CHERRYFIELD RIVERWALK

EXISTING CONDITIONS MEMORANDUM

FEBRUARY 2025

Prepared by

FB Environmental Associates

For

The Town of Cherryfield, Maine

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Introduction

Cherryfield is a small town in Washington County that lies alongside the Narraguagus River. The Narraguagus River spans 50 miles before spilling into the Gulf of Maine.[1] The Cherryfield Riverwalk is an area spanning approximately two miles along the Narraguagus River in downtown Cherryfield. The Riverwalk contains areas of residential development, several public parks and access points to the Narraguagus, and connects to local trail systems including the Down East Sunrise Trail and the Maine Seacoast Mission Trails. The Riverwalk is managed by the Cherryfield Riverwalk Committee (CRC). The CRC aims to improve the resiliency and health of the Narraguagus River and the Riverwalk by evaluating and addressing issues such as sea level rise, flooding, erosion, invasive species, and water quality.

The Narraguagus River offers recreational activities including fishing and kayaking for its residents and visitors to enjoy. The river and its riparian zones also provide habitat to many species that are listed as threatened or of special concern. These species include the upland sandpiper, wood turtle, and bald eagle.[2] Some rare plants can also be found along the banks of the Narraguagus such as Canada Mountain-Ricegrass and Estuary Bur-Marigold.[2] The Narraguagus River, includes multiple protected areas for the spawning and rearing of the endangered Atlantic salmon.[2] Atlantic salmon do much of their spawning and rearing at the head of the tide which falls in the center of the Cherryfield Riverwalk.

To begin assessing the resiliency of the Cherryfield Riverwalk, the Town of Cherryfield was awarded a grant through the Community Resilience Partnership to develop a Riverwalk Management Plan and conduct community outreach. The following report was prepared by FB Environmental to provide an in-depth assessment of existing natural resources and conditions in the Riverwalk region of Cherryfield along the Narraguagus River. This assessment is a compilation of digital and spatial data review, as well as observations from site visits conducted on October 1 and 2, 2024.

1. Natural Resources

1.1 Critical Groundwater and Surface Water Resources

Cherryfield's drinking water supply comes from the Narraguagus River. Along the banks of the Narraguagus River there are four public drinking water supply wells that each have protection areas.[2] These protection areas provide a buffer so the drinking water in Cherryfield continues to be safe to consume. There have been elevated levels of Per- and polyfluoroalkyl substances (PFAS, also known as "forever chemicals") in the water supply in Cherryfield historically, but these issues have not been reported since the 1990s.[3] The Riverwalk study area also contains a significant sand and gravel aquifer within the upper portion of the Riverwalk, just downstream of the Sunrise Trail bridge (Figure 2)[4]. A significant aquifer is capable of being continuously pumped at a rate of 10 gallons per minute or more. The aquifer spans approximately 200 acres on either side of the Narraguagus River. Several drilled bedrock wells are located within the aquifer.

The Narraguagus River is the primary surface water of concern within the Cherryfield Riverwalk. At least seven tributaries to the Narraguagus River are also mapped within the Riverwalk, though not all contained flowing water during the site visit. In Maine, rivers and streams are classified by the Maine Department of Environmental Protection (Maine DEP) based

[1] https://snoflo.org/river-levels/narraguagus-river
[2] https://www.maine.gov/dacf/municipalplanning/comp_plans/Cherryfield%202019.pdf
[3] https://quoddytides.com/WCCC-to-treat-for-high-PFAS-levels-in-drinking-water.html
[4] https://digitalmaine.com/cgi/viewcontent.cgi?article=2364&context=mgs_maps

on designated uses and water quality goals. Fresh surface waters are classified as AA, A, B, and C in order of decreasing water quality and protection (See Title 38 M.R.S.A. Article 4A for more information). Marine waters are classified as SA, SB, and SC. The freshwater portion of the Narraguagus River and all its tributaries within the Riverwalk are classified as Class B, and the tidal portion is Class SB. Class B waters should be suitable for drinking water following treatment, recreation in and on the water, fishing, industrial process, cooling water supply, hydroelectric power generation, navigation, and suitable habitat for aquatic life. Class SB waters must be suitable for the designated uses of recreation in and on the water, fishing, aquaculture, propagation and harvesting of shellfish, industrial process and cooling water supply, hydroelectric power generation, navigation, and as habitat for fish and other estuarine and marine life. Surface waters are also classified according to Section 303(d) of the Clean Water Act by levels of impairment by one or more pollutants. Categories include:

- Category 1 – Meets water quality standards.
- Category 2 – Rivers and streams that meet some designated uses, insufficient data for others.
- Category 3 – Insufficient data.
- Category 4A – Impaired water for uses other than mercury, Total Maximum Daily Load (TMDL) completed.
- Category 4B - Impaired rivers and streams, pollution control requirements expected to result in attainment.
- Category 5 – Impaired water requiring a TMDL or other water quality improvement project. Subcategories are specific to impaired pollutant type.

According to the draft 2024 Maine DEP Integrated Water Quality Monitoring and Assessment Report[5], the portion of the Narraguagus River along the Cherryfield Riverwalk from the confluence with the West Branch to the tidal portion, as well as all the tributaries below the confluence, are listed as Category 2.

The Maine DEP also monitors water quality through its Biological Monitoring Program. Through this program, the Maine DEP counts the population and species of algae and benthic macroinvertebrates (aquatic animals without backbones) living in a stream. Certain invertebrate species are uniquely sensitive to pollution in the water, and therefore, their absence can serve as a key indicator of degrading water quality. Within the Riverwalk section of the Narraguagus River, the Maine DEP has one established macroinvertebrate site and four algae sites[6]. The macroinvertebrate site was last sampled in 2021, attaining Class A standards (higher than its classified B ranking)[7]. Three of the algae sites have not been sampled since 2001, while the remaining site was last sampled in 2016, and met a Class A determination[8].

[5] https://www.maine.gov/dep/water/monitoring/305b/2024/2024_ME_IntegratedRpt-LIST-DRAFT.pdf
[6] https://maine.maps.arcgis.com/apps/webappviewer/index.html?id=8752837d17a64017a84769539ef810a6
[7] https://www.maine.gov/dep/gis/datamaps/lawb_biomonitoring/station_web/S-81M.htm
[8] https://www.maine.gov/dep/gis/datamaps/lawb_biomonitoring/station_web/S-567A.htm

Additional water quality data collected by the Maine DEP are stored in the Environmental and Geographic Analysis Database (EGAD). Approximately 24 stations along the Narraguagus River and its tributaries have been sampled for a variety of physical, chemical, and biological parameters. Within the Cherryfield Riverwalk study region, the Narraguagus River Station 81, located near head of tide, contains the most data points. This station has been consistently sampled every five years since 2001, with additional samples collected in 1993 and 1984. The parameters most consistently collected include temperature, specific conductance, dissolved oxygen, and velocity. Dissolved oxygen concentration (mg/L) has generally increased over the sampling period, while specific conductivity has also experienced a minor increase (Figure 1). Temperature has remained relatively stable. These parameters all remain within DEP's standards for Class B waters. Interpretation of these data should be done cautiously as the number of data points are limited and samples have primarily been collected only in summer months.

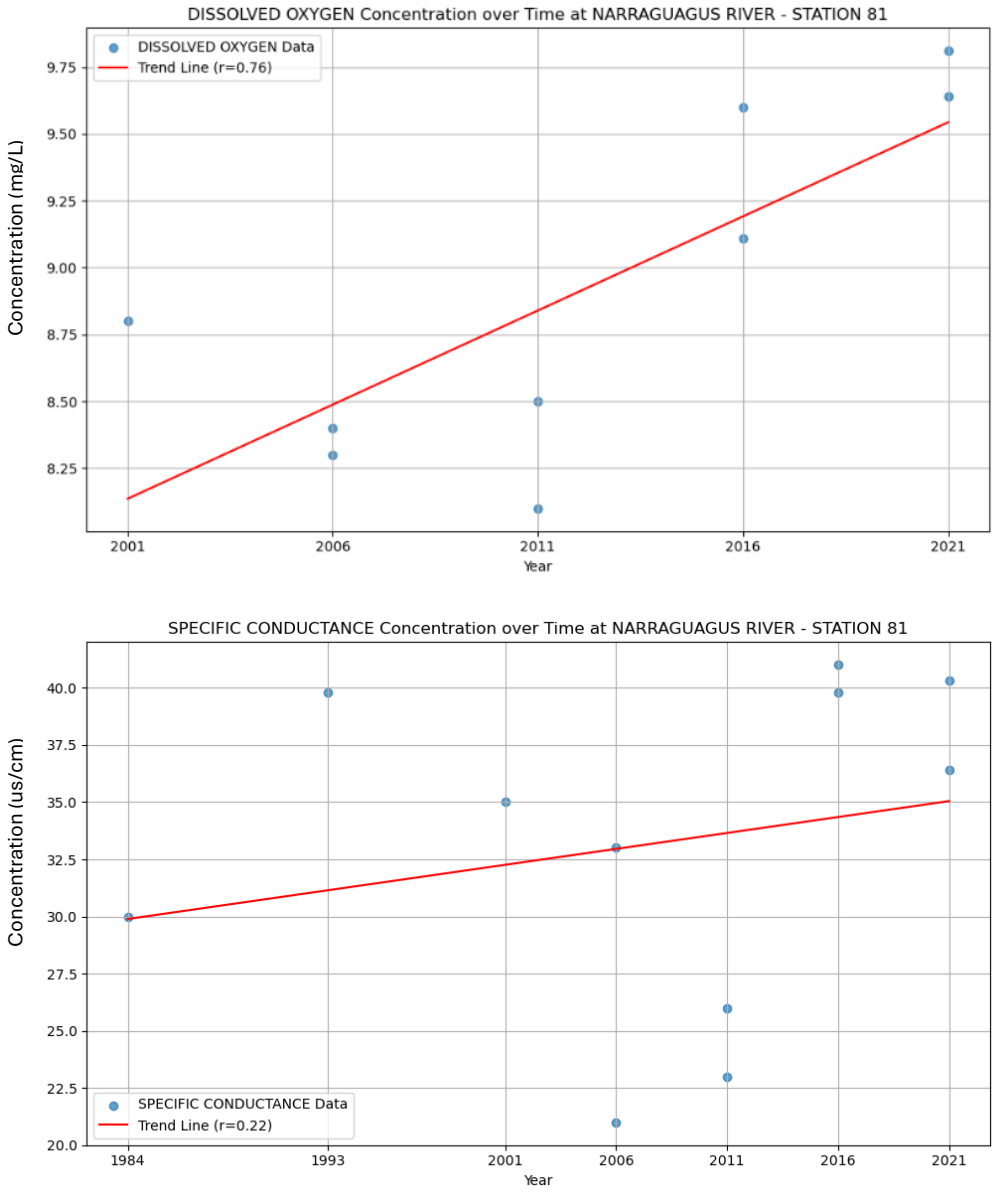


FIGURE 1. SCATTER PLOTS WITH TRENDLINES FOR DISSOLVED OXYGEN (TOP) AND SPECIFIC CONDUCTANCE (BOTTOM) FROM MAINE DEP DATA COLLECTED AT NARRAGUAGUS RIVER STATION 81 IN CHERRYFIELD, ME.

1.2 Threats to Water Resources

The water quality of the Narraguagus River depends in part on the quality of stormwater runoff, the effectiveness of septic systems and other waste-treating systems, and historic uses of the land. Water quality concerns stem primarily from nonpoint sources. A comprehensive water quality data analysis was not included within the scope of this project. An update to the 2003 Narraguagus River Watershed Management Plan is recommended to further evaluate current water quality status, identify watershed-wide sources of pollution, calculate site-specific pollutant reduction estimates from identified sites, and provide detailed recommendations for water quality improvements.

1.2.1 Overboard Discharges and Septic Systems

Overboard discharge systems (OBDs) are one source of concern for water quality within the Narraguagus River. As of January 2023, within the Riverwalk region there are 22 active OBDs and one inactive system (Figure 2). Overboard discharges (OBDs) are discharges to surface waters that are not treated by a sewage treatment facility prior to their discharge into the waterway. In contrast to a septic system which uses a leach field with soil microorganisms to treat and percolate the wastewater into the groundwater, OBDs are discharged directly into surface water after treatment via a septic tank with a sandfilter bed and/or chlorination chamber (Maine Department of Environmental Protection, 2018). Typically, these treatment processes are able to remove 85% or more of pollutant levels from raw wastewater. The presence of one or more OBDs will trigger regulatory closure of an adjacent shellfish area, irrespective of the presence or absence of evidence of contamination as a precautionary measure as OBDs have the potential to discharge bacteria and other pathogens if not properly maintained. An additional 18 OBD systems have already been removed within the Cherryfield Riverwalk study area. OBDs are regulated by the Maine DEP's Overboard Discharge Program.

With no Town sewer service, it is assumed that the remaining residences within the Riverwalk area are serviced by septic systems. Septic systems can likewise pose a serious threat to water resources. Systems located directly adjacent to bodies of water will inevitably have the greatest impact on water quality. Septic system malfunctions can cause leaks that expose local water resources to elevated levels of nutrients and bacteria, impacting their health and recreational value. These malfunctions can easily go unnoticed, with leaks occurring underground and traveling to waters via groundwater. The travel time and filtration of bacteria and nutrients is highly dependent on the underlying soil type, with shallow to bedrock soils providing minimal filtration. Additionally, for historic and older homes such as those found within downtown Cherryfield along the Riverwalk, there are often a lack of record for septic systems, which can contribute to decreased landowner awareness of maintenance need of their septic system.

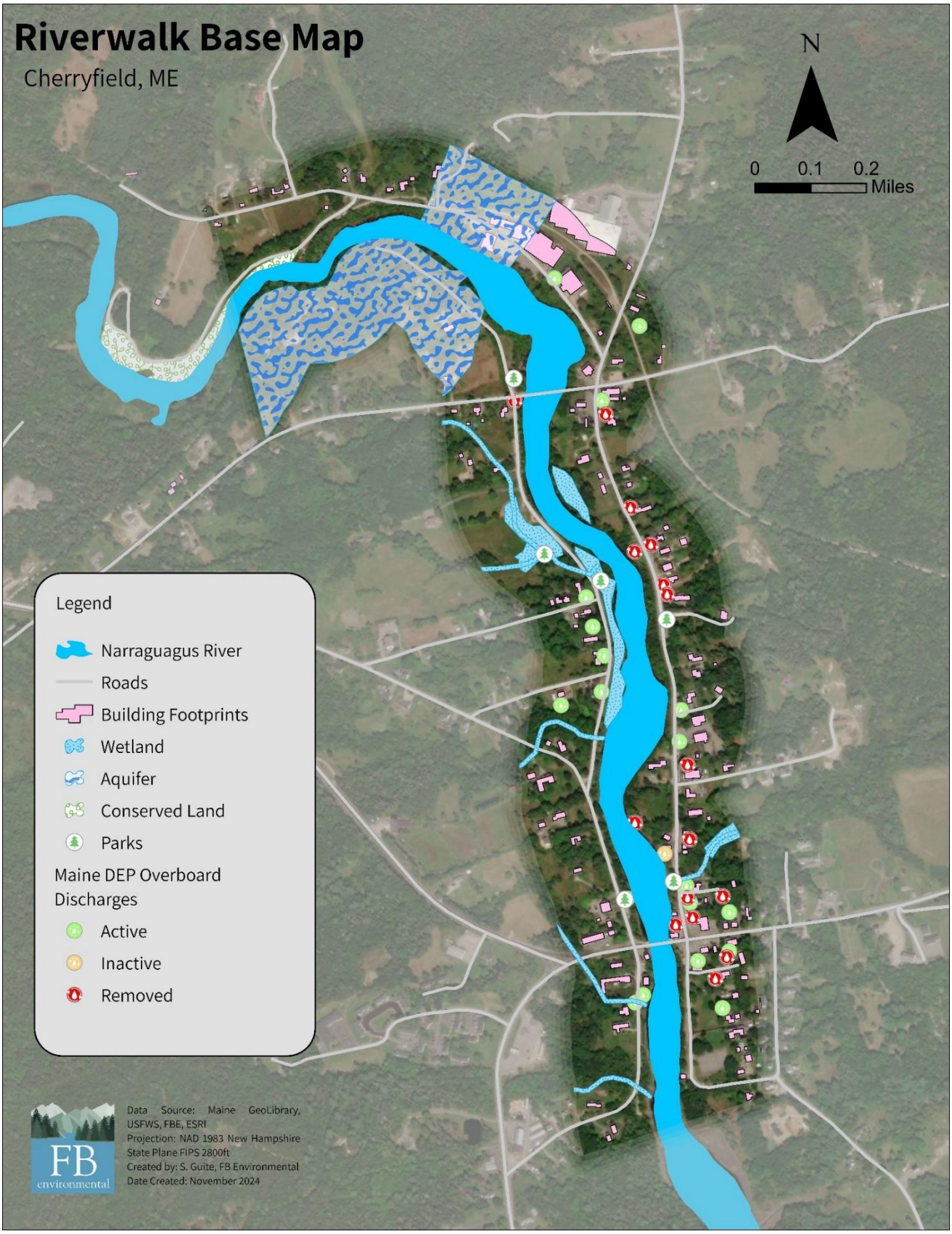


FIGURE 2. CHERRYFIELD RIVERWALK STUDY AREA DEPICTING HYDROLOGIC RESOURCES AND OVERBOARD DISCHARGES.

1.2.2 Nonpoint Source Pollution

Another significant threat to surface water quality in Cherryfield is nonpoint source pollution (NPS). Nonpoint source pollution typically comes from stormwater runoff. Stormwater runoff is caused by the runoff of rainwater and snowmelt along impervious surfaces, such as roads, driveways, and rooftops. This runoff carries sediment, bacteria, nutrients, fertilizers, pesticides, herbicides, oil, grease, and other pollutants into surface waters. This process is even more exaggerated in developed landscapes, where impermeable surfaces decrease infiltration of stormwater runoff. One of the leading concerns in freshwater landscapes is the addition of excess phosphorus, a critical nutrient for biological processes but one that in excess, can fuel algae blooms in surface waters. These algae blooms and their decomposition processes can lead to a depletion of dissolved oxygen, decreased visibility within the water, and increased temperature. Nitrogen is the limiting nutrient in saltwater, and therefore also a concern within the Cherryfield Riverwalk study area. Erosion and nutrient threats may be exacerbated by climate change impacts as Maine continues to see an increase in rainfall intensity and increasing water temperatures.

The Cherryfield Riverwalk was assessed for sources of nonpoint source pollution during the site visit on October 1 and October 2, 2024. From these observations, 16 NPS inputs were identified (Figure 3). The majority of these sites are found in the southern half of the Riverwalk.

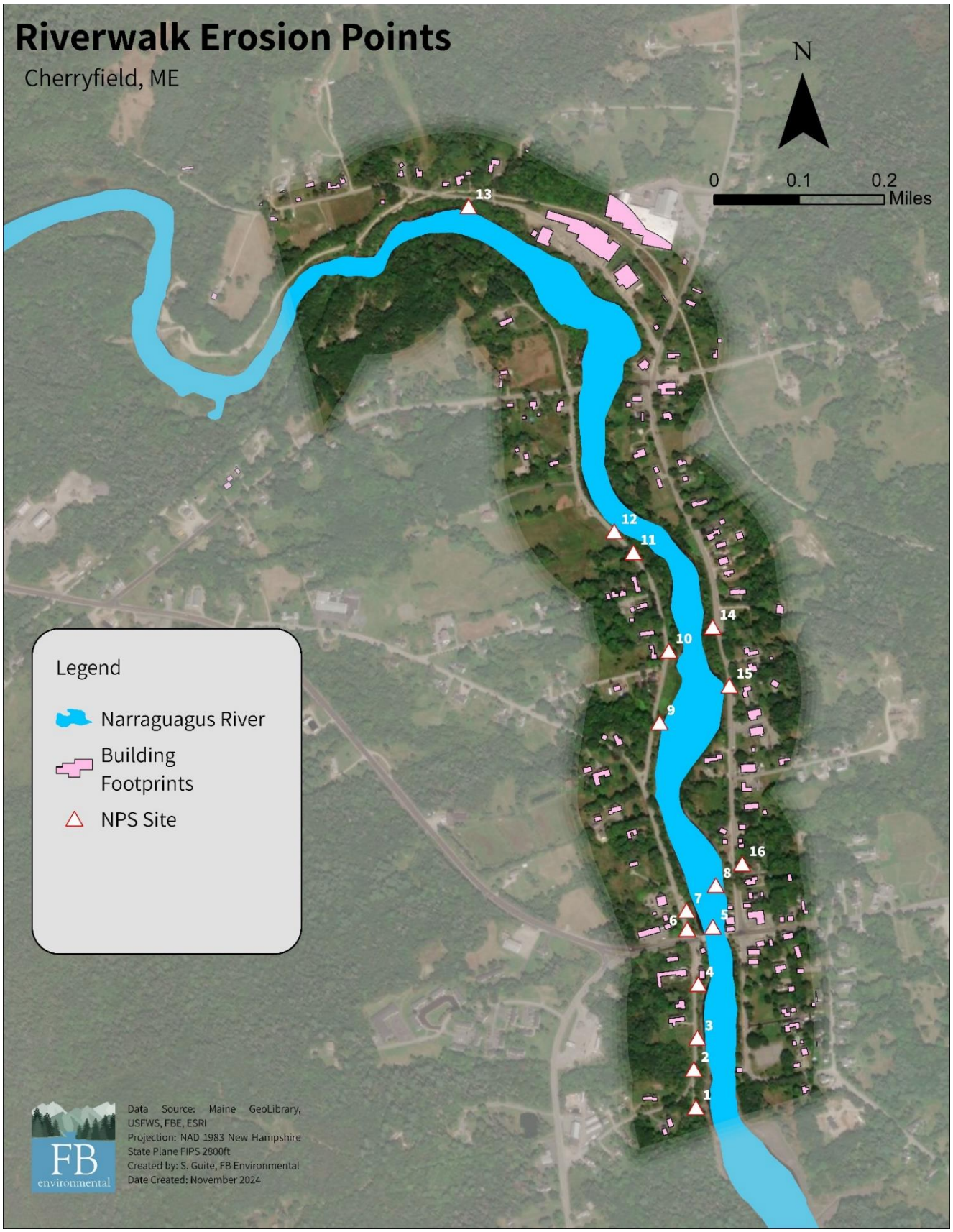


FIGURE 3. MAP OF NPS SITES ALONG THE CHERRYFIELD RIVERWALK IDENTIFIED DURING THE SITE ASSESSMENT ON OCTOBER 1 AND 2, 2024.

1.2.2.1 NPS Input Descriptions

NPS Input 1: Cherryfield Boat Launch

Location (latitude, longitude): 44.5950, -67.9257

Observations: There are potholes above the boat ramp from spinning tires and excess sediment washing into the river from erosion at the boat launch and from the Wilson Hill Road intersection.

Left: Sheet erosion along boat launch going into river. Right: Erosion on Wilson Hill Road washing sediment down the boat launch access road.

NPS Input 2: Wilson Hill Rd Stream Crossing (just north of the boat launch)

Location (latitude, longitude): 44.5956, -67.9257

Observations: There is roadside erosion from ditch runoff and tidal influence at the stream crossing on Wilson Hill Road just north of the boat launch. This is causing eroded material to go into the stream/drainage channel and ultimately the Narraguagus River. The culvert itself is in okay condition.

Erosion along the stream channel and Wilson Hill Road ditch.

NPS Input 3: Across from 19 Wilson Hill Road

Location (latitude, longitude): 44.5962, -67.9256

Observations: Minor roadside erosion is present and is able to reach the river via a path cut through the riparian zone. Rocks have been dumped near the river as well, potentially attempting to mitigate erosion.

Road shoulder erosion and rocks dumped adjacent to the Narraguagus River.

NPS Input 4: Wilson Hill Road Stream Crossing 2 (near 7 Wilson Hill Road)

Location (latitude, longitude): 44.5971, -67.9256

Observations: Road shoulder erosion was observed around the culvert outlet, which is slightly perched. The outlet wall is starting to fail in spots. There is also some stream channel erosion present between the culvert outlet and the confluence with the Narraguagus River.

Left: Streambank erosion along the tributary. Right: Perched culvert outlet and deteriorating wall.

NPS Input 5: Route 1 and River Road Intersection

Location (latitude, longitude): 44.5981, -67.9252

Observations: There is a rusted-out and crushed metal cross culvert at the intersection of Route One and River Road. The ditch feeding the culvert shows signs of erosion and would benefit from additional stabilization.

Culvert at Route 1 and River Road intersection is rusted out and crushed beneath a large stone.

NPS Input 6: River Road Cross Culvert

Location (latitude, longitude): 44.5980, -67.9258

Observations: There is a rusted-out and crushed metal cross culvert along River Road. The culvert outlet channel shows signs of erosion and would benefit from additional stabilization.

Inlet (left) and outlet (right) of crushed culvert across River Road. Right photo also shows erosion of channel.

NPS Input 7: Congregational Church Parking Area

Location (latitude, longitude): 44.5983, -67.9258

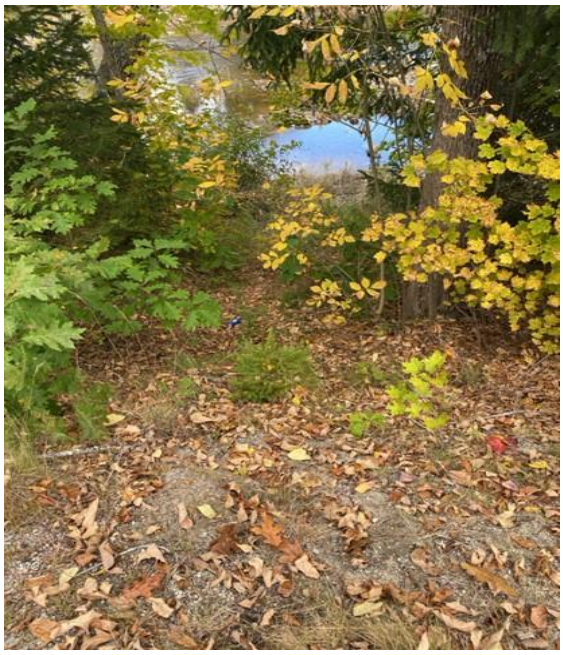
Observations: Minor erosion is occurring from the church parking lot adjacent to the Narraguagus River. Sand piles are also present and not covered to prevent washing into the river.

Left: Congregational church parking lot. Right: Sand pile next to parking lot.

NPS Input 8: River Road Town Right-of-Way

Location (latitude, longitude): 44.59876, -67.9251

Observations: There is erosion present on the road shoulder of River Road throughout the Town right-of-way as well as excess winter sand. A cross culvert at this location is crushed and does not function properly. The area above the culvert is unstable and eroding.



Top Left: Erosion leading down to the Narraguagus River. Top Right: Crushed culvert and unstable outlet. Bottom: Excess winter sand along River Road.

NPS Input 9: River Road Open-Bottom Crossing

Location (latitude, longitude): 44.6015, -67.9264

Observations: Minor erosion is present along the crossing outlet on the sides and on the top. A few stones of the retaining wall have fallen in, causing additional erosion.

Culvert at crossing outlet with failing wall.

NPS Input 10: River Road Crossing (near #74)

Location (latitude, longitude): 44.6028, -67.9262

Observations: There is erosion present on the road shoulder of River Road. A cross culvert at this location is filled with sediment and is eroding above the culvert due to undersized material used for stabilization. According to local stakeholders, the Town had recently replaced the culvert and gravel, which has eroded multiple times in the past. The culvert was 90% blocked at the time of the site visit.

Left: Culvert filled with sediment. Right: Erosion coming off River Road adjacent to the culvert.

NPS Input 11: Crossing by River Road Skating Pond

Location (latitude, longitude): 44.6044, -67.9270

Observations: The culvert across River Road by the skating pond is experiencing erosion above the culvert outlet.

Left: Erosion above culvert outlet. Right: Excess winter sand along River Road by the skating pond, and another view of the erosion along the top of the culvert.

NPS Input 12: River Road Erosion (Upstream of Skating Pond)

Location (latitude, longitude): 44.6048, -67.9274

Observations: There is road shoulder erosion at the site that is going directly into the river. There is also excess sediment from winter sand.

Road shoulder erosion and sediment piles from winter sand along River Road by the skating pond.

NPS Input 13: Stillwater Road Stream Crossing

Location (latitude, longitude): 44.6104, -67.9308

Observations: Twin culverts are present along Stillwater Road. The outlets of both pipes are perched above the stream bed, impacting potential fish passage opportunities.

Twin culverts along Stillwater Road with perched outlets.

NPS Input 14: Main Street Crossing (Near Cemetery)

Location (latitude, longitude): 44.60316, -67.9251

Observations: Minor erosion is occurring above the culvert outlet on Main Street near the cemetery. Runoff from the culvert is carving a channel from the outlet that did not appear to be stabilized or armored.

Left: Erosion along Main Street above culvert crossing near cemetery. Right: Main Street culvert outlet with channel heading towards the Narraguagus River.

NPS Input 15: Main Street Road Erosion

Location (latitude, longitude): 44.6022, -67.9247

Observations: Road shoulder erosion is occurring along the Narraguagus River side of Main Street, causing slumping and cracking of the pavement.

Photo shows cracking and slumping of road from stormwater.

NPS Input 16: Main Street Tributary Crossing

Location (latitude, longitude): 44.5991, -67.9245

Observations: Streambank erosion is occurring along a tributary to the Narraguagus River. A box culvert is in place to transport the stream under Main Street, but the retaining wall around the culvert inlet is beginning to collapse with large stones falling into the stream. The adjacent landowner notes that there are periodic flooding issues along the tributary.

Left: Collapsing retaining wall around the inlet to a tributary stream crossing along Main Street. Right: Streambank erosion along the Narraguagus tributary upstream of the culvert inlet.

1.3 Soils

Within the focus area of the Cherryfield Riverwalk there are 11 soil types (Table 1, Figure 4).[9] The most common soil types are Buxton silt loam, which covers 81.3 acres and approximately 32% of the Riverwalk, and Lamoine-Buxton complex, which covers 63.6 acres and approximately 25% of the Riverwalk.[9] Both Buxton series soils and Lamoine series soils are typically found in glacial deposits on coastal lowlands and river valleys.[10] Both of these are found throughout the Riverwalk and primarily lie along the banks of the Narraguagus. There is also a notable unit of Colton gravelly sandy loam in the northern section just downstream of the Sunrise Trail bridge.[9]

Approximately 69% of the soil is classified as farmland of statewide importance with less than 1% of the area being prime farmland, and 30% are not prime farmland (excluding water).[9] Most of the riverbank before the bend is farmland of statewide importance.[9] Farmland Soils of Statewide Importance are determined by the State to be important for high crop yields but do not meet the conditions of Prime soils.[11]

TABLE 1. CHERRYFIELD RIVERWALK MAJOR SOIL TYPES AND COVERAGES.[9]

Soil Type	Total Acres	Percentage of Riverwalk including water	Percentage of Riverwalk excluding water
Brayton fine sandy loam	0.8	0.30%	0.32%
Buxton silt loam	81.3	27.30%	32.19%
Colton gravelly sandy loam	32.3	10.80%	12.79%
Hermon and Monadnock soils	24.9	8.30%	9.86%
Lamoine silt loam	9.2	3.10%	3.64%
Lamoine-Buxton complex	63.6	21.30%	25.18%
Lamoine-Buxton-Scantic complex	19.3	6.50%	7.64%
Lamoine-Scantic complex	1.9	0.60%	0.75%
Medomak and Wonsqueak soils	0.7	0.20%	0.28%
Scantic silt loam	17.2	5.80%	6.81%
Skerry fine sandy loam	1.4	0.50%	0.55%

[9] https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx
[10] https://soilseries.sc.egov.usda.gov/osdname.aspx
[11] https://www.maine.gov/dacf/ard/resources/docs/prime-farmland-determination-guidelines-v6.pdf

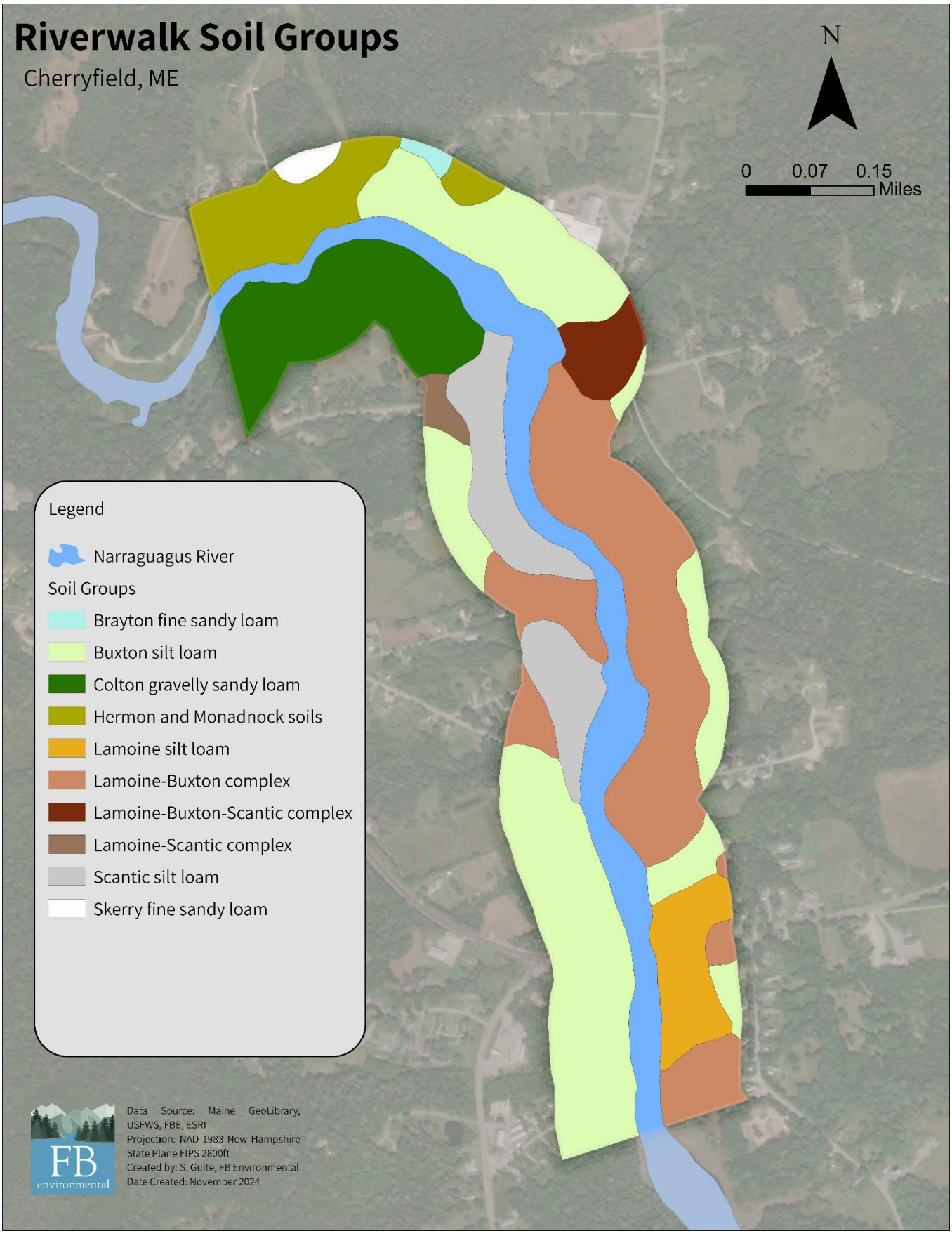


FIGURE 4. SOIL TYPES ALONG THE CHERRYFIELD RIVERWALK.

1.4 Rare and Threatened Flora and Fauna

The Cherryfield Riverwalk along the Narraguagus River contains habitat for multiple state species of special concern including the bald eagle and the wood turtle (Table 2, Figure 5).[2] There are also multiple regions along the Narraguagus home to inland waterfowl and wading birds that are used for breeding, feeding, migrating, and wintering.[12] Cherryfield is the perfect habitat for the bald eagle due to the area's mixed regions of dense forests and rivers, though the mapped habitat area is a small section spanning less than a quarter mile.[13] Wood turtles are often found in slow moving rivers with sandy or gravel substrates, especially in forested riparian zones, like the Narraguagus.[14] Upland sandpipers are also found in Cherryfield, and they are classified as a threatened species. These birds are often found in open peatlands and large grasslands.[15] While these environments are not the most prevalent along the Narraguagus, these birds are commonly spotted in various locations along the river. The Narraguagus River also contains critical habitat for the Atlantic salmon, which is endangered due to habitat loss, pollution, climate change, overfishing, and dams.[16] The Atlantic salmon begins with spawning and rearing in rivers before they migrate towards saltwater[18].

The Narraguagus River also hosts a few rare plant species. As mentioned above, one species is the Canada Mountain-ricegrass which the state of Maine classifies as a species of special concern.[2] Canada Mountain-ricegrass is found along the banks of the Narraguagus in scattered locations.[2] It is primarily found north of the Riverwalk, but can be found smaller regions along the Riverwalk.[2] Since this species is found on the banks of the river, it is very susceptible to damage caused by erosion.

Estuary Bur-marigold is found along the southern region of the Cherryfield Riverwalk, and the state of Maine classifies this plant species as a species of special concern.[2] The Estuary Bur-marigold area of concern spans over a mile south of the Riverwalk.[2]

TABLE 2. RARE AND THREATENED ANIMAL AND PLANT SPECIES FOUND ALONG THE NARRAGUAGUS RIVER IN CHERRYFIELD.[2]

Species Common Name	Species Scientific Name	State Status
Bald Eagle	*Haliaeetus leucocephalus*	Special Concern
Wood Turtle	*Glyptemys insculpta*	Special Concern
Upland Sandpiper	*Bartramia longicauda*	Threatened Species
Canada Mountain-ricegrass	*Oryzopsis canadensis*	Special Concern
Estuary Bur-marigold	*Bidens hyperborea*	Special Concern

[12] https://www.maine.gov/ifw/fish-wildlife/wildlife/beginning-with-habitat/maps/pdf/Cherryfield/Cherryfield%20Map%202.pdf
[13] https://www.maine.gov/ifw/fish-wildlife/wildlife/species-information/birds/bald-eagles.html
[14] https://www.maine.gov/ifw/fish-wildlife/wildlife/species-information/reptiles-amphibians/wood-turtle.html
[15] https://www.maine.gov/ifw/docs/endangered/UplandSandpiper_44_45_2011.pdf
[16] https://www.fisheries.noaa.gov/species/atlantic-salmon/protected

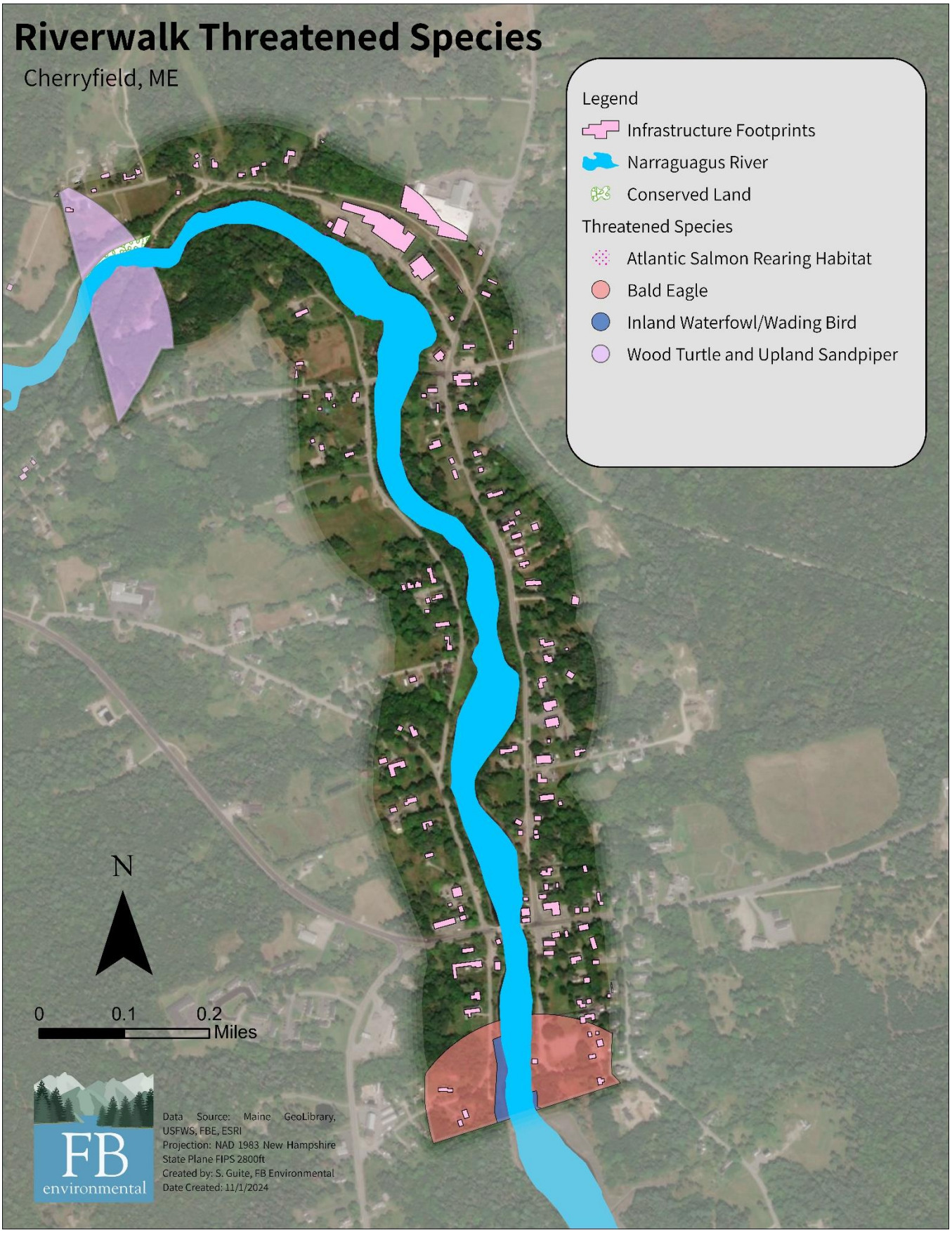


FIGURE 5. THREATENED SPECIES AND CRITICAL HABITAT ALONG THE CHERRYFIELD RIVERWALK.

1.5 Critical Habitats

The Cherryfield Riverwalk contains 17.95 acres of freshwater wetlands. These wetlands are important to Cherryfield, and they act as regions for both stormwater recharge and wildlife habitats.[2] Additionally, the Narraguagus River Estuary reaches the head of the tide between the bridges in downtown Cherryfield.[2] This is an important transitional state for many of the species along the river and provides habitat for marine, freshwater, and anadromous species.

The Narraguagus River contains important aquatic habitat because there are various conditions including freshwater, estuarine, and brackish environments.[2] This river is inhabited by fish that migrate between fresh and salt water and the diverse environment supplies ample nutrition.[2] Freshwater fish species present in the Narraguagus include Atlantic salmon, American shad, alewives, and striped bass.[17] Saltwater fish species that can be found in the river include cod, haddock, hake, and pollock[17]. The fish population is very important to the region and the Downeast Salmon Federation alongside other organizations is currently working to restore the river by replacing old culverts with new, fish-friendly, culverts to restore passage to upstream reaches of the river and its tributaries[18].

1.6 Invasive Species

A ***native*** plant is a part of a given ecosystem that has developed over hundreds or thousands of years in a region or ecosystem. (The word native should be used with a geographic qualifier. All plants are native somewhere, but only plants that have been established for hundreds or thousands of years in Maine are considered native to Maine.) A ***non-native*** plant is a plant introduced to a new place or new type of habitat where it was not previously found, whether intentionally or accidentally. Not all non-native plants are invasive. When many non-native plants are introduced to new places, they cannot reproduce or spread readily without continued human help (e.g., many ornamental plants). An ***invasive*** plant is one that is both non-native and able to establish in many areas, grow quickly, and spread to the point of disrupting existing native plant communities or ecosystems.

Invasive species are the second greatest threat to national biodiversity after habitat loss. Invasive species thrive because they lack natural predators and have differences in growth cycles that often allow them to begin growing earlier in the spring and later in the fall than native species. Invasive species often have adaptations that allow them to spread quickly or inhibit other species' growth by changing soil chemistry. On October 1, 2024, FBE Project Manager, Mindee Goodrum and Project Support, Sierra Guite, visited Cherryfield to do an inventory of invasive terrestrial plants present along the Riverwalk. Nine species were identified within the Riverwalk (Table 3, Figure 6). Of the species identified, the most prevalent were Japanese knotweed and Norway maple. The remaining invasive species present along the Cherryfield Riverwalk are found in smaller areas and amounts. These species are therefore a high priority to manage before they spread further. Most species can be hand pulled when small or a seedling.[19] Larger plants can be cut back or mowed, but this must be done over a number of years as most species will vigorously resprout when cut. Additional and more specific recommendations for treatment will be provided in the Riverwalk Management Plan.

[17] https://alewifeharvesters.org/our-work/where-we-work/cherryfield-fishery
[18] https://www.mainesalmonrivers.org/
[19] https://www.maine.gov/dacf/php/horticulture/invasiveplants.shtml

TABLE 3. INVASIVE TERRESTRIAL PLANT SPECIES IDENTIFIED ALONG THE CHERRYFIELD RIVERWALK.

Name of Invasive	Scientific Name	Individual/ small patch count along Riverwalk	Cluster/large sections along Riverwalk
Autumn Olive	*Elaeagnus umbellata*	1	0
Burning Bush	*Euonymus alatus*	2	0
Goutweed	*Aegopodium*	1	1
Honeysuckle	*Lonicera spp.*	3	1
Japanese Barberry	*Berberis thunbergii*	3	0
Japanese Knotweed	*Reynoutria japonica*	7	2
Multiflora Rose	*Rosa multiflora*	3	0
Norway Maple	*Acer platanoides*	12	3
Reed Canary Grass	*Phalaris arundinacea*	0	3

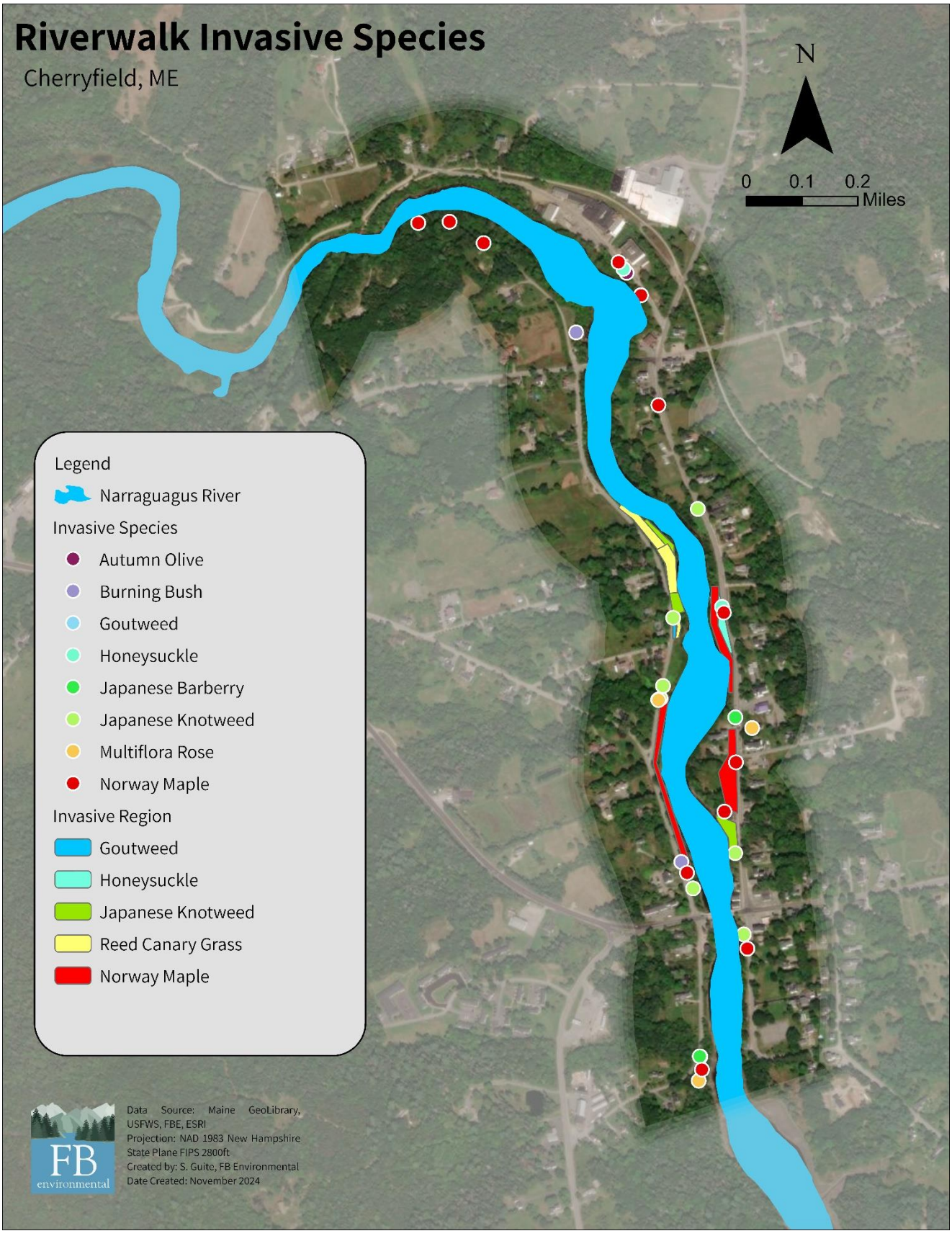


FIGURE 6. INVASIVE PLANT SPECIES AND LOCATIONS ALONG THE CHERRYFIELD RIVERWALK.

Japanese Knotweed (*Fallopia japonica*)

Dense Japanese knotweed in Cherryfield. (FBE)

Japanese knotweed is a perennial herb that can grow up to 10 feet in height. It can be recognized by its hollow stem that has a segmented appearance similar to bamboo. It is native to eastern Asia and was brought to the US for use as an ornamental plant, as well as for livestock fodder and erosion control. It spreads primarily through fragments of its stem or rhizome (part of the root system), which can float and facilitate fast spread of this species along river and stream corridors. Wind-dispersed seeds can also aid its spread. Japanese knotweed found in open uplands, riverbanks, lakeshores, and forest edges.[20] Cherryfield, along the Narraguagus River, has ideal conditions for the growth and spread of Japanese knotweed. This invasive species is extremely resilient and has minimal natural predators, making it especially difficult to manage. Japanese knotweed was observed in seven different small clumps and two large stands along the Cherryfield Riverwalk.

Norway Maple (*Acer platanoides*)

Norway maple is widespread in Maine because it is very shade tolerant.[21] This invasive was brought to the United States as an ornamental tree and now it is often planted because of its purple-red leaves.[21] It spreads through its winged seeds that are carried by the wind or wildlife. This tree is easy to distinguish from other similar maples as the leaves contain a white milky sap which is instead clear on native maple species. To control Norway maple, seedlings should be pulled, and saplings can be cut. [21] Ten small patches and three large sections of Norway maple were documented along the Cherryfield Riverwalk.

Norway maple leaves. (MNAP)

[20] https://www11.maine.gov/dacf/mnap/features/invasive_plants/fallopia.htm
[21] https://www.maine.gov/dacf/mnap/features/invasive_plants/acerplat.htm

Japanese Barberry (*Berberis thunbergii*)

Japanese barberry. (MNAP)

Japanese barberry is a shrub that can grow 2 to 4.5 ft. (0.6-1.3 m) tall[22]. It was first introduced as an ornamental plant when seeds from Russia were planted in the Arnold Arboretum in Boston, MA in 1875. The species now covers much of New England and Midwest states and occurs in a broad range of habitats. Japanese barberry can be identified by long woody grooved stems with small, smooth-edged, and oval leaves growing in clusters of two to six. At each cluster node is a single spine, a defining feature from the European variety. The leaves range in color from green to bluish-green, to dark red. In late spring the plant has pale yellow flower clusters that transition to bright red oblong berries in late summer through the winter. Japanese barberry seeds spread by small mammals and birds that eat the red fruit. Japanese Barberry was observed in three locations along the Cherryfield Riverwalk as small clumps or individuals.

Shrubby Honeysuckles (*Lonicera sp.*)

Multiple invasive shrubby honeysuckle species exist in Maine including Tartarian and Morrow's. Honeysuckle is a native of eastern Asia and was first introduced into North America in the late 1800s[23]. It has been planted widely as an ornamental and for wildlife food and cover. It is a multi-stemmed, upright, deciduous shrub that grows up to 7 ft. (2.1 m) tall. The leaves are opposite, round, and hairy underneath. Honeysuckle is often one of the first shrubs to leaf out in the spring. The fragrant flowers are tubular, white to cream-colored, and develop in mid- spring. Abundant berries ripen to orange or red in color and often persist throughout winter. The bark is light brown and often pubescent on young stems. Several species of exotic bush honeysuckles occur, and distinguishing individual species can be difficult. Honeysuckle readily invades open woodlands, old fields, and other disturbed sites. It can spread rapidly due to birds and mammals dispersing the seeds and can form a dense understory thicket which can restrict native plant growth and tree seedling establishment. Invasive honeysuckle was observed at three locations along the Cherryfield Riverwalk in small patches or individuals.

[22] https://www.maine.gov/dacf/mnap/features/invasive_plants/berberis.htm
[23] https://www.maine.gov/dacf/mnap/features/invasive_plants/lonicera.htm

Multiflora Rose (*Rosa multiflora*)

Multiflora leaves with fringed stipules. (MNAP)

The U.S. Soil Conservation Service promoted the use of multiflora rose in the early 1900's for erosion control and wildlife habitat[24]. It grows as a perennial, thorny bush made of hardy stems that can be about 10 to 15 ft. (3-4.5 m) tall. Leaves are sharply toothed, alternate, and arranged in leaflets of five to eleven. The base of each leaf has distinctive fringed stipules. The plant grows clusters of white or pink flowers in June that last through July before forming red rosehips in the fall. Multiflora Rose was observed in three locations along the Cherryfield Riverwalk. It was observed in small patches or as individuals.

Burning Bush (*Euonymus alatus*)

Burning bush is a deciduous shrub that can reach up to fifteen to twenty feet in height[25]. It was brought to the U.S. from northeastern Asia as an ornamental shrub in 1860. Stems often have corky wing-like structures, with opposite dark green leaves that turn a distinctive bright red in the fall. Burning bush can spread via seed and vegetatively. The seeds are red-orange and coated with a fleshy purple covering. It is shade tolerant, presenting a threat even in established forest habitats. Burning bush can form dense thickets that prohibit other species from growing and may increase predation by deer on nearby native species. Burning bush was identified in only two locations along the Cherryfield Riverwalk, including a planted bush located at the public park on Mill Street.

Burning bush branch with corky wings. (MNAP)

[24] https://www.maine.gov/dacf/mnap/features/invasive_plants/rosa_multiflora.htm
[25] https://www.maine.gov/dacf/mnap/features/invasive_plants/euonymus.htm

Autumn Olive (*Elaeagnus umbellata*)

Autumn olive is a deciduous shrub that can grow ten to fifteen feet in height and width[26]. The branches, leaves, and fruits contain small silvery or brown scales. Fruits are slightly oblong, maturing to red in early fall. Autumn olive was brought to the U.S. from Asia as an ornamental species and was promoted as a food source and cover for wildlife. It spreads primarily by seed, but will sprout vigorously when cut. It is known to form dense stands and can fix nitrogen, giving it an advantage in poor soil environments. Only one small grouping of autumn olive was observed along the Cherryfield Riverwalk.

Autumn olive leaves. (MNAP)

Goutweed (*Aegopodium podagraria*)

Variegated goutweed found along the Cherryfield Riverwalk. (FBE)

Goutweed, also known as Bishop's Weed, is an herbaceous perennial ground cover[27]. It grows up to two feet in height and has three leaflets per stem. Leaves can be solid green or variegated with white. Goutweed is native to Europe and northern Asia and was brought to the US as an ornamental species. It spreads primarily through its rhizomatic root system or through fill contaminated with rhizome fragments and can grow aggressively. It can thrive in a variety of habitats including under light shade. Goutweed was identified in one large patch and one smaller clump along the Cherryfield Riverwalk.

[26] https://www.maine.gov/dacf/mnap/features/invasive_plants/elaeagnus.htm
[27] https://www.maine.gov/dacf/mnap/features/invasive_plants/aegopodium.html

Reed Canary Grass (*Phalaris arundinacea*)

Reed canary grass is a robust perennial grass that can reach up to six feet in height[28]. It has inflorescences of 3-8 inches that begin forming in early summer. It spreads via seed and rhizome. Seeds may be spread by water. Reed canary grass is native to Eurasia and was brought to the US for erosion control and forage on agricultural pastures. It is typically found along stream and riverbanks, lakeshores, marshes, ditches, and roadsides in moist or wet soils. It has some shade tolerance but prefers full sun. Hand pulling or digging may work for small patches, while mowing is preferred for larger patches. Reed canary grass was observed in three dense clumps along the Cherryfield Riverwalk.

A patch of reed canary grass in Cherryfield. (FBE)

2 Public Access to the Cherryfield Riverwalk

The Riverwalk is easily accessible due to its proximity to downtown Cherryfield, though improvements for parking, pedestrian safety, and signage are needed. The Riverwalk is integrated into the downtown area, allowing pedestrians to access it from multiple points. The Riverwalk forms a loop connected by two bridges: one near Route 1 in the town center and the other at the old Calais Rail Bridge. In addition to its scenic views of the town and the Narraguagus River, the Riverwalk also serves as a historic tour through Cherryfield's Historic District, which was added to the National Register of Historic Places in 1990[29]. Along its path, visitors can view dozens of historic buildings significant to Cherryfield's heritage, dating from 1750-1890. Popular with locals and visitors alike, the Riverwalk offers a peaceful space to enjoy both nature and history.

Though much of the Riverwalk is privately owned, public access to the Narraguagus River can also be found along the Riverwalk at the various municipal parks and the boat launch at the southern end off Wilson Hill Road. There are approximately six parks or publicly owned lands for recreational use along the Cherryfield Riverwalk (Figure 7). Public parks include Veteran's Memorial Park, Stewart Park, and the Mill Street Park. Parking is generally limited at these sites, and no formal access paths or structured overlooks to the Narraguagus River exist at these parks. Additionally, the southern end of the Riverwalk connects to the Maine Seacoast Mission trails and the northern portion connects with the Down East Sunrise Trail, further enhancing the recreational opportunities for visitors.[30]

[28] https://www.maine.gov/dacf/mnap/features/invasive_plants/phalaris.pdf
[29] https://storymaps.arcgis.com/stories/e14e6d0748724676953d9fc284fd7ca9
[30] https://mainebyfoot.com/cherryfield/

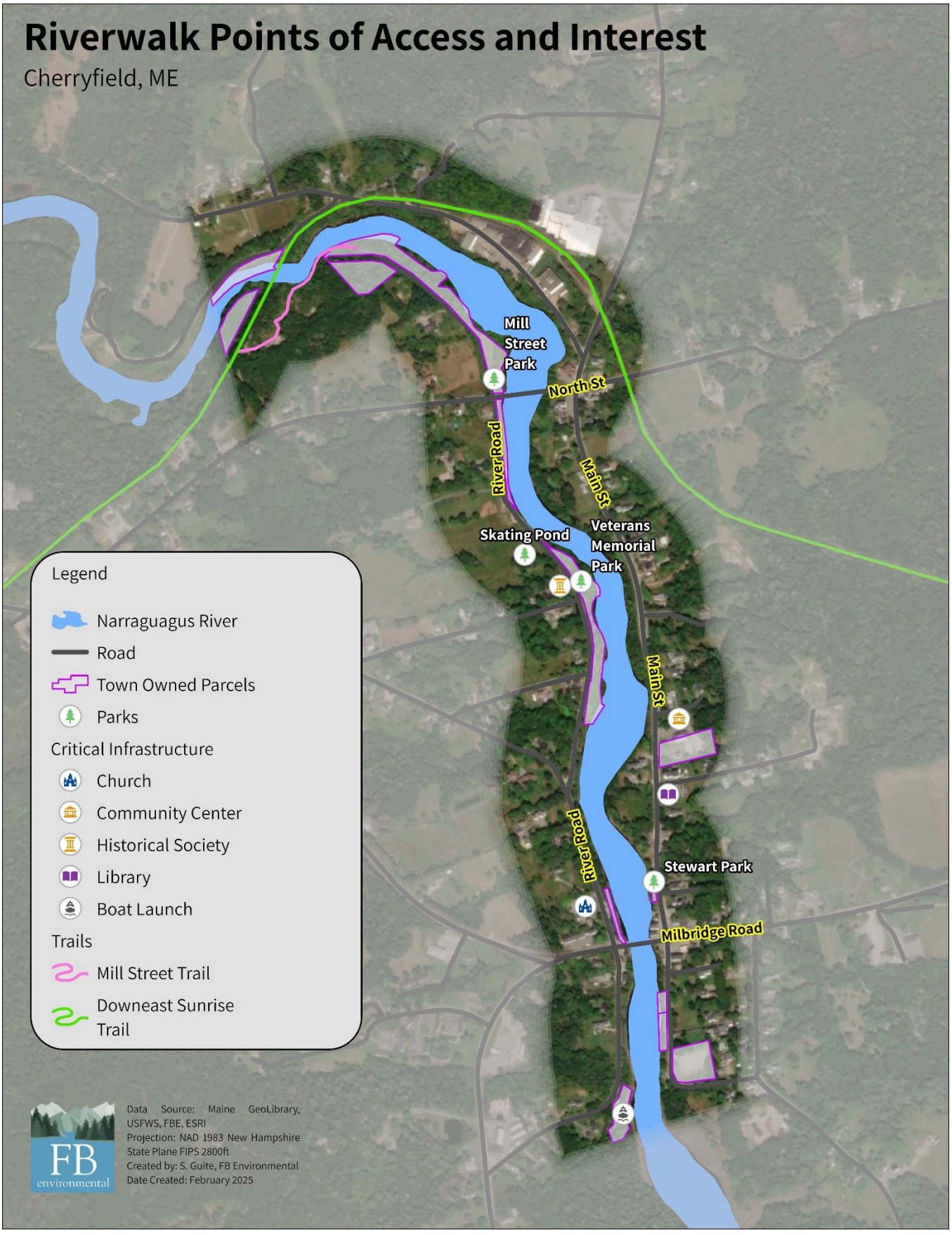


FIGURE 7. MAP OF PUBLIC PROPERTIES, ACCESS POINTS, AND POINTS OF INTEREST ALONG THE CHERRYFIELD RIVERWALK.

3 Flooding and Sea Level Rise Vulnerability

3.1 Infrastructure

The Riverwalk is surrounded by a mix of commercial, residential, and historical structures, along with the natural beauty of the wetlands and the Narraguagus River. Current businesses along the river include Cherryfield Foods Inc, the Paisley Loon, and 4 Main Street Antiques. In addition to its commercial buildings, the Riverwalk also includes the Cherryfield Historic District, filled with dozens of historic residential homes. Several local organizations also have buildings within or adjacent to the Riverwalk including the First Congregational Church, the Cherryfield-Narraguagus Historical Society, the Cherryfield Academy Community Center, the American Legion, and the public library.

The primary roads surrounding the Riverwalk include a mix of state and local roads. River Road and Main Street / Route 93 run parallel to the main stretch of the Riverwalk and are maintained by the Town and the Maine Department of Transportation (MDOT) respectively. Mill Road, North Street, Wilson Hill Road, and Park Street are the remaining Town-maintained roads surrounding the Cherryfield Riverwalk. MDOT is also responsible for the Route 1 / Milbridge Road bridge crossing that traverses the Narraguagus River. Additionally, the Town of Cherryfield owns and maintains a boat launch off Wilson Hill Road that provides access to the Narraguagus River. Stormwater and stream crossing infrastructure are also present along the Cherryfield Riverwalk. 20 culverts were recorded within the region during the October site assessment.

3.2 SLR and Vulnerability

Sea level rise (SLR) is a large threat to many coastal communities in Maine. While Cherryfield does not contain any direct coastal shoreline, the head of the tide on the Narraguagus River lies within the Town center, making the town susceptible to the effects of flooding from sea level rise, storm surge, and extreme precipitation events. The Maine Won't Wait Climate Action Plan[31] discusses the frequency and severity of coastal flooding in Maine has increased in the last decade and is predicted to continue to rise.[32] Freshwater flooding is also expected to increase in response to increases with extreme precipitation events in the northeastern US.[33] This is partly due to the projected increase in short, heavy precipitation events when excess rain falls within a short period of time (i.e., 2-4 inches within a few hours), drainage infrastructure such as culverts cannot handle the large volumes of water. In addition, wetlands, which naturally store floodwaters, cannot always fully mitigate floodwaters during intense precipitation events.

Sea level rise projections (including highest astronomical tide (HAT) and storm surge projections) were sourced from the Maine Geological Survey (MGS). The scenarios used in this analysis included HAT+ 1.6 feet, HAT+ 3.9 feet, and HAT+ 8.8 feet. Although the Maine Climate Council recommends using 1.5 feet of relative sea level rise as a planning threshold for 2050, 1.6 SLR is represented here because that is the data available. Data on flood inundation boundaries due to Category 1, 2, 3, and 4 hurricanes were obtained from the MGS Sea Lake and Overland Surges (SLOSH) dataset. Modeled SLOSH data created by the National Weather Service uses atmospheric pressure, size, forward speed, and track data from historical, hypothetical, or predicted hurricanes to model the wind field driving the storm surge. Data on the inundation boundaries of the flooding of inland freshwaters and coastal waters due to extreme precipitation events were obtained from U.S. Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRMS), digitized by the

[31] https://www.maine.gov/climateplan/sites/maine.gov.climateplan/files/inline-files/MaineWontWait_December2020_printable_12.1.20.pdf
[32] https://www.maine.gov/future/sites/maine.gov.future/files/inline-files/GOPIF_STS_REPORT_092320.pdf
[33] https://www.des.nh.gov/about/boards-and-committees/coastal-flood-risk

Maine GeoLibrary and the FEMA map service. For Cherryfield, FEMA flood zones within the 100-year flood probability were evaluated. This means that regions in this area have a 1% chance of flooding annually due to precipitation events.

The results presented here are based on projections using the best available science and data but should be viewed as approximations that can assist with identifying needed actions to increase the Cherryfield Riverwalk's climate resilience. Projected impacts may underestimate vulnerabilities. For example, sea level rise predictions identified by the MGS are based on historical sea level rise data. Given that sea level rise and storm surges are becoming increasingly severe, these predictions may ultimately underestimate the severity or timeline of inundation by sea level rise. For this reason, the State of Maine suggests municipalities commit to manage for 1.5 feet of SLR by 2050 and 3.9 feet of SLR by 2100, and prepare to manage for 3.9 feet of SLR by 2050 for low-risk-tolerant infrastructure.

There are 164 buildings that fall within the constraints of the Riverwalk (within 0.1 miles from the high-water line of the Narraguagus River between the Old Calais Rail Bridge and the Cherryfield boat launch). Of those, 36% are susceptible to flooding from at least one of the flood projections, indicating a large region of the Cherryfield Riverwalk could be affected during a flood event (Figure 10 and Figure 11). Other key public infrastructure is projected to be impacted under flooding scenarios as well, including the boat launch, which is projected to be flooded on even the lowest level of flooding. Additionally, Wilson Hill Road, Park Street, Main Street, River Road, and Campbell Hill are all susceptible to flooding in different scenarios. The largest flooding concerns are Wilson Hill Road and Park Street, which are susceptible to flooding under 3.9 feet of SLR and a Category 1 hurricane.

3.3 Historic Flooding

Cherryfield has a history of flooding along the Narraguagus River. The US Geological Survey (USGS) maintains a flow gage and water level logger on the Narraguagus River just upstream of the rail bridge. This has been documenting river discharge levels since 1989 and water levels since 2007. The first documented flood occurred in March 1936 when heavy rains caused the ice to jam, resulting in multiple feet of flooding over Park Street, Main Street, and River Road.[2] Another ice jam occurred on March 10, 1942, flooding the same streets and causing significant damage to buildings and vehicles.[2] Local historic photos also document damaging floods in 1955 and 1959 (Figure 8). Due to the recurring ice jams, the Army Corps of Engineers built the Cherryfield Ice Dam in 1961 to help control ice-related flooding.[34] Even with the dam, flooding continued, including a significant event on December 26, 1977

FIGURE 8. (TOP) AFTERMATH OF THE FLOOD OF 1942. (BOTTOM) FLOOD OF 1959 AS SEEN FROM THE ROUTE ONE BRIDGE, DEPICTING DAMAGE TO MAIN STREET HOMES.

[34] https://www.mdislander.com/news/maritime/cherryfield-ice-dam-to-be-removed-in-favor-of-nature-like-fishway/article_59dd8e88-3d4c-11ef-a33c-63e0ce9ef875.html#:~:text=The%20Army%20Corps%20of%20Engineers,structures%20and%20alewife%20harvesting%20infrastructure

that reached a maximum gage height of 13.30ft and average daily discharge of 2640 cubic feet per second.[35]

3.4 Recent Flooding

The most recent reported ice jam was on March 20, 2007 where heavy rains caused the Narraguagus River to reach a level of 13.7 feet and the river deposited large ice chunks along Patty Lane. Other strong storm events have caused flooding along the Narraguagus River. A storm on December 18, 2023 brought nearly two inches of rain to Cherryfield, and up to five inches to areas in Central Maine (Figure 9). The rain combined with ice and snow melt and high tides resulted in a significant flooding event, with the USGS water gauge reporting flows on the Narraguagus in Cherryfield greater than the 90th percentile compared to normal flows for all December flows on record[36]. A second storm in January 2024 caused high flows and flooding for the second time within a 30-day period, with flows on the Narraguagus surging to an all-time high for January[37].

FIGURE 9. FLOODING DURING THE DECEMBER 18, 2023 STORM ALONG THE NARRAGUAGUS RIVER IN CHERRYFIELD.

[35] https://www.maine.gov/dacf/flood/docs/maineriverbasin/maineriverbasinreportappendices.pdf
[36] https://www.weather.gov/media/car/E5s/2023/E5_CAR_2023-12.pdf
[37] https://www.weather.gov/media/car/E5s/2024/E5_CAR_2024-01.pdf

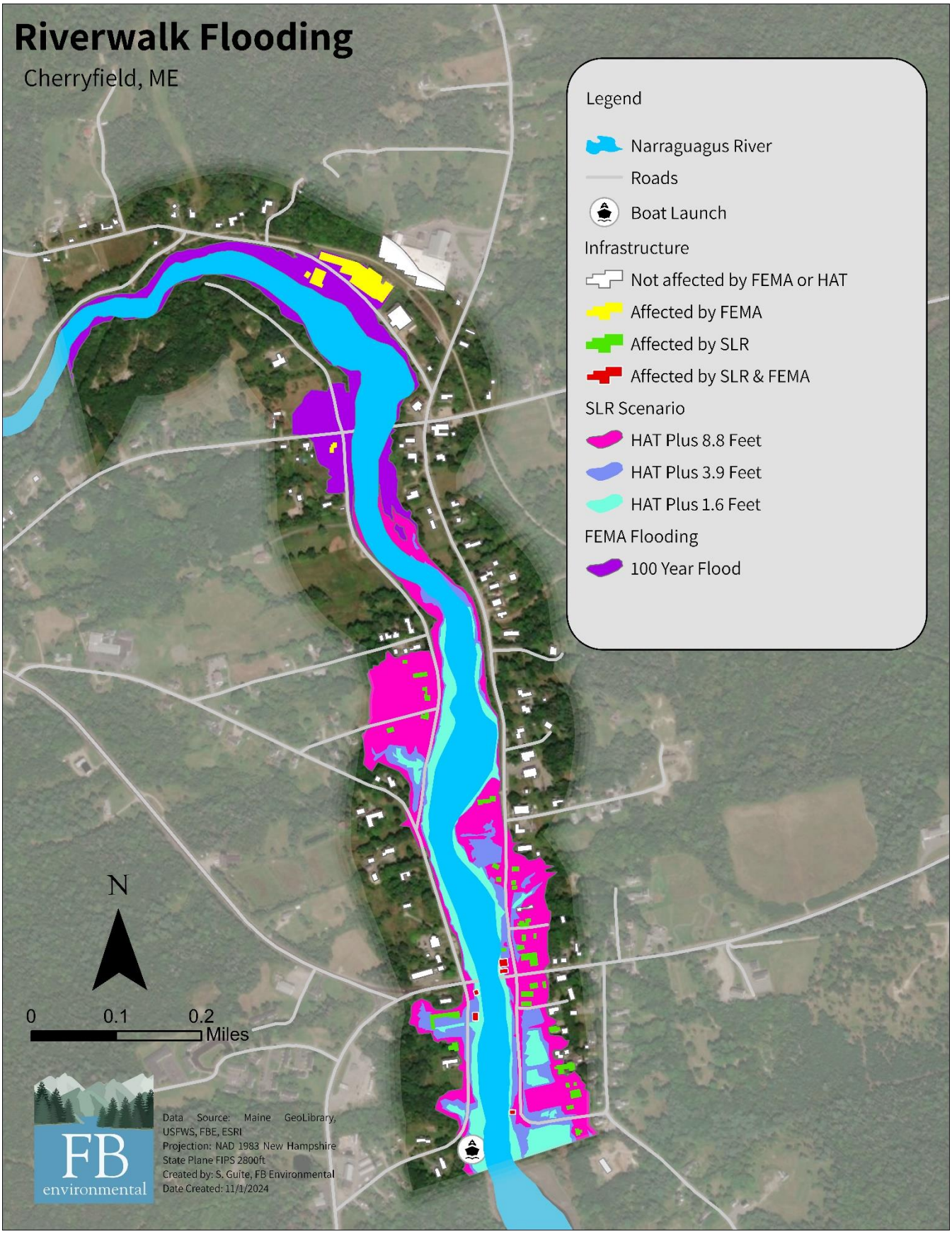


FIGURE 10. SLR AND FEMA FLOOD ZONES SHOWING VULNERABILITIES ALONG THE CHERRYFIELD RIVERWALK.

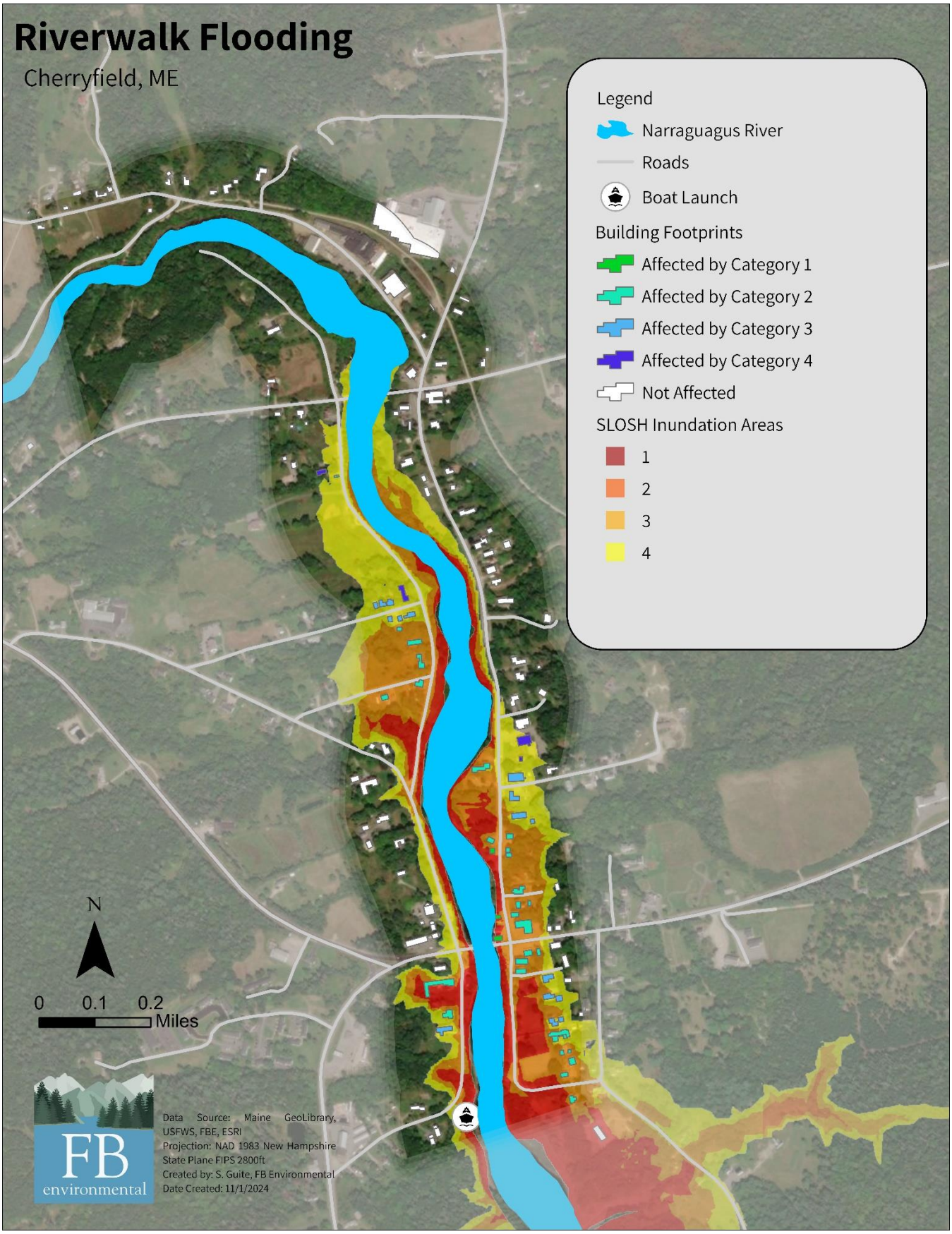


FIGURE 11. SLOSH HURRICANE VULNERABILITY ALONG THE CHERRYFIELD RIVERWALK.