/S
152	-2.8509	P	G
224	0.2991	GC	Shell
235	0.4191	I	Shell
268	0.1491	I	Shell
274	-0.0709	GC	Shell
284	-3.3809	P	G
416	-0.9309	HC	C/S

Crossing Context:

The crossing of Bunker Creek at Route 4 in Durham is a 10.5 by 13-foot concrete structure showing multiple signs of wear and erosion. It features plunge pools on either side and restricts tidal flow to an upstream marsh that is largely tall form cordgrass (in contrast, almost all marshes in the State are dominated by salt hay). The upstream marsh is managed by NH Fish and Game and is a sentinel site with long term monitoring for the Great Bay National Estuarine Research Reserve. The combined overall combined score is 4, a high priority for replacement.

Structure Characteristics:

Structure Type:	Bridge with Abutments	**Date of Last Known Replacement:**	N/A
Structure Material:	Concrete		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	13.88	12.7
Dimension B[CB] (height):	10.54	10.46
Crossing Length (Invert to Invert):	33	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	None	N/A	Concrete	Poor	Wingwalls	Medium
Downstream	None	N/A	Concrete	Poor	Wingwalls	Medium

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
Abutment	Medium	Fair	Overhead electric	Poor

Structure Condition Comments:	N/A

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	Low Salt Marsh	Sparsely Vegetated Intertidal Habitat
Upstream Salt Marsh Migration Potential (acres):	6.29	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	No
Emergency Access or Evacuation Route:	N/A
History of Flooding:	Unknown

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 95

Observer(s) & Organization:	TS, SL (NHDES Coastal)
Municipality:	DURHAM
Stream Name:	Johnson Creek
Road Name:	Piscataqua Rd

Date:	7/27/2018	
Start Time:	7:40:00 AM	
End Time:	9:37:00 AM	
Tide Prediction	**High**	**Low**
Time:	1:33 PM	7:16 AM
Elevation:	6.1	0.2
Tide Chart Location:	Dover Point	

	Score*
Crossing Condition Evaluation	
Crossing Condition	1
Tidal Restriction Evaluation	
Tidal Range Ratio	1
Crossing Ratio	3
Erosion Classification	4
Tidal Restriction Overall Score	3
Tidal Aquatic Organism Passage	
Tidal Range Ratio	1
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	4
Salt Marsh Migration Potential (Wshed.)	5
Vegetation Evaluation	
Vegetation Comparison Matrix	1
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	1,1
Inun. Risk to the Crossing Structure (US, DS)	1,1
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	5
Overall Scores	
Infrastructure	1
Ecological	1
Combined	2

DS view toward structure

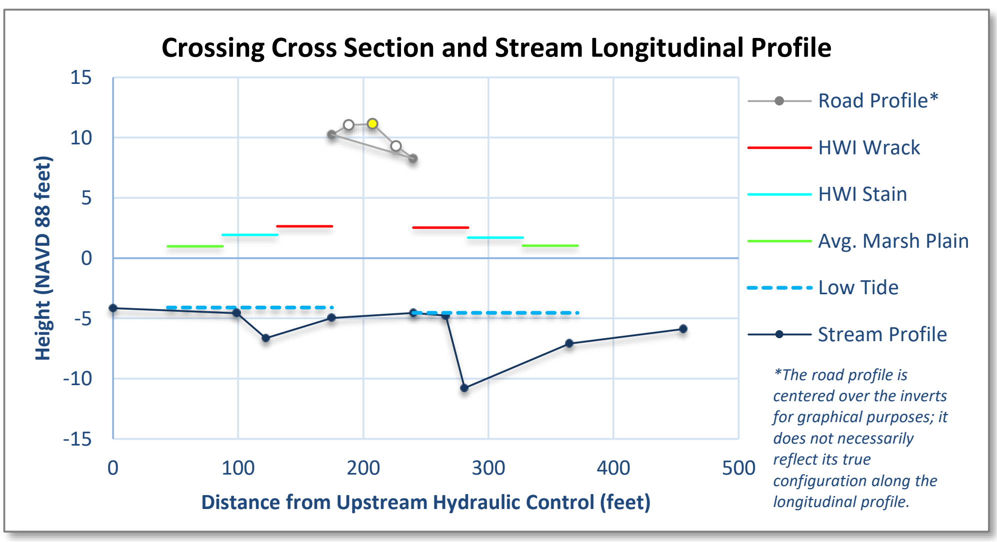
US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority

**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk



Long. Profile

Dist.	Hght.	Feat.	Sub.
0	-4.148	HC	C/S
99	-4.578	HC	C/S
122	-6.648	P	C/S
175	-4.958	I	G
240	-4.538	I	B
266	-4.778	GC	B
281	-10.778	P	C/S
365	-7.098	HC	C/S
456	-5.868	HC	G

Crossing Context:

N/A

Structure Characteristics:

Structure Type:	Bridge with Abutments	**Date of Last Known Replacement:**	N/A
Structure Material:	Concrete		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	16	15.5
Dimension B^{CB}(height):	16.1	13.5
Crossing Length (Invert to Invert):	65	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	None	N/A	Concrete	Good	None	None
Downstream	None	N/A	Concrete	Good	Abutment	Medium

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
Abutment	Low	Fair	Overhead electric	Good

Structure Condition Comments:	Good overall so spalling/scour inside exposing rebar

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	Low Salt Marsh	Low Salt Marsh
Upstream Salt Marsh Migration Potential (acres):	10.97	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	No
Emergency Access or Evacuation Route:	N/A
History of Flooding:	unknown

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 96

Observer(s) & Organization:	JB TS (NHDES Coastal)	**Date:**	7/18/2018	
Municipality:	MADBURY	**Start Time:**	12:30:00 PM	
Stream Name:	Johnson Creek	**End Time:**	2:00:00 PM	
Road Name:	Creek Rd	**Tide Prediction**	**High**	**Low**
		Time:	6:02 PM	11:35 AM
		Elevation:	7.1	-0.5
		Tide Chart Location:	Salmon Falls River	

Crossing Condition Evaluation	Score*
Crossing Condition	5
Tidal Restriction Evaluation	
Tidal Range Ratio	1
Crossing Ratio	5
Erosion Classification	4
Tidal Restriction Overall Score	3
Tidal Aquatic Organism Passage	
Tidal Range Ratio	1
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	2
Salt Marsh Migration Potential (Wshed.)	2
Vegetation Evaluation	
Vegetation Comparison Matrix	4
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	5,4
Inun. Risk to the Crossing Structure (US, DS)	1,1
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	5
Overall Scores	
Infrastructure	5
Ecological	4
Combined	5

DS view toward structure

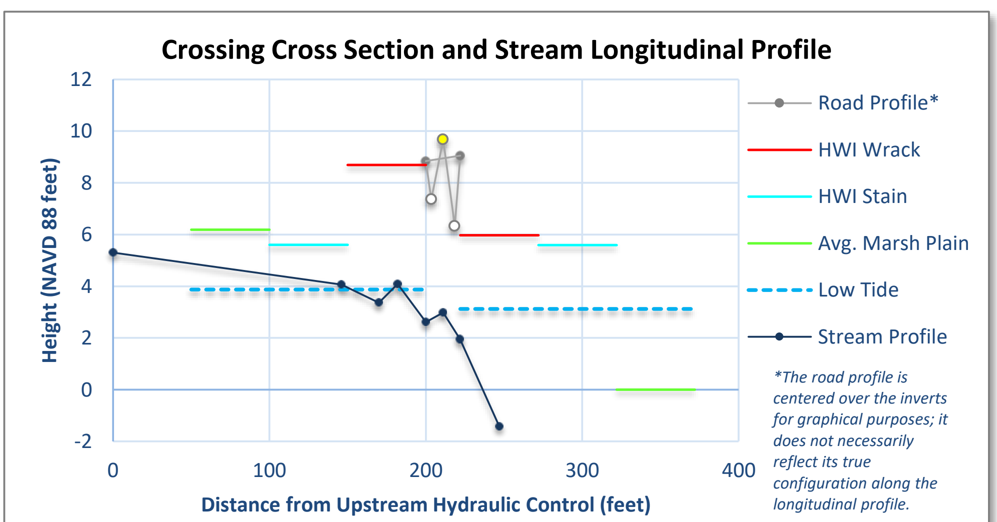
US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority

**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk



Long. Profile

Dist.	Hght.	Feat.	Sub.
0	5.3019	HC	C/S
146	4.0619	HC	C/S
170	3.3619	P	C/S
182	4.0819	HC	C/S
200	2.6119	I	B
211	2.9819	HC	B
222	1.9519	I	B
247	-1.4281	P	B

Crossing Context:

Johnson Creek is a long narrow tidal creek that reaches into Madbury as it becomes brackish and fresh. Creek Road crosses the waterway with a 9.3 feet wide by 6.8 feet tall stone bridge. The crossing condition is poor, crossing ratio is poor and erosion is evident. The overall combined score is 5, highest priority for replacement.

Structure Characteristics:

Structure Type:	Bridge with Abutments	**Date of Last Known Replacement:**	N/A
Structure Material:	Stone		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	9.3	9.3
Dimension B[CB](height):	6.9	6.7
Crossing Length (Invert to Invert):	22	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	None	N/A	None	N/A	Abutment	High
Downstream	None	N/A	None	N/A	Abutment	Medium

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
Culvert	High	N/A	None	Poor

Structure Condition Comments:	Stone abutments with 3 boards over it. Otherwise open

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	Freshwater Marsh	Brackish Riverbank Marsh
Upstream Salt Marsh Migration Potential (acres):	1.30	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	No
Emergency Access or Evacuation Route:	N/A
History of Flooding:	unknown

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 97

Observer(s) & Organization:	JB TS (NHDES Coastal)
Municipality:	DURHAM
Stream Name:	Beards Creek
Road Name:	Dover Rd

Date:	8/3/2018	
Start Time:	12:00:00 PM	
End Time:	1:25:00 PM	
Tide Prediction	**High**	**Low**
Time:	5:53 PM	11:29 AM
Elevation:	6.5	0.4
Tide Chart Location:	Dover Point	

Crossing Condition Evaluation	Score*
Crossing Condition	2
Tidal Restriction Evaluation	
Tidal Range Ratio	5
Crossing Ratio	5
Erosion Classification	0
Tidal Restriction Overall Score	5
Tidal Aquatic Organism Passage	
Tidal Range Ratio	5
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	5
Salt Marsh Migration Potential (Wshed.)	5
Vegetation Evaluation	
Vegetation Comparison Matrix	0
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	1,1
Inun. Risk to the Crossing Structure (US, DS)	5,4
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	5
Overall Scores	
Infrastructure	2
Ecological	5
Combined	5

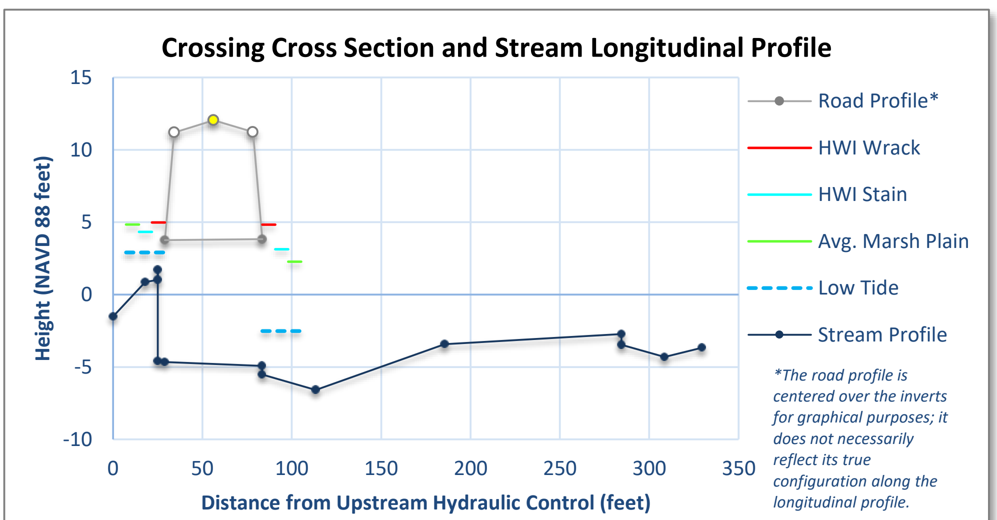
* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority
**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk

DS view toward structure

US view above structure

US view toward structure

DS view above structure



Long. Profile

Dist.	Hght.	Feat.	Sub.
0	-1.5193	P	G
18	0.8607	CB	C
25	1.0107	CB	C
25	1.7107	CB	N/A
25	-4.5893	GC	N/A
29	-4.6693	I	N/A
83.5	-4.9193	I	C/S
83.5	-5.5193	CB	C/S
113.5	-6.5893	P	B
185.5	-3.4193	CB	G
284.5	-2.7193	GC	N/A
284.5	-3.4693	CB	C
308.5	-4.3193	P	S
329.5	-3.6693	HC	G

Crossing Context:

The entrance to the town center of Durham on Route 108 (Dover Road) passes over Beards Creek which drains through an 8.5 high by 7.5-foot-wide concrete box culvert. Stop logs had kept the upstream wetland an open freshwater pond with no tidal exchange. The crossing is in good shape but has severe ecological impacts to the upstream wetlands and will prevent future marsh migration. The overall combined score is a 5, highest priority for replacement due to the ecological impacts. The main sewage line leading to the treatment plant to the south crosses the mouth of the culvert, below the stop logs, so that tidal restoration would require reconfiguration of the sewer line.

Structure Characteristics:

Structure Type:	Box Culvert	**Date of Last Known Replacement:**	N/A
Structure Material:	Concrete		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	7.5	7.5
Dimension B[CB](height):	8.6	8.5
Crossing Length (Invert to Invert):	54.5	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	Concrete	Fair	Metal	Fair	None	None
Downstream	Concrete	Good	Metal	Good	None	None

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
None	None	Good	OHE DS. pump house	Fair

Structure Condition Comments:	Dam condition is poor.

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	Freshwater Marsh	Sparsely Vegetated Intertidal Habitat
Upstream Salt Marsh Migration Potential (acres):	13.45	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	No
Emergency Access or Evacuation Route:	N/A
History of Flooding:	No

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 98

Observer(s) & Organization:	TS, JB (NHDES Coastal)	**Date:**	7/12/2018
Municipality:	DURHAM	**Start Time:**	7:52:00 AM
Stream Name:	Oyster River	**End Time:**	9:30:00 AM
Road Name:	Newmarket Rd		

Tide Prediction	**High**	**Low**
Time:	12:29 PM	6:10 AM
Elevation:	6.8	-0.2
Tide Chart Location:	Dover Point	

Crossing Condition Evaluation	Score*
Crossing Condition	2
Tidal Restriction Evaluation	
Tidal Range Ratio	3
Crossing Ratio	3
Erosion Classification	4
Tidal Restriction Overall Score	3
Tidal Aquatic Organism Passage	
Tidal Range Ratio	3
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	1
Salt Marsh Migration Potential (Wshed.)	1
Vegetation Evaluation	
Vegetation Comparison Matrix	1
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	1,1
Inun. Risk to the Crossing Structure (US, DS)	1,1
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	5
Overall Scores	
Infrastructure	2
Ecological	3
Combined	3

DS view toward structure

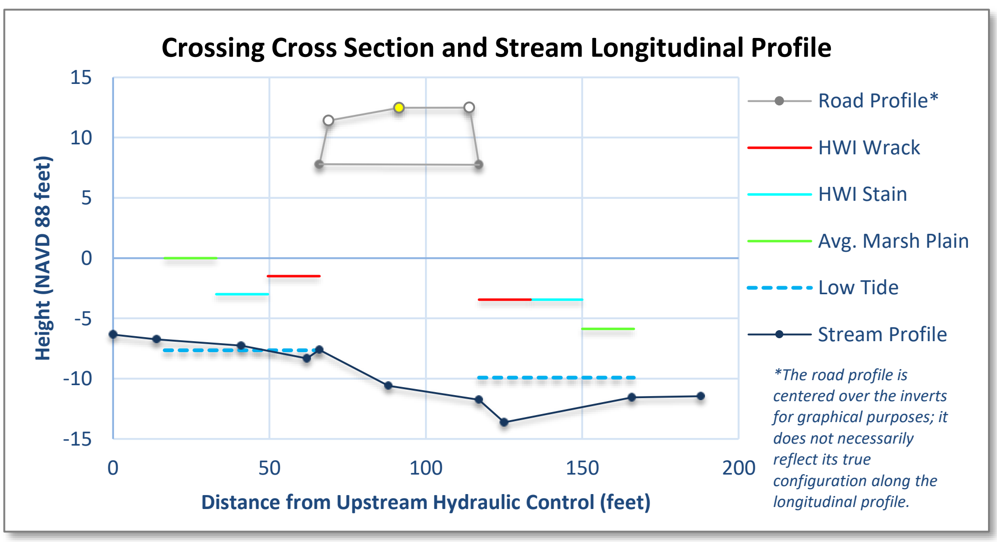
US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority

**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk



Long. Profile

Dist.	Hght.	Feat.	Sub.
0	-6.3428	HC	C
14	-6.7428	CB	C
41	-7.2628	HC	B
62	-8.3128	P	B
66	-7.5928	I	B
88	-10.593	CB	B
117	-11.743	I	S
125	-13.623	P	B
166	-11.543	HC	B
188	-11.443	HC	B

Crossing Context:

N/A

Structure Characteristics:

Structure Type:	Bridge with Abutments	**Date of Last Known Replacement:**	N/A
Structure Material:	Stone		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	25	25
Dimension B^{CB}(height):	15.09	19.07
Crossing Length (Invert to Invert):	51	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	None	N/A	Rip Rap	Fair	Wingwalls	Low
Downstream	None	N/A	Rip Rap	Fair	Wingwalls	Low

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
None	None	Fair		Good

Structure Condition Comments:	N/A

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	Sparsely Vegetated Intertidal Habitat	Sparsely Vegetated Intertidal Habitat
Upstream Salt Marsh Migration Potential (acres):	0.13	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	No
Emergency Access or Evacuation Route:	N/A
History of Flooding:	No

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 99

Observer(s) & Organization:	JB & KL (NHDES Coastal)
Municipality:	DURHAM
Stream Name:	N/A
Road Name:	Bay Rd

Date:	5/3/2018	
Start Time:	10:02:00 AM	
End Time:	1:30:00 AM	
Tide Prediction	**High**	**Low**
Time:	2:50 PM	8:31 AM
Elevation:	7.7	-0.1
Tide Chart Location:	Swamscott River	

Crossing Condition Evaluation	Score*
Crossing Condition	1
Tidal Restriction Evaluation	
Tidal Range Ratio	1
Crossing Ratio	4
Erosion Classification	1
Tidal Restriction Overall Score	2
Tidal Aquatic Organism Passage	
Tidal Range Ratio	1
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	4
Salt Marsh Migration Potential (Wshed.)	4
Vegetation Evaluation	
Vegetation Comparison Matrix	3
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	2,2
Inun. Risk to the Crossing Structure (US, DS)	1,1
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	2
Overall Scores	
Infrastructure	1
Ecological	3
Combined	2

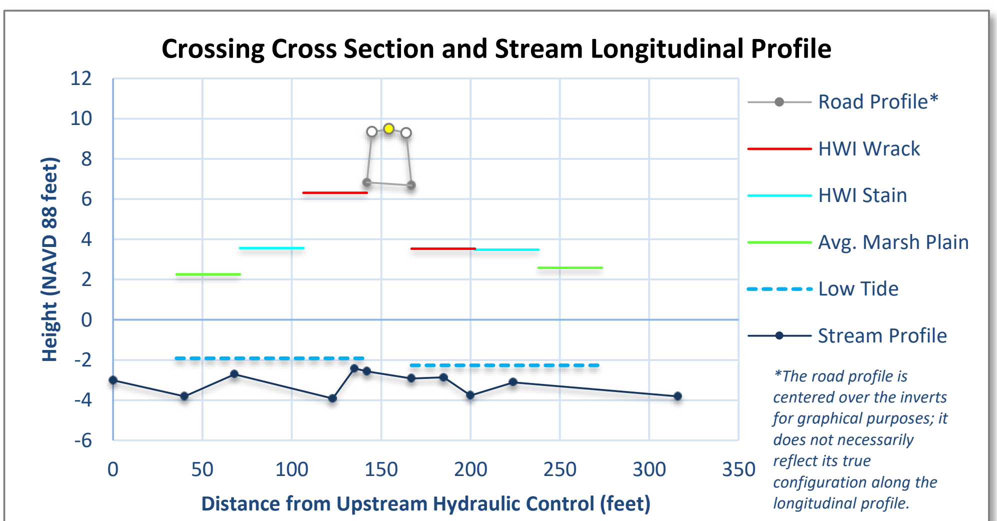
DS view toward structure

US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority
**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk



Long. Profile

Dist.	Hght.	Feat.	Sub.
0	-3.0184	HC	C/S
40	-3.8184	P	G
68	-2.7184	HC	G
123	-3.9184	P	G
135	-2.4184	GC	G
142	-2.5684	I	G
167	-2.9184	I	G
185	-2.8684	GC	G
200	-3.7684	P	C/S
224	-3.1184	HC	G
316	-3.8184	HC	C/S

Crossing Context:

N/A

Structure Characteristics:

Structure Type:	Bridge with Abutments	**Date of Last Known Replacement:**	N/A
Structure Material:	Stone		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	16	16
Dimension B^{CB}(height):	9.4	6.65
Crossing Length (Invert to Invert):	25	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	None	N/A	Concrete	Fair	None	None
Downstream	None	N/A	Other	Good	None	None

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
None	None	Good	Over head electric	Good

Structure Condition Comments:	N/A

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	Low Salt Marsh	Sparsely Vegetated Intertidal Habitat
Upstream Salt Marsh Migration Potential (acres):	7.09	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	No
Emergency Access or Evacuation Route:	N/A
History of Flooding:	No flooding documented

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 100

Observer(s) & Organization:	TS, JB, SG (NHDES Coastal)
Municipality:	NEWMARKET
Stream Name:	Lubberland Creek
Road Name:	Bay Rd

Date:	7/13/2018	
Start Time:	8:00:00 AM	
End Time:	9:49:00 AM	
Tide Prediction	**High**	**Low**
Time:	2:11 PM	8:18 AM
Elevation:	7.5	-1.1
Tide Chart Location:	Squamscott River	

Crossing Condition Evaluation	Score*
Crossing Condition	5
Tidal Restriction Evaluation	
Tidal Range Ratio	5
Crossing Ratio	5
Erosion Classification	5
Tidal Restriction Overall Score	5
Tidal Aquatic Organism Passage	
Tidal Range Ratio	5
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	1
Salt Marsh Migration Potential (Wshed.)	1
Vegetation Evaluation	
Vegetation Comparison Matrix	5
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	3,2
Inun. Risk to the Crossing Structure (US, DS)	3,3
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	5
Overall Scores	
Infrastructure	5
Ecological	5
Combined	5

DS view toward structure

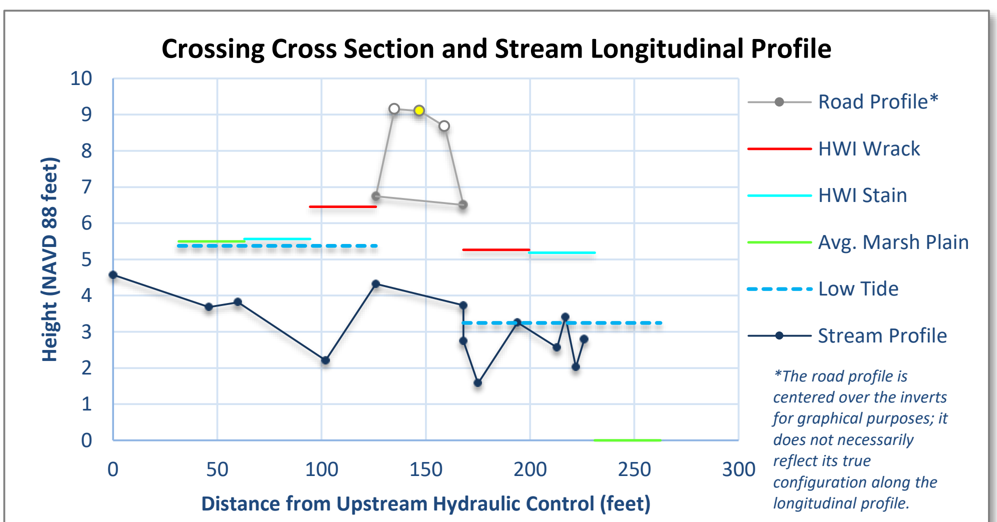
US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority

**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk



Long. Profile

Dist.	Hght.	Feat.	Sub.
0	4.5743	HC	C/S
46	3.6843	CB	C/S
60	3.8143	HC	C/S
102	2.2143	P	C/S
126	4.3243	I	C/S
168	3.7343	I	N/A
168	2.7443	CB	G
175	1.5743	P	G
194	3.2543	HC	C
213	2.5643	CB	C/S
217	3.4143	HC	C/S
222	2.0243	P	G
226	2.7943	HC	G

Crossing Context:

The crossing at Lubberland Creek, where it crosses Bay Road in Newmarket is effectively at the head of tide. The restrictive crossing is in poor condition; it contributes to the inundation risk from stormwater flooding, and is undersized, leading to severe scour, strongly restricting tides and prevention of organism passage. The overall combined score is 5 indicating highest priority for restoration. The culvert is slated to be restored in 2019 and the project champion and abutting landowner is The Nature Conservancy.

Structure Characteristics:

Structure Type:	Elliptical Culvert	**Date of Last Known Replacement:**	N/A
Structure Material:	Steel - Corrugated		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	3.5	4.2
Dimension B^{CB}(height):	2.2	2.8
Crossing Length (Invert to Invert):	42	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	Dry Fit Stone	Poor	Dry Fit Stone	Poor	Wingwalls	High
Downstream	Dry Fit Stone	Poor	Dry Fit Stone	Poor	Wingwalls	High

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
None	None	Fair	Overhead electric	Poor

Structure Condition Comments:	Upstream opening clogged with sediment and veg due to Beaver gate.

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	Freshwater Marsh	Freshwater Stream
Upstream Salt Marsh Migration Potential (acres):	0.00	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	Yes
Emergency Access or Evacuation Route:	N/A
History of Flooding:	historical flooding at crossing.

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 101

Observer(s) & Organization:	JB TS (NHDES Coastal)
Municipality:	NEWINGTON
Stream Name:	N/A
Road Name:	No Name

Date:	7/26/2018	
Start Time:	8:30:00 AM	
End Time:	9:55:00 AM	
Tide Prediction	**High**	**Low**
Time:	12:53 PM	6:37 AM
Elevation:	6.0	0.2
Tide Chart Location:	Dover Point	

Crossing Condition Evaluation	Score*
Crossing Condition	1
Tidal Restriction Evaluation	
Tidal Range Ratio	1
Crossing Ratio	5
Erosion Classification	5
Tidal Restriction Overall Score	4
Tidal Aquatic Organism Passage	
Tidal Range Ratio	1
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	1
Salt Marsh Migration Potential (Wshed.)	1
Vegetation Evaluation	
Vegetation Comparison Matrix	0
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	0,2
Inun. Risk to the Crossing Structure (US, DS)	0,5
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	5
Overall Scores	
Infrastructure	1
Ecological	4
Combined	2

DS view toward structure

US view above structure

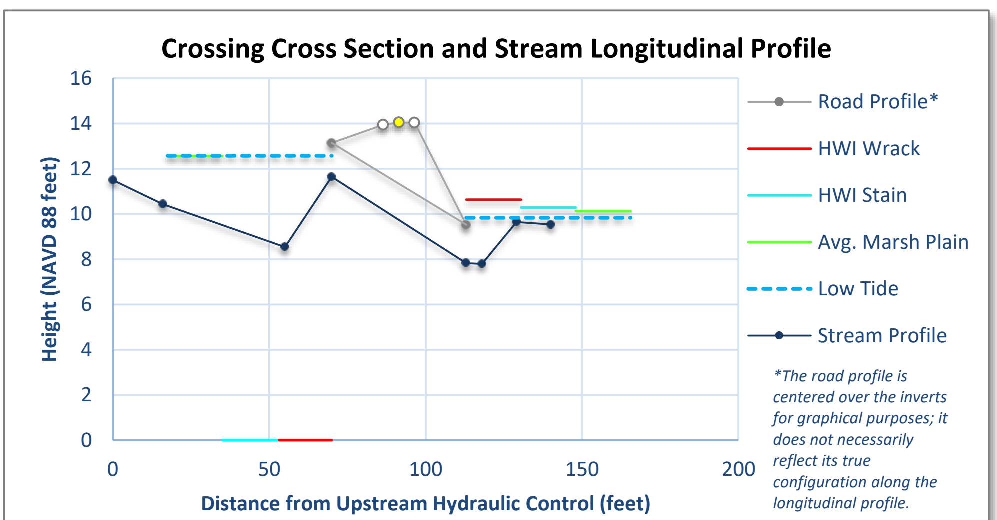
US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority
**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk

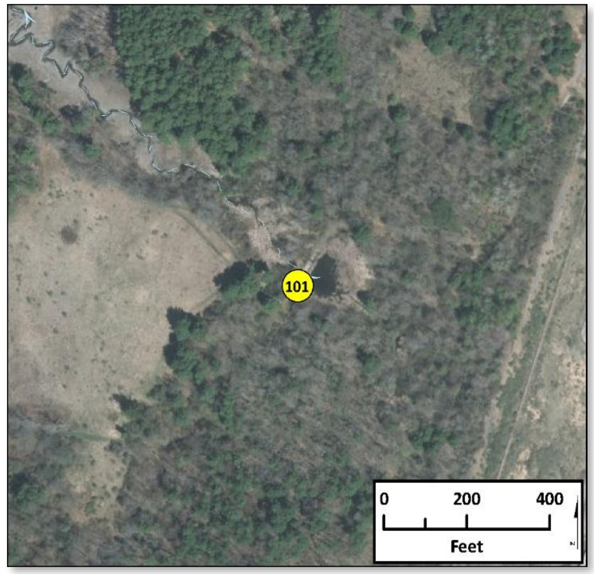
Long. Profile

Dist.	Hght.	Feat.	Sub.
0	11.492	HC	C/S
16	10.432	CB	C/S
55	8.532	P	C/S
70	11.642	I	C/S
113	7.832	I	C
118	7.792	P	C
129	9.642	HC	G
140	9.542	CB	S



Crossing Context:

N/A



Structure Characteristics:

Structure Type:	Round Culvert	**Date of Last Known Replacement:**	N/A
Structure Material:	Steel - Corrugated		
Tide Gate Present:	Yes		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	1.5	1.5
Dimension B[CB](height):	1.5	1.5
Crossing Length (Invert to Invert):	43	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	None	N/A	None	N/A	None	None
Downstream	None	N/A	None	N/A	None	None

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
None	None	N/A	None	Good

Structure Condition Comments:	Vertical structure covering inlet. Barrier to two directional flow. Water trickling in from US pond.

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	Freshwater Marsh	Brackish Marsh
Upstream Salt Marsh Migration Potential (acres):	0.00	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	No
Emergency Access or Evacuation Route:	N/A
History of Flooding:	unknown

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 102

Observer(s) & Organization:	TS, JB (NHDES Coastal)
Municipality:	NEWINGTON
Stream Name:	N/A
Road Name:	Newington Rd

Date:	6/20/2018	
Start Time:	1:10:00 PM	
End Time:	2:20:00 PM	
Tide Prediction	**High**	**Low**
Time:	8:13 PM	2:11 PM
Elevation:	7.4	-0.3
Tide Chart Location:	Squamscott River	

Crossing Condition Evaluation	Score*
Crossing Condition	1
Tidal Restriction Evaluation	
Tidal Range Ratio	2
Crossing Ratio	4
Erosion Classification	4
Tidal Restriction Overall Score	3
Tidal Aquatic Organism Passage	
Tidal Range Ratio	2
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	1
Salt Marsh Migration Potential (Wshed.)	1
Vegetation Evaluation	
Vegetation Comparison Matrix	4
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	1,1
Inun. Risk to the Crossing Structure (US, DS)	1,1
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	5
Overall Scores	
Infrastructure	1
Ecological	4
Combined	3

DS view toward structure

US view above structure

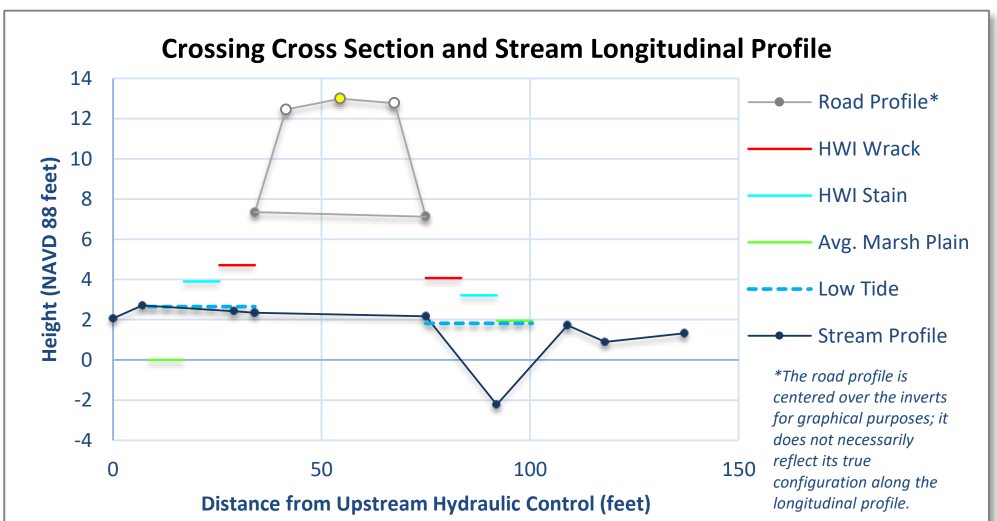
US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority
**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk

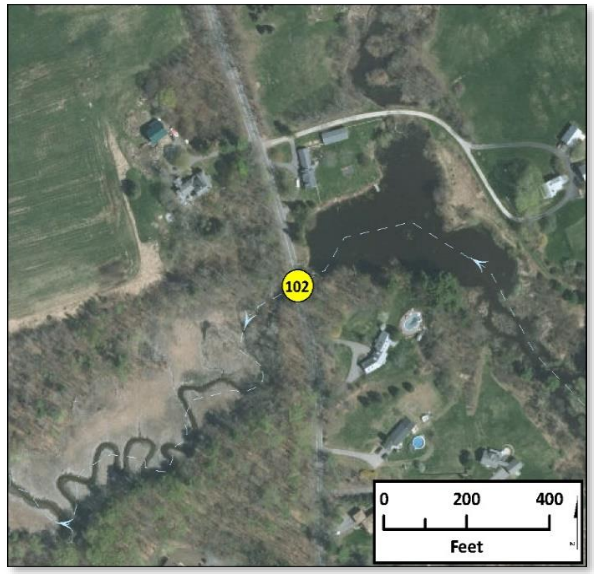
Long. Profile

Dist.	Hght.	Feat.	Sub.
0	2.0621	HC	C
7	2.7121	HC	C
29	2.4221	CB	G
34	2.3421	I	C
75	2.1721	I	C
92	-2.2279	P	C
109	1.7221	HC	G
118	0.9021	P	C
137	1.3221	HC	C



Crossing Context:

N/A



Structure Characteristics:

Structure Type:	Box Culvert	**Date of Last Known Replacement:**	N/A
Structure Material:	Concrete		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	5	5
Dimension B[CB](height):	5	5
Crossing Length (Invert to Invert):	41	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	Concrete	Good	Concrete	Good	Wingwalls	Low
Downstream	Concrete	Good	Rip Rap	Good	None	None

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
Culvert	Low	Fair	Overhead electric	Good

Structure Condition Comments:	N/A

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	Freshwater Swamp	High Salt Marsh
Upstream Salt Marsh Migration Potential (acres):	0.00	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	Yes
Emergency Access or Evacuation Route:	N/A
History of Flooding:	road has washed out in the past.

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 103

Observer(s) & Organization:	TS, Copro (NHDES Coastal)
Municipality:	GREENLAND
Stream Name:	Foss Brook
Road Name:	N/A

Date:	6/27/2018	
Start Time:	7:53:00 AM	
End Time:	9:40:00 AM	
Tide Prediction	**High**	**Low**
Time:	2:03 PM	8:13 AM
Elevation:	6.7	0.0
Tide Chart Location:	Squamscott River	

Crossing Condition Evaluation	Score*
Crossing Condition	4
Tidal Restriction Evaluation	
Tidal Range Ratio	3
Crossing Ratio	4
Erosion Classification	5
Tidal Restriction Overall Score	4
Tidal Aquatic Organism Passage	
Tidal Range Ratio	3
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	2
Salt Marsh Migration Potential (Wshed.)	2
Vegetation Evaluation	
Vegetation Comparison Matrix	1
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	2,2
Inun. Risk to the Crossing Structure (US, DS)	2,3
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	5
Overall Scores	
Infrastructure	4
Ecological	3
Combined	3

DS view toward structure

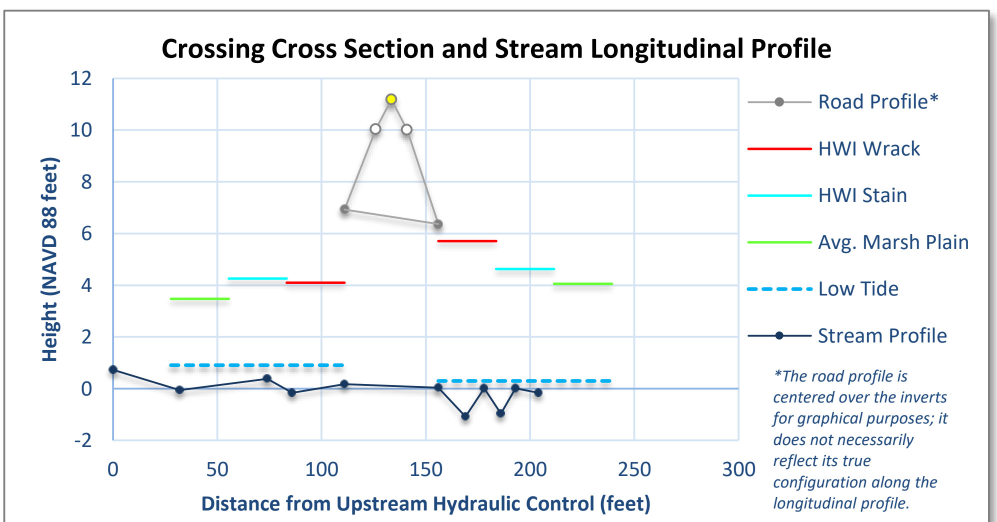
US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority

**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk



Long. Profile

Dist.	Hght.	Feat.	Sub.
0	0.7277	HC	C/S
32	-0.0623	P	C/S
74	0.3777	HC	C/S
86	-0.1623	P	C/S
111	0.1777	I	C/S
156	0.0377	I	G
169	-1.0823	P	G
178	0.0077	HC	G
186	-0.9623	P	G
193	0.0177	HC	S
204	-0.1623	CB	C/S

Crossing Context:

N/A

Structure Characteristics:

Structure Type:	Bridge with Abutments	**Date of Last Known Replacement:**	N/A
Structure Material:	Stone		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	2.9	2.65
Dimension B[CB](height):	7	6.15
Crossing Length (Invert to Invert):	45	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	None	N/A	Dry Fit Stone	Fair	Wingwalls	Low
Downstream	None	N/A	Dry Fit Stone	Poor	Wingwalls	High

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
Abutment	Low	Fair		Fair

Structure Condition Comments:	N/A

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	High Salt Marsh	High Salt Marsh
Upstream Salt Marsh Migration Potential (acres):	1.33	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	Yes
Emergency Access or Evacuation Route:	N/A
History of Flooding:	unknown

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 104

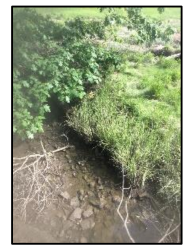
Observer(s) & Organization:	JB, Copro (NHDES Coastal)
Municipality:	GREENLAND
Stream Name:	Shaw Brook
Road Name:	N/A

Date:	6/27/2018	
Start Time:	7:45:00 AM	
End Time:	9:15:00 AM	
Tide Prediction	**High**	**Low**
Time:	2:03 PM	8:13 AM
Elevation:	6.6	0.0
Tide Chart Location:	Squamscott River	

Crossing Condition Evaluation	Score*
Crossing Condition	5
Tidal Restriction Evaluation	
Tidal Range Ratio	2
Crossing Ratio	5
Erosion Classification	5
Tidal Restriction Overall Score	4
Tidal Aquatic Organism Passage	
Tidal Range Ratio	2
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	1
Salt Marsh Migration Potential (Wshed.)	1
Vegetation Evaluation	
Vegetation Comparison Matrix	3
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	2,1
Inun. Risk to the Crossing Structure (US, DS)	3,4
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	5
Overall Scores	
Infrastructure	5
Ecological	3
Combined	4

DS view toward structure

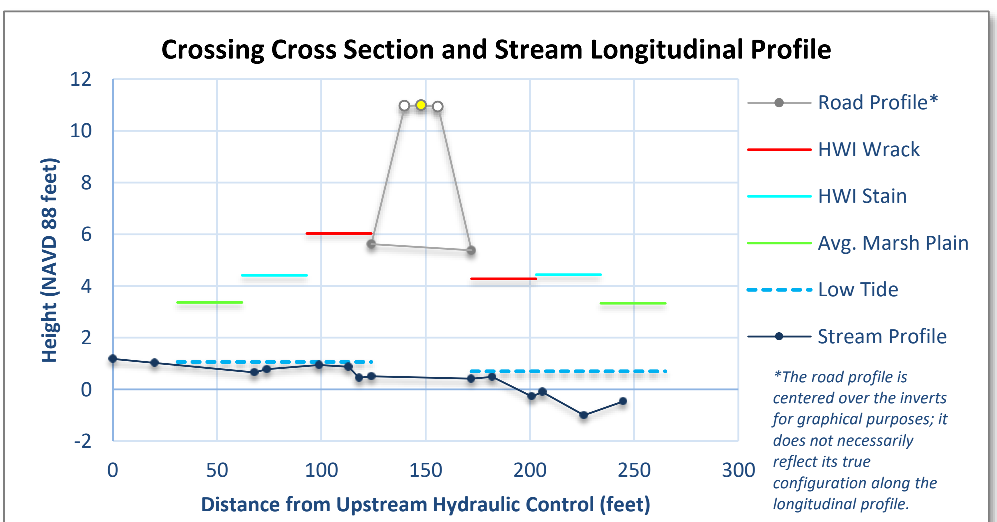
US view above structure



US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority
**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk

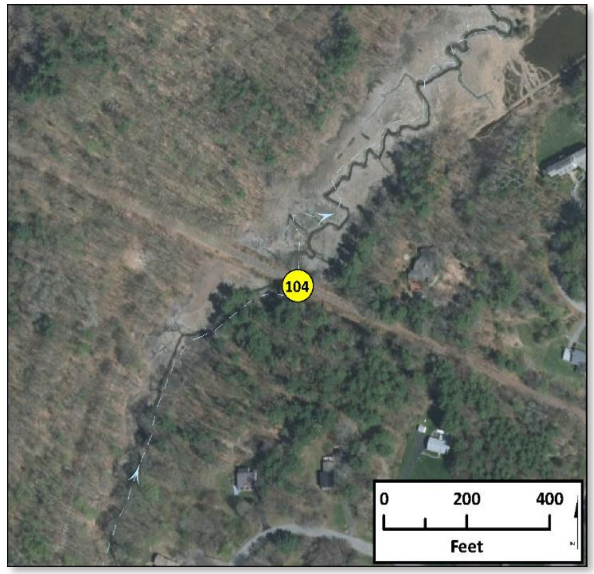


Long. Profile

Dist.	Hght.	Feat.	Sub.
0	1.1808	HC	C/S
20	1.0208	HC	C/S
68	0.6608	P	C/S
74	0.7808	HC	C/S
99	0.9408	CB	S
113	0.8708	CB	C/S
118	0.4508	P	C/S
124	0.5108	I	G
172	0.4108	I	C
182	0.4808	GC	C
201	-0.2792	CB	C
206	-0.0992	HC	G
226	-0.9992	P	C/S
245	-0.4592	HC	C/S

Crossing Context:

The railroad line that traverses the southeast corner of Great Bay crosses several small valleys of salt marsh (#103, 104, 106) and the Winnicut River (#105). This crossing is a granite culvert, about 1.5 feet wide and 5 feet tall, over a small tributary called Shaw Brook. With poor crossing condition, erosion and poor crossing ratio the overall combined score is 4, high priority for replacement.



Structure Characteristics:

Structure Type:	Box Culvert	**Date of Last Known Replacement:**	N/A
Structure Material:	Stone		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	1.7	1.35
Dimension B[CB](height):	5.2	5.05
Crossing Length (Invert to Invert):	48	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	None	N/A	None	N/A	Culvert	Medium
Downstream	None	N/A	None	N/A	Culvert	Medium

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
Culvert	Medium	N/A	None	Poor

Structure Condition Comments:	N/A

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	High Salt Marsh	High Salt Marsh
Upstream Salt Marsh Migration Potential (acres):	0.10	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	No
Emergency Access or Evacuation Route:	N/A
History of Flooding:	unknown

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 105

Observer(s) & Organization:	TS, JB, KL, PS (NHDES Coastal)
Municipality:	GREENLAND
Stream Name:	Winnicut River
Road Name:	N/A

Date:	6/19/2018	
Start Time:	12:50:00 PM	
End Time:	3:00:00 AM	
Tide Prediction	**High**	**Low**
Time:	7:12 PM	1:12 PM
Elevation:	7.5	-0.6
Tide Chart Location:	Squamscott River	

Crossing Condition Evaluation	Score*
Crossing Condition	5
Tidal Restriction Evaluation	
Tidal Range Ratio	1
Crossing Ratio	3
Erosion Classification	3
Tidal Restriction Overall Score	2
Tidal Aquatic Organism Passage	
Tidal Range Ratio	1
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	4
Salt Marsh Migration Potential (Wshed.)	4
Vegetation Evaluation	
Vegetation Comparison Matrix	3
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	1,1
Inun. Risk to the Crossing Structure (US, DS)	1,1
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	5
Overall Scores	
Infrastructure	5
Ecological	3
Combined	4

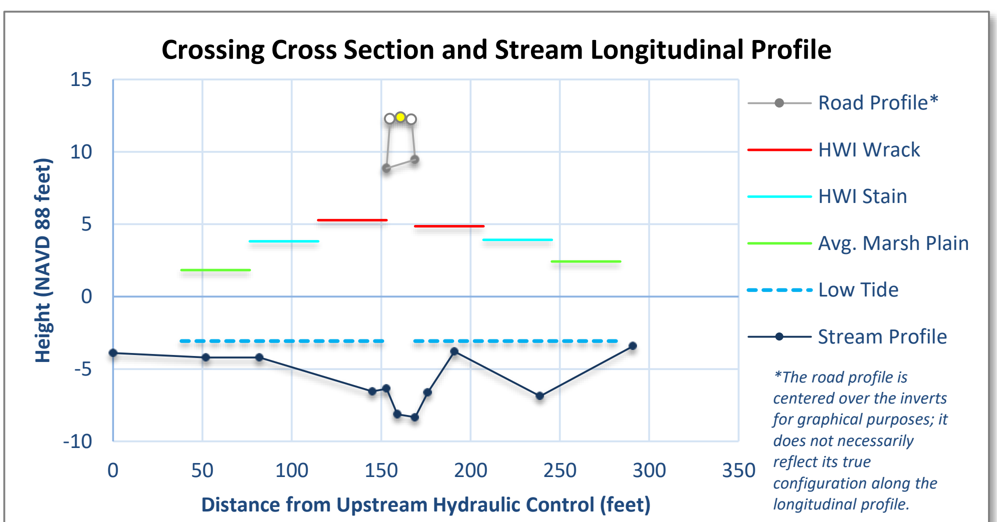
DS view toward structure

US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority
**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk



Long. Profile

Dist.	Hght.	Feat.	Sub.
0	-3.8912	HC	S
52	-4.2012	P	C/S
82	-4.2012	HC	S
145	-6.5412	P	S
153	-6.3612	I	S
159	-8.1412	P	S
169	-8.3312	I	S
176	-6.6312	P	S
191	-3.8012	HC	C
239	-6.8712	P	C/S
291	-3.4212	HC	G

Crossing Context:

The railroad line that traverses the southeast corner of Great Bay crosses several small valleys of salt marsh (#103, 104, 106) and the Winnicut River (#105). The Winnicut River is bridged by the railroad (about 19 feet wide and 18 feet tall) with granite abutments. The crossing condition is poor and exhibits some erosion and minor tidal restriction. The vegetation upstream becomes brackish and is more shaded by large trees and the marsh plain was measured more than 0.5 foot lower, an indicator of peat subsidence. The overall combined score is 4, high priority for replacement.

Structure Characteristics:

Structure Type:	Bridge with Abutments	**Date of Last Known Replacement:**	N/A
Structure Material:	Stone		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	18.8	18.8
Dimension B^{CB}(height):	18.6	16.7
Crossing Length (Invert to Invert):	16	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	None	N/A	Masonry	Poor	Wingwalls	Medium
Downstream	None	N/A	Masonry	Poor	Wingwalls	Medium

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
Abutment	Medium	N/A		Poor

Structure Condition Comments:	Sink hole rail surface river left

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	Low Salt Marsh	Low Salt Marsh
Upstream Salt Marsh Migration Potential (acres):	9.67	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	No
Emergency Access or Evacuation Route:	N/A
History of Flooding:	flooding from dam breach prior to dam removal.

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 106

Observer(s) & Organization:	TS, JB (NHDES Coastal)
Municipality:	GREENLAND
Stream Name:	Winnicut River
Road Name:	N/A

Date:	7/6/2018	
Start Time:	1:45:00 PM	
End Time:	3:00:00 PM	
Tide Prediction	**High**	**Low**
Time:	8:05 PM	2:06 PM
Elevation:	6.8	0.6
Tide Chart Location:	Squamscott River	

Crossing Condition Evaluation	Score*
Crossing Condition	5
Tidal Restriction Evaluation	
Tidal Range Ratio	1
Crossing Ratio	4
Erosion Classification	3
Tidal Restriction Overall Score	3
Tidal Aquatic Organism Passage	
Tidal Range Ratio	1
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	1
Salt Marsh Migration Potential (Wshed.)	1
Vegetation Evaluation	
Vegetation Comparison Matrix	3
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	1,1
Inun. Risk to the Crossing Structure (US, DS)	5,4
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	5
Overall Scores	
Infrastructure	5
Ecological	3
Combined	4

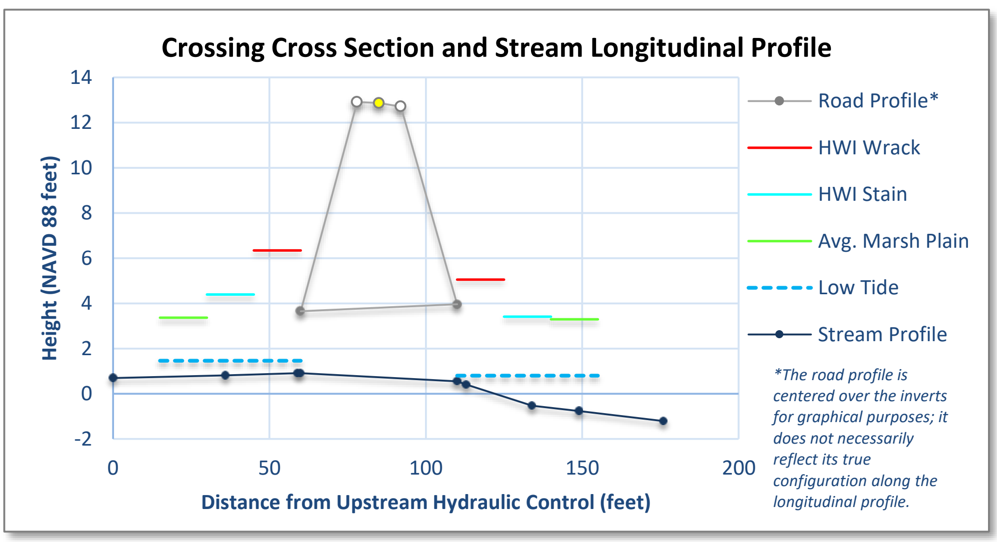
DS view toward structure

US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority
**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk



Long. Profile

Dist.	Hght.	Feat.	Sub.
0	0.6909	HC	S
36	0.8109	HC	B
59	0.9109	CB	B
60	0.9109	I	B
110	0.5509	I	C
113	0.4009	GC	C
134	-0.5291	HC	G
149	-0.7691	HC	G
176	-1.2091	CB	C/S

Crossing Context:

The railroad line that traverses the southeast corner of Great Bay crosses several small valleys of salt marsh (#103, 104, 106) and the Winnicut River (#105). This easternmost crossing is over a tributary to the Winnicut River, a 3 by 3 (approximately) granite culvert. The crossing condition is poor and moderate erosion was observed as well as a change in plant community. The culvert is slightly perched, and high tides often overtop the culvert. The overall combined score is 4, high priority for replacement.

Structure Characteristics:

Structure Type:	Box Culvert	**Date of Last Known Replacement:**	N/A
Structure Material:	Stone		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	3.4	2.4
Dimension B[CB] (height):	2.7	3.4
Crossing Length (Invert to Invert):	50	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	None	N/A	None	N/A	Culvert	Medium
Downstream	None	N/A	None	N/A	Culvert	None

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
Culvert	Medium	N/A	None	Poor

Structure Condition Comments:	N/A

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	High Salt Marsh	High Salt Marsh
Upstream Salt Marsh Migration Potential (acres):	0.39	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	No
Emergency Access or Evacuation Route:	N/A
History of Flooding:	unknown

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 107

Observer(s) & Organization:	JB TS (NHDES Coastal)
Municipality:	GREENLAND
Stream Name:	Winnicut River
Road Name:	Portsmouth Ave

Date:	8/24/2018	
Start Time:	7:21:00 AM	
End Time:	9:03:00 AM	
Tide Prediction	**High**	**Low**
Time:	1:10 PM	7:22 AM
Elevation:	6.4	0.4
Tide Chart Location:	Squamscott River	

Crossing Condition Evaluation	Score*
Crossing Condition	1
Tidal Restriction Evaluation	
Tidal Range Ratio	1
Crossing Ratio	1
Erosion Classification	4
Tidal Restriction Overall Score	2
Tidal Aquatic Organism Passage	
Tidal Range Ratio	1
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	3
Salt Marsh Migration Potential (Wshed.)	3
Vegetation Evaluation	
Vegetation Comparison Matrix	4
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	1,1
Inun. Risk to the Crossing Structure (US, DS)	1,1
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	5
Overall Scores	
Infrastructure	1
Ecological	4
Combined	2

DS view toward structure

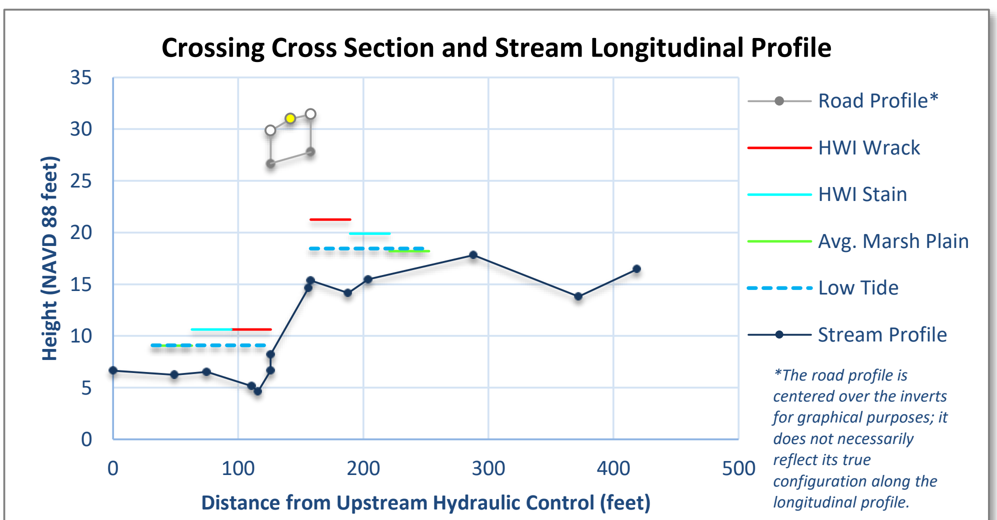
US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority

**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk



Long. Profile

Dist.	Hght.	Feat.	Sub.
0	6.6339	HC	C/S
49	6.2339	P	C/S
75	6.5339	HC	C/S
111	5.1339	CB	G
116	4.6339	P	G
126	6.6339	CB	G
126	8.1839	I	G
156	14.614	CB	B
158	15.364	I	B
188	14.164	P	B
204	15.464	CB	B
288	17.814	HC	C
372	13.814	HC	C
419	16.464	HC	B

Crossing Context:

N/A

Structure Characteristics:

Structure Type:	Bridge with Side Slopes and Abutments	**Date of Last Known Replacement:**	N/A
Structure Material:	Concrete		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	54	54
Dimension B[CB] (height):	21.67	26.3
Crossing Length (Invert to Invert):	32	

Crossing Condition:	Headwall Material	Headwall Condition	Wingwall Material	Wingwall Condition	Scour at Structure	Scour Severity
Upstream	None	N/A	Concrete	Good	None	None
Downstream	None	N/A	Concrete	Good	None	None

Scour in Structure	Scour Severity in Structure	Road Surface Condition	Utilities at Crossing	Structure Condition Overall
None	None	Good	Small pipe DS side of bridge. Electrical conduit?	Good

Structure Condition Comments:	Multiple fish weirs in armored channel under bridge

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	Freshwater Stream	Brackish Riverbank Marsh
Upstream Salt Marsh Migration Potential (acres):	3.67	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	No
Emergency Access or Evacuation Route:	Yes
History of Flooding:	None documented

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 108

Observer(s) & Organization:	JB KL (NHDES Coastal)
Municipality:	NEWMARKET
Stream Name:	N/A
Road Name:	New Rd

Date:	5/17/2018	
Start Time:	9:15:00 AM	
End Time:	11:30:00 AM	
Tide Prediction	**High**	**Low**
Time:	4:38 PM	9:45 AM
Elevation:	7.5	-1.0
Tide Chart Location:	Swamscott River	

Crossing Condition Evaluation	Score*
Crossing Condition	5
Tidal Restriction Evaluation	
Tidal Range Ratio	3
Crossing Ratio	5
Erosion Classification	5
Tidal Restriction Overall Score	4
Tidal Aquatic Organism Passage	
Tidal Range Ratio	3
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	1
Salt Marsh Migration Potential (Wshed.)	1
Vegetation Evaluation	
Vegetation Comparison Matrix	3
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	1,1
Inun. Risk to the Crossing Structure (US, DS)	4,0
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	5
Overall Scores	
Infrastructure	5
Ecological	4
Combined	4

DS view toward structure

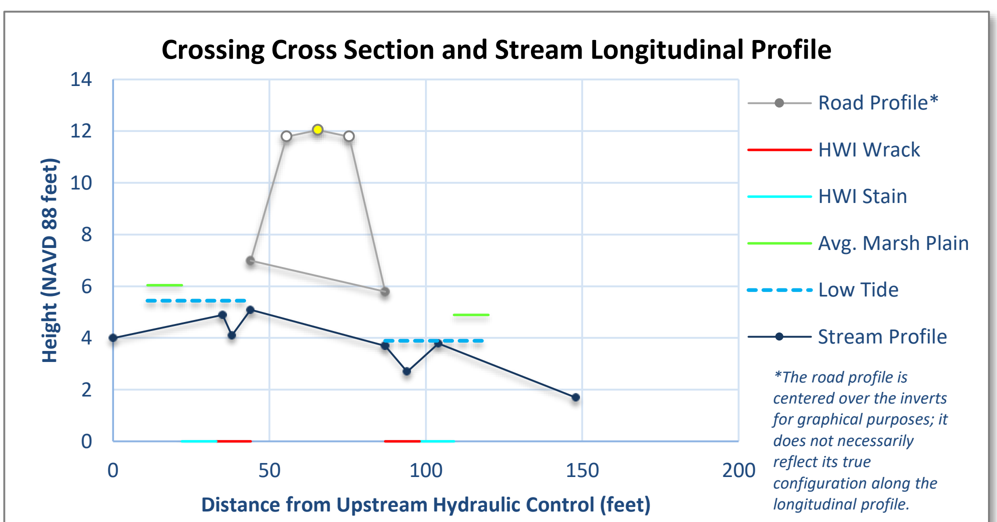
US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority

**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk



Long. Profile

Dist.	Hght.	Feat.	Sub.
0	3.9907	HC	C/S
35	4.8907	HC	C/S
38	4.0907	P	C/S
44	5.0907	I	C/S
87	3.6907	I	G
94	2.6907	P	G
104	3.7907	HC	C
148	1.6907	HC	S

Crossing Context:

This crossing under New Road in Newmarket conducts water to a wetland high in the intertidal zone with little potential for migration. However, its crossing condition is poor, it is restrictive, and it exhibits high erosion. The overall combined score is 4, indicating high priority for replacement.

Structure Characteristics:

Structure Type:	Round Culvert	**Date of Last Known Replacement:**	N/A
Structure Material:	Concrete		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	2	2
Dimension B^{CB}(height):	2	2
Crossing Length (Invert to Invert):	43	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	Masonry	Poor	Masonry	Poor	Headwall	High
Downstream	Masonry	Poor	None	N/A	None	None

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
None	None	Good	Over head electric	Poor

Structure Condition Comments:	N/A

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	Freshwater Marsh	Freshwater Stream
Upstream Salt Marsh Migration Potential (acres):	0.00	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	No
Emergency Access or Evacuation Route:	N/A
History of Flooding:	No

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 109

Observer(s) & Organization:	JB, TS (NHDES Coastal)	**Date:**	7/2/2018	
Municipality:	STRATHAM	**Start Time:**	11:30:00 AM	
Stream Name:	N/A	**End Time:**	12:30:00 PM	
Road Name:	N/A			

Tide Prediction	**High**	**Low**
Time:	5:14 PM	11:20 AM
Elevation:	6.5	0.3
Tide Chart Location:	Squamscott River	

Crossing Condition Evaluation	Score*
Crossing Condition	2
Tidal Restriction Evaluation	
Tidal Range Ratio	1
Crossing Ratio	5
Erosion Classification	0
Tidal Restriction Overall Score	3
Tidal Aquatic Organism Passage	
Tidal Range Ratio	1
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	5
Salt Marsh Migration Potential (Wshed.)	5
Vegetation Evaluation	
Vegetation Comparison Matrix	4
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	3,3
Inun. Risk to the Crossing Structure (US, DS)	4,4
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	5
Overall Scores	
Infrastructure	2
Ecological	4
Combined	3

DS view toward structure

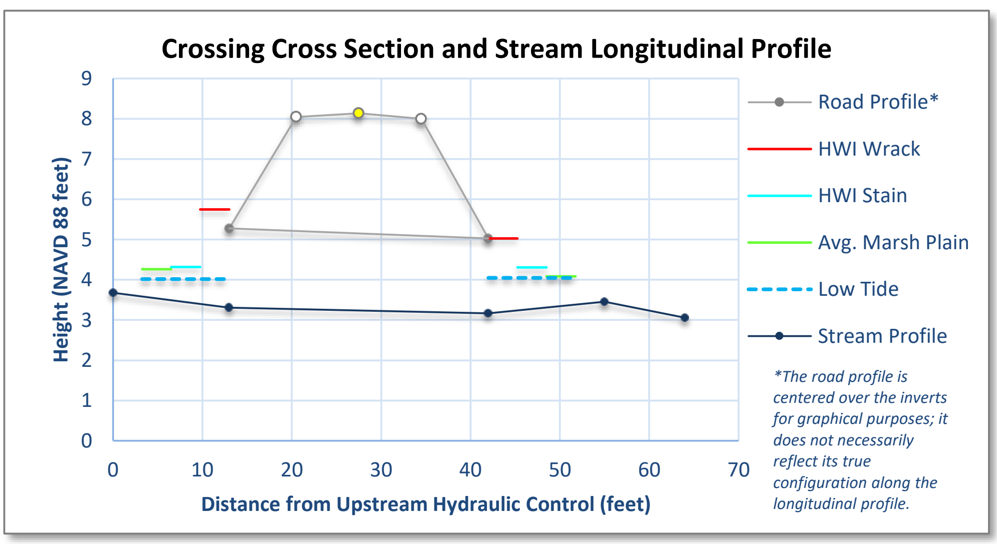
US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority

**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk

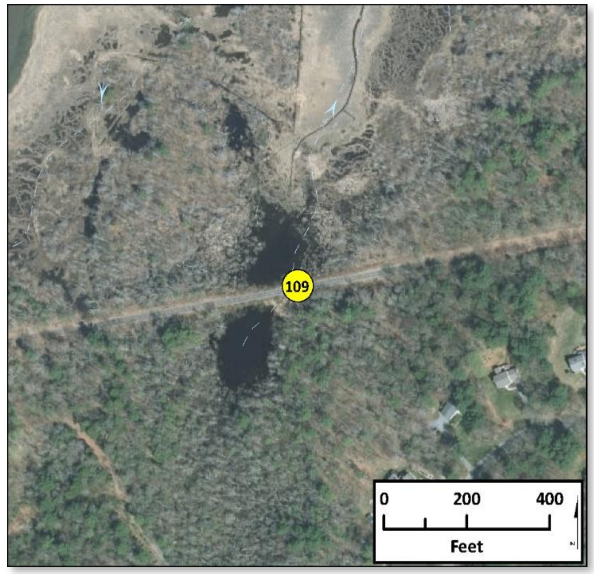


Long. Profile

Dist.	Hght.	Feat.	Sub.
0	3.6765	CB	C/S
13	3.3065	I	C/S
42	3.1665	I	G
55	3.4565	CB	C/S
64	3.0565	P	C/S

Crossing Context:

This is a railroad crossing of a small upper tidal reach with a 2 by 2-foot granite culvert. Ponding on either side of the structure suggests an artificial condition of the wetlands (perhaps a borrow site for fill for the railroad bed). The vegetation appears to be largely salt marsh downstream and fresh upstream. This crossing has an overall combined score of 3, indicating moderate priority for replacement, which may rank higher for marsh migration as sea levels rise.



Structure Characteristics:

Structure Type:	Box Culvert	**Date of Last Known Replacement:**	N/A
Structure Material:	Stone		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	2	2.3
Dimension B^{CB}(height):	1.9	2.3
Crossing Length (Invert to Invert):	29	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	None	N/A	None	N/A	None	None
Downstream	None	N/A	None	N/A	Culvert	None

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
Culvert	Low	N/A	None	Fair

Structure Condition Comments:	N/A

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	Freshwater Swamp	High Salt Marsh
Upstream Salt Marsh Migration Potential (acres):	11.86	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	Yes
Emergency Access or Evacuation Route:	N/A
History of Flooding:	unknown

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 111

Observer(s) & Organization:	JB TS (NHDES Coastal)
Municipality:	NEWFIELDS
Stream Name:	N/A
Road Name:	N/A

Date:	6/26/2018	
Start Time:	7:50:00 AM	
End Time:	9:15:00 AM	
Tide Prediction	**High**	**Low**
Time:	1:20 PM	7:30 AM
Elevation:	6.7	0.1
Tide Chart Location:	Squamscott River	

	Score*
Crossing Condition Evaluation	
Crossing Condition	5
Tidal Restriction Evaluation	
Tidal Range Ratio	3
Crossing Ratio	5
Erosion Classification	4
Tidal Restriction Overall Score	4
Tidal Aquatic Organism Passage	
Tidal Range Ratio	3
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	1
Salt Marsh Migration Potential (Wshed.)	1
Vegetation Evaluation	
Vegetation Comparison Matrix	1
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	1,1
Inun. Risk to the Crossing Structure (US, DS)	3,3
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	5
Overall Scores	
Infrastructure	5
Ecological	3
Combined	4

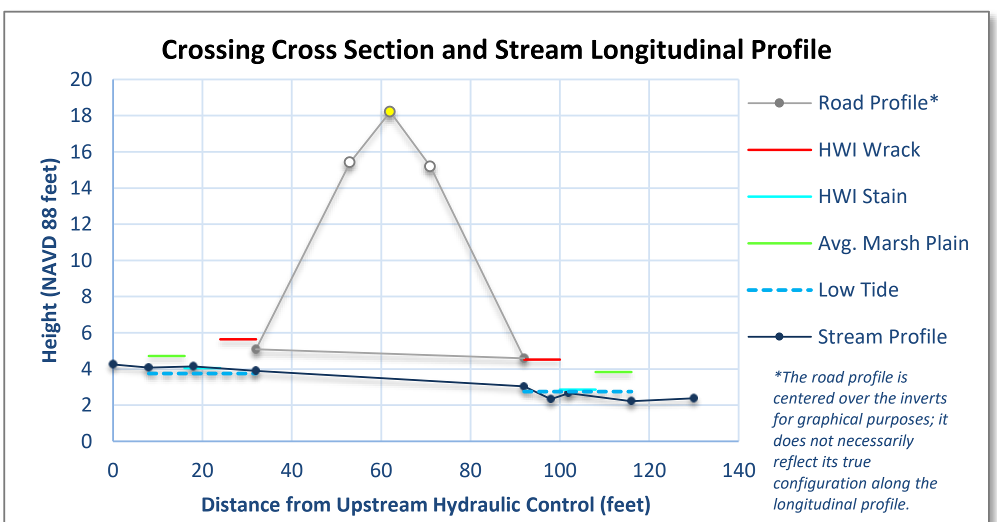
DS view toward structure

US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority
**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk

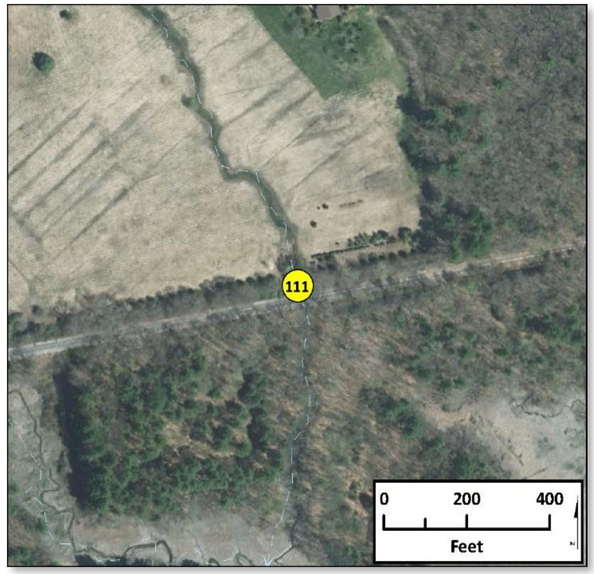


Long. Profile

Dist.	Hght.	Feat.	Sub.
0	4.2487	HC	C/S
8	4.0687	P	C/S
18	4.1387	HC	C/S
32	3.8887	I	C
92	3.0387	I	G
98	2.3387	P	C
102	2.6687	HC	C
116	2.2187	P	S
130	2.3787	HC	C/S

Crossing Context:

This crossing is over a branch of an unnamed brook and marsh and supports the rail line through Newington. It is terribly undersized (1.2 by 1.4 feet granite box culvert), has a poor crossing condition and exhibits high erosion. The crossing has an overall combined score of 4, indicating high priority for replacement.



Structure Characteristics:

Structure Type:	Box Culvert	**Date of Last Known Replacement:**	N/A
Structure Material:	Stone		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	1.4	2.4
Dimension B[CB](height):	1.2	2.2
Crossing Length (Invert to Invert):	60	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	None	N/A	Rip Rap	Poor	Wingwalls	Medium
Downstream	None	N/A	Rip Rap	Poor	Wingwalls	Medium

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
Culvert	Medium	N/A	None	Poor

Structure Condition Comments:	Stones collapsing at structure.

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	Freshwater Marsh	Freshwater Marsh
Upstream Salt Marsh Migration Potential (acres):	0.00	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	No
Emergency Access or Evacuation Route:	N/A
History of Flooding:	Unknown

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 112

Observer(s) & Organization:	TS, JB (NHDES Coastal)
Municipality:	NEWFIELDS
Stream Name:	N/A
Road Name:	N/A

Date:	6/28/2018	
Start Time:	9:30:00 AM	
End Time:	1:22:00 PM	
Tide Prediction	**High**	**Low**
Time:	12:00 AM	12:00 AM
Elevation:	0.0	0.0
Tide Chart Location:	Squamscott River	

Crossing Condition Evaluation	Score*
Crossing Condition	4
Tidal Restriction Evaluation	
Tidal Range Ratio	3
Crossing Ratio	5
Erosion Classification	5
Tidal Restriction Overall Score	4
Tidal Aquatic Organism Passage	
Tidal Range Ratio	3
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	1
Salt Marsh Migration Potential (Wshed.)	1
Vegetation Evaluation	
Vegetation Comparison Matrix	5
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	1,1
Inun. Risk to the Crossing Structure (US, DS)	4,3
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	5
Overall Scores	
Infrastructure	4
Ecological	5
Combined	5

DS view toward structure

US view above structure

US view toward structure

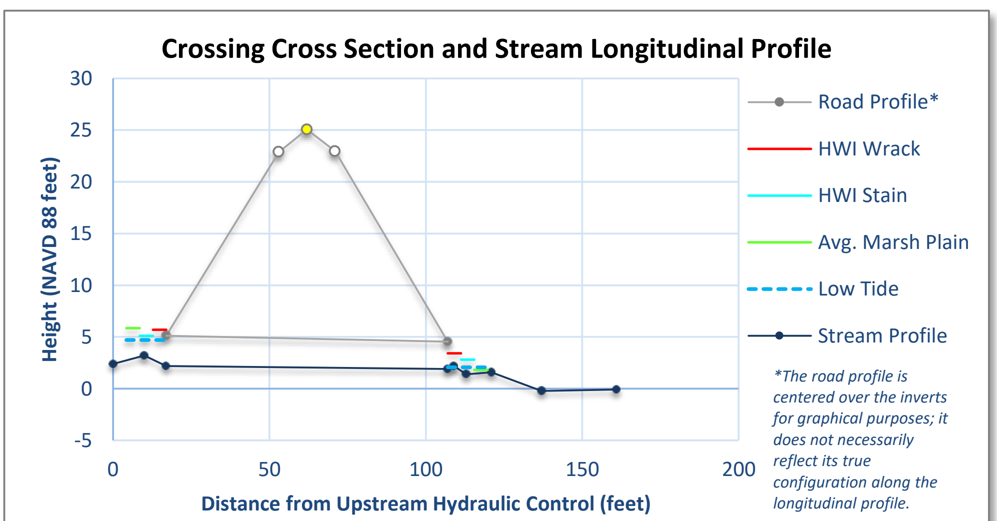
DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority

**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk

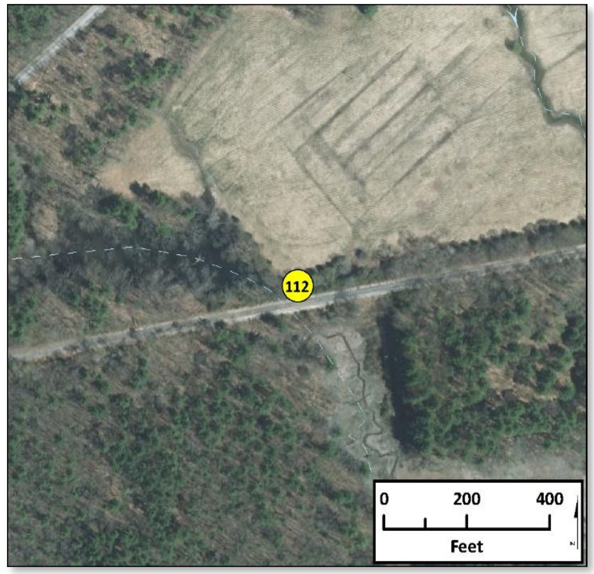
Long. Profile

Dist.	Hght.	Feat.	Sub.
0	2.3856	P	C/S
10	3.2056	CB	C/S
17	2.1856	I	C/S
107	1.9156	I	B
109	2.1856	GC	B
113	1.3756	P	B
121	1.5856	HC	B
137	-0.2244	CB	S
161	-0.0944	HC	B



Crossing Context:

The crossing is a railroad line over the upper reaches of a small drainage to the Squamscott River. It is a stone box culvert about 2 feet wide and 3 feet tall that shows constriction of the channel, erosion and potential impacts to the plant community. The overall combined score is a 5, highest priority for replacement.



Structure Characteristics:

Structure Type:	Box Culvert	**Date of Last Known Replacement:**	N/A
Structure Material:	Stone		
Tide Gate Present:	Yes		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	3	2
Dimension B[CB](height):	3	2.7
Crossing Length (Invert to Invert):	90	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	Dry Fit Stone	Poor	Dry Fit Stone	Fair	Wingwalls	Low
Downstream	None	N/A	Dry Fit Stone	Fair	Wingwalls	Medium

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
Culvert	Low	Fair	None	Poor

Structure Condition Comments:	R clogged DS

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	Freshwater Marsh	Freshwater Stream
Upstream Salt Marsh Migration Potential (acres):	0.00	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	No
Emergency Access or Evacuation Route:	N/A
History of Flooding:	Unknown

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 113

Observer(s) & Organization:	TS, JB (NHDES Coastal)
Municipality:	STRATHAM
Stream Name:	N/A
Road Name:	N/A

Date:	7/5/2018	
Start Time:	1:00:00 PM	
End Time:	2:09:00 PM	
Tide Prediction	**High**	**Low**
Time:	7:18 PM	1:20 PM
Elevation:	6.7	0.6
Tide Chart Location:	Squamscott River	

Crossing Condition Evaluation	Score*
Crossing Condition	5
Tidal Restriction Evaluation	
Tidal Range Ratio	1
Crossing Ratio	5
Erosion Classification	5
Tidal Restriction Overall Score	4
Tidal Aquatic Organism Passage	
Tidal Range Ratio	1
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	3
Salt Marsh Migration Potential (Wshed.)	3
Vegetation Evaluation	
Vegetation Comparison Matrix	4
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	4,2
Inun. Risk to the Crossing Structure (US, DS)	5,5
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	5
Overall Scores	
Infrastructure	5
Ecological	4
Combined	4

DS view toward structure

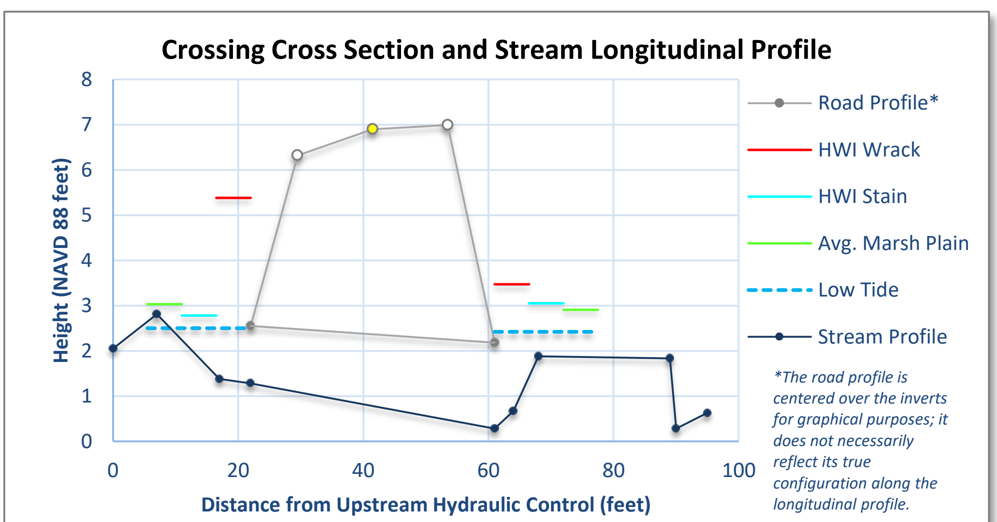
US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority

**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk

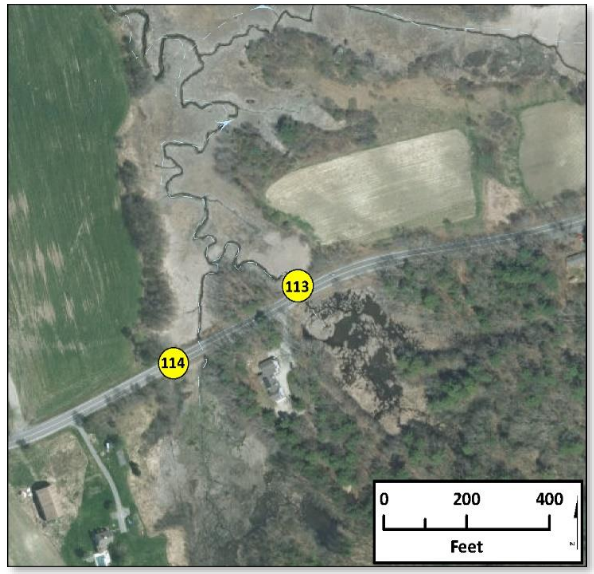


Long. Profile

Dist.	Hght.	Feat.	Sub.
0	2.0516	HC	C/S
7	2.8116	HC	G
17	1.3816	CB	B
22	1.2816	I	B
61	0.2816	I	S
64	0.6716	P	S
68	1.8816	HC	C/S
89	1.8316	HC	C/S
90	0.2816	CB	C/S
95	0.6316	CB	C/S

Crossing Context:

The crossing is on Squamscott Road over one of the unnamed upper marshes in Stratham and is rated an overall combined score of 4: high priority for replacement, due to tidal restriction and erosion associated with the 18-inch round culvert. The tidal creek fills the height of the culvert, even at low tide. Cattails are seen on both sides, but there is extensive marsh loss through ponding on the upstream side.



Structure Characteristics:

Structure Type:	Round Culvert	**Date of Last Known Replacement:**	N/A
Structure Material:	Concrete		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	1.5	1.5
Dimension B[CB](height):	1.5	1.5
Crossing Length (Invert to Invert):	39	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	Dry Fit Stone	Poor	None	N/A	Headwall	Low
Downstream	None	Poor	None	N/A	Wingwalls	Low

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
None	None	Good	None	Poor

Structure Condition Comments:	Structure submerged

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	Invasive Dominant	Brackish Marsh
Upstream Salt Marsh Migration Potential (acres):	4.31	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	Yes
Emergency Access or Evacuation Route:	Yes
History of Flooding:	flooding has occurred with 2+ inches of rain

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 114

Observer(s) & Organization:	TS, JB (NHDES Coastal)
Municipality:	STRATHAM
Stream Name:	N/A
Road Name:	Squamscott Rd

Date:	6/11/2018	
Start Time:	4:45:00 PM	
End Time:	5:51:00 PM	
Tide Prediction	**High**	**Low**
Time:	11:51 AM	6:13 PM
Elevation:	6.9	0.3
Tide Chart Location:	Squamscott River	

Crossing Condition Evaluation	Score*
Crossing Condition	2
Tidal Restriction Evaluation	
Tidal Range Ratio	1
Crossing Ratio	4
Erosion Classification	5
Tidal Restriction Overall Score	3
Tidal Aquatic Organism Passage	
Tidal Range Ratio	1
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	4
Salt Marsh Migration Potential (Wshed.)	4
Vegetation Evaluation	
Vegetation Comparison Matrix	3
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	2,2
Inun. Risk to the Crossing Structure (US, DS)	5,5
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	5
Overall Scores	
Infrastructure	2
Ecological	3
Combined	3

DS view toward structure

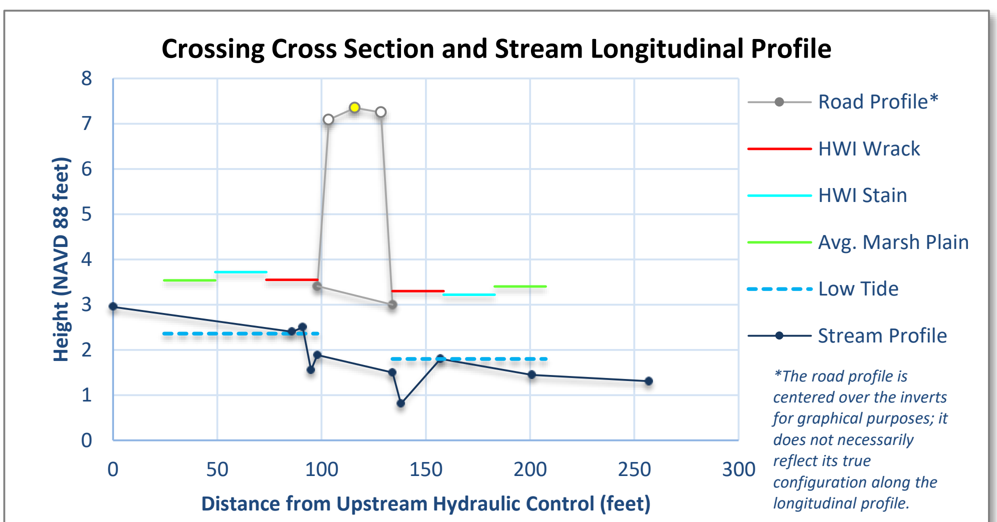
US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority

**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk

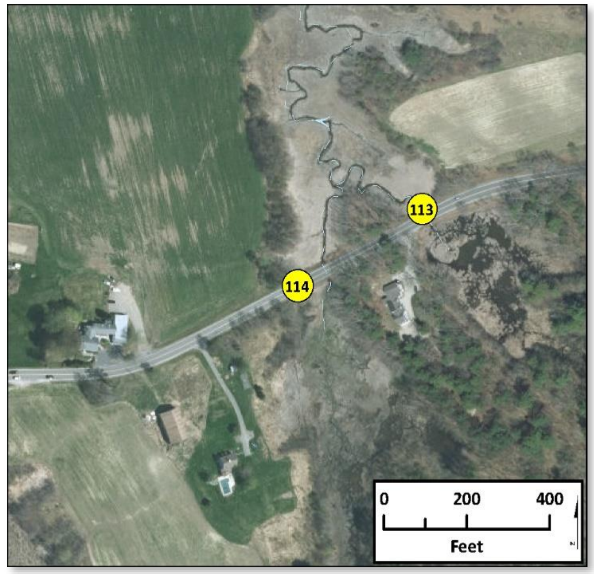


Long. Profile

Dist.	Hght.	Feat.	Sub.
0	2.9491	HC	C/S
86	2.3991	HC	G
91	2.4991	HC	G
95	1.5491	P	C/S
98	1.8891	I	C/S
134	1.4991	I	G
138	0.8091	P	C
157	1.7991	HC	G
201	1.4491	HC	G
257	1.3091	HC	G

Crossing Context:

N/A



Structure Characteristics:

Structure Type:	Round Culvert	**Date of Last Known Replacement:**	N/A
Structure Material:	Concrete		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	1.5	1.5
Dimension B[CB] (height):	1.5	1.5
Crossing Length (Invert to Invert):	36	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	Masonry	Fair	None	N/A	Headwall	Low
Downstream	Concrete	Fair	None	N/A	Headwall	Low

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
None	None	Good	Overhead electric	Fair

Structure Condition Comments:	N/A

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	High Salt Marsh	High Salt Marsh
Upstream Salt Marsh Migration Potential (acres):	7.06	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	Yes
Emergency Access or Evacuation Route:	Yes
History of Flooding:	flooding has occurred with 2+" of rain

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 115

Observer(s) & Organization:	TS,JB,KL (NHDES Coastal)
Municipality:	STRATHAM
Stream Name:	Jewell Hill Brook
Road Name:	Squamscott Rd

Date:	5/31/2018	
Start Time:	12:20:00 PM	
End Time:	2:30:00 AM	
Tide Prediction	**High**	**Low**
Time:	3:44 PM	9:52 AM
Elevation:	6.7	-0.1
Tide Chart Location:	Squamscott River	

Crossing Condition Evaluation	Score*
Crossing Condition	4
Tidal Restriction Evaluation	
Tidal Range Ratio	1
Crossing Ratio	3
Erosion Classification	4
Tidal Restriction Overall Score	3
Tidal Aquatic Organism Passage	
Tidal Range Ratio	1
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	5
Salt Marsh Migration Potential (Wshed.)	5
Vegetation Evaluation	
Vegetation Comparison Matrix	3
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	3,4
Inun. Risk to the Crossing Structure (US, DS)	3,4
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	5
Overall Scores	
Infrastructure	4
Ecological	3
Combined	4

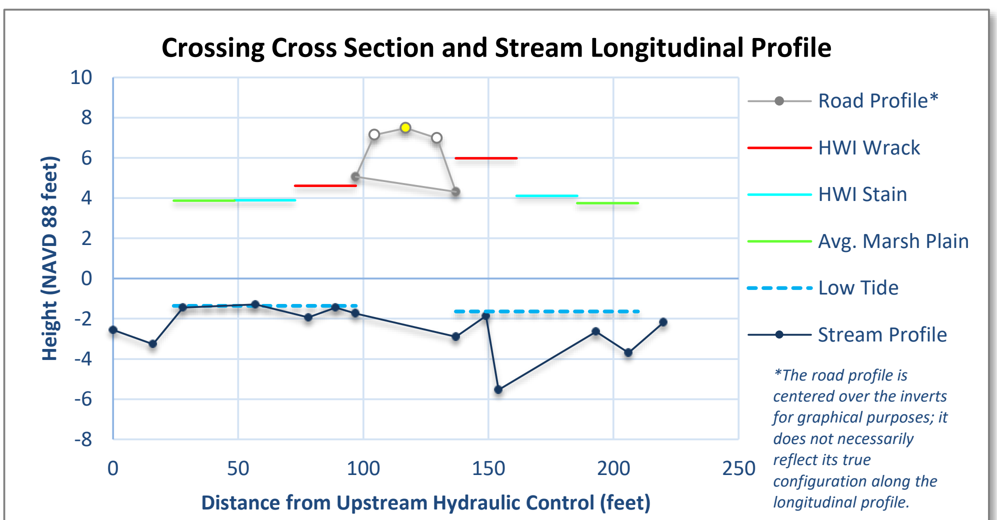
DS view toward structure

US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority
**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk



Long. Profile

Dist.	Hght.	Feat.	Sub.
0	-2.5597	HC	G
16	-3.2597	P	G
28	-1.4397	HC	C/S
57	-1.2897	HC	G
78	-1.9397	P	G
89	-1.4397	GC	C
97	-1.7397	I	C
137	-2.8897	I	G
149	-1.8597	GC	C
154	-5.5397	P	C/S
193	-2.6397	HC	G
206	-3.6997	P	C/S
220	-2.1897	HC	G

Crossing Context:

Jewel Hill Creek carries tides through a fairly significant salt marsh and is crossed by Squamscott Road through an arched culvert, 8 feet wide and about 7 feet high. Although it appears to have been recently replaced, the structure condition was poor. The culvert constricted the channel and may have a negative impact on the plant community upstream. The overall combined score is 4, high priority for replacement.

Structure Characteristics:

Structure Type:	Embedded Pipe Arch Culvert	**Date of Last Known Replacement:**	N/A
Structure Material:	Plastic - Smooth		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	8	8.1
Dimension B^{CB}(height):	7	7.35
Crossing Length (Invert to Invert):	40	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	Concrete	Fair	Rip Rap	Good	Headwall	Medium
Downstream	Concrete	Fair	Rip Rap	Good	Headwall	Medium

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
None	None	Good	Overhead electric	Poor

Structure Condition Comments:	Slanting headwall

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	High Salt Marsh	High Salt Marsh
Upstream Salt Marsh Migration Potential (acres):	11.41	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	Yes
Emergency Access or Evacuation Route:	Yes
History of Flooding:	flooding has occurred with 2+ inches of rain

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 116

Observer(s) & Organization:	JB TS CP (NHDES Coastal)
Municipality:	STRATHAM
Stream Name:	Mill Brook
Road Name:	No Name

Date:	8/27/2018	
Start Time:	9:13:00 AM	
End Time:	10:45:00 AM	
Tide Prediction	**High**	**Low**
Time:	2:58 PM	9:09 AM
Elevation:	6.8	0.2
Tide Chart Location:	Squamscott River	

Crossing Condition Evaluation	Score*
Crossing Condition	1
Tidal Restriction Evaluation	
Tidal Range Ratio	2
Crossing Ratio	3
Erosion Classification	2
Tidal Restriction Overall Score	2
Tidal Aquatic Organism Passage	
Tidal Range Ratio	2
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	1
Salt Marsh Migration Potential (Wshed.)	1
Vegetation Evaluation	
Vegetation Comparison Matrix	0
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	2,2
Inun. Risk to the Crossing Structure (US, DS)	1,2
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	5
Overall Scores	
Infrastructure	1
Ecological	4
Combined	2

DS view toward structure

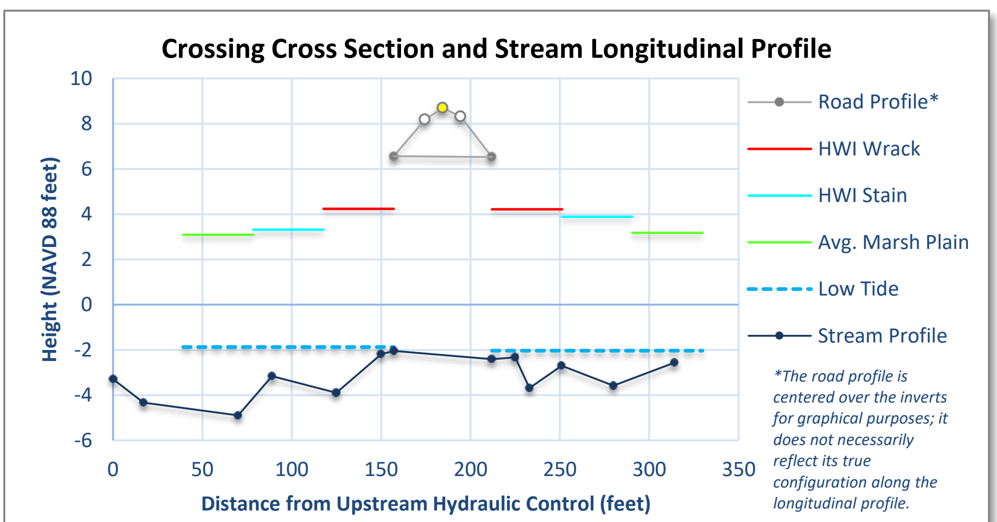
US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority

**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk



Long. Profile

Dist.	Hght.	Feat.	Sub.
0	-3.2958	HC	C/S
17	-4.3358	P	C/S
70	-4.8958	CB	C/S
89	-3.1558	HC	C/S
125	-3.8958	P	C/S
150	-2.1858	GC	B
157	-2.0458	I	B
212	-2.4158	I	B
225	-2.3358	GC	B
233	-3.6858	P	G
251	-2.6958	HC	G
280	-3.5758	P	G
314	-2.5658	HC	G

Crossing Context:

The tidal crossing at Mill Creek is on the drive to Stuart Farm. In 1993 a tide gate was removed and replaced by a large arched culvert. This was one of the first tidal restorations in the State. See link below for more information:

https://www.nrcs.usda.gov/wps/portal/nrcs/detail/nh/technical/?cid=nrcs144p2_015690#Stuart%20Farm

The upstream side had subsided by 1 foot and the vegetation included purple loosestrife and common reed (exotic variety). Purple loosestrife was almost all eliminated, but some common reed remains, and the elevation of the marsh was found to build rapidly (0.12 feet per year in the 1990s). Today the elevation difference of the marsh is only 0.08 feet lower upstream than downstream. The metal pipe corroded and had to be replaced by a 9.5-foot round culvert in 2010. The crossing has an overall combined score of 2, indicating low priority for replacement. See the link below for more information on habitat change after tidal restoration:

https://scholars.unh.edu/jel/21/

Structure Characteristics:

Structure Type:	Round Culvert	**Date of Last Known Replacement:**	N/A
Structure Material:	Plastic - Corrugated		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	9.5	9.5
Dimension B[CB] (height):	9.6	9
Crossing Length (Invert to Invert):	55	

Crossing Condition:	Headwall Material	Headwall Condition	Wingwall Material	Wingwall Condition	Scour at Structure	Scour Severity
Upstream	Rip Rap	Good	None	N/A	Armoring	Low
Downstream	Rip Rap	Good	None	N/A	Armoring	Medium

Scour in Structure	Scour Severity in Structure	Road Surface Condition	Utilities at Crossing	Structure Condition Overall
None	None	Good	None	Good

Structure Condition Comments:	N/A

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	High Salt Marsh	High Salt Marsh
Upstream Salt Marsh Migration Potential (acres):	0.35	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	No
Emergency Access or Evacuation Route:	N/A
History of Flooding:	Prior to replacement

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 117

Observer(s) & Organization:	JB TS KL (NHDES Coastal)
Municipality:	NEWFIELDS
Stream Name:	Parting Brook
Road Name:	N/A

Date:	8/30/2018	
Start Time:	11:00:00 AM	
End Time:	12:00:00 PM	
Tide Prediction	**High**	**Low**
Time:	4:41 PM	10:50 AM
Elevation:	7.1	0.2
Tide Chart Location:	Squamscott River	

Crossing Condition Evaluation	Score*
Crossing Condition	4
Tidal Restriction Evaluation	
Tidal Range Ratio	2
Crossing Ratio	4
Erosion Classification	4
Tidal Restriction Overall Score	3
Tidal Aquatic Organism Passage	
Tidal Range Ratio	2
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	3
Salt Marsh Migration Potential (Wshed.)	3
Vegetation Evaluation	
Vegetation Comparison Matrix	3
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	2,2
Inun. Risk to the Crossing Structure (US, DS)	3,3
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	5
Overall Scores	
Infrastructure	4
Ecological	3
Combined	3

DS view toward structure

US view above structure

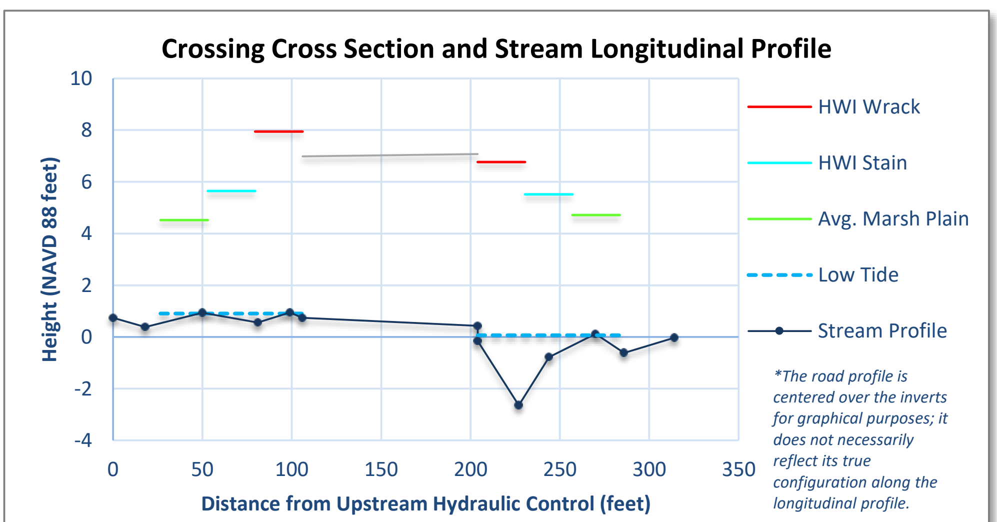
US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority
**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk

Long. Profile

Dist.	Hght.	Feat.	Sub.
0	0.7453	HC	S
18	0.3853	P	S
50	0.9353	HC	S
81	0.5553	P	C/S
99	0.9453	HC	C
106	0.7353	I	C
204	0.4353	I	B
204	-0.1547	CB	B
227	-2.6447	P	S
244	-0.7747	CB	C/S
270	0.1153	HC	S
286	-0.6147	P	C/S
314	-0.0347	HC	S



Crossing Context:

N/A

Structure Characteristics:

Structure Type:	Box Culvert	**Date of Last Known Replacement:**	N/A
Structure Material:	Stone		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	4	3.8
Dimension B[CB](height):	6.22	6.2
Crossing Length (Invert to Invert):	98	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	Dry Fit Stone	Fair	Dry Fit Stone	Fair	None	None
Downstream	Dry Fit Stone	Fair	Dry Fit Stone	Poor	Headwall	High

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
Culvert	Low	N/A	None	Fair

Structure Condition Comments:	US side is solid. Some spawling but good shape. Massive scour behind DS headwall. Water flowing under wood in structure.

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	High Salt Marsh	High Salt Marsh
Upstream Salt Marsh Migration Potential (acres):	2.47	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	Yes
Emergency Access or Evacuation Route:	N/A
History of Flooding:	unknown

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 118

Observer(s) & Organization:	JB TS kl (NHDES Coastal)
Municipality:	EXETER
Stream Name:	N/A
Road Name:	N/A

Date:	8/29/2018	
Start Time:	8:30:00 AM	
End Time:	9:44:00 AM	
Tide Prediction	**High**	**Low**
Time:	4:05 PM	10:15 AM
Elevation:	7.0	0.2
Tide Chart Location:	Squamscott River	

Crossing Condition Evaluation	Score*
Crossing Condition	2
Tidal Restriction Evaluation	
Tidal Range Ratio	2
Crossing Ratio	4
Erosion Classification	3
Tidal Restriction Overall Score	3
Tidal Aquatic Organism Passage	
Tidal Range Ratio	2
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	1
Salt Marsh Migration Potential (Wshed.)	1
Vegetation Evaluation	
Vegetation Comparison Matrix	5
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	1,1
Inun. Risk to the Crossing Structure (US, DS)	4,3
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	5
Overall Scores	
Infrastructure	2
Ecological	4
Combined	2

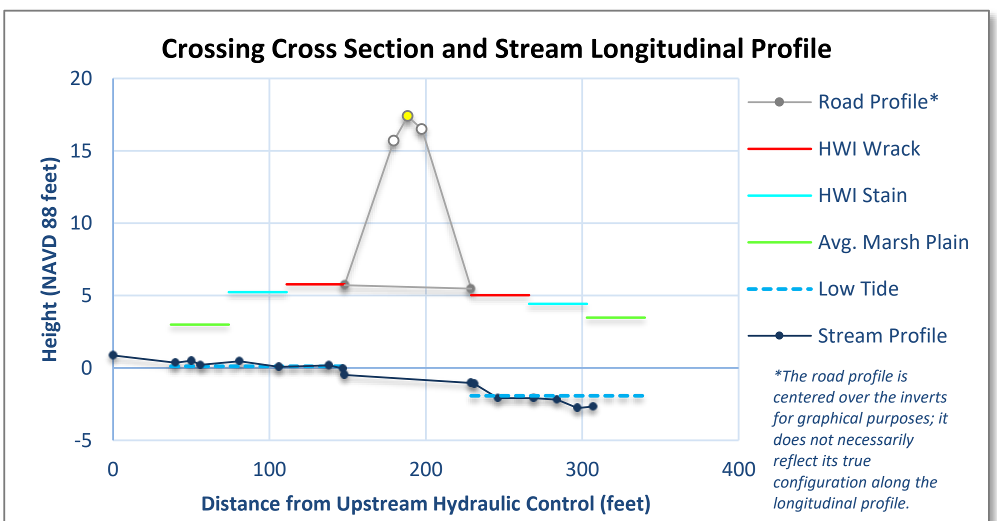
* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority
**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk

DS view toward structure

US view above structure

US view toward structure

DS view above structure

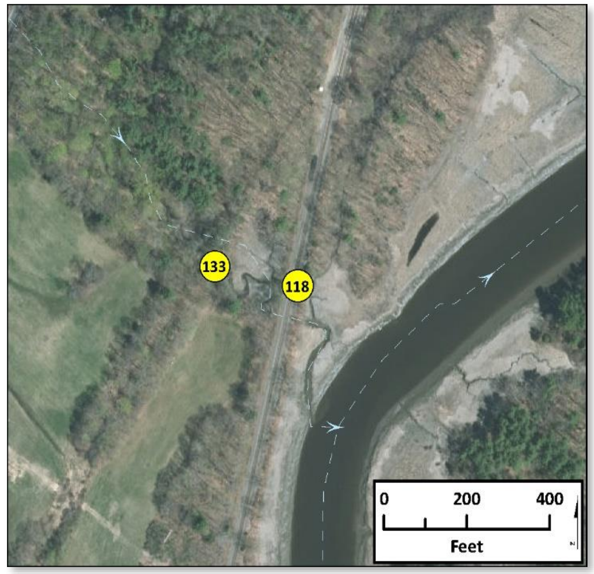


Long. Profile

Dist.	Hght.	Feat.	Sub.
0	0.8685	HC	C
40	0.3585	P	C/S
50	0.5085	HC	G
56	0.2185	P	C/S
81	0.4685	HC	G
106	0.0785	CB	C/S
138	0.1685	HC	C
147	-0.0215	HC	C/S
148	-0.4815	I	C
229	-1.0415	I	B
231	-1.1015	GC	B
246	-2.0915	CB	S
269	-2.0915	HC	G
284	-2.1815	HC	G
297	-2.7715	P	G
307	-2.6515	HC	C/S

Crossing Context:

N/A



Structure Characteristics:

Structure Type:	Box Culvert	**Date of Last Known Replacement:**	N/A
Structure Material:	Stone		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	3.7	4
Dimension B[CB] (height):	6.3	6.5
Crossing Length (Invert to Invert):	81	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	Dry Fit Stone	Fair	Dry Fit Stone	Fair	Wingwalls	Medium
Downstream	Dry Fit Stone	Fair	Dry Fit Stone	Fair	Wingwalls	Medium

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
Culvert	Medium	N/A	Tracks	Fair

Structure Condition Comments:	N/A

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	Brackish Riverbank Marsh	High Salt Marsh
Upstream Salt Marsh Migration Potential (acres):	0.17	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	No
Emergency Access or Evacuation Route:	N/A
History of Flooding:	Unknown

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 119

Observer(s) & Organization:	TS (NHDES Coastal)
Municipality:	EXETER
Stream Name:	N/A
Road Name:	N/A

Date:	8/30/2018	
Start Time:	9:00:00 AM	
End Time:	10:11:00 AM	
Tide Prediction	**High**	**Low**
Time:	4:41 PM	10:50 AM
Elevation:	7.1	0.2
Tide Chart Location:	Squamscott River	

Crossing Condition Evaluation	Score*
Crossing Condition	5
Tidal Restriction Evaluation	
Tidal Range Ratio	3
Crossing Ratio	4
Erosion Classification	3
Tidal Restriction Overall Score	3
Tidal Aquatic Organism Passage	
Tidal Range Ratio	3
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	1
Salt Marsh Migration Potential (Wshed.)	1
Vegetation Evaluation	
Vegetation Comparison Matrix	0
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	1,1
Inun. Risk to the Crossing Structure (US, DS)	5,5
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	5
Overall Scores	
Infrastructure	5
Ecological	4
Combined	4

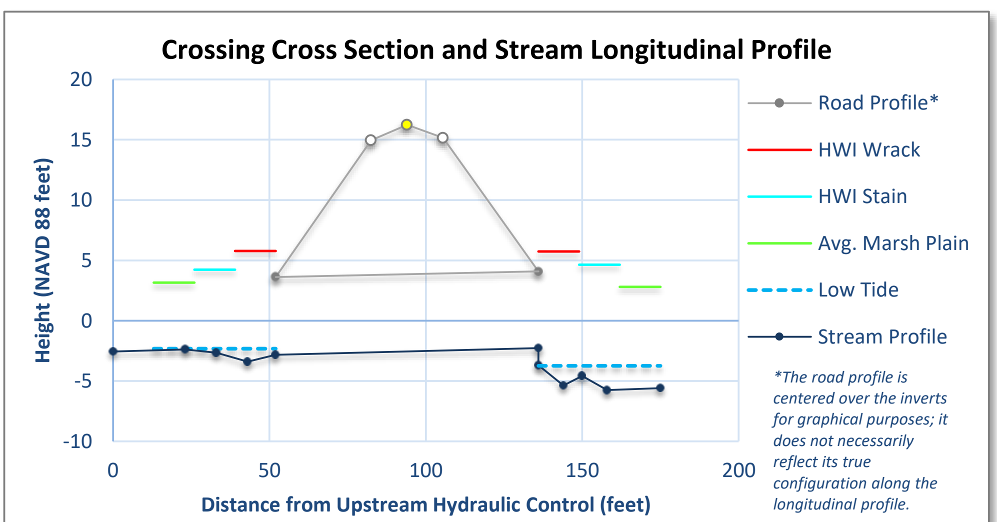
DS view toward structure

US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority
**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk

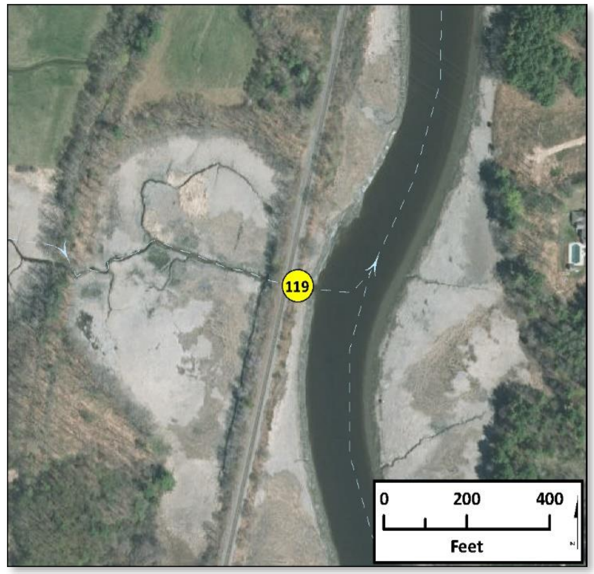


Long. Profile

Dist.	Hght.	Feat.	Sub.
0	-2.5598	HC	C/S
23	-2.3798	HC	C/S
33	-2.6498	CB	S
43	-3.3998	P	C/S
52	-2.8298	I	C
136	-2.2698	I	G
136	-3.6798	CB	G
144	-5.3598	P	G
150	-4.5698	HC	B
158	-5.7498	P	G
175	-5.5898	CB	G

Crossing Context:

The railroad bed traveling north and south on the west side of Great Bay has several crossings of tidal marsh and creeks (117, 118, 119, 121). The granite culvert for this crossing is about 7 feet high by 4 feet wide and conducts water of an unnamed tidal creek to about 10 acres of tidal marsh. The crossing condition is poor, it constricts the channel width, restricts the tidal range and has a perch at low tide. The culvert fills during high tide on a regular basis. The overall combined score is 4, high priority for replacement.



Structure Characteristics:

Structure Type:	Box Culvert	**Date of Last Known Replacement:**	N/A
Structure Material:	Stone		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	3.6	4
Dimension B[CB](height):	6.75	6.85
Crossing Length (Invert to Invert):	84	

Crossing Condition:	Headwall Material	Headwall Condition	Wingwall Material	Wingwall Condition	Scour at Structure	Scour Severity
Upstream	Dry Fit Stone	Poor	Dry Fit Stone	Poor	Wingwalls	Medium
Downstream	Dry Fit Stone	Fair	Dry Fit Stone	Fair	Headwall	Medium

Scour in Structure	Scour Severity in Structure	Road Surface Condition	Utilities at Crossing	Structure Condition Overall
Culvert	Low	N/A	None	Poor

Structure Condition Comments:	Water runs under wood bottom

Ecological Assessment:

	Upstream	Downstream
Natural Community Classification:	High Salt Marsh	High Salt Marsh
Upstream Salt Marsh Migration Potential (acres):	0.08	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	No
Emergency Access or Evacuation Route:	N/A
History of Flooding:	Unknown

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 120

Observer(s) & Organization:	JB TS (NHDES Coastal)
Municipality:	EXETER
Stream Name:	Rocky Hill Brook
Road Name:	Newfields Rd

Date:	6/15/2018	
Start Time:	8:30:00 AM	
End Time:	10:22:00 AM	
Tide Prediction	**High**	**Low**
Time:	3:22 PM	9:28 AM
Elevation:	7.6	-1.2
Tide Chart Location:	Squamscott River	

Crossing Condition Evaluation	Score*
Crossing Condition	5
Tidal Restriction Evaluation	
Tidal Range Ratio	3
Crossing Ratio	3
Erosion Classification	5
Tidal Restriction Overall Score	4
Tidal Aquatic Organism Passage	
Tidal Range Ratio	3
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	1
Salt Marsh Migration Potential (Wshed.)	1
Vegetation Evaluation	
Vegetation Comparison Matrix	1
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	1,1
Inun. Risk to the Crossing Structure (US, DS)	2,2
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	5
Overall Scores	
Infrastructure	5
Ecological	3
Combined	4

DS view toward structure

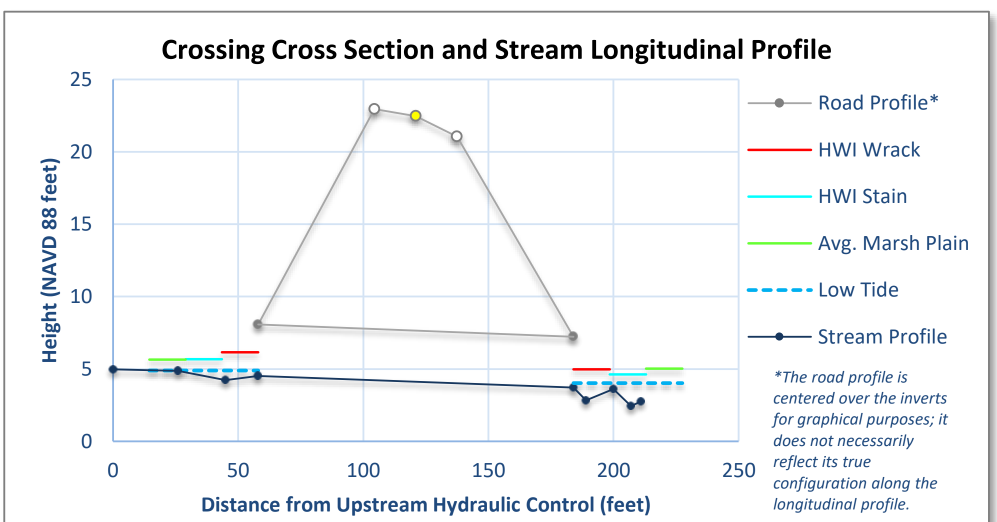
US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority

**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk

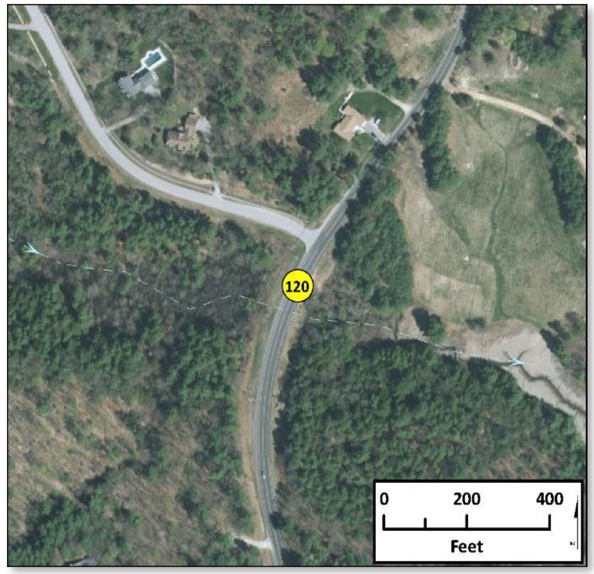


Long. Profile

Dist.	Hght.	Feat.	Sub.
0	4.9738	HC	C/S
26	4.8738	HC	S
45	4.2338	P	C/S
58	4.5138	I	S
184	3.7238	I	C
189	2.8238	P	C
200	3.6238	HC	C
207	2.4438	P	C
211	2.7438	HC	C

Crossing Context:

Newfield's Road crosses Rocky Hill Brook well above the railroad bed and the Brook runs through a 3.5-foot round metal pipe (although the upstream pipe exiting the road bed is partially crushed). The crossing condition is poor, with strong evidence of erosion and the culvert constricts the channel flow. The overall combined score is 4 for this culvert, indicating a high priority for replacement.



Structure Characteristics:

Structure Type:	Round Culvert	**Date of Last Known Replacement:**	N/A
Structure Material:	Steel - Corrugated		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	2.5	3.5
Dimension B[CB](height):	3.2	3.5
Crossing Length (Invert to Invert):	126	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	Masonry	Poor	Masonry	Poor	Culvert	High
Downstream	Masonry	Good	Rip Rap	Poor	Culvert	High

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
Culvert	High	Good	OHE	Poor

Structure Condition Comments:	US grate fallen

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	Freshwater Stream	Freshwater Stream
Upstream Salt Marsh Migration Potential (acres):	0.00	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	No
Emergency Access or Evacuation Route:	Yes
History of Flooding:	None documented

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 121

Observer(s) & Organization:	JB KL (NHDES Coastal)
Municipality:	EXETER
Stream Name:	Rocky Hill Brook
Road Name:	N/A

Date:	6/14/2018	
Start Time:	8:30:00 AM	
End Time:	11:00:00 AM	
Tide Prediction	**High**	**Low**
Time:	2:29 PM	8:36 AM
Elevation:	7.5	-1.0
Tide Chart Location:	Squamscott River	

Crossing Condition Evaluation	Score*
Crossing Condition	5
Tidal Restriction Evaluation	
Tidal Range Ratio	1
Crossing Ratio	4
Erosion Classification	5
Tidal Restriction Overall Score	3
Tidal Aquatic Organism Passage	
Tidal Range Ratio	1
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	1
Salt Marsh Migration Potential (Wshed.)	1
Vegetation Evaluation	
Vegetation Comparison Matrix	0
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	1,1
Inun. Risk to the Crossing Structure (US, DS)	5,5
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	5
Overall Scores	
Infrastructure	5
Ecological	4
Combined	4

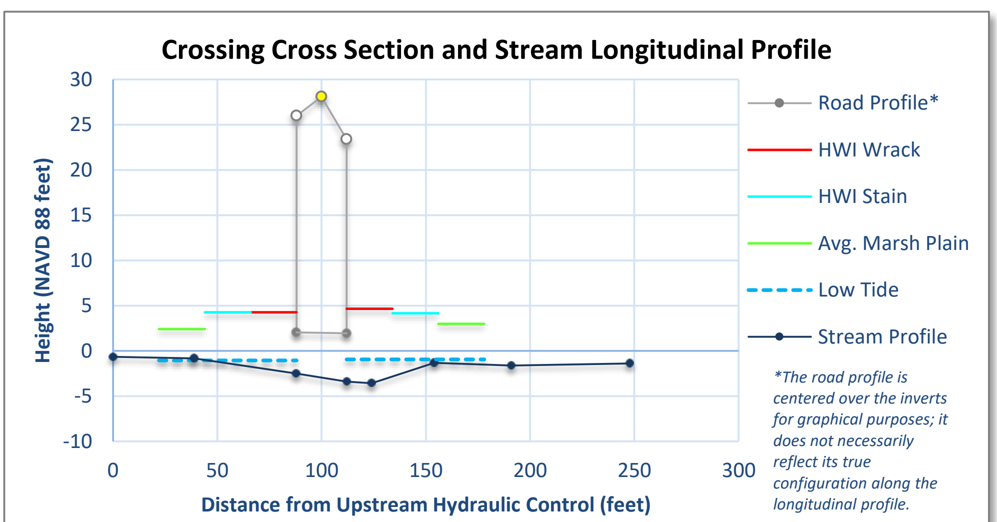
DS view toward structure

US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority
**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk

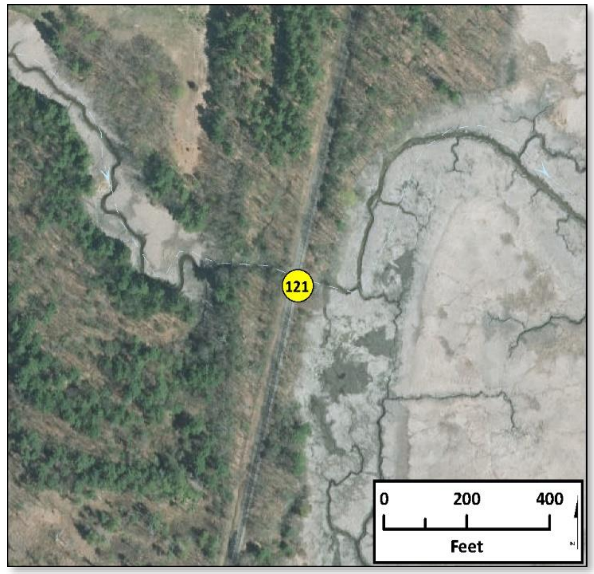


Long. Profile

Dist.	Hght.	Feat.	Sub.
0	-0.656	HC	S
39	-0.846	HC	S
88	-2.516	I	S
112	-3.406	I	C/S
124	-3.576	P	C/S
154	-1.316	HC	S
191	-1.606	P	S
248	-1.376	HC	S

Crossing Context:

The railroad bed traveling north and south on the west side of Great Bay has several crossings of tidal marsh and creeks (117, 118, 119, 121). Rocky hill brook is tidal marsh where it crosses under the railroad through a 4-foot-wide and 5.5-foot-tall stone bridge. The crossing condition is poor showing channel constriction and severe erosion, with high tides overfilling the structure on a daily basis. The upstream marsh is more than 0.5 feet lower than the downstream marsh plain, indicating restriction has led to subsidence. The overall combined score is 4, high priority for replacement.



Structure Characteristics:

Structure Type:	Bridge with Abutments	**Date of Last Known Replacement:**	N/A
Structure Material:	Stone		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	4	3.9
Dimension B[CB](height):	5.7	5.5
Crossing Length (Invert to Invert):	24	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	Dry Fit Stone	Poor	None	N/A	Headwall	High
Downstream	Dry Fit Stone	Fair	None	N/A	Headwall	High

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
None	None	N/A	Tracks	Poor

Structure Condition Comments:	Scour from lack of wingwalls

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	Brackish Marsh	Brackish Riverbank Marsh
Upstream Salt Marsh Migration Potential (acres):	0.00	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	No
Emergency Access or Evacuation Route:	N/A
History of Flooding:	Unknown

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 123

Observer(s) & Organization:	JB TS (NHDES Coastal)	**Date:**	6/13/2018	
Municipality:	EXETER	**Start Time:**	7:45:00 AM	
Stream Name:	Wheelwright Creek	**End Time:**	9:27:00 AM	
Road Name:	Portsmouth Ave	**Tide Prediction**	**High**	**Low**
		Time:	1:36 PM	7:45 AM
		Elevation:	7.4	-0.7
		Tide Chart Location:	Squamscott River	

Crossing Condition Evaluation	Score*
Crossing Condition	1
Tidal Restriction Evaluation	
Tidal Range Ratio	3
Crossing Ratio	2
Erosion Classification	3
Tidal Restriction Overall Score	3
Tidal Aquatic Organism Passage	
Tidal Range Ratio	3
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	1
Salt Marsh Migration Potential (Wshed.)	1
Vegetation Evaluation	
Vegetation Comparison Matrix	0
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	1,1
Inun. Risk to the Crossing Structure (US, DS)	1,1
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	5
Overall Scores	
Infrastructure	1
Ecological	4
Combined	3

DS view toward structure

US view above structure

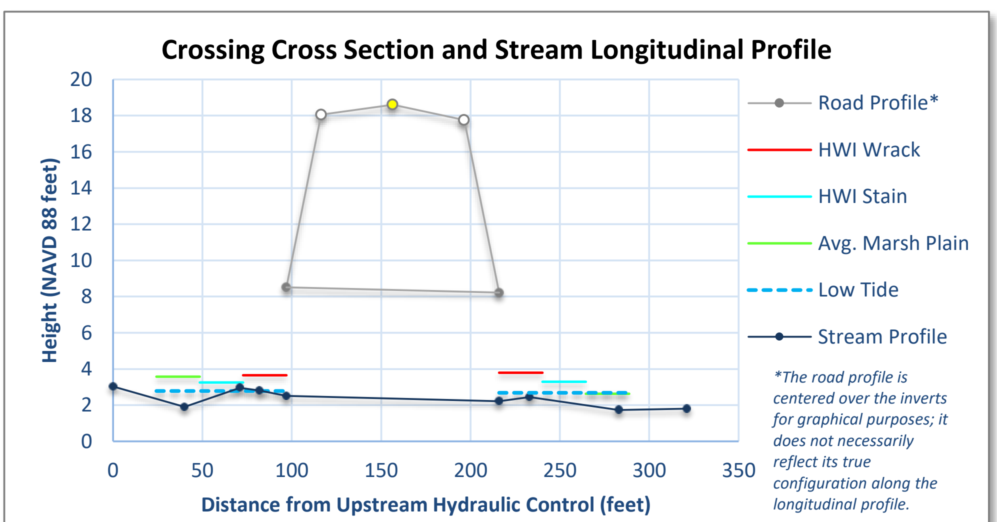
US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority
**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk

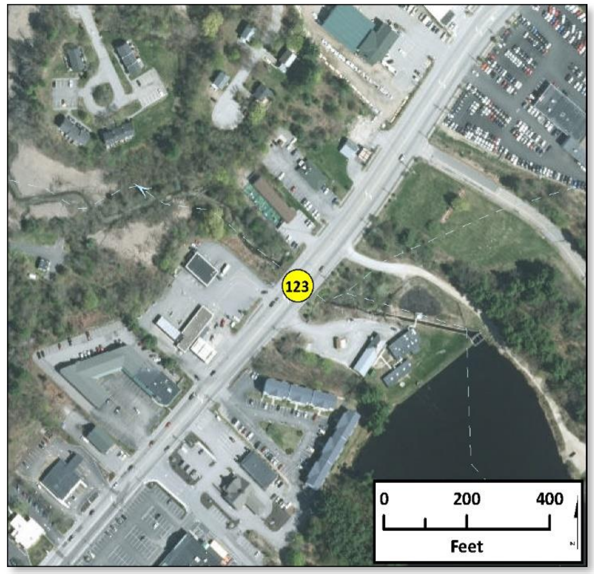
Long. Profile

Dist.	Hght.	Feat.	Sub.
0	3.0324	HC	B
40	1.9024	P	C
71	2.9524	HC	C
82	2.8124	GC	C
97	2.5124	I	C
216	2.2224	I	C
233	2.4524	HC	C
283	1.7324	HC	C
321	1.8024	HC	C



Crossing Context:

N/A



Structure Characteristics:

Structure Type:	Box Culvert	**Date of Last Known Replacement:**	N/A
Structure Material:	Concrete		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	16	16
Dimension B[CB](height):	6	6
Crossing Length (Invert to Invert):	119	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	Concrete	Good	Concrete	Good	None	None
Downstream	Concrete	Good	Concrete	Good	None	None

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
None	None	Good	OHE	Good

Structure Condition Comments:	N/A

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	Freshwater Stream	Brackish Riverbank Marsh
Upstream Salt Marsh Migration Potential (acres):	0.00	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	Yes
Emergency Access or Evacuation Route:	Yes
History of Flooding:	Chronic reoccurring flooding.

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 124

Observer(s) & Organization:	TS, JB (NHDES Coastal)
Municipality:	EXETER
Stream Name:	Norris Brook
Road Name:	Swazey Pkwy

Date:	6/29/2018	
Start Time:	9:30:00 AM	
End Time:	10:30:00 AM	
Tide Prediction	**High**	**Low**
Time:	3:21 PM	9:31 AM
Elevation:	6.6	0.1
Tide Chart Location:	Squamscott River	

Crossing Condition Evaluation	Score*
Crossing Condition	1
Tidal Restriction Evaluation	
Tidal Range Ratio	1
Crossing Ratio	4
Erosion Classification	3
Tidal Restriction Overall Score	3
Tidal Aquatic Organism Passage	
Tidal Range Ratio	1
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	2
Salt Marsh Migration Potential (Wshed.)	2
Vegetation Evaluation	
Vegetation Comparison Matrix	5
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	3,3
Inun. Risk to the Crossing Structure (US, DS)	5,5
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	5
Overall Scores	
Infrastructure	3
Ecological	4
Combined	3

DS view toward structure

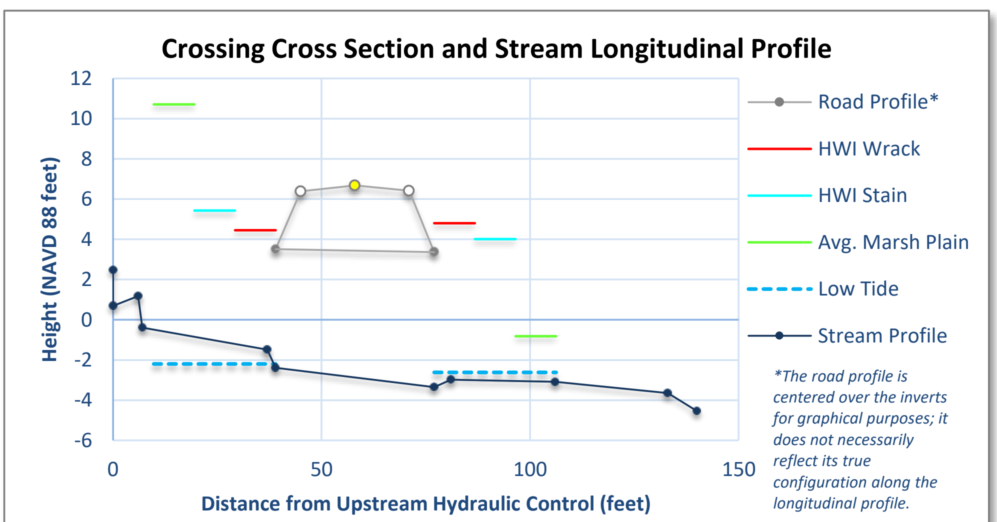
US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority

**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk

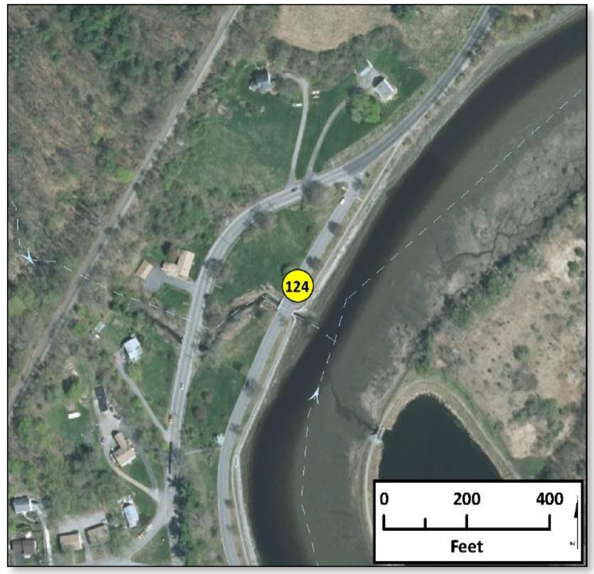


Long. Profile

Dist.	Hght.	Feat.	Sub.
0	2.4798	HC	N/A
0	0.6898	CB	B
6	1.1798	HC	B
7	-0.3902	HC	B
37	-1.4902	GC	B
39	-2.3902	I	B
77	-3.3502	I	C
81	-2.9902	GC	B
106	-3.0902	HC	C
133	-3.6502	HC	C
140	-4.5402	CB	C

Crossing Context:

N/A



Structure Characteristics:

Structure Type:	Box Culvert	**Date of Last Known Replacement:**	N/A
Structure Material:	Concrete		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	5.57	5.5
Dimension B^{CB}(height):	5.85	6.26
Crossing Length (Invert to Invert):	38	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	Masonry	Good	Masonry	Good	Wingwalls	Low
Downstream	Masonry	Good	Masonry	Good	Wingwalls	Low

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
None	None	Good	Water pipe for watering, electric wire running us	Good

Structure Condition Comments:	N/A

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	Brackish Riverbank Marsh	Sparsely Vegetated Intertidal Habitat
Upstream Salt Marsh Migration Potential (acres):	1.95	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	Yes
Emergency Access or Evacuation Route:	N/A
History of Flooding:	Chronic flooding. Susceptible to storm surge.

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 125

Observer(s) & Organization:	JB, TS (NHDES Coastal)
Municipality:	Rye
Stream Name:	N/A
Road Name:	N/A

Date:	8/1/2018	
Start Time:	8:55:00 AM	
End Time:	9:45:00 AM	
Tide Prediction	**High**	**Low**
Time:	3:20 PM	9:00 AM
Elevation:	7.7	0.3
Tide Chart Location:	Portsmouth Harbor	

Crossing Condition Evaluation	Score*
Crossing Condition	4
Tidal Restriction Evaluation	
Tidal Range Ratio	1
Crossing Ratio	4
Erosion Classification	3
Tidal Restriction Overall Score	3
Tidal Aquatic Organism Passage	
Tidal Range Ratio	1
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	4
Salt Marsh Migration Potential (Wshed.)	4
Vegetation Evaluation	
Vegetation Comparison Matrix	1
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	3,4
Inun. Risk to the Crossing Structure (US, DS)	5,5
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	5
Overall Scores	
Infrastructure	4
Ecological	1
Combined	4

DS view toward structure

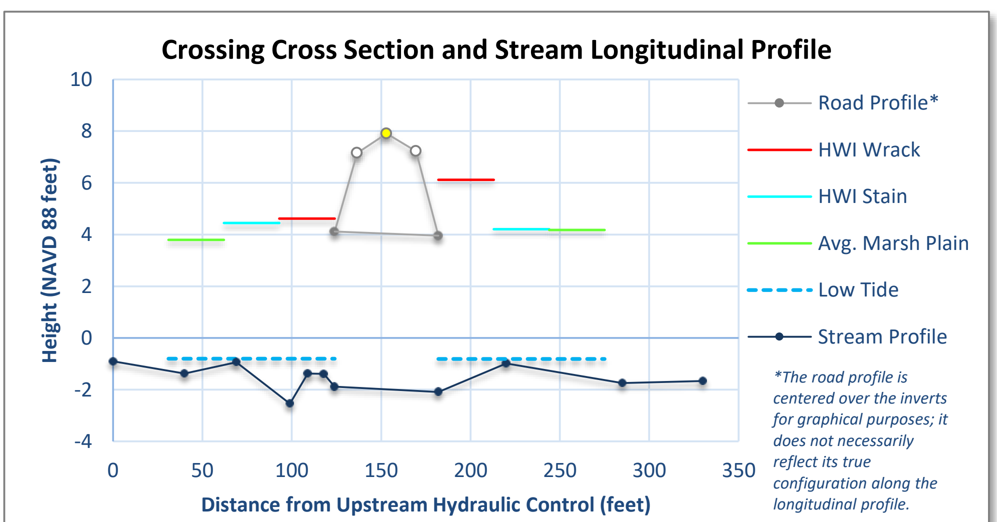
US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority

**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk



Long. Profile

Dist.	Hght.	Feat.	Sub.
0	-0.9032	HC	G
40	-1.3832	P	G
69	-0.9432	HC	G
99	-2.5432	P	G
109	-1.3732	CB	G
118	-1.3932	GC	C
124	-1.8832	I	C
182	-2.0932	I	B
220	-0.9832	HC	G
285	-1.7432	HC	G
330	-1.6632	HC	G

Crossing Context:

Route 1A crosses an extensive back-barrier salt marsh at Rye Harbor several times and this crossing provides tidal flow to a fragmented marsh that also receives flow through a crossing to the south (#46). Tidal waters are conducted through a 6 by 6-foot concrete culvert installed circa 1997 to restore tidal exchange and halt the spread of exotic *Phragmites* (common reed). The crossing condition is fair, the channel is constricted, and the high tide stain indicates that the culvert overfills regularly. The overall combined score is 4, high priority for replacement.

Structure Characteristics:

Structure Type:	Box Culvert	**Date of Last Known Replacement:**	1998
Structure Material:	Concrete		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	6	6
Dimension B[CB] (height):	6	6
Crossing Length (Invert to Invert):	58	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	Concrete	Good	Rip Rap	Fair	None	None
Downstream	Concrete	Good	Rip Rap	Poor	Wingwalls	High

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
Culvert	Low	Fair	Overhead electric	Fair

Structure Condition Comments:	N/A

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	High Salt Marsh	High Salt Marsh
Upstream Salt Marsh Migration Potential (acres):	8.94	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	Yes
Emergency Access or Evacuation Route:	Yes
History of Flooding:	Prone during high tide events, flooding along 1A

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 126

Observer(s) & Organization:	TS, JB, PS, KL (NHDES Coastal)
Municipality:	North Hampton
Stream Name:	Chapel Brook
Road Name:	N/A

Date:	7/20/2018	
Start Time:	1:49:00 PM	
End Time:	2:30:00 PM	
Tide Prediction	**High**	**Low**
Time:	6:38 PM	12:34 PM
Elevation:	8.9	0.3
Tide Chart Location:	Hampton Harbor	

Crossing Condition Evaluation	Score*
Crossing Condition	2
Tidal Restriction Evaluation	
Tidal Range Ratio	5
Crossing Ratio	5
Erosion Classification	2
Tidal Restriction Overall Score	4
Tidal Aquatic Organism Passage	
Tidal Range Ratio	5
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	5
Salt Marsh Migration Potential (Wshed.)	5
Vegetation Evaluation	
Vegetation Comparison Matrix	1
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	3,4
Inun. Risk to the Crossing Structure (US, DS)	5,5
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	2
Overall Scores	
Infrastructure	4
Ecological	5
Combined	5

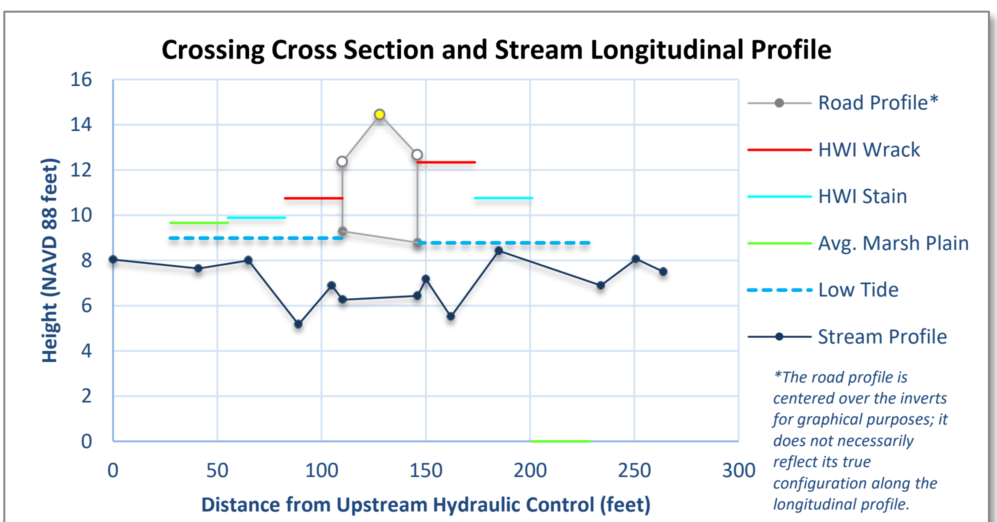
* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority
**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk

DS view toward structure

US view above structure

US view toward structure

DS view above structure



Long. Profile

Dist.	Hght.	Feat.	Sub.
0	8.0357	HC	C/S
41	7.6357	P	S
65	7.9957	HC	G
89	5.1657	P	C
105	6.8957	GC	B
110	6.2557	I	B
146	6.4257	I	B
150	7.1657	GC	B
162	5.5157	P	S
185	8.4257	HC	S
234	6.8857	P	G
251	8.0657	GC	C
264	7.4957	I	C

Crossing Context:

Tidal flow supporting the salt marsh at Philbrick's Pond has been restricted by the trolley berm of the early 1900s as well as Route 1A (crossing #39). A recent investigation into the hydrodynamic flows and how they may be restored to rejuvenate the degraded salt marsh showed that the small clay pipe (2.5 feet in diameter) under the trolley berm was intact, but restricted tides, while the culvert under Route 1A was less restrictive (CMA Engineers 2018). The overall combined score of 5 indicates highest priority for replacement, but it will require landowner permission.

Structure Characteristics:

Structure Type:	Round Culvert	**Date of Last Known Replacement:**	N/A
Structure Material:	Stone		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	2.5	2.5
Dimension B[CB](height):	2.5	2.5
Crossing Length (Invert to Invert):	36	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	Dry Fit Stone	Fair	None	N/A	Headwall	Medium
Downstream	Dry Fit Stone	Fair	None	N/A	Headwall	Medium

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
None	None	N/A	N/A	Fair

Structure Condition Comments:	Clay pipe, completely flooded

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	Low Salt Marsh	Low Salt Marsh
Upstream Salt Marsh Migration Potential (acres):	29.89	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	No
Emergency Access or Evacuation Route:	N/A
History of Flooding:	undersized culvert, flooded US marsh

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 127

Observer(s) & Organization:	TS, JB (NHDES Coastal)
Municipality:	New Castle
Stream Name:	N/A
Road Name:	N/A

Date:	8/23/2018	
Start Time:	3:45:00 PM	
End Time:	4:25:00 PM	
Tide Prediction	**High**	**Low**
Time:	10:39 PM	4:19 PM
Elevation:	8.1	1.2
Tide Chart Location:	Portsmouth Harbor	

Crossing Condition Evaluation	Score*
Crossing Condition	2
Tidal Restriction Evaluation	
Tidal Range Ratio	5
Crossing Ratio	3
Erosion Classification	4
Tidal Restriction Overall Score	4
Tidal Aquatic Organism Passage	
Tidal Range Ratio	5
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	1
Salt Marsh Migration Potential (Wshed.)	1
Vegetation Evaluation	
Vegetation Comparison Matrix	5
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	4,4
Inun. Risk to the Crossing Structure (US, DS)	5,5
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	4
Overall Scores	
Infrastructure	4
Ecological	5
Combined	5

DS view toward structure

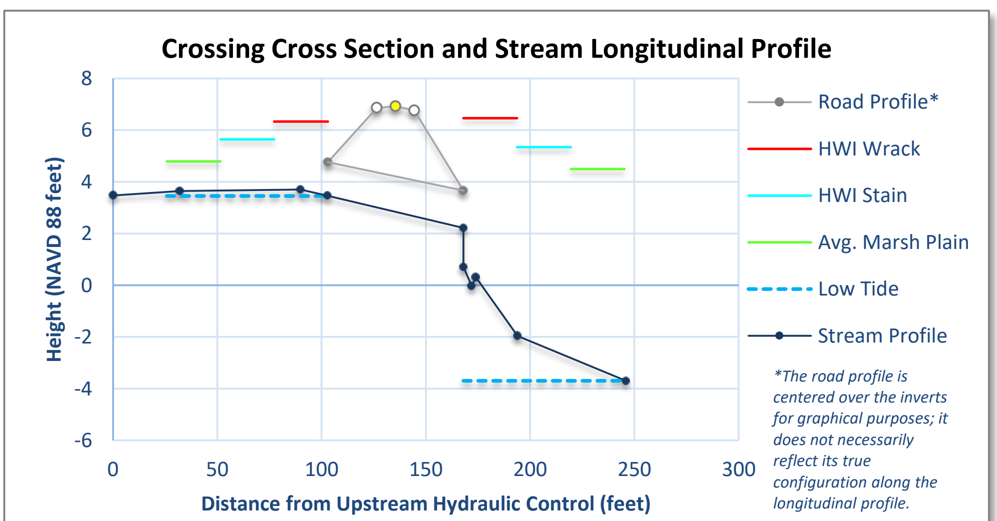
US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority

**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk



Long. Profile

Dist.	Hght.	Feat.	Sub.
0	3.4726	HC	C/S
32	3.6426	HC	C/S
90	3.7026	CB	C/S
103	3.4626	I	G
168	2.2126	I	C
168	0.7126	CB	C
172	-0.0274	P	G
174	0.3026	HC	G
194	-1.9574	CB	C
246	-3.6974	HC	S

Crossing Context:

A small head of tide marsh on New Castle Island is crossed by River Road and a new 1.25-foot round pipe was installed in 2011 to improve tidal flow to the marsh, which was being invaded by weedy species such as a non-native form of common reed (Phragmites). The site has a history of flooding and continues to show signs of restriction. The overall combined score is 5: highest priority for replacement.

Structure Characteristics:

Structure Type:	Round Culvert	**Date of Last Known Replacement:**	N/A
Structure Material:	Concrete		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	1.25	1.25
Dimension B[CB](height):	1.25	1.25
Crossing Length (Invert to Invert):	65	

Crossing Condition:	Headwall Material	Headwall Condition	Wingwall Material	Wingwall Condition	Scour at Structure	Scour Severity
Upstream	None	N/A	None	N/A	None	None
Downstream	None	N/A	None	N/A	None	None

Scour in Structure	Scour Severity in Structure	Road Surface Condition	Utilities at Crossing	Structure Condition Overall
None	None	Fair	Overhead electric	Fair

Structure Condition Comments:	Metal girdle elevating DS structure

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	High Salt Marsh	Sparsely Vegetated Intertidal Habitat
Upstream Salt Marsh Migration Potential (acres):	0.20	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	Yes
Emergency Access or Evacuation Route:	N/A
History of Flooding:	road flooding due to storm surge and heavy rain

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 128

Observer(s) & Organization:	TS, JB (NHDES Coastal)
Municipality:	Hampton Falls
Stream Name:	N/A
Road Name:	N/A

Date:	8/14/2018	
Start Time:	10:20:00 AM	
End Time:	11:20:00 AM	
Tide Prediction	**High**	**Low**
Time:	2:27 PM	8:28 AM
Elevation:	9.7	-1.3
Tide Chart Location:	Hampton Harbor	

Crossing Condition Evaluation	Score*
Crossing Condition	1
Tidal Restriction Evaluation	
Tidal Range Ratio	5
Crossing Ratio	5
Erosion Classification	3
Tidal Restriction Overall Score	4
Tidal Aquatic Organism Passage	
Tidal Range Ratio	5
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	5
Salt Marsh Migration Potential (Wshed.)	5
Vegetation Evaluation	
Vegetation Comparison Matrix	4
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	2,2
Inun. Risk to the Crossing Structure (US, DS)	3,1
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	5
Overall Scores	
Infrastructure	1
Ecological	5
Combined	5

DS view toward structure

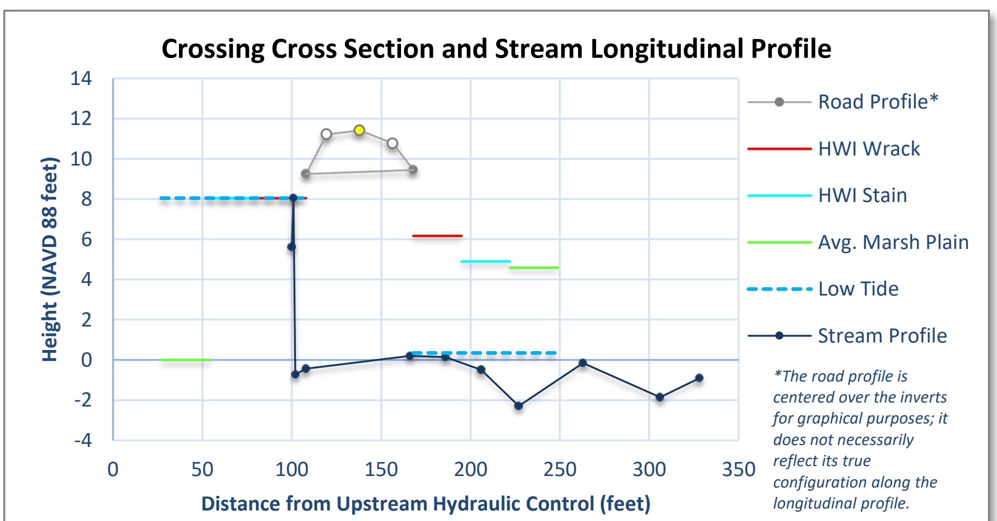
US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority

**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk

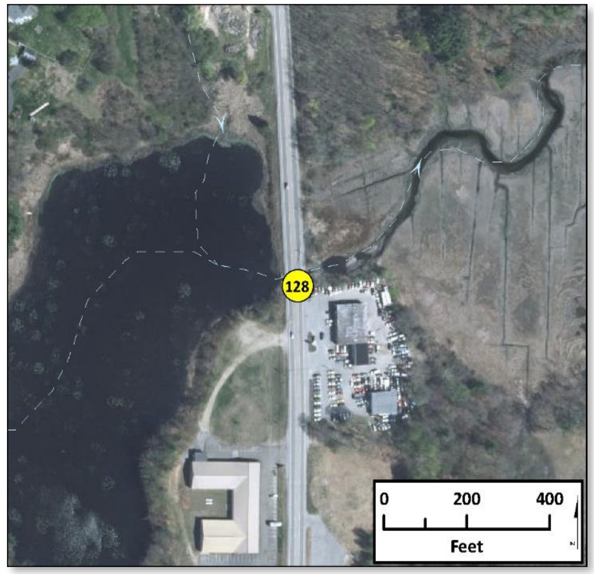


Long. Profile

Dist.	Hght.	Feat.	Sub.
100	5.5973	CB	C/S
101	8.0473	HC	N/A
102	-0.7327	CB	B
108	-0.4327	I	B
166	0.2073	I	B
186	0.1373	GC	B
206	-0.4927	CB	B
227	-2.2927	P	B
263	-0.1527	HC	S
306	-1.8527	P	B
328	-0.9127	HC	G

Crossing Context:

In Hampton Falls the head of tide for a narrow marsh 'finger' ends at the Dodge Ponds Dam just upstream of Route 1. The Route 1 cement culvert over the waterway is approximately 10 by 9 feet with wingwalls and fitted with slots for stoplogs (absent). The tide reaches about 5 feet above the culvert invert but is stopped by the dam, which impounds about 8 feet of water. The crossing condition is very good, but the dam restricts the tides completely, leading to an ecological score of 5 and an overall combined score of 5, highest priority for replacement.



Structure Characteristics:

Structure Type:	Bridge with Abutments	**Date of Last Known Replacement:**	N/A
Structure Material:	Concrete		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	10	10.91
Dimension B[CB](height):	9.8	8.96
Crossing Length (Invert to Invert):	60	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	None	N/A	None	N/A	None	None
Downstream	None	N/A	N/A	Poor	None	None

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
None	None	Good	Overhead electric	Good

Structure Condition Comments:	Dam directly upstream from inlet

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	Freshwater Marsh	High Salt Marsh
Upstream Salt Marsh Migration Potential (acres):	12.32	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	Yes
Emergency Access or Evacuation Route:	Yes
History of Flooding:	Past local flooding problems.

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 129

Observer(s) & Organization:	JB, TS (NHDES Coastal)	**Date:**	9/6/2018	
Municipality:	Seabrook	**Start Time:**	2:15:00 PM	
Stream Name:	N/A	**End Time:**	2:40:00 PM	
Road Name:	N/A	**Tide Prediction**	**High**	**Low**
		Time:	8:57 PM	2:56 PM
		Elevation:	9.6	0.4
		Tide Chart Location:	Hampton Harbor	

Crossing Condition Evaluation	Score*
Crossing Condition	2
Tidal Restriction Evaluation	
Tidal Range Ratio	3
Crossing Ratio	2
Erosion Classification	4
Tidal Restriction Overall Score	3
Tidal Aquatic Organism Passage	
Tidal Range Ratio	3
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	5
Salt Marsh Migration Potential (Wshed.)	5
Vegetation Evaluation	
Vegetation Comparison Matrix	1
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	2,2
Inun. Risk to the Crossing Structure (US, DS)	2,3
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	3
Overall Scores	
Infrastructure	2
Ecological	3
Combined	3

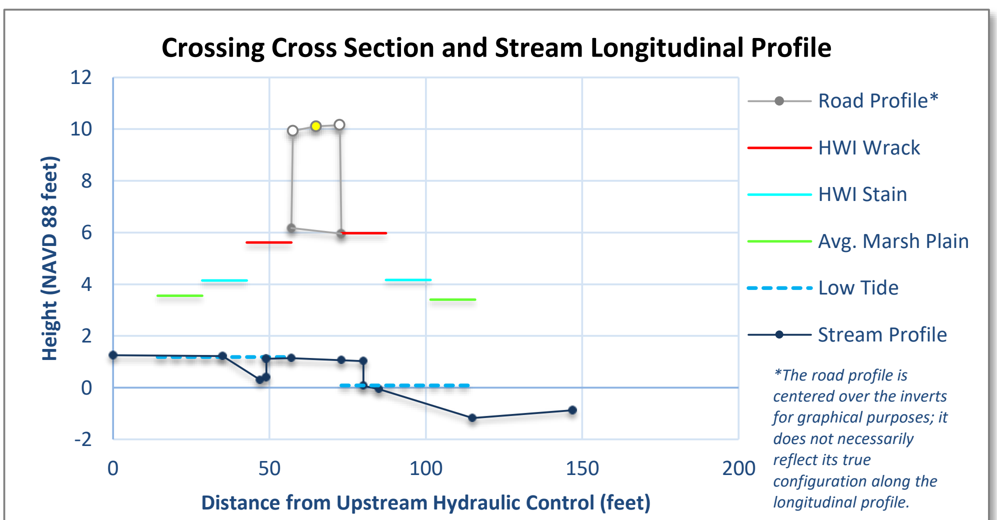
DS view toward structure

US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority
**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk

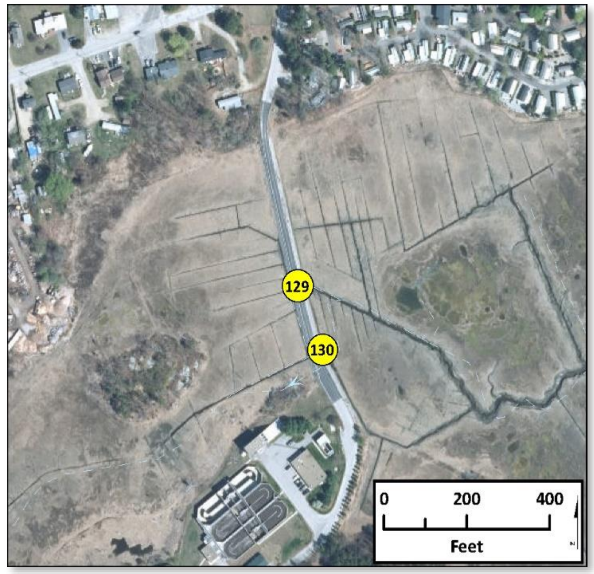


Long. Profile

Dist.	Hght.	Feat.	Sub.
0	1.255	HC	G
35	1.225	HC	C
47	0.305	P	G
49	0.395	CB	G
49	1.115	GC	G
57	1.145	I	C
73	1.055	I	C
80	1.025	GC	C
80	0.075	CB	G
85	-0.055	HC	G
115	-1.175	CB	C/S
147	-0.875	HC	S

Crossing Context:

N/A



Structure Characteristics:

Structure Type:	Box Culvert	**Date of Last Known Replacement:**	N/A
Structure Material:	Concrete		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	8	8
Dimension B[CB](height):	5	5
Crossing Length (Invert to Invert):	16	

Crossing Condition:	Headwall Material	Headwall Condition	Wingwall Material	Wingwall Condition	Scour at Structure	Scour Severity
Upstream	Concrete	Fair	Concrete	Fair	Culvert	Low
Downstream	Concrete	Fair	Concrete	Fair	Culvert	Low

Scour in Structure	Scour Severity in Structure	Road Surface Condition	Utilities at Crossing	Structure Condition Overall
Culvert	Low	Good	Wastewater treatment facility	Fair

Structure Condition Comments:	Wood support beams inside structure. Skirt causing perch downstream and lip US

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	High Salt Marsh	High Salt Marsh
Upstream Salt Marsh Migration Potential (acres):	27.34	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	No
Emergency Access or Evacuation Route:	N/A
History of Flooding:	Unknown

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 130

Observer(s) & Organization:	TS, JB (NHDES Coastal)
Municipality:	Seabrook
Stream Name:	N/A
Road Name:	N/A

Date:	9/6/2018	
Start Time:	2:52:00 PM	
End Time:	3:40:00 PM	
Tide Prediction	**High**	**Low**
Time:	8:57 PM	2:56 PM
Elevation:	9.6	0.4
Tide Chart Location:		

Crossing Condition Evaluation	Score*
Crossing Condition	2
Tidal Restriction Evaluation	
Tidal Range Ratio	2
Crossing Ratio	1
Erosion Classification	5
Tidal Restriction Overall Score	3
Tidal Aquatic Organism Passage	
Tidal Range Ratio	2
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	5
Salt Marsh Migration Potential (Wshed.)	5
Vegetation Evaluation	
Vegetation Comparison Matrix	1
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	2,2
Inun. Risk to the Crossing Structure (US, DS)	2,3
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	3
Overall Scores	
Infrastructure	2
Ecological	1
Combined	2

DS view toward structure

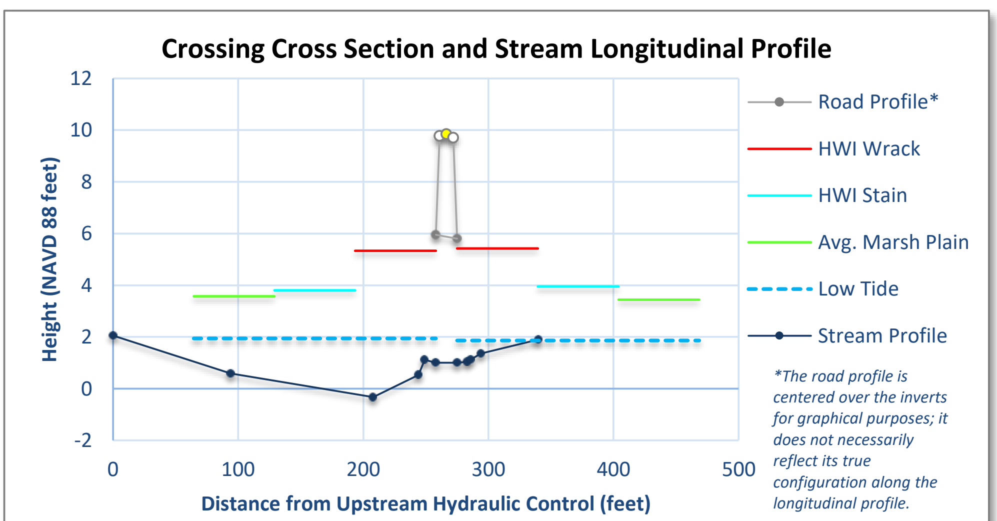
US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority

**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk

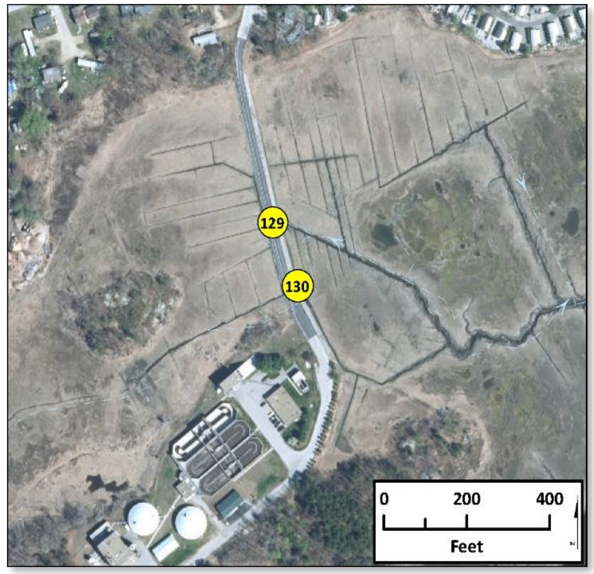


Long. Profile

Dist.	Hght.	Feat.	Sub.
0	2.0525	HC	B
94	0.5825	HC	B
208	-0.3275	P	C/S
244	0.5325	CB	C
249	1.1225	GC	C
258	1.0025	I	C
275	1.0025	I	G
283	1.0425	CB	C
286	1.1325	HC	C
294	1.3625	HC	G
340	1.9025	HC	C

Crossing Context:

N/A



Structure Characteristics:

Structure Type:	Box Culvert	**Date of Last Known Replacement:**	N/A
Structure Material:	Concrete		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	8	8
Dimension B[CB](height):	5	5
Crossing Length (Invert to Invert):	17	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	Concrete	Good	Concrete	Good	Wingwalls	Low
Downstream	Concrete	Fair	Concrete	Fair	Wingwalls	Low

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
Culvert	Low	Good	WWTF	Fair

Structure Condition Comments:	N/A

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	High Salt Marsh	High Salt Marsh
Upstream Salt Marsh Migration Potential (acres):	27.34	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	No
Emergency Access or Evacuation Route:	N/A
History of Flooding:	Unknown

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 131

Observer(s) & Organization:	JB TS (NHDES Coastal)
Municipality:	Hampton
Stream Name:	Kenney Brook
Road Name:	N/A

Date:	8/28/2018	
Start Time:	9:00:00 AM	
End Time:	10:00:00 AM	
Tide Prediction	**High**	**Low**
Time:	1:26 PM	7:33 AM
Elevation:	8.4	0.2
Tide Chart Location:	Hampton Harbor	

Crossing Condition Evaluation	Score*
Crossing Condition	2
Tidal Restriction Evaluation	
Tidal Range Ratio	5
Crossing Ratio	3
Erosion Classification	5
Tidal Restriction Overall Score	4
Tidal Aquatic Organism Passage	
Tidal Range Ratio	5
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	1
Salt Marsh Migration Potential (Wshed.)	1
Vegetation Evaluation	
Vegetation Comparison Matrix	3
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	3,3
Inun. Risk to the Crossing Structure (US, DS)	2,3
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	5
Overall Scores	
Infrastructure	2
Ecological	5
Combined	3

DS view toward structure

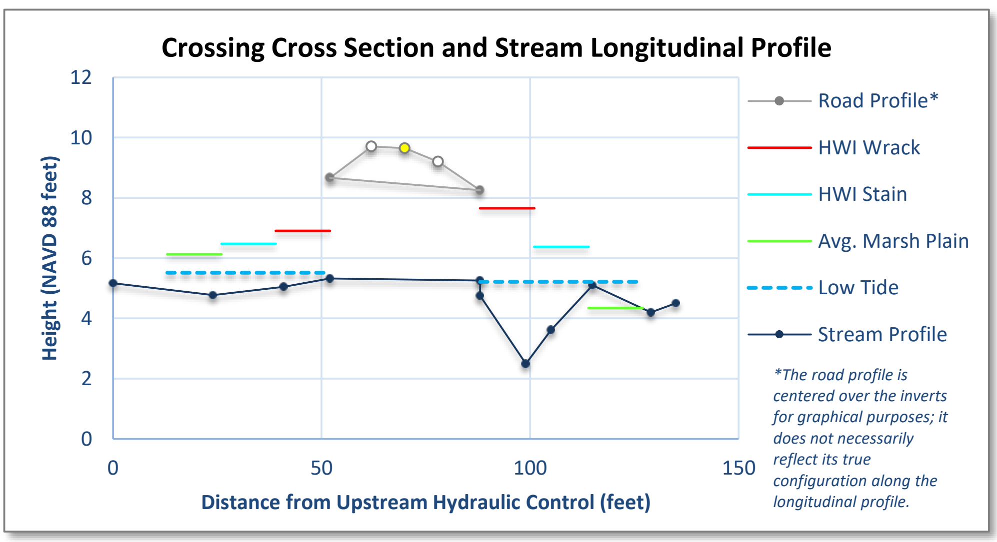
US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority

**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk



Long. Profile

Dist.	Hght.	Feat.	Sub.
0	5.1657	HC	C/S
24	4.7757	P	C/S
41	5.0457	HC	C/S
52	5.3257	I	C/S
88	5.2557	I	G
88	4.7557	CB	G
99	2.4957	P	C
105	3.6057	CB	G
115	5.0957	HC	C
129	4.2057	P	C/S
135	4.5057	HC	C

Crossing Context:

Marsh Lane crosses Kenney Brook in Hampton and conducts flow through a 3-foot round culvert. It is rated an overall combined score of 3, indicating a moderate priority for replacement due to high scour scores and relatively deep downstream pool. It sits at a high position in the landscape, but improvements may benefit fish passage, especially as sea levels rise.

Structure Characteristics:

Structure Type:	Round Culvert	**Date of Last Known Replacement:**	N/A
Structure Material:	Plastic - Corrugated		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	3	3
Dimension B[CB](height):	3	3
Crossing Length (Invert to Invert):	36	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	None	N/A	Rip Rap	Fair	None	None
Downstream	None	N/A	Dry Fit Stone	Fair	Wingwalls	Low

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
None	None	Good	OHE DS	Fair

Structure Condition Comments:	Pipe good. Wingwalls fair and road sinking in over pipe

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	Freshwater Stream	Brackish Riverbank Marsh
Upstream Salt Marsh Migration Potential (acres):	0.83	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	Yes
Emergency Access or Evacuation Route:	N/A
History of Flooding:	Known local flooding problems

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 132

Observer(s) & Organization:	TS, JB (NHDES Coastal)
Municipality:	Rye
Stream Name:	N/A
Road Name:	N/A

Date:	8/28/2018	
Start Time:	7:30:00 AM	
End Time:	8:22:00 AM	
Tide Prediction	**High**	**Low**
Time:	1:34 PM	7:18 AM
Elevation:	7.9	0.2
Tide Chart Location:	Portsmouth Harbor	

Crossing Condition Evaluation	Score*
Crossing Condition	1
Tidal Restriction Evaluation	
Tidal Range Ratio	4
Crossing Ratio	3
Erosion Classification	3
Tidal Restriction Overall Score	3
Tidal Aquatic Organism Passage	
Tidal Range Ratio	4
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	2
Salt Marsh Migration Potential (Wshed.)	2
Vegetation Evaluation	
Vegetation Comparison Matrix	1
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	4,5
Inun. Risk to the Crossing Structure (US, DS)	5,5
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	5
Overall Scores	
Infrastructure	5
Ecological	4
Combined	3

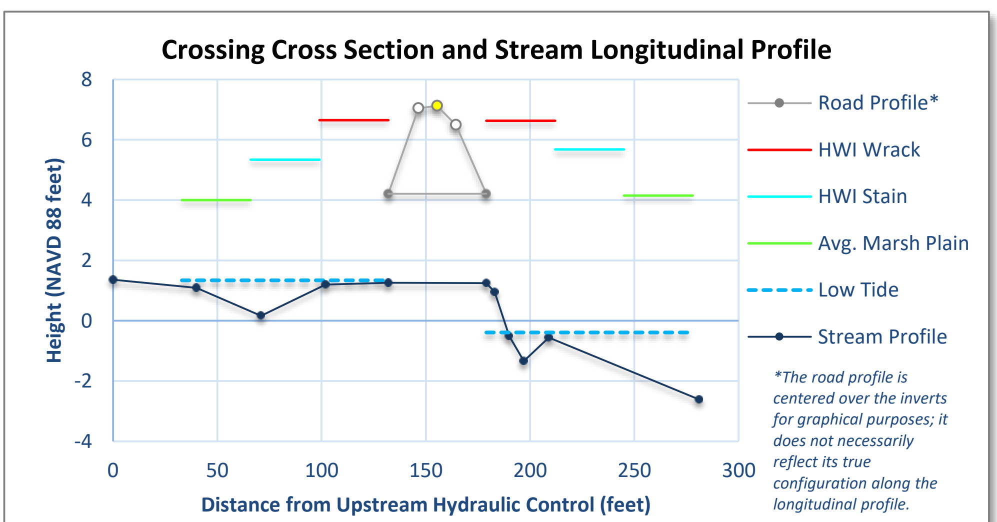
DS view toward structure

US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority
**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk

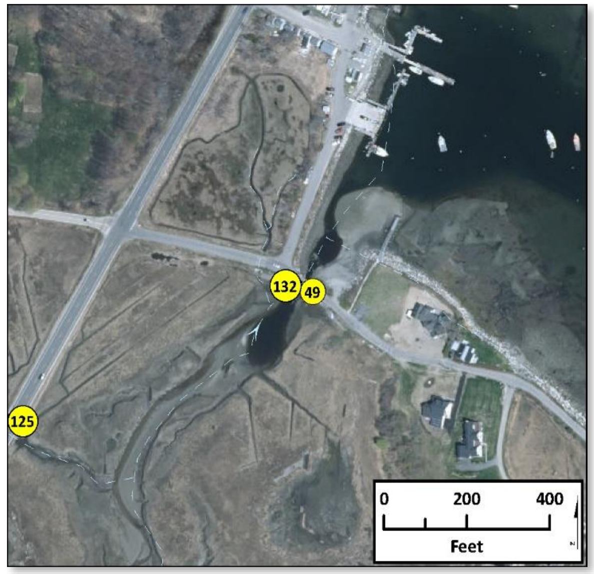


Long. Profile

Dist.	Hght.	Feat.	Sub.
0	1.3594	HC	G
40	1.0894	CB	G
71	0.1594	P	C/S
102	1.1994	HC	C
132	1.2594	I	G
179	1.2494	I	B
183	0.9494	GC	B
190	-0.5106	CB	G
197	-1.3406	P	G
209	-0.5606	HC	G
281	-2.6106	HC	G

Crossing Context:

A small rectangular marsh surrounded by roads and cut off from tides during the development of Rye Harbor was restored to tidal exchange in 1998 by the addition of a 3 by 4-foot concrete culvert that runs under Harbor Road. Common reed covered wetland which had been partially filled with dredge spoil. Restoration included the new culvert and the area had the fill and a small tidal creek excavated. The crossing is in very good condition, but the culvert still restricts some of the tidal flow. It has an overall combined score of 3, a moderate priority for replacement.



Structure Characteristics:

Structure Type:	Box Culvert	**Date of Last Known Replacement:**	1997
Structure Material:	Concrete		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	4	4
Dimension B[CB](height):	3	3
Crossing Length (Invert to Invert):	47	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	Concrete	Good	Rip Rap	Fair	Wingwalls	Low
Downstream	Concrete	Good	Rip Rap	Fair	Wingwalls	Low

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
None	None	Fair	Overhead electric	Good

Structure Condition Comments:	N/A

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	Low Salt Marsh	High Salt Marsh
Upstream Salt Marsh Migration Potential (acres):	1.63	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	Yes
Emergency Access or Evacuation Route:	N/A
History of Flooding:	6"""""""""" over road on 1/4/18

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 133

Observer(s) & Organization:	TS, JB (NHDES Coastal)	**Date:**	9/10/2018
Municipality:	Newfields	**Start Time:**	8:45:00 AM
Stream Name:	N/A	**End Time:**	10:00:00 AM
Road Name:	N/A		

Tide Prediction	High	Low
Time:	2:27 PM	8:35 AM
Elevation:	8.1	-1.1
Tide Chart Location:	Squamscott River	

Crossing Condition Evaluation	Score*
Crossing Condition	5
Tidal Restriction Evaluation	
Tidal Range Ratio	5
Crossing Ratio	5
Erosion Classification	3
Tidal Restriction Overall Score	4
Tidal Aquatic Organism Passage	
Tidal Range Ratio	5
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	1
Salt Marsh Migration Potential (Wshed.)	1
Vegetation Evaluation	
Vegetation Comparison Matrix	4
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	1,1
Inun. Risk to the Crossing Structure (US, DS	5,2
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	5
Overall Scores	
Infrastructure	5
Ecological	5
Combined	4

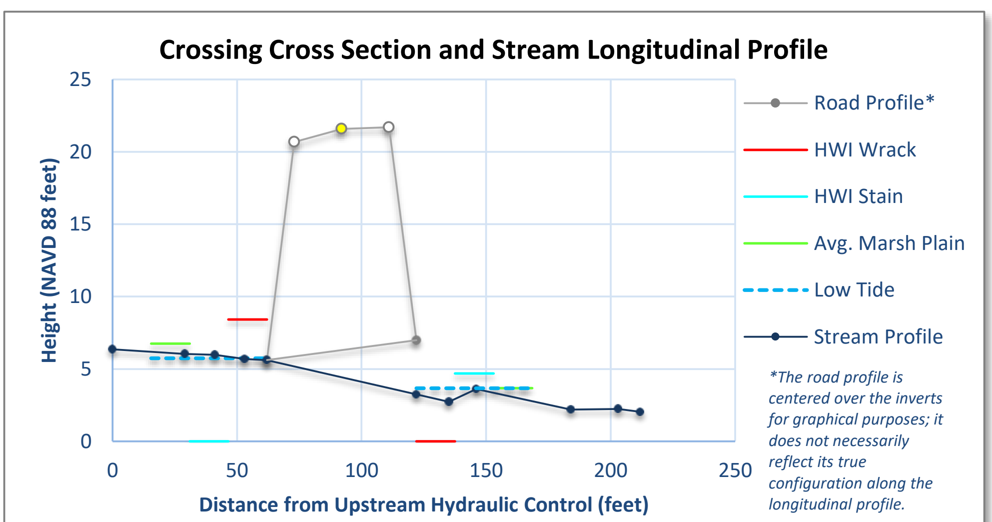
DS view toward structure

US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority
**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk

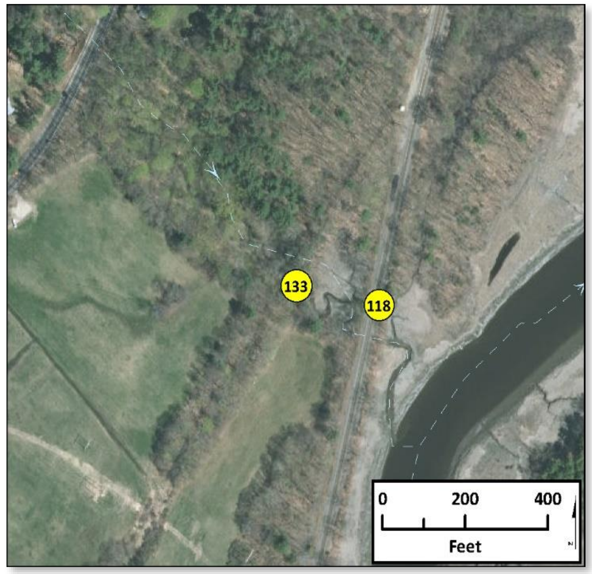


Long. Profile

Dist.	Hght.	Feat.	Sub.
0	6.3579	HC	S
29	6.0379	CB	G
41	5.9779	HC	G
53	5.6979	CB	C
62	5.6179	I	S
122	3.2379	I	G
135	2.7379	P	C/S
146	3.6079	HC	C
184	2.1879	CB	S
203	2.2379	HC	C
212	2.0379	CB	S

Crossing Context:

A small head of tide marsh that extends west from the Squamscott River in Newfields is crossed by an unnamed access road that conducts flow through a granite box culvert that may have been 4 by 4 feet in cross-section when installed. Currently, the upstream inlet appears to be collapsed and blocked by sediment. As might be expected, this culvert is not functional and is at risk for failure. The overall combined score is 4: high priority for replacement.



Structure Characteristics:

Structure Type:	Box Culvert	**Date of Last Known Replacement:**	N/A
Structure Material:	Stone		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	0	3.6
Dimension B^{CB}(height):	0	4
Crossing Length (Invert to Invert):	60	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	None	N/A	None	N/A	Culvert	High
Downstream	Dry Fit Stone	Poor	Dry Fit Stone	Poor	Wingwalls	Medium

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
Culvert	Medium	N/A	None	Poor

Structure Condition Comments:	Collapsed US, no structure to measure, see photo

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	Freshwater Stream	Low Salt Marsh
Upstream Salt Marsh Migration Potential (acres):	0.00	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	No
Emergency Access or Evacuation Route:	N/A
History of Flooding:	Unknown

Tidal Crossing Summary Sheet

New Hampshire's Tidal Crossing Assessment Protocol

Crossing ID: 134

Observer(s) & Organization:	JB (NHDES Coastal)
Municipality:	Hampton
Stream Name:	N/A
Road Name:	N/A

Date:	10/16/2018	
Start Time:	1:08:00 PM	
End Time:	2:25:00 PM	
Tide Prediction	**High**	**Low**
Time:	5:28 AM	11:42 AM
Elevation:	7.5	1.7
Tide Chart Location:	Hampton Harbor	

Crossing Condition Evaluation	Score*
Crossing Condition	5
Tidal Restriction Evaluation	
Tidal Range Ratio	3
Crossing Ratio	5
Erosion Classification	5
Tidal Restriction Overall Score	4
Tidal Aquatic Organism Passage	
Tidal Range Ratio	3
Salt Marsh Migration Evaluation	
Salt Marsh Migration Potential (Eval. Unit)	1
Salt Marsh Migration Potential (Wshed.)	1
Vegetation Evaluation	
Vegetation Comparison Matrix	0
Infrastructure Risk Evaluation	
Inundation Risk to the Roadway (US, DS)	3,3
Inun. Risk to the Crossing Structure (US, DS)	0,5
Adverse Impacts Evaluation**	
Inundation Risk to Low-Lying Development	5
Overall Scores	
Infrastructure	5
Ecological	4
Combined	4

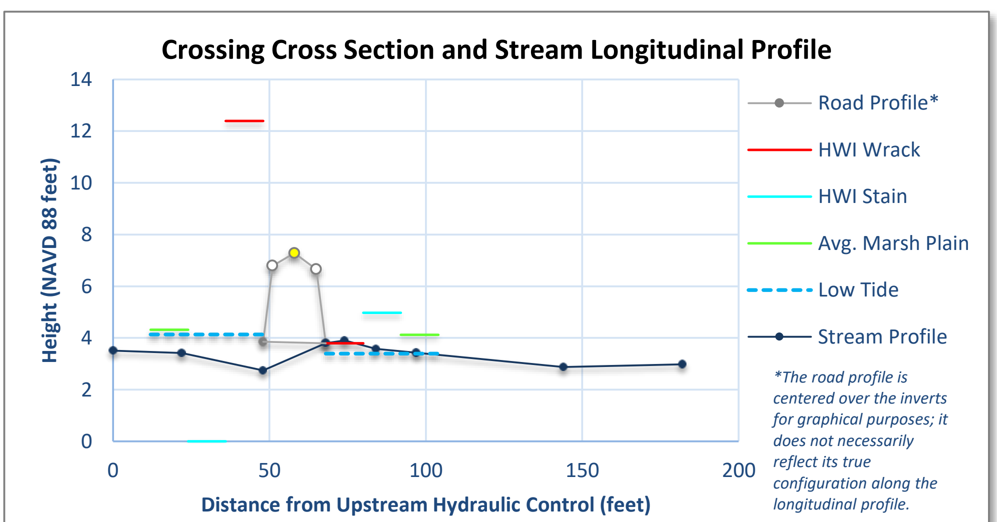
DS view toward structure

US view above structure

US view toward structure

DS view above structure

* Scoring system ranges from 1 to 5, where 1 = lowest replacement priority and 5 = highest replacement priority
**Adverse Impacts Evaluation scores range from 1 to 5, where 1 = high risk and 5 = low risk



Long. Profile

Dist.	Hght.	Feat.	Sub.
0	3.5135	HC	C/S
22	3.4135	CB	C/S
48	2.7435	I	C/S
68	3.7935	I	G
74	3.9035	HC	G
84	3.5835	CB	S
97	3.4335	P	S
144	2.8735	HC	C/S
182	2.9835	HC	C/S

Crossing Context:

At the head of a tidal creek just south of the Taylor River is a berm barrier to 1-2 feet of tidal flow with a 1-foot metal pipe for drainage that is crushed at the downstream end. Current conditions are poor and prevent tidal flow leading to an overall combined score of 4: high priority for replacement. The culvert should be replaced unless the berm has no current use, in which case it should be removed.

Structure Characteristics:

Structure Type:	Round Culvert	**Date of Last Known Replacement:**	N/A
Structure Material:	Steel - Corrugated		
Tide Gate Present:	No		

Crossing Dimensions (ft):	Upstream	Downstream
Dimension A (width):	1	0
Dimension B[CB](height):	1	0
Crossing Length (Invert to Invert):	20	

Crossing Condition:	**Headwall Material**	**Headwall Condition**	**Wingwall Material**	**Wingwall Condition**	**Scour at Structure**	**Scour Severity**
Upstream	None	N/A	None	N/A	Culvert	High
Downstream	None	N/A	None	N/A		

Scour in Structure	**Scour Severity in Structure**	**Road Surface Condition**	**Utilities at Crossing**	**Structure Condition Overall**
Culvert	High	N/A	None	Poor

Structure Condition Comments:	NO DS STRUCTURE. BURIED

Ecological Assessment:	Upstream	Downstream
Natural Community Classification:	Invasive Dominant	Freshwater Stream
Upstream Salt Marsh Migration Potential (acres):	0.58	

Flood Hazard & Emergency Access

Site Identified in Hazard Mitigation Plan:	No
Emergency Access or Evacuation Route:	N/A
History of Flooding:	Culvert washed out and buried upon assessment.

Appendix C: User Guide for ArcGIS Collector

The NH Tidal Protocol is comprised of both field and desktop analyses. Field data for the Resilient Tidal Crossings Project was collected using the ESRI ArcGIS "Collector Classic (v.19.0.2)" App which interfaces directly with ArcGIS Online (AGOL). All seven (7) tables found in the Tidal Crossing geodatabase are accessible in Collector, but only four (4) of these are used for entering collected data in the field (the other three are for desktop assessments). The four field data collection tables are: Site Assessment, Structure Condition, Longitudinal Profile, and Tide Gate. Refer to Appendix B: Data Dictionary Tables for full list of tables and their attributes.

The Tidal Protocol was originally designed and formatted to collect field data using an Excel based paper form. As a result, the aforementioned database tables are not described in the Tidal Protocol (Steckler, 2017); however, they were designed for Protocol compatibility. The Structure Condition table contains fields pertaining to the crossing type and general condition. The Site Assessment table contains information about the assessment itself (such as time and place) as well as the natural community assessment and cross-section elevation data. The Longitudinal Profile table is where data is entered for each individual point on the Longitudinal Profile. The Tide Gate table is only used when a tide gate is present at the site.

Data collected with the App is uploaded wirelessly at the end of each day and is immediately accessible on AGOL. UNH Technology Transfer (T^2) tailored the Collector App to contain the necessary data collection tables, each with their specific assessment parameters, and created the associated private web map feature service (refer to Section 3.1). The web map, which is viewable both in Collector and in AGOL, contains a point layer of all 134 Tidal Crossings and each point can be selected to view and edit that site's data. All 7 tables are viewable for each point and are auto-populated with data in AGOL whenever data is uploaded from Collector.

Getting Started

1 Log into ArcCollector using your ArcGIS Online login information.

2) Open the SADES Tidal Crossing Map

For Wireless Data Collection:

- If collecting data while connected to the internet, simply select your Map in the "All Maps" section.

For Offline Data Collection (preferred):

- If collecting data offline you will need to download an offline map WHILE STILL CONNECTED TO THE INTERNET:
    - Select the download icon in the bottom right hand corner of the map option (cloud with downward pointing arrow)

- Download a new topographic basemap
- Select ‘Work Area’ on basemap
    - Zoom in on the area you want to work in. This can include one or many site locations. YOUR WORK AREA MUST INCLUDE ALL SITES YOU INTEND TO VISIT THAT DAY.
- Once you select a work area, Select “Map Detail” at the bottom of the screen. Zoom in or out to choose the clarity of the map while it is offline. The higher the map resolution the larger the file size, which slows down the app. To maximize efficiency, select a resolution that does need exceed a file size of 5 MB. Estimated file size is shown on the bottom of the screen.
- Select “Download” in top right corner.
- The map is now downloaded to the device. Select “On Device” at the top of the screen and select the newly downloaded map.

Note: In order to download a new offline map with a different work area than your current map you will need to delete the existing one. Select the Menu icon in the top-center of the screen (box with upward pointing arrow), select “Manage” from the drop down menu then select “Remove” under the existing map. You can then create a new map by repeating step 2.
** Downloaded Maps can be used multiple times. If reusing a downloaded map, make sure to upload collected data at the end of each day. You must be connected to the internet to upload data.*

3) Select the site you are going to assess on the map by tapping on it. When you select a site, all seven tables will appear. **Once again, for field purposes, you only need to use four of these tables for data entry: <u>Site Assessment, Structure Condition, Longitudinal Profile, and Tide Gate.</u>**

4) To begin collecting data in one of these tables, Select “New” underneath the table name.

- To reopen the newly created table at a later time, select “View” and choose the existing table.
- Existing tables can be edited by selecting the table, selecting the symbol in the top right hand corner of the table (box with upward facing arrow), and selecting edit in the drop down menu.

5) Once the new table is created, you can individually select each field in the table and enter in the appropriate data. When you have finished entering data in a table, select “Submit” in the top right corner. DO NOT SELECT CANCEL IN THE TOP LEFT CORNER as this will discard the data you have collected in this session.

**The Site Assessment and Structure Condition tables have many fields. The Longitudinal Profile table only has 5 fields and will need to be submitted at each profile shot location. The Tide Gate table has a small number of fields to be filled out only if a tide gate is present at the site.*

6) UPLOADING DATA Once all the necessary data is entered into Collector, return to the office and enable the wireless internet connection to upload them to ArcGIS Online. If you collected data while connected to the internet, the data will have automatically uploaded to ArcGIS every time you selected 'submit'. If you downloaded an offline map, you will need to go back to the "Maps" page and select the map download button again (it will now show a cloud with up and down pointing arrows and a number in red). This will upload all collected data to ArcGIS Online.

Best Practices

NHCP developed a set of standard practices for the field crew that has proven to be the most effective way to conduct assessments:

1) Arrive on site about an hour before low tide whenever possible to give yourself enough time.

2) In a two-person crew, have one person record data and the other person run the rod.

3) Make a work plan prior to leaving the office.

4) If you need to download a new site map, be sure to do so in the office while you still have access to the internet.

5) Ipad or mobile data collection device should be in "Airplane Mode" and not connected to the internet to conserve battery in the field. Bring a charger to charge device while driving.

6) Download a copy of the Tidal Protocol on the device to be used as a reference in the field. This comes in handy often as the ArcCollector App does not have specific instructions on how to collect and enter data.

Appendix B: Data Dictionary Tables

	A	B	C	D	E	F	G	H	I	J
1										
2	**Site Information Table**									
3	**Field_Name**	**Character count**	**Field_Alias**	**Character count**	**Required (Y=Yes; N=No; P=Preferred)**	**Format**	**Default_Value**	**Input Style**	**Visible in Collector App**	**Description and/or Lookup/Dropdown Details**
4	CROSSING_ID	11	Crossing ID	11	Y	Int	Null	Auto - Calculated	Yes - Greyed Out	Unique ID. Combination of town and watershed codes
5	TOWN	4	Town	4	Y	Text	Null	Auto - Calculated	Yes - Greyed Out	
6	STREAM_NAME	11	Stream Name	11	Y	Text	Null	Auto - Calculated	Yes - Greyed Out	
7	ROAD_NAME_A	11	Road Name (Auto)	16	Y	Text	Null	Auto - Calculated	Yes - Greyed Out	
8	ROAD_NAME_F	11	Road Name (Field)	17	Y	Text	Null	User Input - Text Field	Yes	If road name is different than in "Road Name - Auto"
9	NUMBER_STRUCTURES	17	Number of Structures	20	Y	Int	Null	User Input - Numeric	Yes	
10	Status	6	Status	6	Yes	Text		User Input - Lookup/Dropdown	Yes	Status of assessment for the crossings: Complete, In Progress, New
11										
12										
13	**Site Assessement Table**									
14	**Field_Name**	**Character count**	**Field_Alias**	**Character count**	**Required (Y=Yes; N=No; P=Preferred)**	**Format**	**Default_Value**	**Input Style**	**Visible in Collector App**	**Description and/or Lookup/Dropdown Details**
15	CROSSING_ID	11	Crossing ID	11	Y	Int	Null	Auto - Calculated	Yes - Greyed Out	Unique ID. Combination of town and watershed codes
16	OBSERVERS	9	Observers	9	Y	Text	Null	User Input - Text Field	Yes	
17	ORGANIZATION	12	Organization	12	Y	Text	Null	User Input - Lookup/Dropdown	Yes	List organizations in order of observers
18	ASSESSMENT_DATE	15	Assessment Date	15	Y	Date	Null	User Input - Lookup/Dropdown	Yes	Date of original assessment
19	RETURN_ASSESS_DATE	18	Return Assessment Date	22	N	Date	Null	User Input - Lookup/Dropdown	Yes	Date of return assessment
20	START_TIME	10	Start Time	10	Y	Text	Null	User Input - Text Field	Yes	for original assessment date
21	PREDICTED_HIGH_TIME	19	Predicted High Tide Time	24	P	Time	Null	User Input - Lookup/Dropdown	Yes	Predicted high tide from nearest tide chart
22	PREDICTED_LOW_TIME	18	Predicted Low Tide Time	23	P	Time	Null	User Input - Lookup/Dropdown	Yes	Predicted low tide from nearest tide chart
23	PREDICTED_HIGH_HEIGHT	21	Predicted High Tide Height	26	P	Double	Null	User Input -Numeric	Yes	Predicted high tide height from nearest tide chart
24	PREDICTED_LOW_HEIGHT	20	Predicted Low Tide Height	25	P	Double	Null	User Input -Numeric	Yes	Predicted low tide height from nearest tide chart
25	LOCATION_NEAREST_TIDE_CHART	27	Location of Nearest Tide Chart	30	P	Text	Null	User Input - Lookup/Dropdown	Yes	Options: Dover Point, Hampton Harbor, Jaffrey Point, Portsmouth Harbor, Salmon Falls River, Squamscott River
26	GENERAL_NOTES	13	General Assessment Notes	24	N	Text	Null	User Input - Text Field	Yes	General notes about site visit and assessment
27	ROAD_CONDITION	14	Road Surface Condition	22	Y	Text	Null	User Input - Lookup/Dropdown	Yes	Options: good, fair, poor
28	CONTROL_POINT_HEIGHT	20	Height of Established Control Point	35	Y	Double	Null	User Input - Numeric	Yes	
29	LEVEL_LOCATION_CONTROL_POINT	28	Level Setup Location For Control Point	38	Y	Text	Null	User Input - Lookup/Dropdown	Yes	Options: R, U, D
30	CONT_POINT_DESCRIPTION	22	Describe Control Point Location	31	Y	Text	Null	User Input - Text Field	Yes	
31	CENTERLINE_ROAD_HEIGHT	22	Height At Road Centerline	25	Y	Double	Null	User Input - Numeric	Yes	
32	CENTERLINE_LOCATION	19	Level Setup Location For Road Centerline	40	Y	Text	Null	User Input - Lookup/Dropdown	Yes	Options: R, U, D
33	US_LOW_TIDE_ELEV	16	Upstream Low Tide Water Elevation	33	Y	Double	Null	User Input - Numeric	Yes	
34	US_LOW_LOCATION	15	Level Loc. For Us Low Tide Water Elevation	42	Y	Text	Null	User Input - Lookup/Dropdown	Yes	Options: R, U, D
35	US_HWI_STAIN_ELEV	17	Upstream HWI Stain Elevation	28	Y	Double	Null	User Input - Numeric	Yes	
36	US_HWI_STAIN_LOCATION	21	Level Setup Location For Us HWI Stain	37	Y	Text	Null	User Input - Lookup/Dropdown	Yes	Options: R, U, D
37	US_HWI_WRACK_ELEV	17	Upstream HWI Wrack Elevation	28	Y	Double	Null	User Input - Numeric	Yes	

Appendix B: Data Dictionary Tables

	A	B	C	D	E	F	G	H	I	J
3	Field_Name	Character count	Field_Alias	Character count	Required (Y=Yes; N=No; P=Preferred)	Format	Default_Value	Input Style	Visible in Collector App	Description and/or Lookup/Dropdown Details
38	US_HWI_LOCATION	15	Level Setup Location For US HWI Wrack	37	Y	Text	Null	User Input - Lookup/Dropdown	Yes	Options: R, U, D
39	US_CEILING_ELEV	15	Upstream Ceiling of Structure Elevation	39	Y	Double	Null	User Input - Numeric	Yes	
40	US_CEILING_LOCATION	19	Level Setup Loc. For US Ceiling Of Structure	44	Y	Text	Null	User Input - Lookup/Dropdown	Yes	Options: R, U, D
41	US_ROAD_SURFACE_ELEV	20	Upstream Road Surface Elevation	31	Y	Double	Null	User Input - Numeric	Yes	
42	US_ROAD_SURFACE_LOCATION	24	Level Setup Location For US Road Surface	40	Y	Text	Null	User Input - Lookup/Dropdown	Yes	Options: R, U, D
43	US_MARSH_PLAIN_1_ELEV	21	Upstream Marsh Plain Shot 1	27	Y	Double	Null	User Input - Numeric	Yes	
44	US_MARSH_PLAIN_1_LOCATION	25	Level Setup Loc. For US Marsh Plain Shot 1	42	Y	Text	Null	User Input - Lookup/Dropdown	Yes	Options: R, U, D
45	US_MARSH_PLAIN_2_ELEV	21	Upstream Marsh Plain Shot 2	27	Y	Double	Null	User Input - Numeric	Yes	
46	US_MARSH_PLAIN_2_LOCATION	25	Level Setup Loc. For US Marsh Plain Shot 2	42	Y	Text	Null	User Input - Lookup/Dropdown	Yes	Options: R, U, D
47	US_MARSH_PLAIN_3_ELEV	21	Upstream Marsh Plain Shot 3	27	Y	Double	Null	User Input - Numeric	Yes	
48	US_MARSH_PLAIN_3_LOCATION	25	Level Setup Loc. For US Marsh Plain Shot 3	42	Y	Text	Null	User Input - Lookup/Dropdown	Yes	Options: R, U, D
49	US_MARSH_PLAIN_4_ELEV	21	Upstream Marsh Plain Shot 4	27	Y	Double	Null	User Input - Numeric	Yes	
50	US_MARSH_PLAIN_4_LOCATION	25	Level Setup Loc. For US Marsh Plain Shot 4	42	Y	Text	Null	User Input - Lookup/Dropdown	Yes	Options: R, U, D
51	DS_LOW_TIDE_WATER_ELEV	22	Downstream Low Tide Water Elevation	35	Y	Double	Null	User Input - Numeric	Yes	
52	DS_LOW_TIDE_WATER_LOCATION	26	Level Setup Loc. For DS Lt Water Elevation	42	Y	Text	Null	User Input - Numeric	Yes	Options: R, U, D
53	DS_HWI_STAIN_ELEV	17	Downstream HWI Stain Elevation	30	Y	Double	Null	User Input - Numeric	Yes	
54	DS_HWI_STAIN_LOCATION	21	Level Setup Location for DS HWI Stain	37	Y	Text	Null	User Input - Lookup/Dropdown	Yes	Options: R, U, D
55	DS_HWI_WRACK_ELEV	17	Downstream HWI Wrack Elevation	30	Y	Double	Null	User Input - Numeric	Yes	
56	DS_HWI_WRACK_LOCATION	21	Level Setup Location For DS HWI Wrack	37	Y	Text	Null	User Input - Lookup/Dropdown	Yes	Options: R, U, D
57	DS_CEILING_ELEV	15	Downstream Ceiling Of Structure Elevation	41	Y	Double	Null	User Input - Numeric	Yes	
58	DS_CEILING_LOCATION	19	Level Setup Loc. For DS Ceiling Of Structure	44	Y	Text	Null	User Input - Lookup/Dropdown	Yes	Options: R, U, D
59	DS_ROAD_SURFACE_ELEV	20	Downstream Road Surface Elevation	33	Y	Double	Null	User Input - Numeric	Yes	
60	DS_ROAD_SURFACE_LOCATION	24	Level Setup Location For DS Road Surface	40	Y	Text	Null	User Input - Lookup/Dropdown	Yes	Options: R, U, D
61	DS_MARSH_PLAIN_1_ELEV	21	Downstream Marsh Plain Shot 1	29	Y	Double	Null	User Input - Numeric	Yes	
62	DS_MARSH_PLAIN_1_LOCATION	25	Level Setup Loc. For DS Marsh Plain Shot 1	42	Y	Text	Null	User Input - Lookup/Dropdown	Yes	Options: R, U, D
63	DS_MARSH_PLAIN_2_ELEV	21	Downstream Marsh Plain Shot 2	29	Y	Double	Null	User Input - Numeric	Yes	
64	DS_MARSH_PLAIN_2_LOCATION	25	Level Setup Loc. For DS Marsh Plain Shot 2	42	Y	Text	Null	User Input - Lookup/Dropdown	Yes	Options: R, U, D
65	DS_MARSH_PLAIN_3_ELEV	21	Downstream Marsh Plain Shot 3	29	Y	Double	Null	User Input - Numeric	Yes	
66	DS_MARSH_PLAIN_3_LOCATION	25	Level Setup Loc. For DS Marsh Plain Shot 3	42	Y	Text	Null	User Input - Lookup/Dropdown	Yes	Options: R, U, D
67	DS_MARSH_PLAIN_4_ELEV	21	Downstream Marsh Plain Shot 4	29	Y	Double	Null	User Input - Numeric	Yes	
68	DS_MARSH_PLAIN_4_LOCATION	25	Level Setup Loc. For DS Marsh Plain Shot 4	42	Y	Text	Null	User Input - Lookup/Dropdown	Yes	Options: R, U, D
69	CROSS_SECTION_COMMENTS	22	Cross Section and Long Profile Comments	39	N	Text	Null	User Input - Text Field	Yes	
70	US_TP_FORESIGHT_ELEV	20	Upstream TP Foresight Elevation	31	N	Double	Null	User Input - Numeric	Yes	
71	US_TP_FORESIGHT_LOC	19	Level Setup Location For US TP Foresight	40	N	Text	Null	User Input - Lookup/Dropdown	Yes	Options: R, U, D
72	US_TP_BACKSIGHT_ELEV	20	Upstream TP Backsight Elevation	31	N	Double	Null	User Input - Numeric	Yes	
73	US_TP_BACKSIGHT_LOC	19	Level Setup Location For US TP Backsight	40	N	Text	Null	User Input - Lookup/Dropdown	Yes	Options: R, U, D
74	DS_TP_FORESIGHT_ELEV	20	Downstream TP Foresight Elevation	33	N	Double	Null	User Input - Numeric	Yes	
75	DS_TP_FORESIGHT_LOC	19	Level Setup Location For DS TP Foresight	40	N	Text	Null	User Input - Lookup/Dropdown	Yes	Options: R, U, D
76	DS_TP_BACKSIGHT_ELEV	20	Downstream TP Backsight Elevation	33	N	Double	Null	User Input - Numeric	Yes	
77	DS_TP_BACKSIGHT_LOC	19	Level Setup Location For DS TP Backsight	40	N	Text	Null	User Input - Lookup/Dropdown	Yes	Options: R, U, D
78	QC_HEIGHT_CONTROL	17	QC Height Of Established Control Point	38	Y	Double	Null	User Input - Numeric	Yes	
79	QC_LEVEL_LOCATION		QC_LEVEL_LOCATION		Y	Text	Null	User Input - Lookup/Dropdown	Yes	Options: R, U, D

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	A	B	C	D	E	F	G	H	I	J
3	**Field_Name**	**Character count**	**Field_Alias**	**Character count**	**Required (Y=Yes; N=No; P=Preferred)**	**Format**	**Default_Value**	**Input Style**	**Visible in Collector App**	**Description and/or Lookup/Dropdown Details**
80	US_NATURAL_COMMUNITY	20	Upstream Natural Community Classification	41	Y	Text	Null	User Input - Lookup/Dropdown	Yes	Options: sparsely vegetated intertidal habitat, low salt marsh, high salt marsh, marsh elder shrubland, coastal salt pond marsh/meadow, brackish marsh, brackish riverbank marsh, freshwater marsh, freshwater swamp, invasive dominant
81	DS_NATURAL_COMMUNITY	20	Downstream Natural Community Classification	43	Y	Text	Null	User Input - Lookup/Dropdown	Yes	Options: sparsely vegetated intertidal habitat, low salt marsh, high salt marsh, marsh elder shrubland, coastal salt pond marsh/meadow, brackish marsh, brackish riverbank marsh, freshwater marsh, freshwater swamp, invasive dominant, subtidal
82	US_INVASIVE_PRESENT	19	Upstream Invasive Species Present	33	Y	Text	Null	User Input - Lookup/Dropdown	Yes	Options: phragmites, narrowleaf cattail, perennial pepperweed, purple loosestrife, Japanese knotweed, none
83	DS_INVASIVE_PRESENT	19	Downstream Invasive Species Present	35	Y	Text	Null	User Input - Lookup/Dropdown	Yes	Options: phragmites, narrowleaf cattail, perennial pepperweed, purple loosestrife, Japanese knotweed, none
84	COMMUNITY_INVASIVE_COMMENTS	27	Natural Community Or Invasives Comments	39	N	Text	Null	User Input - Text Field	Yes	
85	OBSERVATIONS_VEGETATION	23	Observations Of Vegetation Dieback	34	P	Text	Null	User Input - Text Field	Yes	
86	CONFIRMATION_US_NWI	19	Confirmation/Correct US Nwi Class	33	Y	Text	Null	User Input - Text Field	Yes	
87	CONFIRMATION_DS_NWI	19	Confirmation/Correct DS Nwi Class	33	Y	Text	Null	User Input - Text Field	Yes	
88	VEG_CLASSIFICATION	18	Vegetation Comparison Matrix Code	33	Y	Text	Null	User Input - Lookup/Dropdown	Yes	Options: 1A, 1B, 1C, 2A, 2B, 2C, 3A, 3B, 3C
89	HABITAT_CONDITION_US	20	Upstream Condition of Salt Marsh or Wetland H	51	Y	Text	Null	User Input - Lookup/Dropdown	Yes	Options: good condition, somewhat altered or impacted, highly altered or impacted
90	HABITAT_CONDITION_DS	20	Downstream Condition of Salt Marsh or Wetlar	53	Y	Text	Null	User Input - Lookup/Dropdown	Yes	Options: good condition, somewhat altered or impacted, highly altered or impacted
91	OTHER_INFRASTRUCTURE_US	23	Other Infrastructure **Upstream**	29	Y	Text	Null	User Input - Lookup/Dropdown	Yes	Options: N/A, berm, dike, ditch, rip rap, seawall
92	OTHER_INFRASTRUCTURE_DS	23	Other Infrastructure **Downstream**	31	Y	Text	Null	User Input - Lookup/Dropdown	Yes	Options: N/A, berm, dike, ditch, rip rap, seawall
93	HABITAT_INFRASTRUCTURE_COM	26	Habitat Condition & Infrastructure Comments	43	N	Text	Null	User Input - Text Field	Yes	
94	FISH_WILDLIFE_COMMENTS	22	Fish & Wildlife Observations & Comments	39	N	Text	Null	User Input - Text Field	Yes	
95	LOW_LYING_INFRA_OBS	19	Low-Lying Infrastructure Observations	37	N	Text	Null	User Input - Text Field	Yes	
96	ANCILLARY_USE_CROSS	19	Ancillary Uses At Crossing	26	N	Text	Null	User Input - Text Field	Yes	
97	UTILITIES_CROSS	15	Utilities At Crossing	21	N	Text	Null	User Input - Text Field	Yes	
98	OTHER_CROSSING_COMMENTS	23	Other Crossing Comments	23	N	Text	Null	User Input - Text Field	Yes	
99	TIME_ASSESS_COMPLETE	20	Time Assessment Completed	25	Y	Text	Null	User Input - Text Field	Yes	for original assessment date
100										
101										
102	**Structure Condition Table**									
103	**Field_Name**	**Character count**	**Field_Alias**	**Character count**	**Required (Y=Yes; N=No; P=Preferred)**	**Format**	**Default_Value**	**Input Style**	**Visible in Collector App**	**Description and/or Lookup/Dropdown Details**
104	If there is more than one sructure at the site then the following fields will be collected for **EACH** structure									
105	CROSSING_ID	11	Crossing ID	11	Y	Int	Null	Auto - Calculated	Yes - Greyed Out	Unique ID. Combination of town and watershed codes

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	A	B	C	D	E	F	G	H	I	J
3	Field_Name	Character count	Field_Alias	Character count	Required (Y=Yes; N=No; P=Preferred)	Format	Default_Value	Input Style	Visible in Collector App	Description and/or Lookup/Dropdown Details
106	STRUCTURE_TYPE	14	Structure Type	14	Y	Text	Null	User Input - Lookup/Dropdown	Yes	Options: round culvert, elliptical culvert, pipe arch culvert, box culvert, embedded round culvert, embedded elliptical culvert, embedded pipe arch culvert, open bottom arch, arch-bridge, bridge with abutments, bridge with side slopes, bridge with side slopes & abutments, other
107	STRUCTURE_MATERIAL	18	Structure Material	18	Y	Text	Null	User Input - Lookup/Dropdown	Yes	Options: concrete, stone, aluminum-corrugated, plastic-corrugated, steel-corrugated, wood, plastic-smooth, steel-smooth, other
108	US_DIMENSION_A	14	Upstream - Dimension A	22	Y	Double	Null	User Input - Numeric	Yes	
109	US_DIMENSION_B_CB	17	Upstream - Dimension B(CB)	26	Y	Double	Null	User Input - Numeric	Yes	
110	US_DIMENSION_B_LT	17	Upstream - Dimension B (LT)	27	Y	Double	Null	User Input - Numeric	Yes	
111	US_DIMENSION_C	14	Upstream - Dimension C	22	N	Double	Null	User Input - Numeric	Yes	
112	US_DIMENSION_D	14	Upstream - Dimension D	22	N	Double	Null	User Input - Numeric	Yes	
113	US_LOW_TIDE_PERCH	17	Upstream Low Tide Perch	23	Y	Double	Null	User Input - Numeric	Yes	input '0' if no perch
114	US_HEADWALL_MATERIAL	7	Upstream Headwall - Materials	29	Y	Text	Null	User Input - Lookup/Dropdown	Yes	Options: metal, concrete, masonry, gabion, riprap, other, none, dry fit stone
115	US_HEADWALL_CONDITION	7	Upstream Headwall - Condition	29	Y	Text	Null	User Input - Lookup/Dropdown	Yes	Options: good, fair, poor, N/A
116	US_WINGWALL_MATERIAL	7	Upstream Wingwall - Materials	29	Y	Text	Null	User Input - Lookup/Dropdown	Yes	Options: metal, concrete, masonry, gabion, riprap, other, none, dry fit stone
117	US_WINGWALL_CONDITION	7	Upstream Wingwall - Condition	29	Y	Text	Null	User Input - Lookup/Dropdown	Yes	Options: good, fair, poor, N/A
118	US_STRUCTURE_SCOUR	5	Scour at Structure - Upstream	29	Y	Text	Null	User Input - Lookup/Dropdown	Yes	Options: none, footer, abutment, armoring, culvert, wingwalls, headwall
119	US_SCOUR_SEVERITY	10	Severity of Scour - Upstream	28	Y	Text	Null	User Input - Lookup/Dropdown		Options: none, low, medium, high
120	DS_DIMENSION_A	14	Downstream - Dimension A	24	Y	Double	Null	User Input - Numeric	Yes	
121	DS_DIMENSION_B_CB	17	Downstream - Dimension B(CB)	28	Y	Double	Null	User Input - Numeric	Yes	
122	DS_DIMENSION_B_LT	17	Downstream - Dimension B(LT)	28	Y	Double	Null	User Input - Numeric	Yes	
123	DS_DIMENSION_C	14	Downstream - Dimension C	24	N	Double	Null	User Input - Numeric	Yes	
124	DS_DIMENSION_D	14	Downstream - Dimension D	24	N	Double	Null	User Input - Numeric	Yes	
125	DS_LOW_TIDE_PERCH	17	Downstream Low Tide Perch	25	Y	Double	Null	User Input - Numeric	Yes	input '0' if no perch
126	DS_HIGH_TIDE_PERCH	18	Downstream High Tide Perch	26	Y	Double	Null	User Input - Numeric	Yes	input '0' if no perch
127	DS_HEADWALL_MATERIAL	20	Downstream Headwall - Materials	31	Y	Text	Null	User Input - Lookup/Dropdown	Yes	Options: metal, concrete, masonry, gabion, riprap, other, none, dry fit stone
128	DS_HEADWALL_CONDITION	21	Downstream Headwall - Condition	31	Y	Text	Null	User Input - Lookup/Dropdown	Yes	Options: good, fair, poor, N/A
129	DS_WINGWALL_MATERIAL	20	Downstream Wingwall - Materials	31	Y	Text	Null	User Input - Lookup/Dropdown	Yes	Options: metal, concrete, masonry, gabion, riprap, other, none, dry fit stone
130	DS_WINGWALL_CONDITION	21	Downstream Wingwall - Condition	31	Y	Text	Null	User Input - Lookup/Dropdown	Yes	Options: good, fair, poor, N/A
131	DS_STRUCTURE_SCOUR	18	Scour at Structure - Downstream	31	Y	Text	Null	User Input - Lookup/Dropdown	Yes	Options: none, footer, abutment, armoring, culvert, wingwalls, headwall
132	DS_SCOUR_SEVERITY	17	Severity of Scour - Downstream	30	Y	Text	Null	User Input - Lookup/Dropdown		Options: none, low, medium, high
133	SCOUR_INSIDE	12	Scour inside the Structure	26	Y	Text	Null	User Input - Lookup/Dropdown	Yes	Options: none, footer, channel, culvert, abutment, armoring
134	SCOUR_INSIDE_SEVERITY	21	Severity of Scour inside Structure	34	Y	Text	Null	User Input - Lookup/Dropdown	Yes	Options: none, low, medium, high
135	OVERALL_STRUCTURE_CONDITION	27	Structure Condition - Overall	29	Y	Text	Null	User Input - Lookup/Dropdown	Yes	Options: good, fair, poor
136	STRUCTURE_CONDITION_COMMENTS	28	STRUCTURE_CONDITION_COMMENTS	28	N	Text	Null	User Input - Text Field	Yes	

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3	**Field_Name**	**Character count**	**Field_Alias**	**Character count**	**Required (Y=Yes; N=No; P=Preferred)**	**Format**	**Default_Value**	**Input Style**	**Visible in Collector App**	**Description and/or Lookup/Dropdown Details**
137										
138										
139	**Longitudinal Profile Table**									
140	**Field_Name**	**Character count**	**Field_Alias**	**Character count**	**Required (Y=Yes; N=No; P=Preferred)**	**Format**	**Default_Value**	**Input Style**	**Visible in Collector App**	**Description and/or Lookup/Dropdown Details**
141	CROSSING_ID	11	Crossing ID	11	Y	Int	Null	Auto - Calculated	Yes - Greyed Out	Unique ID. Combination of town and watershed codes
142	DISTANCE	8	Distance	8	N	Double	Null	User Input - Numeric	Yes	
143	HEIGHT	6	Height	6	N	Double	Null	User Input - Numeric	Yes	
144	CODE	4	Code	4	N	Text	Null	User Input - Lookup/Dropdown	Yes	Options: HC, P, GC, I. CB, CH
145	SUBSTRATE	9	Substrate	9	N	Text	Null	User Input - Lookup/Dropdown	Yes	Options: C/S, S, G, C, B, Bed, N/A
146	LOCATION	8	Location	8	N	Text	Null	User Input - Lookup/Dropdown	Yes	Options: R, U, D
147										
148										
149	**Desktop Assessment Table**									
150	**Field_Name**	**Character count**	**Field_Alias**	**Character count**	**Required (Y=Yes; N=No; P=Preferred)**	**Format**	**Default_Value**	**Input Style**	**Visible in Collector App**	**Description and/or Lookup/Dropdown Details**
151	CROSSING_ID	11	Crossing ID	11	Y	Int	Null	Auto - Calculated	Yes - Greyed Out	Unique ID. Combination of town and watershed codes
152	PERSON_CONTACTED	16	Person Contacted	16	Y	Text	Null	User Input - Text Field	Yes - Greyed Out	
153	AFFILIATION_OF_CONTACT	22	Affiliation Of Person Contacted	31	Y	Text	Null	User Input - Text Field	Yes - Greyed Out	
154	DATE_OF_PERSON_CONTACT	22	Date Of Contact For Person Contacted	36	Y	Text	Null	User Input - Text Field	Yes - Greyed Out	
155	AGE_OF_STRUCTURE	16	Age Of Structure	16	Y	Int	Null	User Input - Numeric	Yes - Greyed Out	
156	HAZ_MIT_SIZE	12	Site Identified in Hazard Mitigation Plan	41	Y	Text	Null	User Input - Lookup/Dropdown	Yes - Greyed Out	
157	REPLACEMENT_PLANS	17	Replacement Plans	17	Y	Text	Null	User Input - Text Field	Yes - Greyed Out	
158	HISTORY_OF_FLOODING	19	History Of Flooding	19	Y	Text	Null	User Input - Text Field	Yes - Greyed Out	
159	EMERGENCY_ACCES	15	Emergency Access Or Evacuation Route	36	Y	Text	Null	User Input - Lookup/Dropdown	Yes - Greyed Out	Options: yes, no
160	INTERVIEW_COMMENTS	18	Other Interview Comments	24	N	Text	Null	User Input - Text Field	Yes - Greyed Out	
161	CROSSING_OUTLET_TO	18	Crossing Outlets Directly To	28	Y	Text	Null	User Input - Lookup/Dropdown	Yes - Greyed Out	Options: Atlantic Ocean, subtidal, both, neither
162	NUM_DS_CROSSINGS	16	Number Of Downstream Tidal Crossings	36	Y	Int	Null	User Input - Numeric	Yes - Greyed Out	
163	NUM_US_CROSSINGS	16	Number Of Upstream Tidal Crossings	34	Y	Int	Null	User Input - Numeric	Yes - Greyed Out	
164	NUM_DS_RESTRICTIONS	19	Number Of Downstream Tidal Restrictions	39	Y	Int	Null	User Input - Numeric	Yes - Greyed Out	
165	NUM_US_RESTRICTIONS	19	Number Of Upstream Tidal Restrictions	37	Y	Int	Null	User Input - Numeric	Yes - Greyed Out	
166	US_WATERSHED_AREA	17	Upstream Watershed Area	23	Y	Double	Null	User Input - Numeric	Yes - Greyed Out	
167	US_SALT_MARSH_AREA	18	Upstream Salt Marsh Area	24	Y	Double	Null	User Input - Numeric	Yes - Greyed Out	
168	PERCENT_WETLAND	15	Watershed Land Use - Percent Wetland	36	Y	Double	Null	User Input - Numeric	Yes - Greyed Out	
169	PERCENT_FORESTED	16	Watershed Land Use - Percent Forested	37	Y	Double	Null	User Input - Numeric	Yes - Greyed Out	
170	PERCENT_IMPERVIOUS	18	Watershed Land Use - Percent Impervious	39	Y	Double	Null	User Input - Numeric	Yes - Greyed Out	
171	PERCENT_DEVELOPED	17	Watershed Land Use - Percent Developed	38	Y	Double	Null	User Input - Numeric	Yes - Greyed Out	
172	US_CHANNEL_WIDTH	16	Upstream Channel Width	22	Y	Double	Null	User Input - Numeric	Yes	
173	DS_CHANNEL_WIDTH	16	Downstream Channel Width	24	Y	Double	Null	User Input - Numeric	Yes	
174	US_MAX_POOL_WIDTH	17	Upstream Maximum Pool Width	27	Y	Double	Null	User Input - Numeric	Yes	
175	DS_MAX_POOL_WIDTH	17	Downstream Maximum Pool Width	29	Y	Double	Null	User Input - Numeric	Yes	

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3	**Field_Name**	**Character count**	**Field_Alias**	**Character count**	**Required (Y=Yes; N=No; P=Preferred)**	**Format**	**Default_Value**	**Input Style**	**Visible in Collector App**	**Description and/or Lookup/Dropdown Details**
176	CHANNEL_POOL_COMMENTS	21	Channel And Pool Width Comments	31	N	Text	Null	User Input - Text Field	Yes	
177	IMPOUNDMENT	11	Upstream Impoundment	20	Y	Text	Null	User Input - Lookup/Dropdown	Yes	Options: yes, no
178	US_WATERSHED_MIGRATION	22	US Watershed Area Of Marsh Migration	36	Y	Double	Null	User Input - Numeric	Yes - Greyed Out	
179	US_EVAL_UNIT_AREA_MIG	21	US Eval. Unit Area Of Marsh Migration	37	Y	Double	Null	User Input - Numeric	Yes - Greyed Out	
180	NHBEOS	6	NHBEOS	6	Y	Int	Null	User Input - Text Field	Yes - Greyed Out	
181	US_NWI_CLASS	12	Upstream NWI Classification	27	Y	Text	Null	User Input - Text Field	Yes - Greyed Out	
182	DS_NWI_CLASS	12	Downstream NWI Classification	29	Y	Text	Null	User Input - Text Field	Yes - Greyed Out	
183	MODELED_ROAD_SUR_INUND	22	Modeled Road Surface Inundation	31	Y	Text	Null	User Input - Lookup/Dropdown	Yes - Greyed Out	Options: yes, no
184	MODELED_ROAD_INUND_1_PER	24	Modeled Road Inundation With 1% Annual Floo	44	Y	Text	Null	User Input - Lookup/Dropdown	Yes - Greyed Out	Options: yes, no
185	INUNDATION_COMMENTS	19	Inundation Risk Comments	24	N	Text	Null	User Input - Text Field	Yes - Greyed Out	
186	US_INFRASTRUCTURE_IMPACTS	25	Upstream Infrastructure Impacts	31	Y	Int	Null	User Input - Numeric	Yes - Greyed Out	
187	US_IMPACTS_1_PER	16	Upstream Infr. Impacts With 1% Annual Flood	43	Y	Int	Null	User Input - Numeric	Yes - Greyed Out	
188	CURRENT_QAQC_STATUS	19	Current QA/QC Status	20	N	Text	Null	User Input - Text Field	Yes - Greyed Out	
189	QAQC_STAFF	10	QA/QC Staff	11	N	Text	Null	User Input - Lookup/Dropdown	Yes - Greyed Out	Options: Shea Flanagan, Pete Steckler, other
190	QAQC_COMMENTS	13	QA/QC Comments	14	N	Text	Null	User Input - Text Field	Yes - Greyed Out	
191	QAQC_ASSESS_TEAM_RESP	21	QA/QC Assessment TEam Response	30	N	Text	Null	User Input - Text Field	Yes - Greyed Out	
192	EDIT_DATE	9	Edit Date	9	Y	Date	Null	Auto - Logged	Yes - Greyed Out	
193	EDITOR	6	Editor	6	Y	Text	Null	Auto - Logged	Yes - Greyed Out	
194	EDITOR_COMMENTS	15	Editor Comment	14	N	Text	Null	User Input - Text Field	Yes	
195										
196										
197	**Tide Gate Table**									
198	**Field_Name**	**Character count**	**Field_Alias**	**Character count**	**Required (Y=Yes; N=No; P=Preferred)**	**Format**	**Default_Value**	**Input Style**	**Visible in Collector App**	**Description and/or Lookup/Dropdown Details**
199	CROSSING_ID	11	Crossing ID	11	Y	Int	Null	Auto - Calculated	Yes - Greyed Out	Unique ID. Combination of town and watershed codes
200	TIDE_GATE_TYPE	14	Tide Gate Type	14	Y	Text	Null	User Input - Lookup/Dropdown	Yes	Options: N/A, flap gate, sluice gate, self-regulating, stop log, other
201	TIDE_GATE_CONTROL	17	Tide Gate Control Mechanism	27	Y	Text	Null	User Input - Lookup/Dropdown	Yes	Options: N/A, Counterweights, electric actuator, manual gear, other
202	TIDE_GATE_DEVICE_MATERIAL	25	Tide Gate Device Material	25	Y	Text	Null	User Input - Lookup/Dropdown	Yes	Options: N/A, Metal, Concrete, Wood, Other
203	TIDE_GATE_DEVICE_CONDITION	26	Tide Gate Device Condition	26	Y	Text	Null	User Input - Lookup/Dropdown	Yes	Options: N/A, Good, Fair, Poor
204	TIDE_GATE_COMMENTS	18	Tide Gate Comments	18	Y	Text	Null	User Input - Text Field	Yes	
205										
206										
207	**Replacement History Table**									
208	**Field_Name**	**Character count**	**Field_Alias**	**Character count**	**Required (Y=Yes; N=No; P=Preferred)**	**Format**	**Default_Value**	**Input Style**	**Visible in Collector App**	**Description and/or Lookup/Dropdown Details**
209	CROSSING_ID	11	Crossing ID	11	Y	Int	Null	Auto - Calculated	Yes - Greyed Out	Unique ID. Combination of town and watershed codes
210	NRCS_ID	7	NRCS Site ID#	13	Y	Int	Null	User Input - Numeric	No	NRCS Site # associated with site
211	NRCS_SC	7	NRCS Score	10	Y	Text	Null	User Input - Lookup/Dropdown	No	Options: A, I, A/I
212	DES_PERMIT_NUM	4	Permit #	8	N	Int	Null	User Input - Text	No	DES Permit # Associated with replacement

Appendix B: Data Dictionary Tables

	A	B	C	D	E	F	G	H	I	J
3	**Field_Name**	**Character count**	**Field_Alias**	**Character count**	**Required (Y=Yes; N=No; P=Preferred)**	**Format**	**Default_Value**	**Input Style**	**Visible in Collector App**	**Description and/or Lookup/Dropdown Details**
213	DES_PERMIT_APPLICANT	8	Permit Applicant	16	N	Text	Null	User Input - Text	No	Organization which applied for replacement permit
214	DES_PERMIT_LANGUAGE	9	Permit Language	15	N	Text	Null	User Input - Text	No	Description of replacement plans/results outlined in pe
215	DATE_LAST_RECONSTRUCT	21	Date Of Last Reconstruction	27	N	Date	Null	User Input - Lookup/Dropdown	Yes	Year
216	DATE_LAST_REPAIR	16	Date Of Last Repair	19	N	Date	Null	User Input - Lookup/Dropdown	Yes	Year
217										
218										
219	**Scores Table**									
220	**Field_Name**	**Character count**	**Field_Alias**	**Character count**	**Required (Y=Yes; N=No; P=Preferred)**	**Format**	**Default_Value**	**Input Style**	**Visible in Collector App**	**Description and/or Lookup/Dropdown Details**
221	CROSSING_ID	11	Crossing ID	11	Y	Int	Null	Auto - Calculated	Yes - Greyed Out	Unique ID. Combination of town and watershed codes
222	CROSSING_CONDITION_EVAL	23	Crossing Condition Evaluation	29	Y	Int	Null	User Input - Numeric	No	
223	TIDAL_RANGE_RATIO_EVAL	22	Tidal Range Ratio Evaluation	28	Y	Int	Null	User Input - Numeric	No	
224	CROSSING_RATIO_EVAL	19	Crossing Ratio Evaluation	25	Y	Int	Null	User Input - Numeric	No	
225	EROSION_CLASS_EVAL	18	Erosion Classification Evaluation	33	Y	Int	Null	User Input - Numeric	No	
226	TIDAL_RESTRICTION_EVAL	22	Tidal Restriction Overall Score	31	Y	Double	Null	User Input - Numeric	No	
227	TIDAL_AOP_EVAL	14	Tidal Aquatic Organism Passage Evaluation	41	Y	Int	Null	User Input - Numeric	No	
228	SALT_MARSH_MIG_WSHED_EVAL	25	Salt Marsh Migration Potential Watershed	40	Y	Int	Null	User Input - Numeric	No	
229	SALT_MARSH_MIG_EU_EVAL	22	Salt Marsh Migration Potential Evaluation Unit	46	Y	Int	Null	User Input - Numeric	No	
230	VEGETATION_EVAL	15	Vegetation Evaluation	21	Y	Int	Null	User Input - Numeric	No	
231	INNUNDATION_RISK_ROAD	21	Inundation Risk To Roadway	26	Y	Int	Null	User Input - Numeric	No	
232	INNUNDATION_RISK_STRUCT	23	Inundation Risk To Crossing Structure	37	Y	Int	Null	User Input - Numeric	No	
233	INNUNDATION_RISK_LOW_LYING	26	Inundation Risk To Low-Lying Development	40	Y	Int	Null	User Input - Numeric	No	
234	OVERALL_INFRA_SCORE	19	Overall Infrastructure Score	28	Y	Int	Null	User Input - Numeric	No	
235	OVERALL_ECOLOG_SCORE	20	Overall Ecological Score	24	Y	Int	Null	User Input - Numeric	No	
236	OVERALL_COMBINED_SCORE	22	Overall Combined Score	22	Y	Int	Null	User Input - Numeric	No	
237										
238										
239	**Photos Table**									
240	**Field_Name**	**Character count**	**Field_Alias**	**Character count**	**Required (Y=Yes; N=No; P=Preferred)**	**Format**	**Default_Value**	**Input Style**	**Visible in Collector App**	**Description and/or Lookup/Dropdown Details**
241	CROSSING_ID	11	Crossing ID	11	Y	Int	Null	Auto - Calculated	Yes - Greyed Out	Unique ID. Combination of town and watershed codes
242	ASSESSMENT_DATE	15	Assesment Date	14	Y	Date	Null	User Input	Yes	
243	COMMENTS	8	Comments	8	N	Text	Null	User Input - Text Field	Yes	
244	GlobalID	8	GlobalID	8						
245	CreationDate	12	CreationDate	12	Y	Date	Null	Auto - Calculated		
246	Creator	7	Creator	7	Y	Text	Null	Auto - Calculated		
247	EditDate	8	EditDate	8	N	Date	Null	Auto - Calculated		
248	Editor	6	Editor	6	N	Text	Null	Auto - Calculated		
249										

Appendix A: Table of New Hampshire's Tidal Crossings

CROSSING ID	Town	Road	Stream	Number of Structures
1	Seabrook	Route 286	Blackwater River	0
3	Seabrook	Route 286	N/A	0
4	Seabrook	South Main St	N/A	0
5	Seabrook	Cross Beach Rd	N/A	0
6	Seabrook	Causeway St	Mill Creek	1
7	Seabrook	N/A	N/A	2
8	Hampton	Brown Ave	N/A	0
9	Hampton	Brown Ave	N/A	0
10	Hampton	Brown Ave	N/A	0
11	Hampton	Highland Ave	N/A	0
12	Hampton	Ross Ave	N/A	1
13	Hampton	Church St	N/A	0
14	Hampton	Winnacunnet Rd	Tide Mill Creek	0
15	Hampton	High St	N/A	1
16	Hampton	High St	N/A	0
17	Hampton	Cusack Rd	N/A	0
18	Hampton	NH Rt 101	Tide Mill Creek	1
19	Hampton	NH Rt 101	N/A	0
20	Hampton	Landing Rd	N/A	1
21	Hampton	Drakeside Rd	N/A	0
22	Hampton	Lafayette Rd	Taylor River	1
23	Hampton	Merrill Industrial Dr	N/A	0
24	Hampton	NH Rt 101	Drakes River	0
25	Hampton	Drakeside Rd	Drakes River	0
26	Hampton	N/A	Taylor River	1
28	Hampton Falls	N/A	Hampton Falls River	1
29	Hampton Falls	N/A	Hampton Falls River	0
30	Hampton Falls	N/A	Browns River	2
31	Hampton	Interstate 95 N	Taylor River	0
32	Hampton Falls	Interstate 95 N	N/A	0
33	Hampton	Huckleberry Ln	N/A	0
34	Hampton	Ocean Blvd	N/A	0
35	North Hampton	Appledore Ave	Little River	0
36	North Hampton	Ocean Blvd	N/A	1
37	North Hampton	Atlantic Ave	Little River	0
38	North Hampton	Woodland Rd	Little River	0
39	North Hampton	Ocean Blvd	Chapel Brook	0
40	Rye	Ocean Blvd	N/A	0
41	Rye	Causeway Rd	N/A	0
42	North Hampton	Old Locke Rd	N/A	0
43	North Hampton	Old Locke Rd	N/A	0
44	Rye	Ocean Blvd	Bailey Brook	0
45	Rye	Ocean Blvd	N/A	2
46	Rye	Ocean Blvd	N/A	1
47	Rye	Locke Rd	N/A	0

Appendix A: Table of New Hampshire's Tidal Crossings

48	Rye	Driveway	N/A	0
49	Rye	Harbor Rd	N/A	0
50	Rye	Ocean Blvd	N/A	1
51	Rye	Ocean Blvd	N/A	0
52	Rye	Brackett Rd	N/A	0
53	Rye	Wallis Rd	N/A	0
54	Rye	Wallis Rd	N/A	0
55	Rye	Ocean Blvd	N/A	0
56	Rye	Marsh Rd	N/A	0
57	Rye	Parsons Rd	N/A	0
58	Rye	Ocean Blvd	N/A	0
59	Rye	Pioneer Rd	Berrys Brook	0
60	Rye	Brackett Rd	Berrys Brook	0
61	New Castle	Wild Rose Ln	N/A	0
62	New Castle	Wentworth Rd	N/A	0
63	New Castle	Pit Ln	N/A	0
64	New Castle	Quarterdeck Ln	N/A	0
65	Rye	N/A	N/A	0
66	Portsmouth	Sagamore Ave	Sagamore Creek	1
67	Portsmouth	Lafayette Rd	Sagamore Creek	0
68	Portsmouth	Belle Isle Rd	N/A	0
69	Portsmouth	Marcy St	South mill pond	1
70	Portsmouth	Junkins Ave	N/A	1
71	Portsmouth	Junkins Ave	N/A	1
72	Portsmouth	Bartlett St	Hodgson Brook	0
73	Portsmouth	Maplewood Ave	N/A	1
74	Portsmouth	N/A	N/A	1
75	Portsmouth	Market St	N/A	0
76	Portsmouth	Rt 1 Byp	Not Surveyable	0
78	Portsmouth	N/A	N/A	0
79	Newington	N/A	N/A	0
80	Newington	N/A	Paul Brook	0
81	Newington	N/A	N/A	1
82	Newington	N/A	N/A	0
83	Newington	N/A	N/A	0
84	Rollinsford	Sligo Rd	Sligo Brook	0
85	Rollinsford	Sligo Rd	N/A	0
86	Dover	Atlantic Ave	Fresh Creek	0
87	Dover	Washington St	Cocheco River	1
88	Dover	Washington St	Cocheco River	1
89	Dover	Spur Rd	Varney Brook	0
90	Dover	Spaulding Tpke N	Varney Brook	2
91	Dover	Dover Point Rd	Varney Brook	0
92	Madbury	Piscataqua Bridge Rd	N/A	0
93	Durham	Piscataqua Rd	Bunker Creek	0
94	Durham	Bunker Ln	Bunker Creek	0
95	Durham	Piscataqua Rd	Johnson Creek	0

Appendix A: Table of New Hampshire's Tidal Crossings

96	Madbury	Creek Rd	Johnson Creek	0
97	Durham	Dover Rd	Beards Creek	0
98	Durham	Newmarket Rd	Oyster River	0
99	Durham	Bay Rd	N/A	1
100	Newmarket	Bay Rd	Lubberland Creek	1
101	Newington	No Name	N/A	0
102	Newington	Newington Rd	N/A	0
103	Greenland	N/A	Foss Brook	0
104	Greenland	N/A	Shaw Brook	0
105	Greenland	N/A	Winnicut River	0
106	Greenland	N/A	Winnicut River	0
107	Greenland	Portsmouth Ave	Winnicut River	1
108	Newmarket	New Rd	N/A	0
109	Stratham	N/A	N/A	0
110	Stratham	N/A	Squamscott River	1
111	Newfields	N/A	N/A	0
112	Newfields	N/A	N/A	0
113	Stratham	N/A	N/A	0
114	Stratham	Squamscott Rd	N/A	0
115	Stratham	Squamscott Rd	Jewell Hill Brook	0
116	Stratham	No Name	Mill Brook	1
117	Newfields	N/A	Parting Brook	0
118	Exeter	N/A	N/A	0
119	Exeter	N/A	N/A	1
120	Exeter	Newfields Rd	Rocky Hill Brook	0
121	Exeter	N/A	Rocky Hill Brook	1
122	Stratham	Nh Rt 101 W	Squamscott River	0
123	Exeter	Portsmouth Ave	Wheelwright Creek	1
124	Exeter	Swazey Pkwy	Norris Brook	0
125	Rye	N/A	N/A	1
126	North Hampton	N/A	Chapel Brook	0
127	New Castle	N/A	N/A	1
128	Hampton Falls	N/A	N/A	0
129	Seabrook	N/A	N/A	1
130	Seabrook	N/A	N/A	1
131	Hampton	N/A	Kenney Brook	1
132	Rye	N/A	N/A	1
133	Newfields	N/A	N/A	1
134	Hampton	N/A	N/A	1