T E C H N I C A L M E M O R A N D U M

To:	Kim Reed and Dennis McCarthy, Town of Rye, New Hampshire
	Sally Soule, NH DES
From:	Whitney Baker, FB Environmental
Subject:	Septic System Database for the Town of Rye, New Hampshire
Date:	January 3, 2014
cc:	Emily DiFranco and Forrest Bell, FB Environmental
Attached:	*Town of Rye Septic System Database.xlsx*

1.0 Introduction

This memo provides information for the Town of Rye, New Hampshire, on the septic system database created by FB Environmental. The overall goal of the septic database task is to facilitate municipal management of septic systems by ranking systems according to risk of pollution to Rye's streams, estuaries, and beaches. The database will assist town departments in ensuring that septic systems are properly maintained and is a starting point for further action. Recommended next steps include filling in data gaps on systems with no permits on file, and considering an ongoing septic system maintenance and inspection program at the municipal level for aging systems.

The database is a list of properties in order of highest to lowest priority for ensuring that septic systems are maintained and functioning properly. Although there is a thorough state-level permitting and inspection process to ensure that new septic systems are properly designed and built, there is no program which checks whether a system continues to function properly over its long service life of approximately forty years. 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 even occasional errors in design or installation which were not discovered earlier. Sometimes malfunctions persist for years with or without the homeowner's knowledge, polluting streams and beaches with bacteria. 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 and provide the greatest benefit to health and safety.

The database consists of several categories of properties, covering the entire watershed of Parsons Creek. The highest priority properties are built lots with *no record on file* of a septic system permit, followed by built lots *with a record* of a septic system, and then finally unbuilt lots. Within each of these categories, properties are ranked by environmental sensitivity, as described in detail below.

2.0 How the Database was Created

There are two major components to the septic systems database, soil and environmental risk factors and system age as indicated by permit records.

2.1 Environmental Risk Factors

Soil and environmental risk factors refer to the sensitivity to septic failure in various areas of the town. Higher risk factors indicate a greater risk to health and safety if a septic system should fail, because bacteria and algae-causing nutrients will have a more direct route to 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.

Rye parcels: Rye parcel data was obtained in 2009 by FBE via the NH DES Beach Program with support from Rockingham Planning Commission and permission from the Rye Planning Department. The original source of the data layer is Sewell/Rockingham Planning Commission and dates from 2008. 3100+ parcel records are included in the data layer which includes information on map/lot size, value, and address.

Soil and Environmental Risk Map: This layer indicates the risk to water quality if a septic system should malfunction, based on the following:

1. **Natural Resources Conservation Service Soils Data.** Each of the soil limitation factors below is assigned a value from 0 to 1 by NRCS representing the degree of limitation within each soil component.

    a. **Filtering capacity**: 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 environmental, health, and performance concern.

b. **Flooding**: 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. **Ponding**: 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. **Depth to bedrock**: 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. **Slope**: 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 in unstable slopes.

f. **Depth to saturated zone**: Soils with shallow depth to a water table may become waterlogged during periods of heavy precipitation and are slow to drain. These soils have the potential to contaminate ground water which may create health and environmental hazards.

g. **Seepage**: 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.

2. **Wetlands:** Using National Hydrography Dataset (NHD) data, all wetland areas received a risk factor of one.

3. **Proximity to Streams:** Using data from UNH-GRANIT streams, all areas within a 100 foot buffer of streams were assigned a risk factor of one.

4. **Flood Zones:** FEMA flood zones (A, AE, AO, and VE) were assigned a risk factor of one.

All the above risk factors were assessed and displayed geographically as a map of risk to the environment if septic systems fail. Each condition was assigned a risk factor of one, and the map indicates the sum of risk factors, ranging from 0 to 9. Though a risk factor of 9 is possible, risk factors in this case did not exceed a total of 8. The larger the value, the greater the potential limitation and risk to the environment in case of septic system failure. This map does not alter the need for onsite septic investigations. The map shows **only** the risk from natural soil and landscape factors and does not consider the age of existing septic systems (Figure 1).

Septic Risk by Parcel Map: Septic risks by parcel were spatially analyzed using the "Polygon in Polygon" component of Hawths Analysis package in ArcMap 9.2 to calculate an area weighted rank for each parcel based on the underlying soil and environmental risk factors located within each individual parcel. The result (Figure 2) is that each parcel has an associated environmental risk factor from septic system failures. The total risk factor value for each parcel is listed in column B of the septic system database spreadsheet.

2.2 Infrastructure Risk Factors

Beyond the soil and landscape risk factors described above, certain infrastructure factors carry a higher risk of septic system failure. These include design suitability, installation quality, maintenance history, and age of system (typical system lifespan often considered 40 years).The best proxy for these infrastructure issues is permit history.

Buildings with water supplies 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 present. If a septic system is present, but has no permits of any kind on file, it may pre-date modern permitting and inspection procedures, or could have been installed without permits and oversight.

To incorporate these infrastructure risk factors into the database, septic system permit information was downloaded in spreadsheet form from the NH DES OneStop online database on March 4, 2013, using the "Application & Approval Status" link from NH DES Subsurface web page: http://www2.des.state.nh.us/OneStop/Subsurface_Menu.aspx.

For the Town of Rye, approximately one-third of NH DES Subsurface records could be matched to a valid map and lot number in the GIS parcel dataset on file. All NH DES approvals that could be matched to a map and lot number are shown below in Figure 3.

To fill in the gaps of missing septic system approval dates, the next step was to manually review town septic records. The task of reviewing records for the remaining 2000+ parcels without OneStop approval data was not feasible given limited time. In order to narrow our search and further prioritize the town parcels, FBE selected only the parcels within the Parsons Creek Watershed.

A total of 843 parcels exist within the Parsons Creek Watershed. Of this total, 664 parcels are known built lots. Unbuilt lots are assumed to not have septic systems. Of the 664 built lots within the watershed, 200 parcels had existing subsurface records at the state level. For the remaining 464 parcels within the watershed with no septic approval data, town paper files were reviewed. The manual file review resulted in 155 additional septic approval dates with 309 watershed parcels remaining with no septic data at the town or state level. In some cases, when no approval dates were found, additional information such as construction approval dates or design plan approval dates were noted.

Figure 1: Soil and Environmental Septic Risk Factor Map for Parsons Creek Watershed.

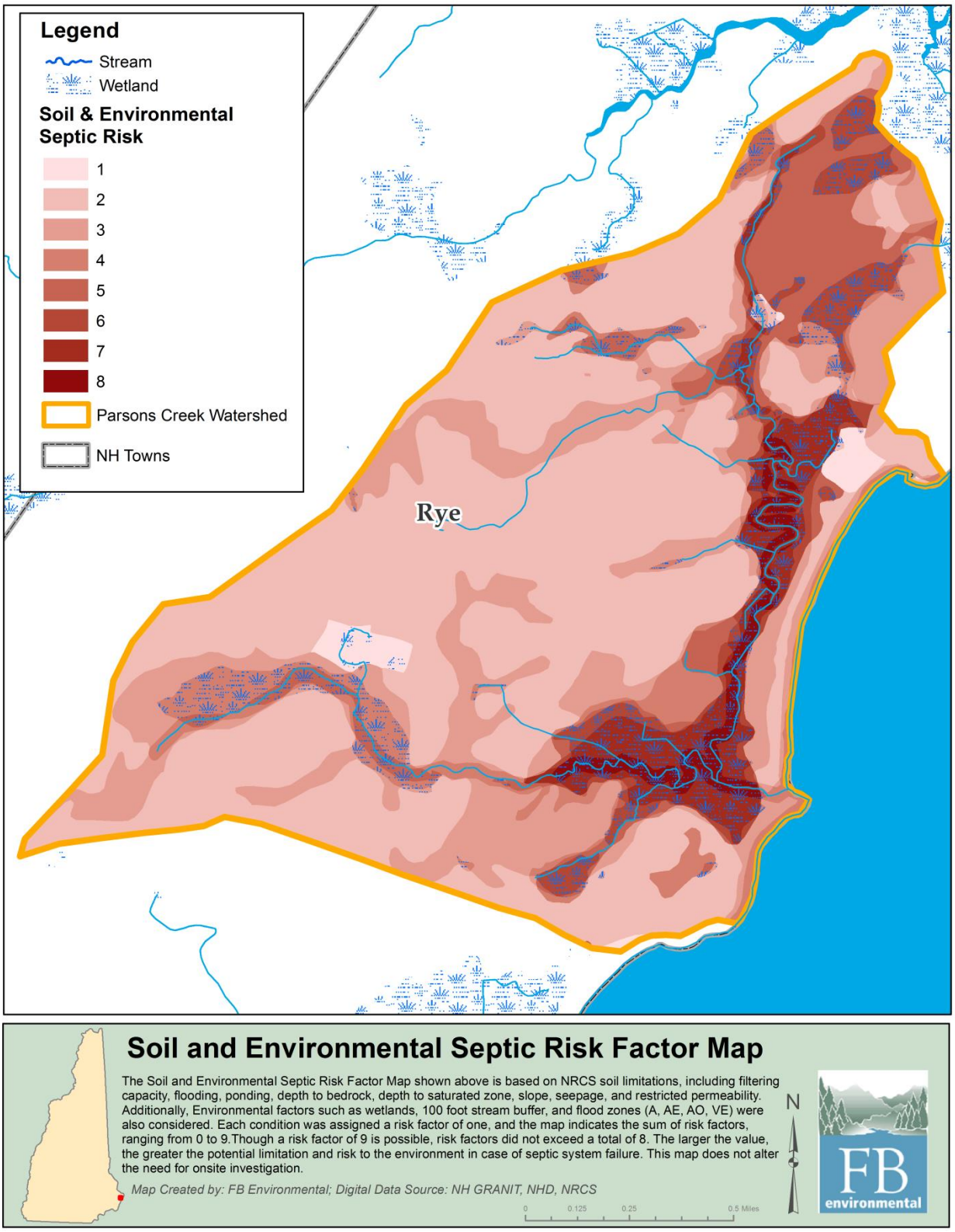


Figure 2: Septic Risk by Parcel for the Parsons Creek Watershed – Parcels included in the current Septic System Database.

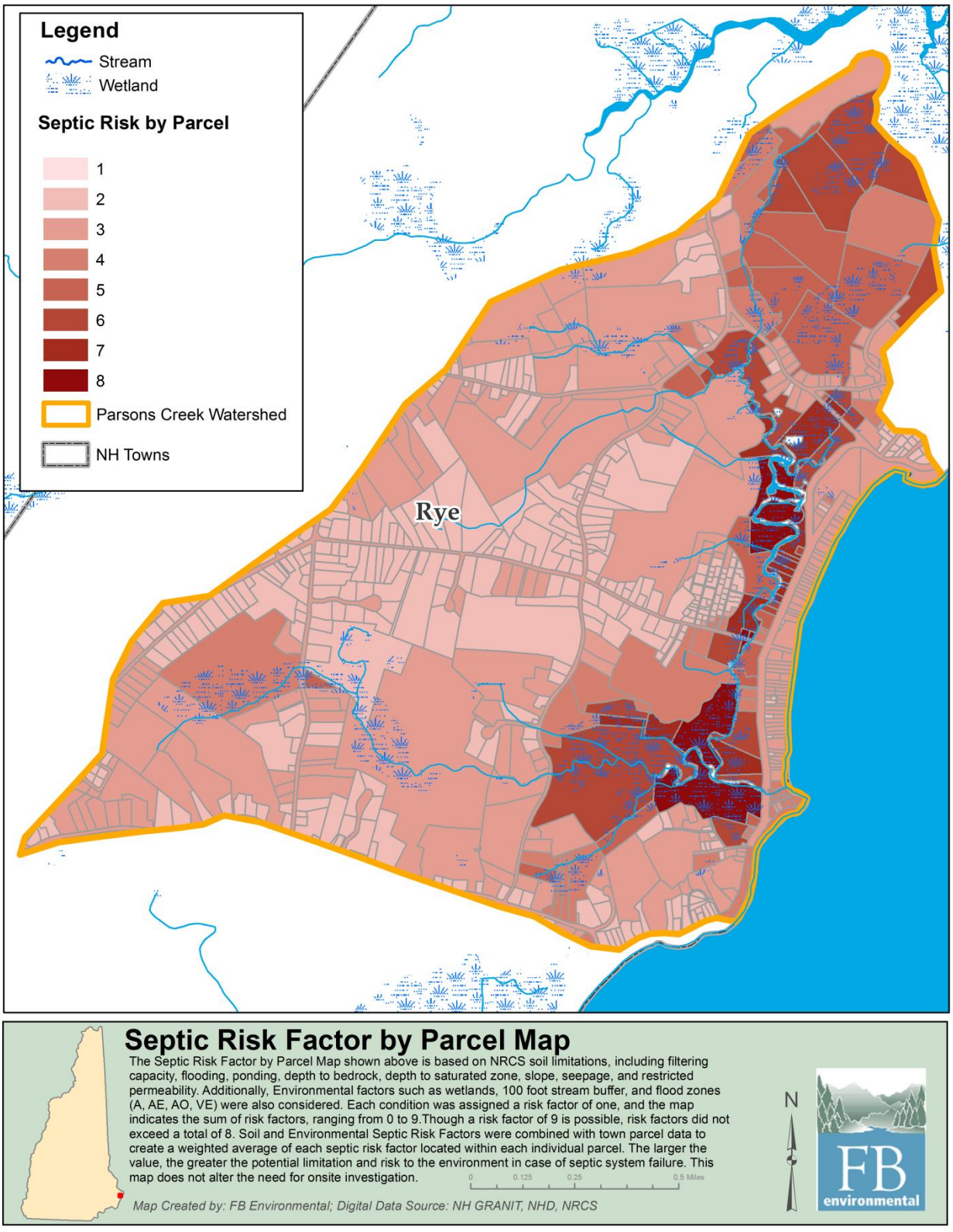
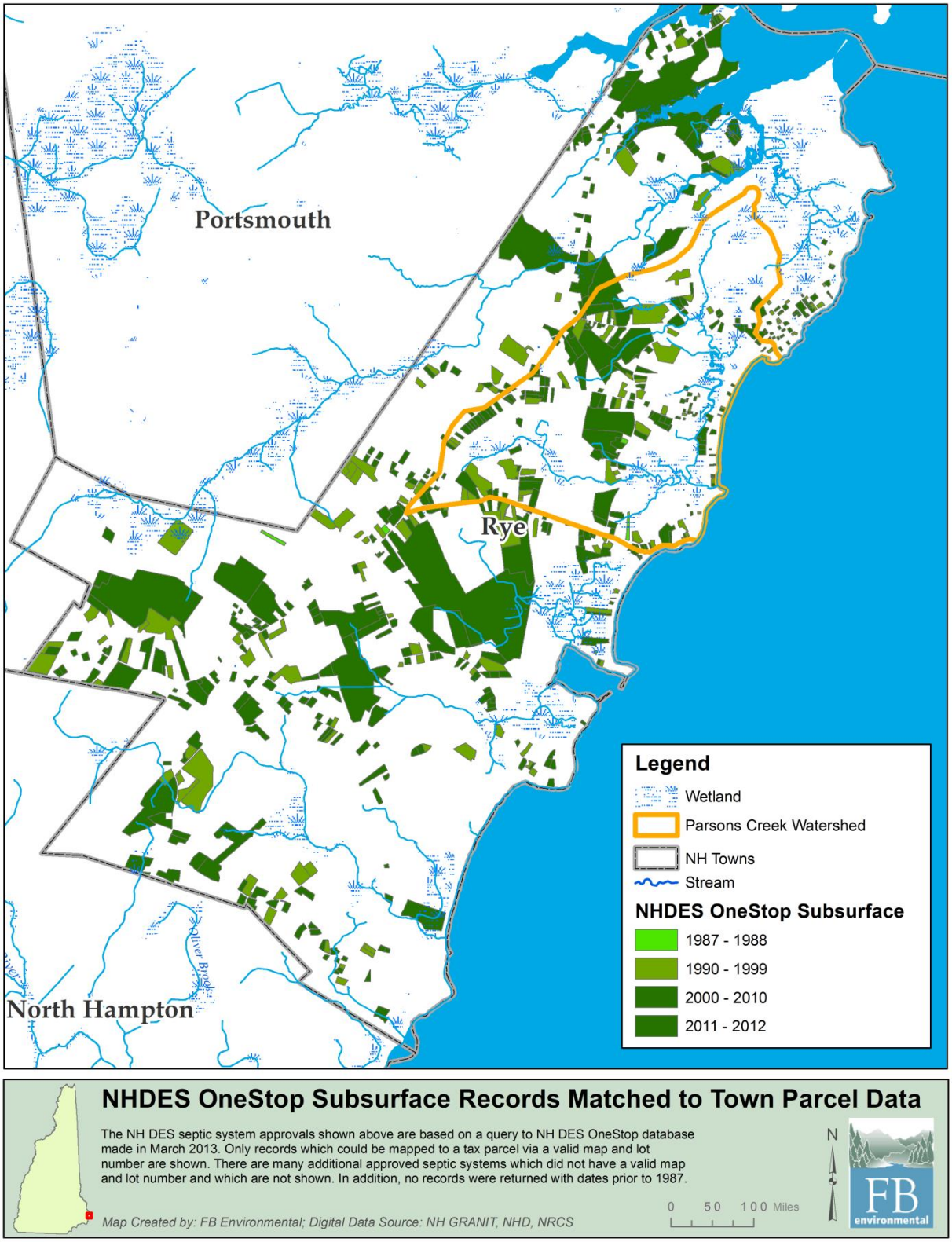


Figure 3: Rye Parcels with New Hampshire DES Septic System Approval Dates in the New Hampshire OneStop Database.



2.4 Septic Database Spreadsheet

The resulting septic system database is a prioritized list of all parcels (built and unbuilt lots) within the Parsons Creek Watershed. The spreadsheet contains a list of tax parcels which have been ranked according to order of priority for a complete septic system database. The priority is as follows:

1. **Category 1, top priority parcels:** Built parcels without a NHDES Subsurface Bureau approval date in the OneStop online database system **OR** in the town paper files (i.e., there is no clear record of a septic system at either the state or town level). These parcels are ranked by risk to surface water in case of a system failure.
2. **Category 2, second priority parcels:** Built parcels with a NHDES Subsurface Bureau approval date (acquired either through the NH OneStop Database or town paper file search), with parcels ranked by risk to surface water in case of a system failure.
3. **Category 3, third priority parcels:** Unbuilt parcels without a NHDES Subsurface Bureau approval date in the OneStop online database system, ranked by risk to surface water in case of a system failure.
4. **Category 4, lowest priority parcels:** Unbuilt parcels with a NHDES Subsurface Bureau approval data are ranked by risk to surface water in case of a system failure. This category probably represents lots that are being built now.

Description of Data Columns:

1. *Column A: Priority #*

   Column A is the overall priority number given to each parcel based on the parcel category and environmental risk factors, as described above.

2. *Column B: Septic Risk Score*

   The septic risk score represents environmental risk factors only (regardless of whether the parcel is built, has a septic permit, etc). It is based on the GIS analysis of various soil limitation features, wetlands, proximity to streams and flooding as described in Section 2.0 above.

3. *Column C: Septic Risk Priority Category (1-4)*

   This column denotes the septic risk categories used to prioritize the database. These categories are described in detail on the "notes" section in the septic database spreadsheet, and in section 2.4 above.

4. *Columns D-H: Tax & Map Lot Data*

   Column D is the tax/map/lot/unit identification numbers for each parcel in a single column. Columns E, F, G and H break apart these ID codes for sorting or filtering reasons depending on the database user.

5. *Column I: Location Address*

   The physical address of parcel, when available.

6. *Column J: Type*

   Column J includes information of whether there is a building located on the parcel. Options include: Built, Unbuilt, and Building Only. Unbuilt lots are assumed to not have a septic system.

7. *Column K: NH DES Approval Yr.*

   NH DES Subsurface septic system approval dates are included in column K. If no record exists at the Town and/or State level, "unknown" is entered into the cell.

8. *Column L: Town Approval Yr.*

   Town septic system approval dates are included in column L. If no record exists at the Town and/or State level, "unknown" is entered into the cell.

9. *Column M: Additional Information / Dates*

   This column includes additional information (other than official DES septic approval dates) that may aid the town in understanding the age of the septic system existing on the parcel.

2.0 Recommendations for Next Steps

The septic system database is a tool for protecting public health and safety in the Parsons Creek watershed in Rye, but in order to be effective, follow-up action is needed. Below are recommendations for using the database effectively.

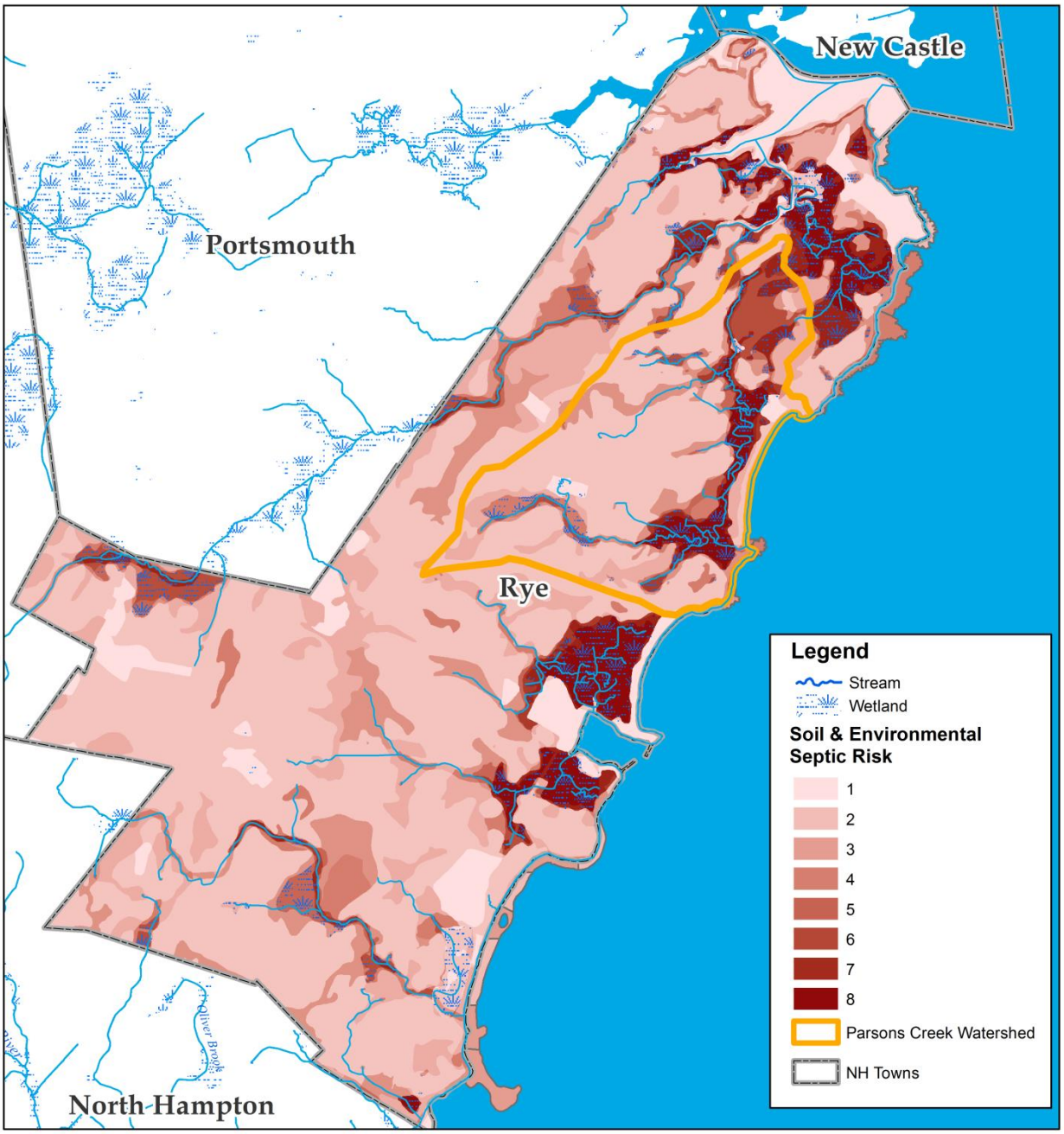
First, this list provides a well-researched basis for prioritizing future municipal septic system management programs. Potential programs could include property-owner education efforts, a septic system maintenance ordinance (e.g., minimum pump-out intervals), targeted follow-up to instances of high bacteria counts at stream and beach sites (e.g., dye-test of wastewater systems in adjacent high risk buildings), or an in-depth survey of buildings that apparently have no permitted wastewater system. For buildings with no septic system permits, in particular, 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.

It is also recommended that future efforts are made to allow database users to query the septic system database by subwatershed or drainage area. This will provide an additional prioritization of parcels and would also allow the town to direct bacteria investigations and sampling using the watershed approach.

In addition to municipal steps, it is recommended that Rye host a meeting to discuss this database and its potential use with regional and state partners. NH DES Subsurface Division handles permitting and inspection of new septic systems. The Rockingham Regional Planning Commission and UNH Technology Transfer (T2) Program have also been working on integrating town parcel data into computer maps using GIS. The UNH T2 Program in particular is working on a sustainable state-wide parcel map which can be valuable to Rye for septic system research, as well as many other possible uses. See http://www.t2.unh.edu/mosaic-parcel-map-project for more information on the state-wide parcel map effort. Other regional partners include the NH Shellfish Department, which regularly conducts shoreline surveys to identify possible sources of bacteria to estuaries; and the NH Beach Inspection Program, which tests beach waters for bacteria and which has provided strong support to Rye in the past. Also, the Piscataqua Region Estuaries Partnership tracks a suite of water quality indicators across the region, including those related to septic systems. Inviting these regional partners to participate or provide input to a Rye community task force on septic system management options is recommended.

Town wide Septic Risk Maps



Soil and Environmental Septic Risk Factor Map

The Soil and Environmental Septic Risk Factor Map shown above is based on NRCS soil limitations, including filtering capacity, flooding, ponding, depth to bedrock, depth to saturated zone, slope, seepage, and restricted permeability. Additionally, Environmental factors such as wetlands, 100 foot stream buffer, and flood zones (A, AE, AO, VE) were also considered. Each condition was assigned a risk factor of one, and the map indicates the sum of risk factors, ranging from 0 to 9.Though a risk factor of 9 is possible, risk factors did not exceed a total of 8. The larger the value, the greater the potential limitation and risk to the environment in case of septic system failure. This map does not alter the need for onsite investigation.

Map Created by: FB Environmental; Digital Data Source: NH GRANIT, NHD, NRCS

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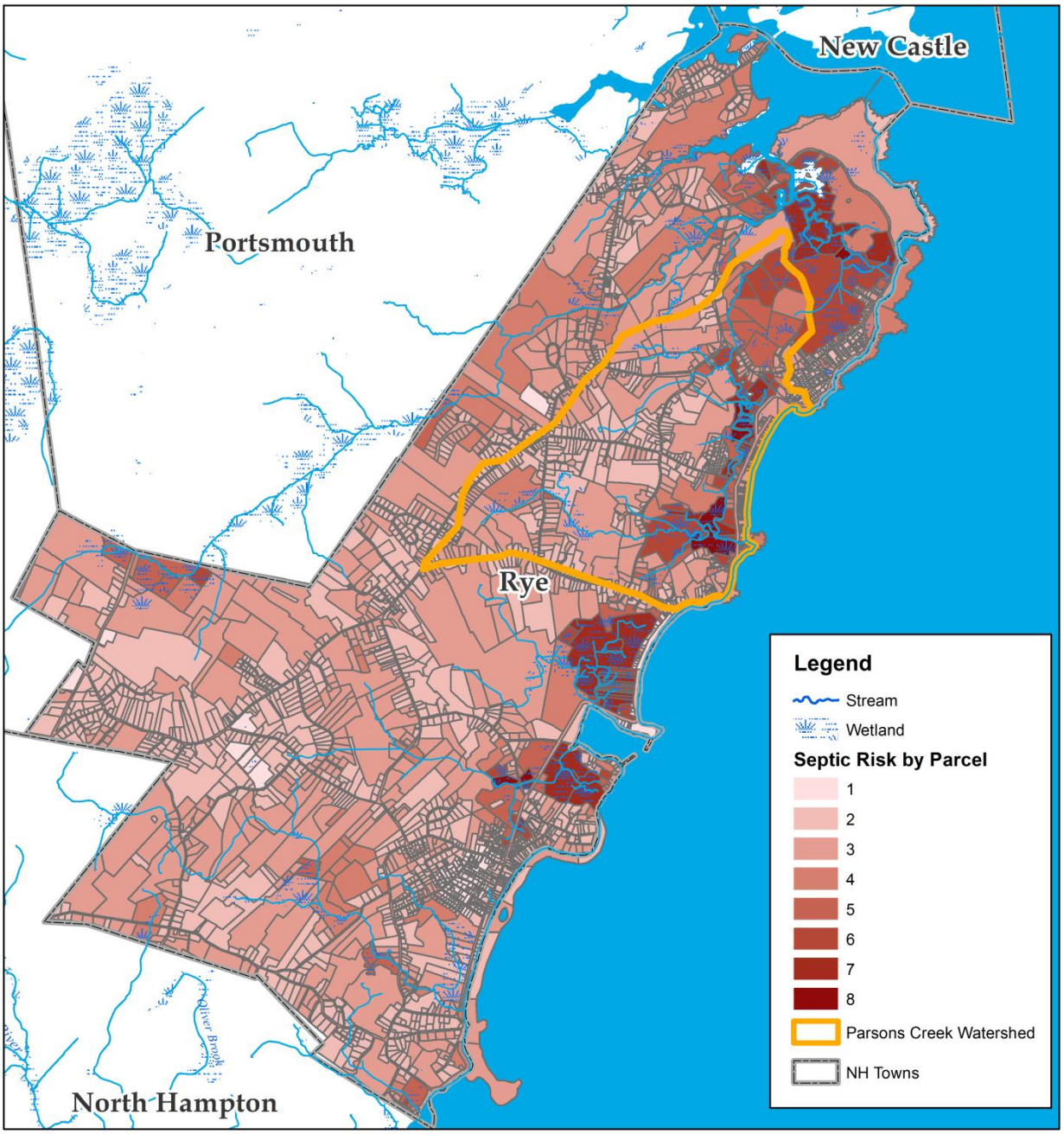
FB environmental



Septic Risk Factor by Parcel Map

The Septic Risk Factor by Parcel Map shown above is based on NRCS soil limitations, including filtering capacity, flooding, ponding, depth to bedrock, depth to saturated zone, slope, seepage, and restricted permeability. Additionally, Environmental factors such as wetlands, 100 foot stream buffer, and flood zones (A, AE, AO, VE) were also considered. Each condition was assigned a risk factor of one, and the map indicates the sum of risk factors, ranging from 0 to 9.Though a risk factor of 9 is possible, risk factors did not exceed a total of 8. Soil and Environmental Septic Risk Factors were combined with town parcel data to create a weighted average of each septic risk factor located within each individual parcel. The larger the value, the greater the potential limitation and risk to the environment in case of septic system failure. This map does not alter the need for onsite investigation.

Map Created by: FB Environmental; Digital Data Source: NH GRANIT, NHD, NRCS

N

0 0.25 0.5 1 Miles

FB environmental