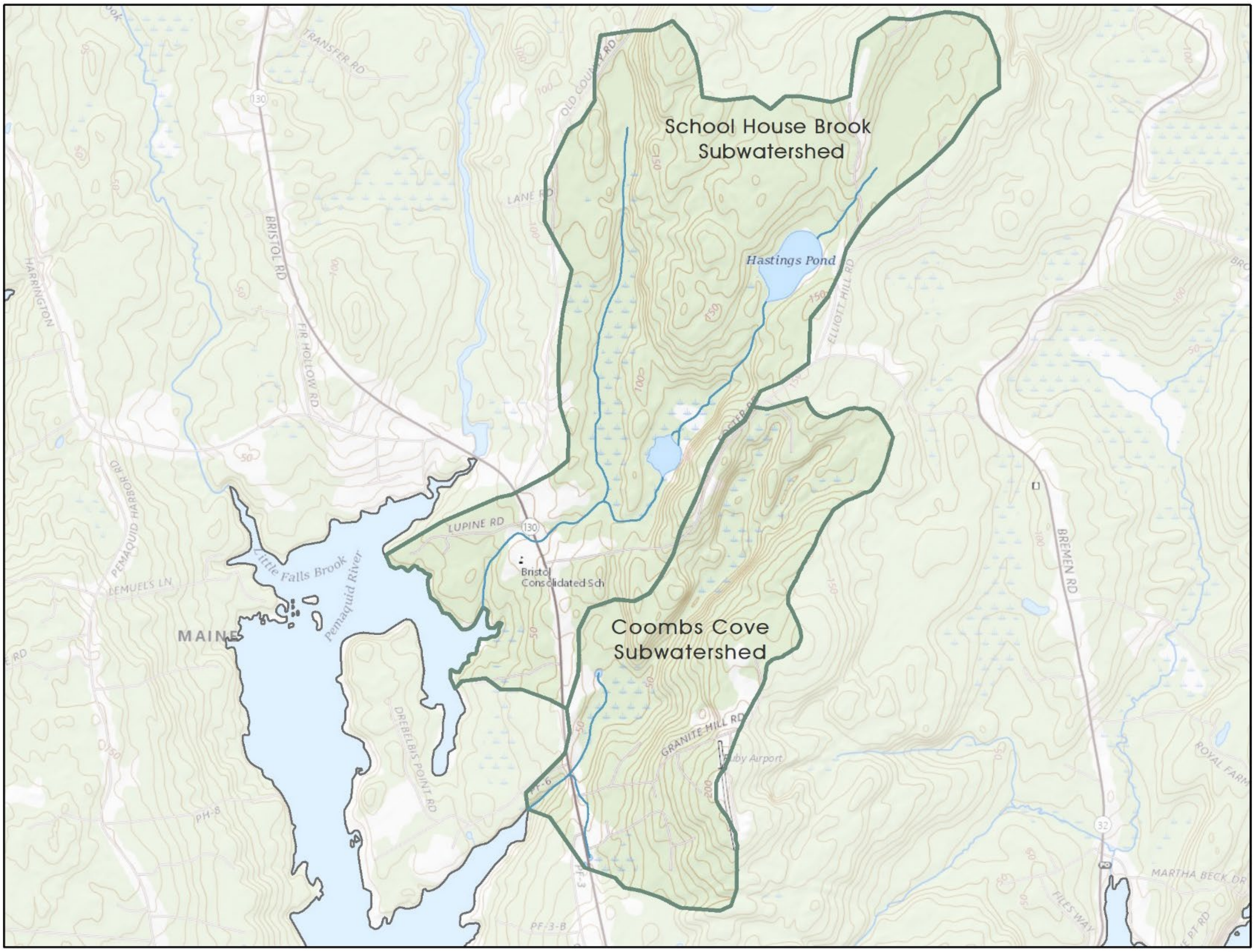
SCHOOL HOUSE BROOK AND COOMBS COVE SUBWATERSHEDS

SEPTIC SYSTEM RISK ASSESSMENT REPORT



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PREPARED FOR

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EXECUTIVE SUMMARY

The goal of this septic system risk assessment report is to assist the Town of Bristol with town management of septic systems by providing a ranked septic system database according to each parcel's risk of pollution to the Pemaquid River estuary for the School House Brook and Coombs Cove subwatersheds. **This assessment does not identify failing or malfunctioning systems, but rather identifies those that present a higher risk to local waterbodies if they were to fail or malfunction.**

Why properly functioning septic systems are important:

- Research and real-world experience show that septic systems of all ages sometimes malfunction for a wide variety of reasons, including poor maintenance, excessive loading with fats or solids, overloading due to water supply leaks, damage from tree roots or vehicles, old age, and even occasional errors in the design and/or installation.
- Malfunctioning systems can potentially release untreated wastewater laden with fecal matter and excess nutrients into the groundwater and nearby waterbodies, such as into the tributaries that run into the Pemaquid River and estuary.
- Shellfish flats in the Pemaquid River estuary are an important resource for the community. Tracking and preventing pollution is a step in removing flat closures.

What the results of this report provide:

- Parcels located within the School House Brook and Coombs Cove subwatersheds are prioritized for risk level based on both infrastructure risk factors (e.g., septic system age) and soil and environmental risk factors (e.g., soil permeability, depth to bedrock, distance to nearest waterbody; see list on right for full details). Figure 1 maps parcel priority levels.
- Within the School House Brook and Coombs Cove subwatersheds, 14 parcels are identified as highest priority due to lack of permit on file with the town or state. Buildings for which there is no wastewater system record suggest that risk factors such as age of system, design suitability, and installation quality may be present, or it may pre-date modern permitting and inspection procedures.
- In addition, 24 parcels are identified as moderately high priority with septic systems 30 years and older, 29 parcels are identified as moderate priority with systems 10-20 years old, and 10 systems are identified as low priority with systems newer than 10 years old. 31 parcels are vacant and are not a priority.

What next steps the Town of Bristol and community can take:

- Identify the status of systems identified as high or moderately high risk and attempt to locate the septic permit or approximate age of the septic system.
- Consider implementing a septic system maintenance ordinance, such as a pump-out ordinance.

Septic systems are designed to treat wastewater before it reaches groundwater or adjacent surface waters. Diagram © EPA

Septic System Infrastructure Risk Factors:

- *Age of system*
- *Design suitability*
- *Maintenance history*

Environmental Risk Factors:

- *Soil limitation factors:*
  - *Filtering capacity*
  - *Flooding*
  - *Ponding*
  - *Depth to bedrock*
  - *Slope*
  - *Depth to saturated zone*
  - *Seepage*
  - *Restricted permeability*
  - *Too steep*
- *Proximity to:*
  - *Wetlands*
  - *Waterbodies*

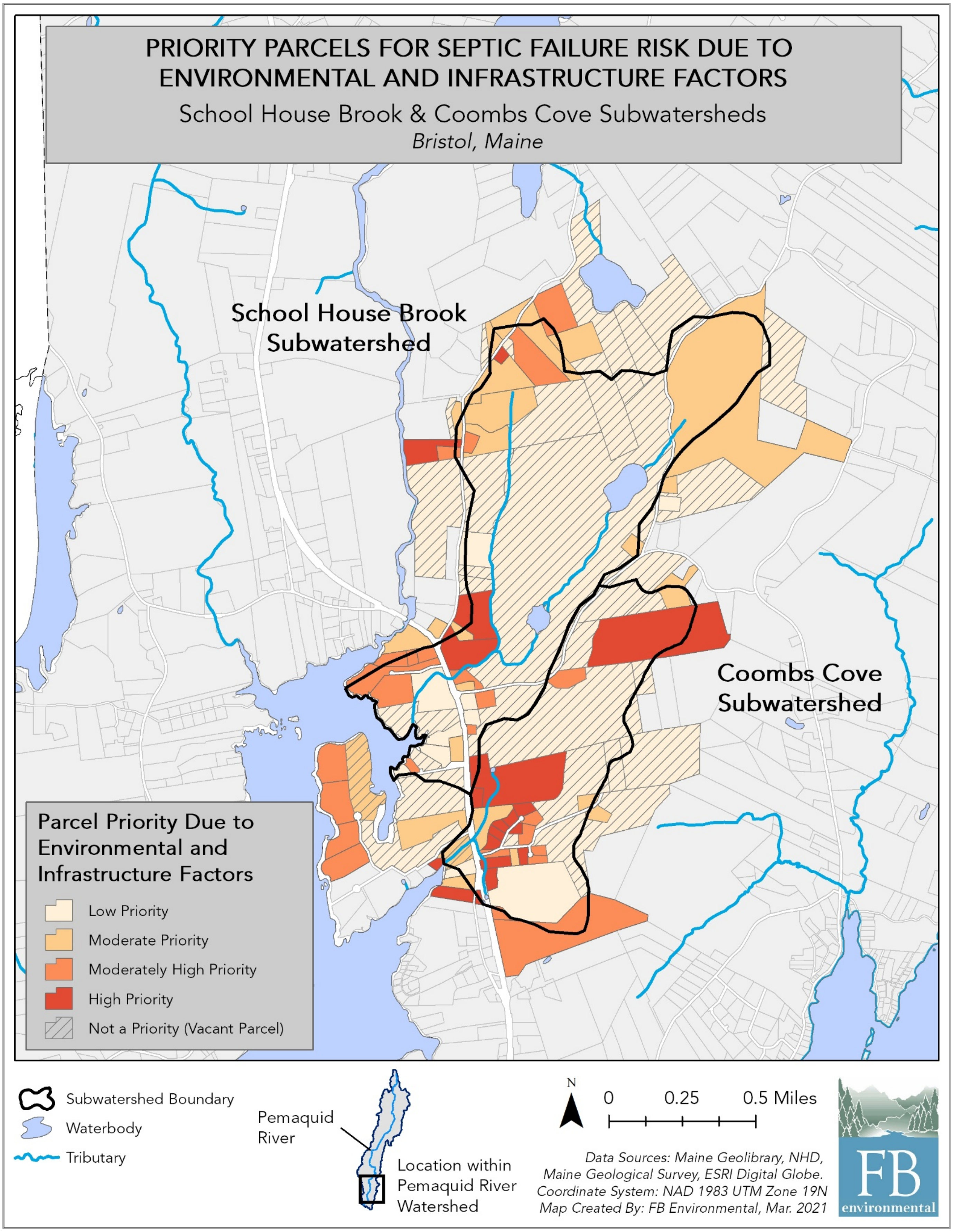

Figure 1. Parcel priority level due to a combined score of environmental and infrastructure factors.

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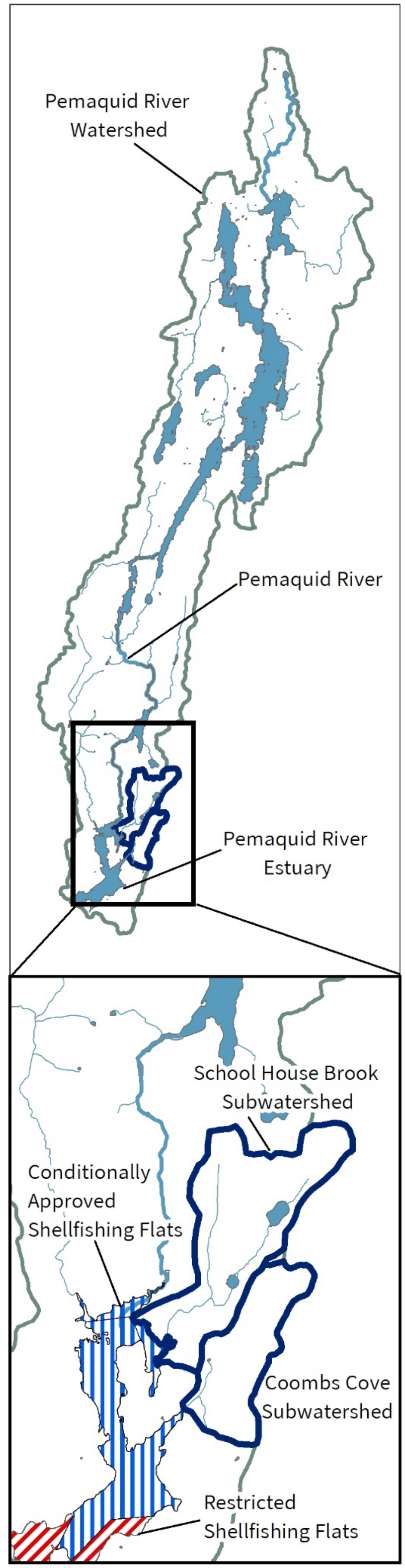
INTRODUCTION

This report provides information for the Town of Bristol, Maine on the School House Brook and Coombs Cove subwatershed septic system database created by Rachel Bizarro at the Town of Bristol and the resulting risk assessment conducted by FB Environmental. The goal of this septic system database and risk assessment is to facilitate municipal management of septic systems by ranking systems according to their risk of pollution to the Pemaquid River. **This assessment does not identify failing or malfunctioning systems, but rather identifies those that present a higher risk to local waterbodies if they were to fail or malfunction.**

The database will assist the town in ensuring that septic systems are properly maintained and will act as a starting point for further action. Recommended next steps are provided at the end of this report.

The tributaries that flow through the School House Brook subwatershed and Coombs Cove subwatershed enter the northern portion of the Pemaquid River estuary, which, along with the lower Pemaquid River, is listed as impaired on the Maine Department of Environmental Protection (Maine DEP) 303(d) list due to elevated fecal indicators and the proximity of the local marina. The northern portion of the Pemaquid River estuary is classified as conditionally approved for shellfish harvesting and the southern portion of the estuary is listed as prohibited. **As shellfishing is an important resource for the surrounding community, shellfish flat closures have led the Bristol Shellfish Committee and the Town of Bristol to track potential pollution sources in the surrounding waterways and landscape.** This septic system risk assessment follows several years of investigative sampling throughout the larger Pemaquid River watershed which indicated potential fecal contamination in the watershed from malfunctioning septic systems.



Although there is a thorough State-level permitting (Subsurface Wastewater Disposal permit, coordinated by Maine Division of Environmental Health) and inspection process to ensure that new septic systems are properly designed and built, there is no program that checks whether a system continues to function properly over its long service life of approximately 30 years. The average life expectancy of septic systems nationwide is 15-25 years (Clayton 1973). However, a more recent study based on an extensive review of records in Maine estimated a maximum life for septic systems of 40 years (Dix and Hoxie, 2001). Research and real-world experience shows that systems of all ages sometimes malfunction for a wide variety of reasons, including poor maintenance, excessive loading with fats or solids, overloading due to water supply leaks, damage from tree roots or vehicles, old age, and errors in the design and/or installation of the original system. Sometimes malfunctions may persist for years with or without the homeowner's knowledge, potentially releasing untreated wastewater laden with fecal matter and excess nutrients to nearby waterbodies. It is impractical to check all systems in a town or watershed at one time.

Therefore, a prioritized list was created to direct resources in an orderly and efficient manner to provide the greatest benefit to both public and watershed health.

The database lists parcels in order of highest to lowest priority for ensuring that septic systems are maintained and functioning properly. Parcels located within the School House Brook and Coombs Cove subwatersheds are divided into five categories and prioritized based on both infrastructure risk factors (e.g., septic system age) and soil and environmental risk factors (e.g., soil permeability, depth to bedrock, distance to nearest waterbody).

SEPTIC SYSTEM DATABASE

The septic system database, combined by Rachel Bizarro at the Town of Bristol, for School House Brook and Coombs Cove, contains 108 parcels. First, FB Environmental staff used Esri ArcMap Geographic Information Systems (GIS) software to identify all parcels within the School House Brook and Coombs Cove subwatersheds. Septic permit information for each parcel was then reviewed and digitized by the Town of Bristol to obtain relevant septic permit information. Appendix A provides additional details on the methods used to build the database. The database contains two categories of information that are used to understand septic system risk: 1) septic system infrastructure risk, and 2) soil and environmental risk.

SEPTIC SYSTEM INFRASTRUCTURE RISK FACTORS

Certain infrastructure factors influence risk of septic system failure: these include design suitability, installation quality, maintenance history, and age of system (typical system lifespan often ranges from 15 – 40 years, with a 30-year lifespan used for determining priority levels for this report). The best proxy that is available consistently across all septic records for these infrastructure issues is septic permit date.

Buildings for which there is no wastewater system record (permit or approval) on file with either the town or the State suggest that one or more of these risk factors is likely present. If a septic system is present, but has no permit of any kind on file, it may pre-date the modern permitting and inspection procedures, or it could have been installed without a permit or supervision.

SOIL AND ENVIRONMENTAL RISK FACTORS

Soil and environmental risk factors refer to the sensitivity to septic failure in various areas of the watershed. Higher risk factors indicate a greater risk to health and safety if a septic system should malfunction because fecal contamination and excess nutrients will have a more direct route to nearby waterbodies and swimming areas. These risk factors were determined using GIS (computer mapping), along with publicly-available data. An outline of the data used to determine the risk factor and each data source follows.

1. **Soil Limitation Factors**: Using Natural Resources Conservation Service soils data, each of the soil limitation factors below was assigned a value from 0 to 1 by NRCS, representing the degree of limitation within each soil component. Refer to Appendix A for full descriptions of each soil component.
    a. Filtering capacity
    b. Flooding
    c. Ponding
    d. Depth to bedrock
    e. Slope
    f. Depth to saturated zone
    g. Seepage
    h. Restricted permeability
    i. Too steep
2. **Wetlands:** Using National Hydrography Dataset (NHD) data, all wetland areas received a risk factor of one.
3. **Within 100 ft. Stream Buffer**: Using NHD data, all areas within 100 feet of streams received a risk factor of one.
4. **Flood Zones:** Using FEMA flood zones data, all areas within the Special Flood Hazard Area (SFHA), or “base flood” or “100-year flood” zones, (e.g., zones A, AE, AO, and VE) received a risk factor of one.

All the above risk factors were assessed and displayed geographically as a map of priority areas due to the relative risk to the environment if septic systems fail (Figure 2, Figure 3a). Each risk factor category had a maximum rating of 1, and the map indicates the sum of risk factor categories, ranging from 0 to 12. Though a risk factor of 12 is possible, risk factors in this case per parcel did not exceed a total of 3.72, indicating moderate risk. The larger the value, the greater the potential limitation and risk to the environment in case of septic system failure.

Overall, the soil and environmental conditions in Bristol do not show the more severe limitations for septic systems seen in other northern New England coastal areas, where maximum risk scores can be in the range of 6 to 8. Because this information is not assembled using individual permits, these data are provided for the entire mainland portion of the Town of Bristol, and can be used for future planning decisions of additional high priority areas to pursue for septic system risk assessments.

Septic risks due to soil and environmental factors by parcel were calculated using an area-weighted rank for each parcel based on the underlying soil and environmental risk factors located within each individual parcel. The result (Figure 3b) is that each parcel has an associated environmental risk factor for potential septic system failures. This map does not alter the need for onsite septic investigations on all properties, as appropriate.

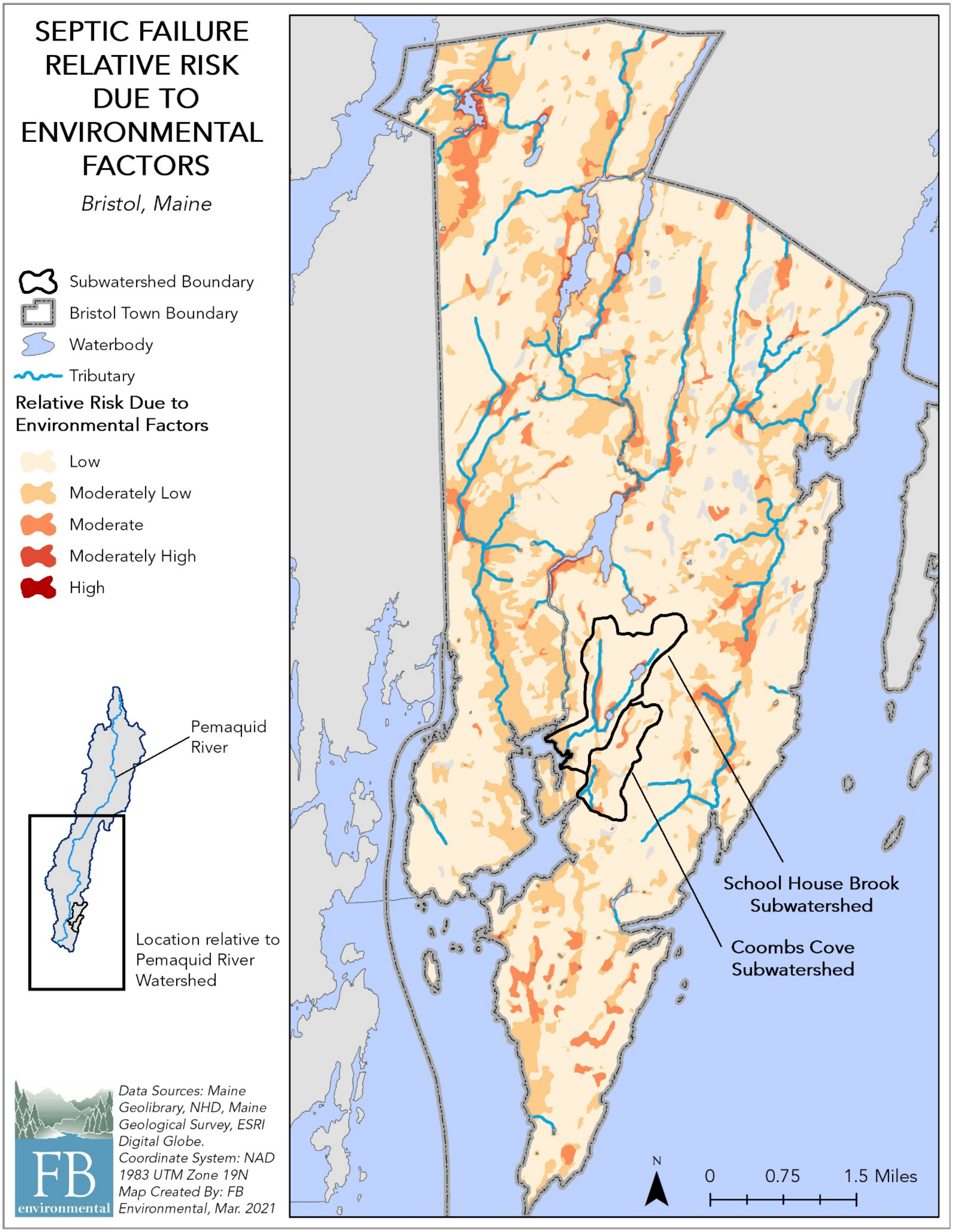


Figure 2. Septic failure relative risk due to environmental factors, displayed for the Town of Bristol.

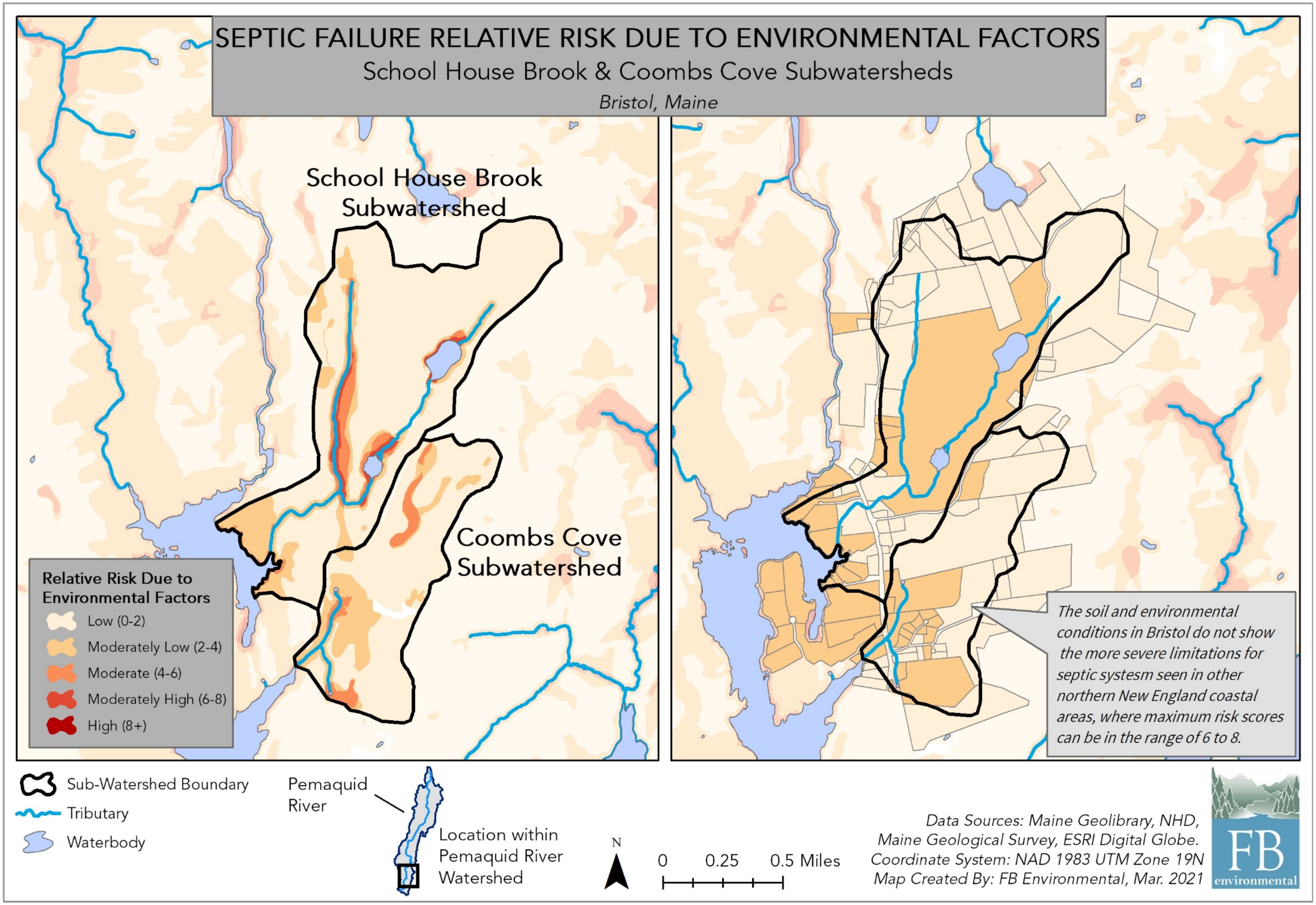


Figure 3. Septic failure relative risk due to environmental factors displayed geographically (left, Fig. 3a) and by weighted average by parcel (right, Fig. 3b).

ANALYSIS AND RESULTS OF SCORING

Septic Failure Risk Priority Categories

The resulting septic system database is a prioritized list of all parcels (built and unbuilt lots) within the School House Brook and Coombs Cove subwatersheds. The spreadsheet contains a list of tax parcels which have been ranked according to order of priority.

The priority is as follows:

1. **Highest Priority Parcels:** Septic parcels WITHOUT a Subsurface Wastewater Disposal permit on file with the town (i.e., there is no clear record of septic system approval), and parcels with unknown status (unknown if on private septic, or other). Parcels are ranked by risk to surface water in case of a system failure by Soil and Environmental Risk Factor (higher risk factor = higher priority/ranking). There are 14 parcels that fall within this category.
2. **Moderately High Priority Parcels:** Septic parcels WITH a Subsurface Wastewater Disposal permit on file with the town that is more than 30 years old (1991 and older). Parcels are ranked by risk to surface water in case of a system failure by Soil and Environmental Risk Factor (higher risk factor = higher priority/ranking). There are 24 parcels that fall within this category.
3. **Moderate Priority Parcels:** Septic parcels WITH a Subsurface Wastewater Disposal permit on file with the town that is between 10 – 20 years old (1992– 2011). Parcels are ranked by risk to surface water in case of a system failure by Soil and Environmental Risk Factor (higher risk factor = higher priority/ranking). There are 29 parcels that fall within this category.
4. **Low Priority Parcels:** Septic parcels built within the last 10 years (2012 – present). Parcels are ranked by risk to surface water in case of a system failure by Soil and Environmental Risk Factor (higher risk factor = higher priority/ranking). There are 10 parcels that fall within this category.
5. **Not a Priority Parcels:** Vacant land and parcels with accessory buildings lacking plumbing. There are 31 parcels that fall within this category.

In addition to septic permit date, the full septic system database provides additional details on the installed system. The digitized septic permit database was reviewed for additional factors or inconsistencies found that may cause a septic system to be at increased risk of fecal contamination to waterbodies, should the system malfunction or fail. For example, parcels with disposal system components identified as "primitive systems" or a parcel with a variance may indicate higher risk, should the system be overused or malfunction.

Parcels with a primitive system were assigned a higher priority factor. All septic variances in these watersheds are "replacement system variances," used when replacing obsolete wastewater systems on sites which do not meet some modern setback, minimum lot size, or other requirements. Generally, the greater good from a new replacement system outweighs the reduced siting requirements these variances entail. Parcels with replacement variances were not assigned a higher risk score, since the environmental risk factor may account for some of the variance conditions.

The soil/environmental and infrastructure factors were then combined into a single septic failure map that shows range of the priority levels for parcels, shown in Figure 4. These factors were combined into a category-weighted risk factor. Soil and environmental risk factor scores were multiplied by weighting values assigned to each infrastructure risk factor category (i.e., highest priority = 4, moderately high priority = 3, moderate priority = 2, lowest priority = 1). A high weighting value (4) reflects a higher risk of septic failure due to infrastructure factors, which is then prioritized from high to low risk soil and environmental score. Thus, the highest priority properties are those with no septic permits on file, located in an area where a septic failure would quickly reach surface waters. Refer to the database for specific parcel information. A subwatershed map of septic malfunction risk level due to only infrastructure factors is displayed in Figure 5.

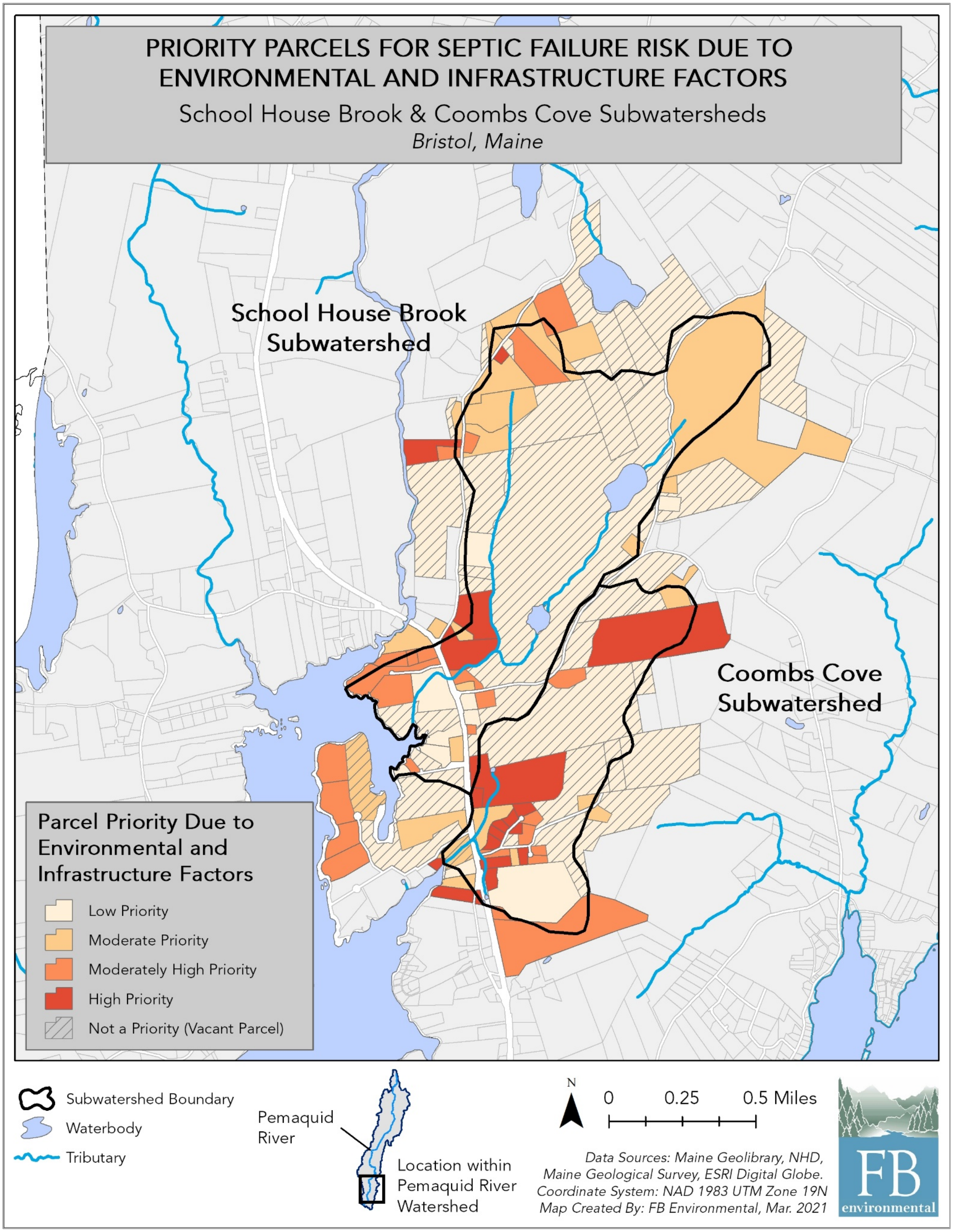


Figure 4. Parcel priority due to a combined score of environmental and infrastructure factors.

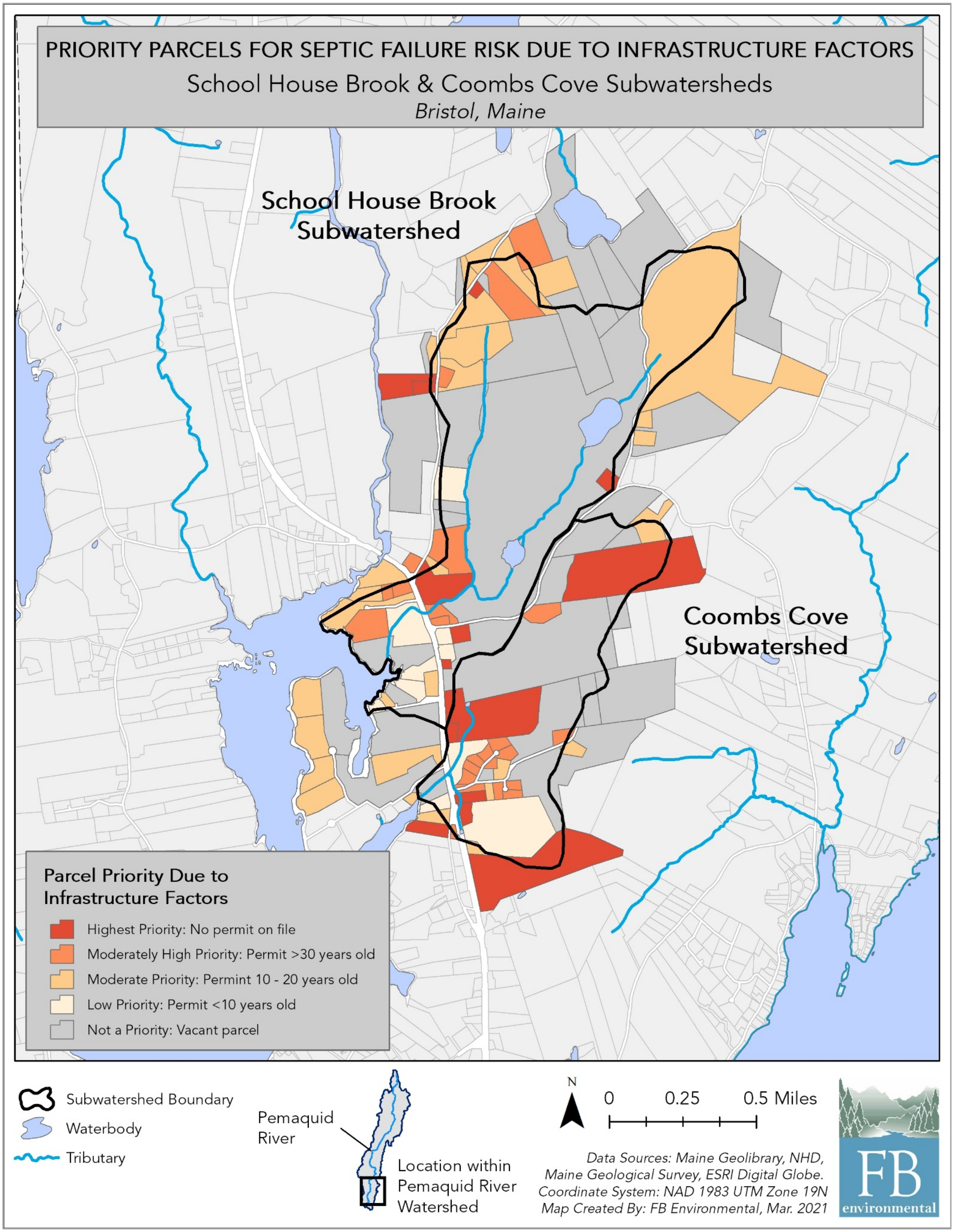


Figure 5. Parcel priority due to septic system due to only infrastructure factors.

RECOMMENDATIONS FOR NEXT STEPS

The septic system database is a tool for protecting public health and safety in the School House Brook and Coombs Cove subwatersheds, but in order to be effective, follow-up action is needed. Below are recommendations for using the database effectively.

- **Identify the status of highest priority parcels:**
    - Attempt to locate and estimate age and condition of septic systems with no permit on record. For buildings with no septic system permits, it is likely that some of these buildings have systems, but their permits have either been misfiled or pre-date current State or town databases. A community task force to examine these options is recommended.
    - If any additional high priority parcels are identified as being unbuilt lots, remove them from the highest priority category.
- **Follow up with landowners with parcels identified as moderately high priority parcels.** Work collaboratively with landowners to raise awareness of malfunctioning septic system signs and consequences and inform landowners of the importance of septic system maintenance and pump-outs.
- **Implement a schedule for updating the septic and sewer database regularly.** It will be important for the database to be visited at least annually to add newly created parcels or recent permits.
- **Consider implementing a septic system maintenance ordinance (e.g., minimum pump-out intervals).** Regular pump-outs and maintenance are important to prevent a system from malfunctioning or failing. Regular service also helps discover and correct malfunctions promptly.
    - A septic system maintenance ordinance could be phased in, if necessary, by starting with parcels located within the shoreland zone.
    - Pump-outs can be efficiently tracked by requiring septic haulers to submit reports monthly (or at other intervals) of all properties they have served within town, reducing the reporting burden on homeowners.
    - Minimum pump-out intervals are recommended to range from 3 to 5 years. More frequent pump-outs could be required for commercial and/or short-term rental properties. Less frequent pump-outs could be allowed for systems with advanced treatment systems (e.g., aerated systems) or other extenuating circumstances.
    - An example of ordinance may require a three-year pump-out in the shoreland protection zone, and a five year pump-out interval in other zones, with exceptions such as a yearly interval requirement for short-term rentals and a ten year requirement for homes with advanced treatment systems or a maximum occupancy of two people.
- **Host "septic socials" in areas with a high density of septic systems.** A septic social is a fun, casual event where a local resident hosts a get-together for their friends and neighbors to learn about septic system maintenance. Septic socials should be held in known "hotspot" areas of bacteria and in areas where there are many homes with septic systems. Both School House Cove and Coombs Cove Tributary are a good fit for a septic social. While a local resident will provide the meeting space and the attendees, the town or consultants can provide the educational material.
- **Engage with landowners with additional outreach on septic system maintenance.** Consider mailing a septic system maintenance survey to gather information on when and how often landowners perform septic system maintenance. Enclose educational materials.
- **If a failing or malfunctioning septic system is identified, support landowners in finding financial assistance if needed.** The Small Community Grant Program provides grants to municipalities to help replace malfunctioning septic systems that are polluting a waterbody or causing a public nuisance.

APPENDIX: METHODS

DATABASE CREATION

The most up-to-date Geographic Information Systems (GIS) shapefile for each town's parcels was clipped to only include parcels located partially or entirely within the School House Brook and Coombs Cove subwatersheds. Specific sources for shapefiles are listed in the database metadata that accompanies this report. The parcel list and any associated address and owner data (if available) were exported from GIS to an Excel spreadsheet. Right-of-way, road, and open water/marsh parcels were removed from the lists, if easily identified within the parcel data. A total of 108 parcels were included in the School House Brook and Coombs Subwatershed Septic System Database.

SEPTIC SYSTEM PERMIT METHODS

The Town of Bristol collected septic system permit history from the Maine Septic Permit Search and from the town's paper permits, scanned copies, or an existing electronic source. The Town of Bristol also reviewed parcels without permits and determined several of them to be unbuilt lots or lots with accessory structures. FB Environmental reviewed all data entered for each parcel and used septic permit date from each permit as a proxy for infrastructure risks. In addition, FBE reviewed additional fields for details indicating additional risk of failure or additional risk of contamination if a failure occurs.

SOILS DATA DESCRIPTIONS

Soil data incorporated into the soil and environmental risk factors was sourced from the Natural Resources Conservation Service Soils Data.

a. <u>Filtering capacity:</u> The saturated hydraulic conductivity of soil, known as Ksat, is an important physical property that influences the capacity of the soil to retain and transport water. The soil horizon with the maximum Ksat governs the leaching and seepage potential (or filtering capacity) of the soil. When this rate is high, transmission of fluids through the soil is unimpeded, and leaching and seepage may become an environmental, health, and performance concern.
b. <u>Flooding:</u> Flooding has the potential to transport agricultural waste off site and pollute surface waters. Flooding also limits building, recreational, and sanitary facility use and management of these soils.
c. <u>Ponding:</u> Ponding is the condition where standing water is on the soil surface for a given period of time. Soils that pond have restrictions that limit the installation and function of most land use applications. Soil features considered are ponding duration and frequency.
d. <u>Depth to bedrock:</u> The depth to bedrock restricts the construction, installation, and functioning of septic tank adsorption fields and other site applications. Shallow soils have limited adsorptive capacity and biologically active zones through which waste materials can percolate. These soils may pose environmental and health risks when used as filter fields.
e. <u>Slope:</u> Absorption fields cannot be located too close to cuts or on steep slopes as there is a danger that sewage can seep laterally out of the slope or cut before it has a chance to be fully treated. Septic systems can also cause slope failures if located on unstable slopes.
f. <u>Depth to saturated zone:</u> Soils with shallow depth to water table may become waterlogged during periods of heavy precipitation and are slow to drain. These soils have the potential to contaminate groundwater, which may create health and environmental hazards.
g. <u>Seepage:</u> The soil's bottom layer Ksat (saturated hydraulic conductivity) governs the leaching and seepage potential of the soil. When this rate is high, transmission of fluids through the soil and underlying materials is unimpeded, and leaching and seepage may become an environmental, health, and performance concern.

h. Restricted permeability: The soil horizon with the minimum Ksat governs the rate of water movement through the whole soil. When this rate is low, transmission of fluids into and through the soil is impeded, and runoff, infiltration, and percolation of pollutants may result in environmental, health, and performance concerns.
i. Too Steep: For non-rated "rock outcrop" soil types, a risk score of five (which was the highest score among all soil types) was manually assigned on the basis that rock outcrops are extremely unsuitable for septic systems. For non-rated "urban land" soil types, the risk factor similar to surrounding rated soils was chosen. Generally, the highest score was chosen if there were multiple surrounding soil units (excluding waterbodies). The reason for choosing the highest of the scores is the proximity to properties and people, which elevates risk of harm if there is a wastewater failure.

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