

## **SECTION 1—INTRODUCTION**

### **1.1 ~ Importance on Natural Resources**

Natural resources contribute to Brookline's community character, quality of life, and recreation opportunities. They also play a role in determining the type and location of development. Natural resources in Brookline include forest and conservation land, wildlife, ponds, river, streams, as well as natural systems that cannot be seen as easily. These natural systems provide valuable services to communities free of charge, including flood storage, clean air, water purification, productive soils, wildlife habitat, waste recycling, and temperature moderation. Loss of these services impacts human health, safety, the economy, and quality of life. This chapter divides Brookline's natural resources into 2 broad categories—water-based resources and services and land-based resources and services. Within each category there is a discussion of the specific resources present in Brookline; resulting land use implications; and conservation goals, recommendations, and implementation steps.

### **1.2 ~ Natural Resources and the Town of Brookline**

#### Support for Natural Resource Protection in Brookline

Residents of Brookline demonstrated broad support for natural resource conservation at 2010 Master Plan Forum as well as in their responses to the 2010 Master Plan Survey. In addition, residents showed support in this area at the 2008 Brookline Route 13 and Route 130 Visioning Forum and its associated surveys. Furthermore, natural resources are integral to the qualities and characteristics identified in the overall vision for Brookline.

#### Role of the Town of Brookline

The Town of Brookline can play a critical role in promoting and preserving the natural resources that are so critical to quality of life and community character in Brookline. Thoughtful planning can ensure that natural services remain intact and functional for the wellbeing of all citizens and that public access is maintained to natural resources used for recreation. To date, Brookline has adopted a number of ordinances designed to protect its natural resources.

Brookline Zoning & Land Use Ordinance 1100 *Wetlands Conservation District* ~ the purpose of this ordinance is to control and guide land use to prevent the destruction, pollution, or alteration of wetlands, which provide valuable natural services to the community. Prohibited uses include salt storage sheds, automobile junk yards, solid or hazardous waste facilities and/or bulk storage of hazardous materials, use of fertilizer (except lime and/or wood ash), sand and gravel excavation and processing, and dumping or disposal of snow collected from roadways or parking areas. Permitted uses are those that do not result in the erection of any structure or alter the surface configuration by the addition of fill.

Brookline Zoning & Land Use Ordinance 1200 *Floodplain Ordinance* ~ This ordinance applies to all land designated as special flood hazard areas by the Federal Emergency Management Agency in publications dated September 25, 2009 or as amended. Among its provisions, this ordinance requires that all proposed developments in any special flood hazard areas receive a permit. It also allows the Building Inspector to review all building permit applications for new construction or substantial improvements to determine whether the proposed building sites will be reasonably safe from flooding. Building inspectors must also be provided assurance that new and replacement septic systems in flood prone areas will not be impaired or create contamination during periods of flooding.

Brookline Zoning & Land Use Ordinance 1300 *Aquifer Protection Ordinance* ~ This ordinance creates the Aquifer Protection District, which is a zoning overlay district that applies to all areas designated as stratified drift aquifers by the US Geological Survey. It regulates land use practices related to commercial-industrial land use in order to maintain and protect existing and potential ground water resources and surface water fed by groundwater from contamination.

Brookline Zoning & Land Use Ordinance 1500 *Open Space Development* ~ an Open Space Development plan is required for all developments 20 acres or greater, unless the Planning Board deems that topography, wetlands, soils, or other considerations prevent the proposal from accomplishing the purposes of the ordinance or when an Open Space Development is unnecessary to meet the purposes of the ordinance. A minimum of 35% of the gross tract area must be set aside as permanent open space through easement or deed for low-impact recreation, agriculture, or conservation uses.

## **SECTION 2—NATURAL RESOURCES VISION FOR BROOKLINE**

Comments received:

- “While the respondents showed a preference for continuing toward the goal of holding at least 25% of the land in conservation, much fewer favored the town purchasing the land to be conserved.”
- “The preservation of the natural resources and the use of them for recreation activities such as swimming, boating, etc. is a relatively healthy match for the goal of maintaining the rural character of town.”

## **SECTION 3—IDENTIFICATION OF WATER-BASED RESOURCES AND SERVICES**

### **3.1 ~ Watersheds**

A watershed is an area of land that drains downslope through a network of drainage pathways to the lowest point. These pathways can be underground or on the surface and they typically become progressively larger as the water moves downstream. Watersheds vary in size and every stream, tributary, and river has an associated watershed. Small watersheds join to become larger watersheds. Nearly all of Brookline lies within the Nissitissit River sub-watershed. The Nissitissit River sub-watershed flows southeasterly into the main stem of the Nashua River just north of the center of Pepperell, MA. The Nissitissit River sub-watershed is part of the Nashua River Watershed and the larger Merrimack River Watershed.

There is a great deal of interconnectivity in watersheds, between tributaries and the main river, surface water and ground water, and wetlands. In addition, because water flows downstream, an action that impacts water quality, quantity, or rate of movement in one location affects locations downstream as well. For this reason, all neighborhoods and communities within a watershed must work together to make sound land use decisions.

### **3.2 ~ Major Surface Water Bodies**

#### *Nissitissit River*

The Nissitissit River is 9.2 miles long and is fed by a number of smaller streams, including North Stream, Scabbard Mill Brook, Village Brook, Stonehouse Brook, Talbot Brook, Wallace Brook, and Rocky Pond

Brook. There are roughly 60.5 square miles or 38,764 acres of land area in the Nissitissit River sub-watershed. 1,583 acres or roughly 7% of this land area is permanently protected; another 1,259 acres has limited protection (*Nashua River Watershed, 5 Year Action Plan, 2003-2007*).

Water quality in the Nissitissit has remained high, due in part to the fact that only about 7% of the land area in the Nissitissit River sub-watershed is impervious surface (*Nashua River Watershed, 5 Year Action Plan, 2003-2007*). In addition, there are no discharge permits for the Nissitissit River.

Significant conservation efforts, particularly in Brookline, have resulted in a 300 foot vegetated buffer along almost 50% of the Nissitissit (*Nashua River Watershed, 5 Year Action Plan, 2003-2007*). As a result, the Nissitissit River has been identified as one of the highest quality aquatic habitats in the Nashua River watershed. It provides prime habitat for native brook trout and five listed rare species. At the same time, while much of the Nissitissit River sub-basin has little or no development, the area is experiencing residential development pressure. Given that such a low percentage of the land area is impervious surface, there is not immediate concern over stormwater runoff and non-point source pollution issues. Sound land use planning now will ensure these do not become issues in the future.

#### Lake Potanipo

Lake Potanipo is 136 acres (NH Fish & Game) or 169.9 acres (NH DES) with an average depth of 12 feet (NH Fish & Game) or 13.5 feet (NH DES) and a maximum depth of 27 feet (NH Fish & Game) or 25.1 ft (NH DES). Lake Potanipo provides habitat to a variety of fish species, including largemouth bass, chain pickerel, yellow perch, pumpkinseed, hornpout (brown bullhead), and black crappie (*NH Fish & Game Department*). It also provides habitat for the endangered Brook floater and the threatened Fern-leaved false foxglove, both listed on the NH Natural Heritage Inventory. The lake supports a number of recreational uses including boating, fishing, swimming, and water skiing. There is one public beach for Town residents and one private beach for Camp Tevya, as well as a few small beaches located at private properties around the lake. The 2003-2007 Nashua River Watershed 5 Year Action Plan lists Lake Potanipo as the most threatened water body in the Nissitissit River watershed. There are 27 houses and seasonal cottages around Lake Potanipo and a 500 acre back parcel with rights to the lake (*NH DES*).

#### Melendy Pond

Melendy Pond is 18 acres (NH Fish & Game) or 16.7 acres (NH DES) with an average depth of 12 feet (NH Fish & Game) or 8.9 feet (NH DES) and a maximum depth of 20 feet (NH Fish & Game) or 22.4 feet (NH DES). Melendy Pond is a naturally occurring water body that provides habitat to a variety of fish species, including largemouth bass, chain pickerel, yellow perch, and hornpout (brown bullhead) (*NH Fish & Game Department*). The NH Natural Heritage Bureau does not list any Rare, Threatened, or Endangered Species in Melendy Pond. There are 23 houses around the Pond's shoreline; many are seasonal cottages though there are some year-round homes. Melendy Pond is used for a variety of recreation activities including boating, fishing, and swimming. There is one designated public access for boats, which is suitable for small motor boats, kayaks, and canoes. There are several small, private beaches located on private properties around the Pond, but no public beaches. Melendy Pond also serves as water source for toilets and showers for several homes on the shoreline.

### **3.3 ~ Wetlands**

#### Importance and Function of Wetlands

Wetlands are areas that have water at or near the surface, saturated soils for at least part of the year, and plants that are tolerant of wet conditions. Swamps are the most common type of wetland in New

Hampshire and are simply forested wetlands. New Hampshire is approximately 6-10% wetlands and has the distinction of being one of only three states to have retained over 80% of its wetlands since 1780 (NH DES).

Wetlands provide a number of critical services to communities. One of the most important is their protection of water quality and drinking water. Wetlands remove excess nitrogen and retain sediments that contain contaminants such as heavy metals and excess nutrients. This prevents these contaminants from entering waterways and polluting waters downstream. Wetlands also play an important role in flood prevention and maintenance of water flow. During periods of floods, wetlands decelerate runoff from upland areas and release it slowly, decreasing peak flood flows and mitigating flood damage. In dry periods, wetlands feed streams through groundwater discharge, which maintains in-stream flow and is important for water supply and wildlife habitat.

Wetlands are a vital wildlife habitat, supporting almost two-thirds of the state’s most threatened wildlife. Wetlands support wildlife of all sizes, from amphibian species that depend on vernal pools for breeding habitat to moose that utilize wetlands for their food source. Finally, wetlands support recreation and the state’s economy, which is heavily based on natural resources and tourism. Quality of life in New Hampshire and in Brookline is very dependent on clean water, wildlife, and outdoor recreation, which wetlands greatly contribute to.

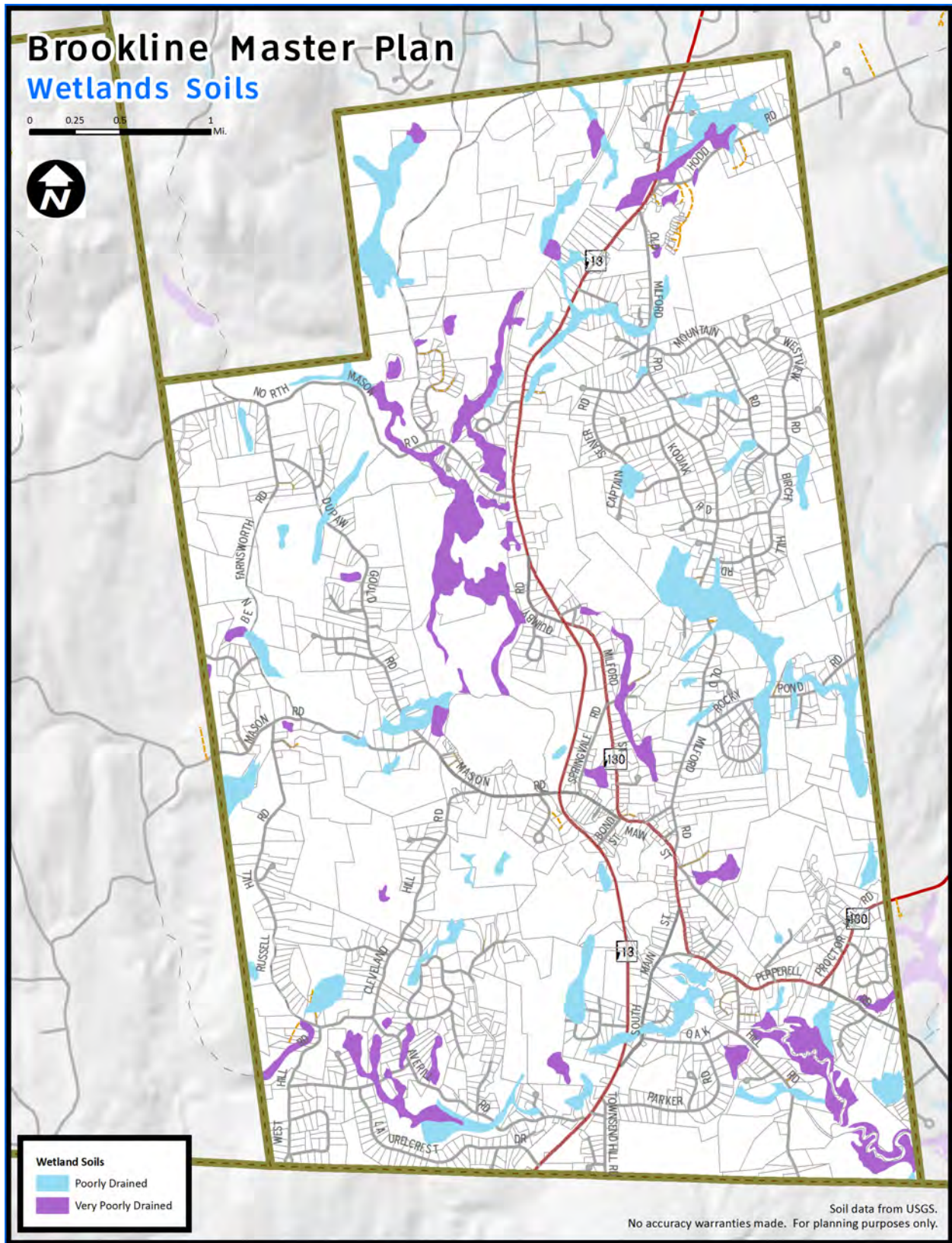
Table of Wetlands Soils in Brookline

Soil Name	Drainage	Symbol	Abundance
Borochemists	Very poor	BoA, BpA	
Chocorua	Very poor	Cu	
Greenwood	Very poor	Gw	
Saco Variant	Very poor	Sm	
Scarboro	Very poor	So, Sr	
Ridgebury	Very poor	RbA, ReA, ReB	
Saugatuck	Very poor	Sn	
Binghamville	Poor	Bg	
Leicester Variant	Poor	LeA, LsA	
Leicester-Walpole Complex	Poor	LtA, LtB, LvA, LvB	
Pipestone	Poor	PiA, PiB	

Description of Wetland Locations in Brookline

Major concentrations of wetland soils are found throughout Brookline. In the southern portion of Town, wetland soils are located in the areas of Wallace Brook, Stickney Brook, Rocky Pond Brook, and the Nissitissit River. Wetlands soils can be found in the central portion of Brookline near Lancy Brook, Lake Potanipo, North Stream, Village Brook, and Stonehouse Brook. In the northern portion of Brookline, wetland soils are located in the areas of Scabbard Mill Brook and Melendy Pond.

Map of Wetlands Soils in Brookline



Brookline's Wetlands Conservation District Ordinance

The Wetlands Conservation District was passed as part of Brookline's Zoning Ordinance in 1987. The purpose of this ordinance is to control and guide land use to prevent the destruction, pollution, or alteration of wetlands, which provide valuable natural services to the community. Additional details about the ordinance are described earlier in this chapter.

**3.4 ~ Flood Storage Lands**

Importance of Flood Storage Lands

According to the Federal Emergency Management Agency, flooding is the second most common and widespread natural disaster behind fires. As noted above, wetlands provide natural flood storage to a community. One acre of wetlands can typically store one million gallons of water (US EPA). In addition, trees and other wetlands vegetation slow the speed of flood water, which combined with flood storage, can lower flood heights and decrease destruction.

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### Brookline's Floodplain Ordinance

Brookline's Floodplain Ordinance applies to all land designated as special flood hazard areas by the Federal Emergency Management Agency in publications dated September 25, 2009 or as amended. Among its provisions, this ordinance requires all proposed development in any special flood hazard areas receive a permit. Additional details about the ordinance are described earlier in this chapter.

## **3.5 ~ Water Supply Lands**

### Importance of Aquifers to Brookline's Water Supply

Aquifers play a very significant role in Brookline, as all water for commercial, industrial, municipal, and residential needs comes from private wells. Recognizing this importance, Brookline adopted an Aquifer Protection Ordinance. This ordinance creates the Aquifer Protection District, which is a zoning overlay district that applies to all areas designated as stratified drift aquifers by the US Geological Survey. It regulates land use practices related to commercial-industrial land use in order to maintain and protect existing and potential ground water resources and surface water fed by groundwater from contamination.

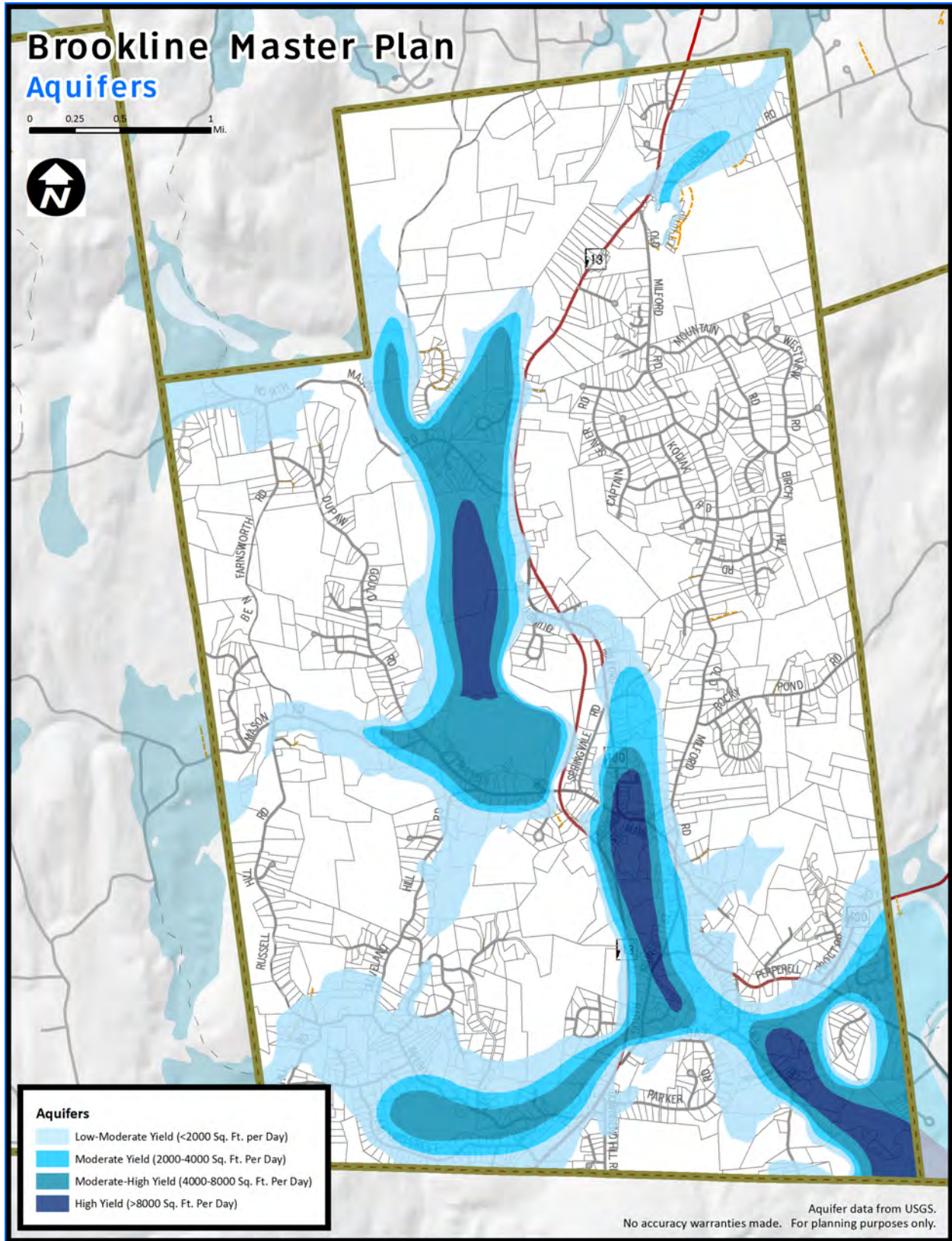
### Aquifer Types

In 1987, the USGS conducted a mapping exercise and survey titled "Hydrogeology of Stratified Drift Aquifers and Water Quality in the Nashua Regional Planning Commission Area." This study found that aquifers currently in use or that have the potential for future use in Brookline are typically stratified drift or glacial till.

Stratified drift aquifers provide the best potential for yielding adequate water supplies in Brookline; according to the USGS study, 31% of Brookline is underlain by stratified drift. Stratified drift aquifers are typically comprised of sorted sand and gravel, which has a high porosity and therefore contains larger quantities of water.

Glacial till aquifers are typically much shallower than stratified drift, contain less water, and tend to be localized in extent. Therefore, they are better suited for domestic use only. A concern with glacial till aquifers is that their shallow nature leaves them more susceptible to contamination from land use practices such as septic system failures, agricultural runoff, industrial pollution, and surface runoff containing road salt.

Map of Aquifers in Brookline



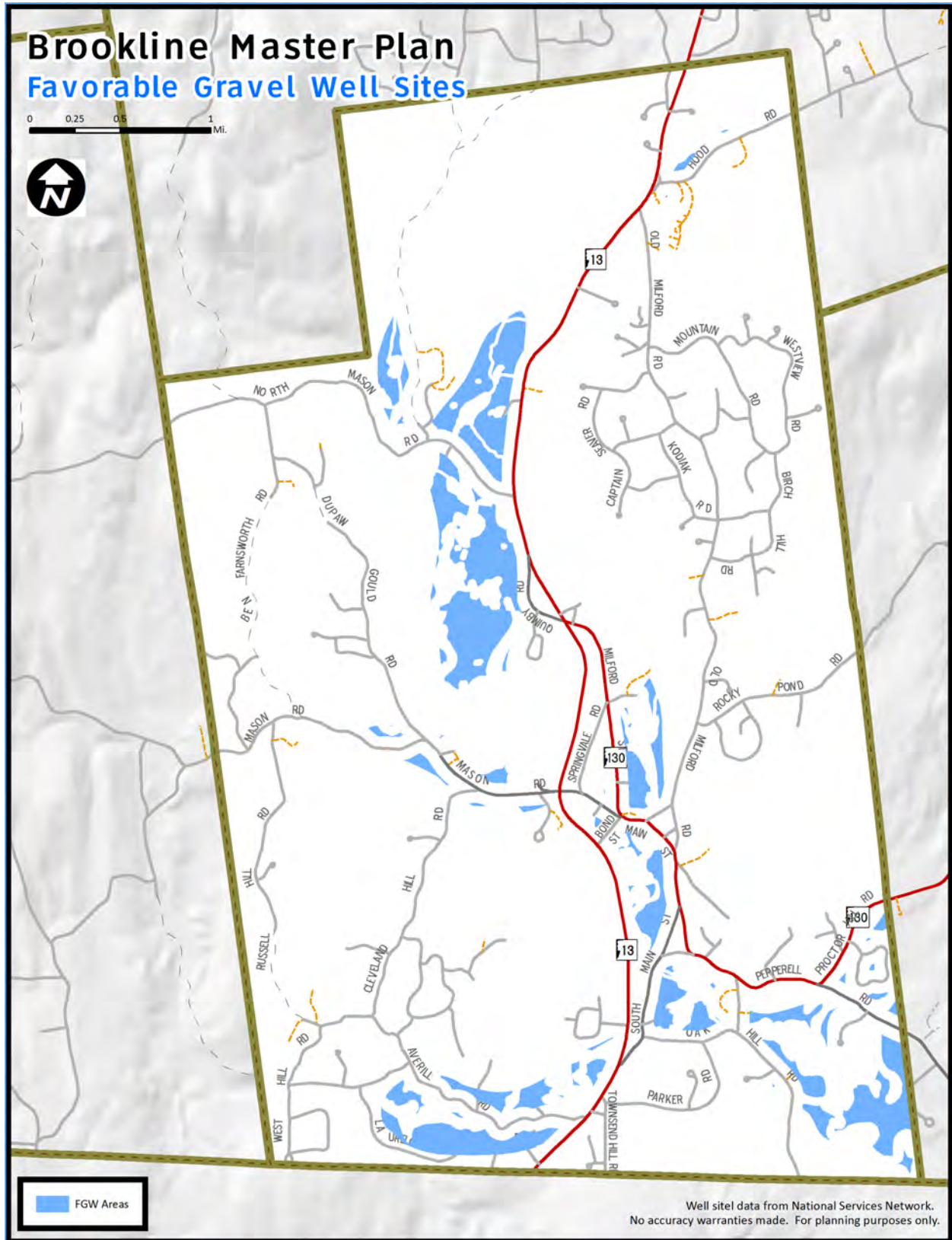
*NH DES Favorable Gravel Well Analysis*

In the 1990s, the USGS and NH DES mapped stratified drift aquifers in New Hampshire. The maps showed large areas underlain by these aquifers, however, only a small fraction of these areas is likely to produce high yielding community wells. In response, NH DES developed a technique called Favorable Gravel Well Analysis to analyze these maps and account for constraints to siting a community well. This analysis provides a tool to help planners make better use of stratified drift aquifer maps, understand the relative scarcity or abundance of potential high-yield well locations, and highlight the need to protect future drinking water resources.

The two constraints considered in this analysis are water quantity and quality. Wells must yield enough water to meet community needs and must be located far enough away from known or potential contaminants to preserve water quality.

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Map of Favorable Gravel Well Sites in Brookline



### Anticipated Future Demand for Water in Brookline

Comments received:

- “Brookline residents mainly use wells. The respondents want to leave public infrastructure as is but view the lack of these services as a disadvantage to economic growth.”

## **SECTION 4—WATER-BASED RESOURCES CONSERVATION AND PROTECTION**

### **4.1 ~ Special Areas of Focus**

#### Lake Potanipo and Melendy Pond

Variable milfoil (*Myriophyllum heterophyllum*) established in Lake Potanipo in 2002. Since then, this invasive aquatic plant has increased exponentially and has become very dense in several shallow locations around the lake. As of 2008, approximately 39 acres of Lake Potanipo were invested with milfoil. Variable milfoil also established in Melendy Pond in 2002. Melendy Pond is a shallow waterbody with a mix of sandy, silty, and organic substrates that make it a prime habitat for milfoil. In 2008, DES biologists predicted that within 10 years the entire Pond will be dominated by milfoil (DES). A significant amount of research and analysis on the topic of milfoil in Brookline’s water bodies can be found in two papers written by NH Dept. of Environmental Services, entitled “Long-Term Variable Milfoil Management and Control Plan for Lake Potanipo, Brookline, NH” and “Long-Term Variable Milfoil Management and Control Plan for Melendy Pond, Brookline, NH.”

#### Nissitissit River

#### Marshes & Vernal Pools

### **4.2 ~ Implications for Land Use**

#### Wetlands

- The health of wetlands is critical to the functioning of other natural services. Therefore, careful consideration should be given to land use decisions that have the potential to impact wetlands.
- Vernal pools provide crucial habitat and breeding ground for amphibians and should continue to be protected under Brookline’s Wetlands Conservation District ordinance.

#### Surface & Ground Water

- Land use decisions have a direct impact on water quality and quantity for both ground and surface water in Brookline. They can also impact downstream and downslope communities within the watershed.
- The amount of impervious surface in groundwater recharge areas impacts groundwater quantity and surface water quality. Decreasing the amount of impervious surface will result in increased recharge rates and decreased runoff.
- The shallow nature of glacial till aquifers leaves them more susceptible to contamination from land use practices. Compatible land use siting is essential to protect water quality in Brookline’s aquifers.

### **4.3 ~ Water-based Resources Goals/Recommendations**

#### Lake Potanipo, Melendy Pond, and Nissitissit River

- Consider limiting or prohibiting additional development around Lake Potanipo to preserve water quality.

- Investigate the option for the Town of Brookline to obtain the 1<sup>st</sup> right to purchase land surrounding Lake Potanipo if it is ever available for sale.
- Pursue easements to create buffers along the Nissitissit River, Lake Potanipo, and Melendy Pond where they do not currently exist. Maintain a 300 foot vegetated buffer along the Nissitissit River to protect water quality and wildlife habitat, to prevent flood damage, and to provide recreational opportunities.

#### Ordinances

- Enforce the existing Wetlands Conservation District ordinance and Aquifer Protection ordinance.
- As the amount of impervious surface increases in Brookline, consider adopting a Permanent Stormwater Management ordinance, similar to the model outlined in the Innovative Land Use Planning Techniques Handbook, and/or a Maximum Impervious Surface ordinance, similar to the model developed by the Nashua Regional Planning Commission.
- Consider adopting a Shoreland Protection ordinance, similar to that outlined in the Innovative Land Use Planning Techniques Handbook.

#### Impervious Surfaces

- Promote the use of permeable surfaces and Low Impact Development techniques throughout Brookline.
- Decrease the required road width in new developments to reduce the amount of impervious surface.
- Research non-salt road de-icing methods to limit salt application throughout Brookline, not just within the Aquifer Protection District.

#### Monitoring and Education

- Educate the public on the importance of water quality and the steps they can take to improve it.
- Encourage residents to work with the Nashua River Watershed Association's volunteer water quality monitoring program for the Nissitissit River.
- Continue and expand the Brookline Conservation Commission's water quality monitoring of Melendy Pond and Lake Potanipo.
- Develop an inspection and maintenance program for septic systems.
- Develop a comprehensive program to protect Brookline from the further introduction and spread of invasive species. Work with NH DES to conduct public education campaigns on milfoil and other invasive species.

#### **4.4 ~ Water-based Resources Implementation Steps**

- Follow recommendations in "Long-Term Variable Milfoil Management and Control Plan for Lake Potanipo, Brookline, NH" prepared by NH DES  
[http://des.nh.gov/organization/divisions/water/wmb/exoticspecies/documents/lake\\_potanipo.pdf](http://des.nh.gov/organization/divisions/water/wmb/exoticspecies/documents/lake_potanipo.pdf)
- Follow recommendations in "Long-Term Variable Milfoil Management and Control Plan for Melendy Pond, Brookline, NH" prepared by NH DES  
[http://des.nh.gov/organization/divisions/water/wmb/exoticspecies/documents/melendy\\_pond.pdf](http://des.nh.gov/organization/divisions/water/wmb/exoticspecies/documents/melendy_pond.pdf)
- Follow recommendations in "Nashua River Watershed 5 Year Action Plan 2003-2007" prepared by The Nashua River Watershed Association and the MA Watershed Initiative Nashua Team.  
[http://www.nashuariverwatershed.org/5yr\\_plan/subbasins/nissitissit.htm](http://www.nashuariverwatershed.org/5yr_plan/subbasins/nissitissit.htm)
- Post information on invasive species at boat launches, on conservation lands, and on the Brookline website.

**SECTION 5—IDENTIFICATION OF LAND-BASED RESOURCES AND SERVICES**

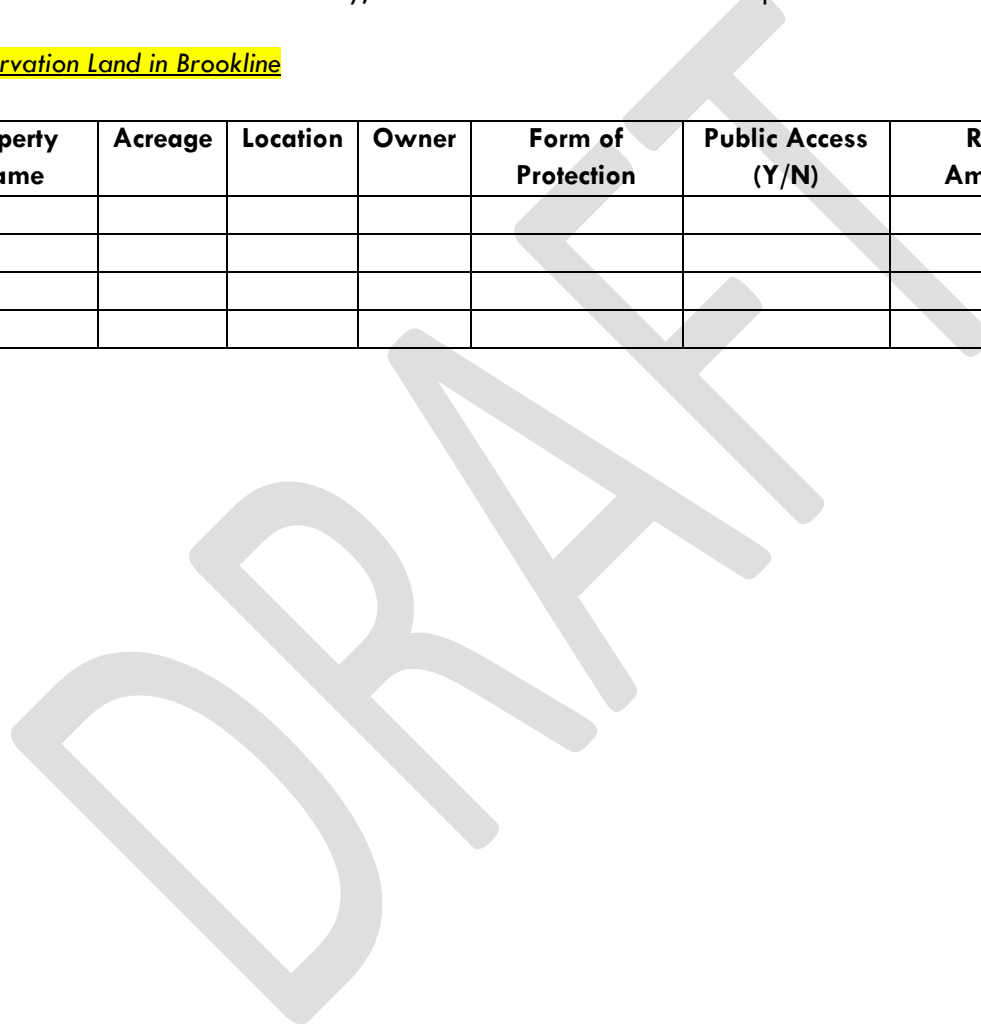
**5.1 ~ Conservation Land**

Summary of Town Goals and Plan for Conservation Land

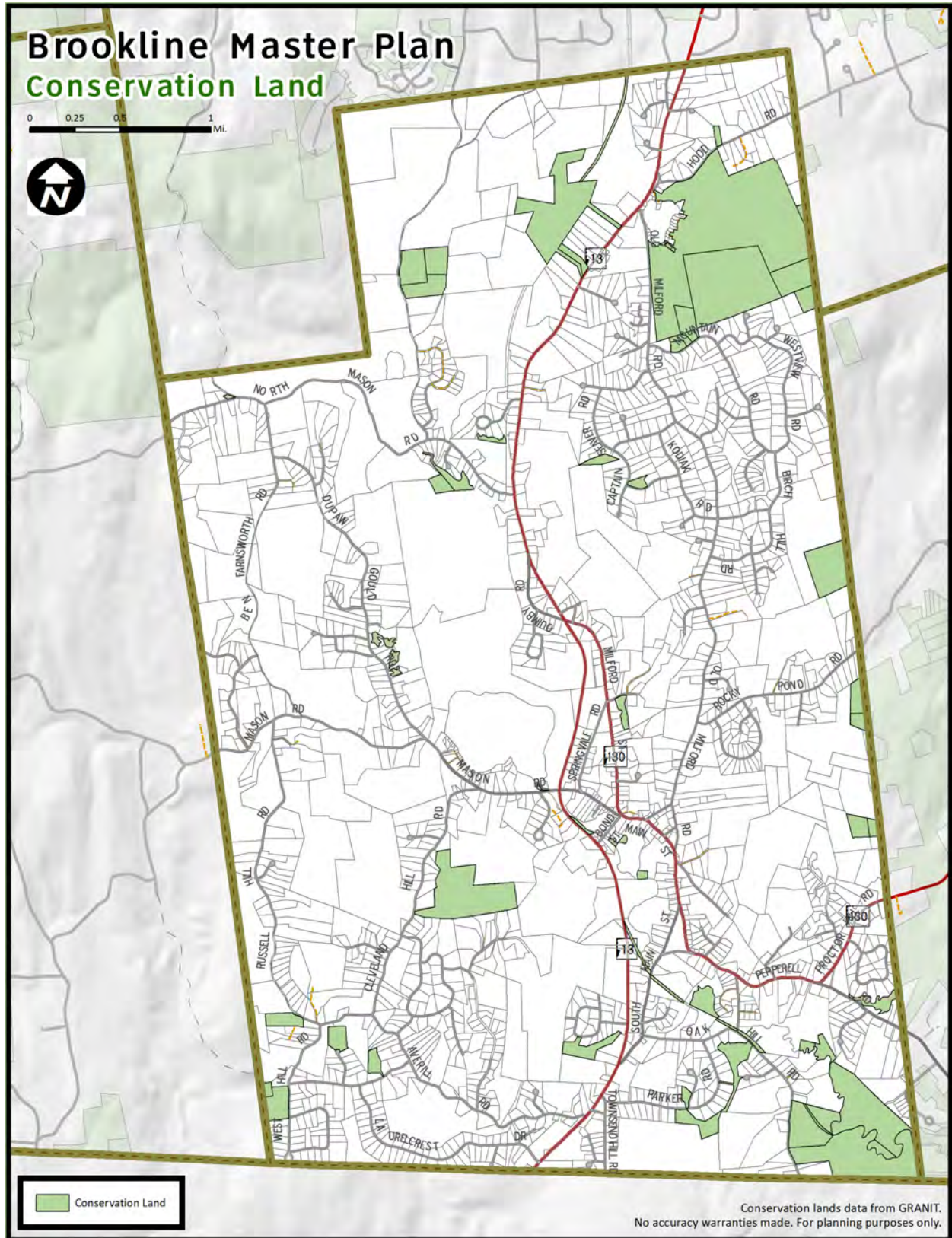
The Brookline Conservation Commission has set a goal of protecting a minimum of 25% of the Town’s land for conservation. When asked how they felt about this goal, 58% of respondents to the Master Plan survey stated the goal seemed about right. Twenty two percent stated it should be higher and 20% thought it should be lower. Currently, about 17% of the Town’s land is protected.

**Conservation Land in Brookline**

Property Name	Acreage	Location	Owner	Form of Protection	Public Access (Y/N)	Recreational Amenities (Y/N)



Map of Conservation Land in Brookline



## 5.2 ~ Soils

### Importance of Soils in Determining Land Use and Capability of Development

Soil types are one of the most critical determinants of a parcel's capability to support development. This is particularly true in Brookline, where they serve as the sole medium for sewage purification through individual septic systems. Soil data presented in this section comes from three studies by the US Dept. of Agriculture's Natural Resources Conservation Service—"Soil Potentials for Development," "Town of Brookline Soils and their Interpretations for Various Land Uses," and "Soils Survey of Hillsborough County, New Hampshire-Eastern Part." These studies are available in Town Hall.

### Soil types and their Implications for Land Use

A majority of soils found in Brookline are either Hinckley-Windsor or Canton-Chatfield. Hinckley-Windsor soils are found in the low-lying land of the Town Center and southeast quadrant of Brookline. They are typically described as excessively drained, gravelly, and sandy although there are some lands within this group that are poorly and very poorly drained or wetlands. Canton-Chatfield soils are well-drained, loamy, and often found on slopes and covered with forest. A more specific analysis can be accomplished by dividing Brookline's soil types into the following categories.

**Wetlands or Wet Soils**—these poorly and very poorly drained soils serve as water storage areas that recharge stream flows during dry months. They are often nearly level and may be ponded or have standing water on their surface. They pose tremendous problems to development and their active use for development purposes is prohibited under the Wetlands Zoning Ordinance.

**Floodplain Soils**—these soils are found adjacent to river and streams, which deposit the soil by flooding these waterways. Given that Brookline has only a few minor waterways, there is little floodplain soil in Town. Floodplain soils are among the finest agricultural soils in NH.

**Sand and Gravel Soils**—these soils are excessively drained and are characterized by their rapid permeability. They are among the predominant soil types in Brookline. Because of their rapid permeability, they act as a poor filter. These soils may also be stony, especially the Hinckley soils. They are highly erodible, are the least stable for holding slopes or banks, and do not yield significant groundwater.

**Seasonal Wet Soils**—these soils are moderately well drained and found in upland depressions. Because they generally form a relatively thin soil layer over bedrock, they tend to have a seasonally high water table, which imposes severe restrictions on their ability to be used for septic systems and home construction. They are found in scattered locations among the hills surrounding the low-lying Town Center and southeast portion of Brookline.

**Shallow-to-Bedrock Soils**—this category contains several soil types that generally form an extremely thin layer over bedrock (30-40 inches deep). They are moderately to well drained, are generally covered by woodlands, and have very limited capacity to yield groundwater. Because they are so thin, their use for septic systems is severely limited, though sites with sufficient depth to bedrock can be found.

**Hardpan Soils**—these soils are characterized by a 24 inch layer of well-drained soil underlain by a dense, slowly permeable hardpan layer of up to 60 inches deep. Due to this hardpan layer, these soils

have severe limitations for use as septic system leaching areas. They are found in one location in Brookline, just south of Lake Potanipo on the slopes of a drumlin, or glacier-formed hill.

Deep-Stoney Soils—soils in this category represent the predominant soil type in Brookline. They are well-drained, often contain stones and boulders at or near the surface, and are found on slopes of the hilly uplands that surround the Main Street area and Route 13. Depth to bedrock is typically in excess of five feet. Much of this soil type is covered by woodland and has moderate groundwater availability. The greatest limitations to development imposed by these soils come from their stoniness and the fact that they are typically found on slopes.

*Analysis of Soil Types to Support Septic Function and associated Implications for Land Use*

This analysis examines soil type and slope in combination to determine limitations for subsurface septic system installation and operation. It is based on analysis by the Natural Resources Conservation Service of the US Department of Agriculture, which examines the following characteristics of land areas for their capability to support the safe installation and operation of septic systems:

1. Permeability of soil
2. Depth to water table
3. Depth to bedrock
4. Steepness of slope
5. Stoniness or rockiness of soil
6. Susceptibility of flooding

Land areas are categorized as possessing either slight, moderate, or severe limitations to proper septic system operation due to the combination of these six characteristics.

Slight Limitations—land areas designated as having slight limitations are the most capable of supporting safe septic system operations. Any limitations of these areas are considered to be easy and inexpensive to overcome. Unless other site characteristics limit their suitability, they are recommended for active use and development. In fact, given that there is so little land in this classification in Brookline, these parcels should be used as efficiently as possible. Very little land in Brookline is underlain by soils in this slight limitation category. This land totals roughly 150 to 200 acres and is scattered throughout Town among parcels ranging in size from 5 to 20 acres.

Moderate Limitations—land areas in this category have moderate limitations or constraints to septic system installation and operation. Their development and use will require planning, careful review, and usually remedial engineering or landscaping work to overcome the limitations imposed. These limitations will not preclude the development of these parcels, but they are identified to alert interested parties that special consideration and potentially expensive remedial work may be required to safely develop such sites. Land areas in this category are scattered among the hilly uplands and occur more frequently than parcels of slight limitation. However, they still comprise only about one-fifth of Brookline's total land. Therefore, they should be used as efficiently as feasible while recognizing their limitations. Moderate density clustering may be feasible on selected sites. Land with moderate limitations is predominantly found in the southeast corner of Brookline, west and southwest of Russell Hill, south of North Mason Road, along portions of Old Milford Road, and south of Rocky Pond Road.

Severe Limitations—land areas with this designation have the poorest capability to be used for septic system operations due to one or more of the characteristics used to evaluate its potential. This designation should not be interpreted to mean that these land areas are incapable of supporting development.

Rather, the severe designation alerts developers and planning board members of the need to identify the limitations and to ensure that all remedial actions to overcome the limitations are made. The importance of site inspections in such cases cannot be over-emphasized. Approximately 80% of the Town falls into this category.

It is important to remember that this analysis combines information regarding both soil types and slope, and that it does so at a scale that is unsuitable for site-specific analysis and decision making. This analysis will not replace or eliminate the need for a site investigation to determine land capability. It is provided to give a broad overview of the potential for development in Brookline and to alter the planning board about potential problems certain lands will present. In addition, while soil types are delineated on the Master Plan maps with a reasonable degree of accuracy, specific soil types referred to on the map are those of the predominant soil type within the mapped area. Actual boundaries between soils on the ground are not so easily discernable and will vary from those mapped. Therefore, site inspections and more thorough study of the soils at any site cannot be replaced by the maps that accompany this report.

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**5.3 ~ Forest Lands**

Recent and Current Town Forestry Activities

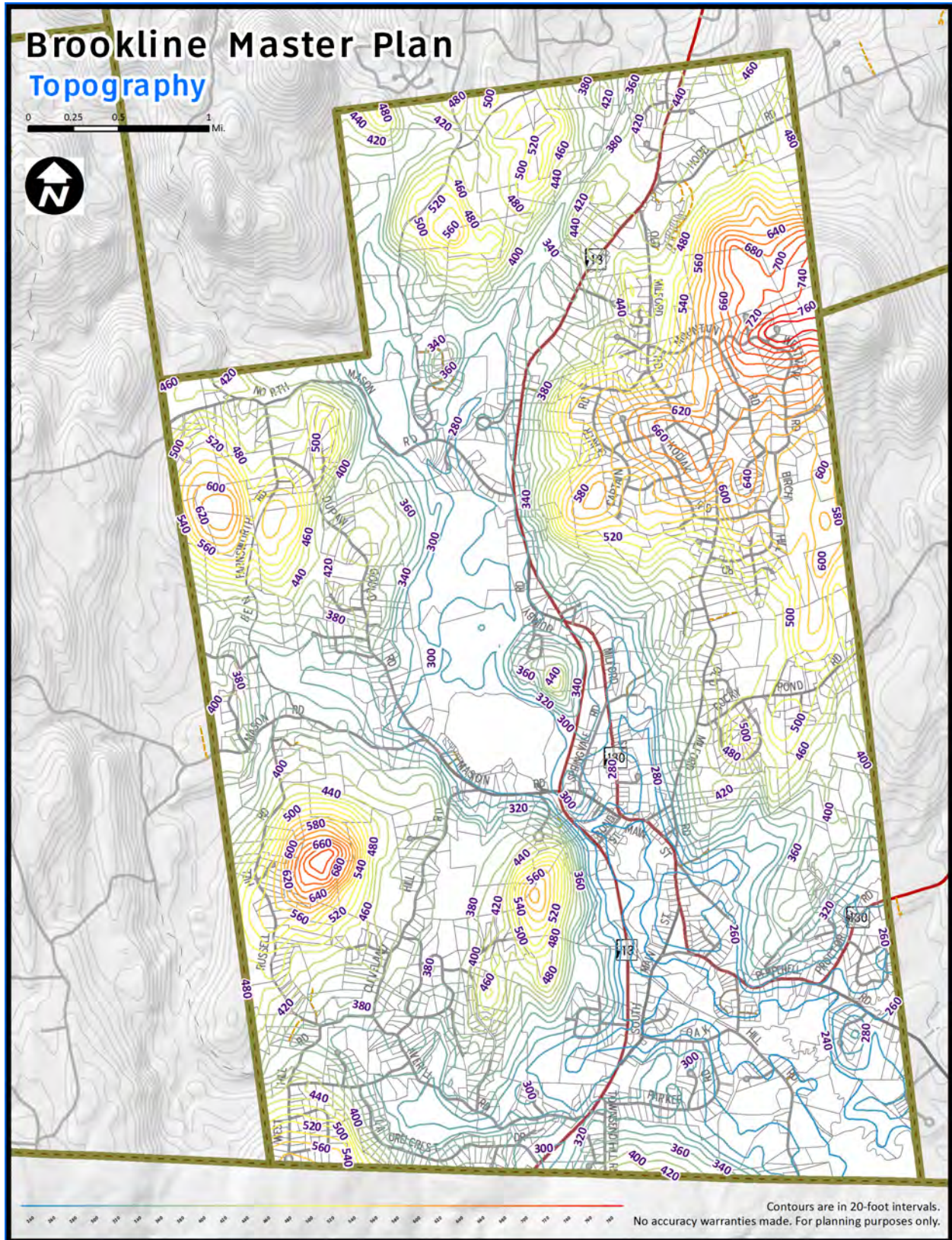
Future Town Forestry Goals, Activities, and Focus Areas

Summary of Brookline Forest Management Plan (if available)

**5.4 ~ Hilltops, Elevation, and Slopes**

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Topographic Map of Brookline



**Scenic Views in Brookline**

Name	Location	Elevation (feet aMSL)	Public Access (Y/N)	Protected (Y/N)
Birch Hill		810		
Russell Hill		738		
Unnamed	Northwest corner	642		
Potanipo Hill		627		
Bear Hill		615		
Unnamed	Southwest of Rocky Pond	613		
Hutchinson Hill		600		
West Hill		590		
Unnamed	Northwest corner	557		
Unnamed	East of Corey Hill	523		
Corey Hill		515		
Hobart Hill		508		
Rock Ramond		477		

Slope Categories and Associated Land Use Implications

Slope measures the pitch or steepness of land between two points. It is expressed as a percentage, which is calculated by dividing the change in elevation between two points by the distance between the two points. Steep slopes are defined as having 15 feet or greater of vertical rise over 100 feet of horizontal run, or a 15% slope. Maps and descriptions of slopes should not be used as a definitive guide to where development should and should not occur. Rather, specific site characteristics should be investigated to identify potential problems and to decide whether they can be overcome. Slope data must be used in conjunction with soil and water resources data to determine a specific site’s natural capability to support a proposed use.

25% and Greater Slopes—land with slopes greater than 25% are the most difficult to develop. They require extreme care and typically need special landscaping and engineering to be developed properly. There are several concerns with developing steep slopes such as these. The loss of vegetation and disruption of natural drainage patterns brought about by development on steep slopes can cause erosion problems leading to potential flooding, stream sedimentation, and slope instability. In addition, providing infrastructure to hillside development can be expensive to engineer and construct. The typically shallow, poorly draining soils on slopes are not suitable for septic systems. High failure rates of septic systems on steep slopes are a serious threat to ground and surface water quality. Furthermore, road construction requires switchbacks and extensive regrading to regulate the gradient and ensure motorist safety.

15% to 25% Slopes—although they are somewhat less severe, development on 15-25% slopes face the same difficulties in terms of erosion, septic, infrastructure, and road construction limitations.

8% to 15% Slopes—land in this category will have similar limitations to land with steeper slopes, however, in many cases the costs to overcome these concerns are not prohibitively expensive to make development

unfeasible. Development potential of sites with these slopes will most likely be determined by site specific characteristics, such as soil depth, soil type, and the intensity of proposed development. As a result, site specific investigations and a close review of proposed septic and erosion safeguards are critical for any development in this category. It is expected that more proposals will be submitted for development on slopes in this category as suitable flatter land becomes less available.

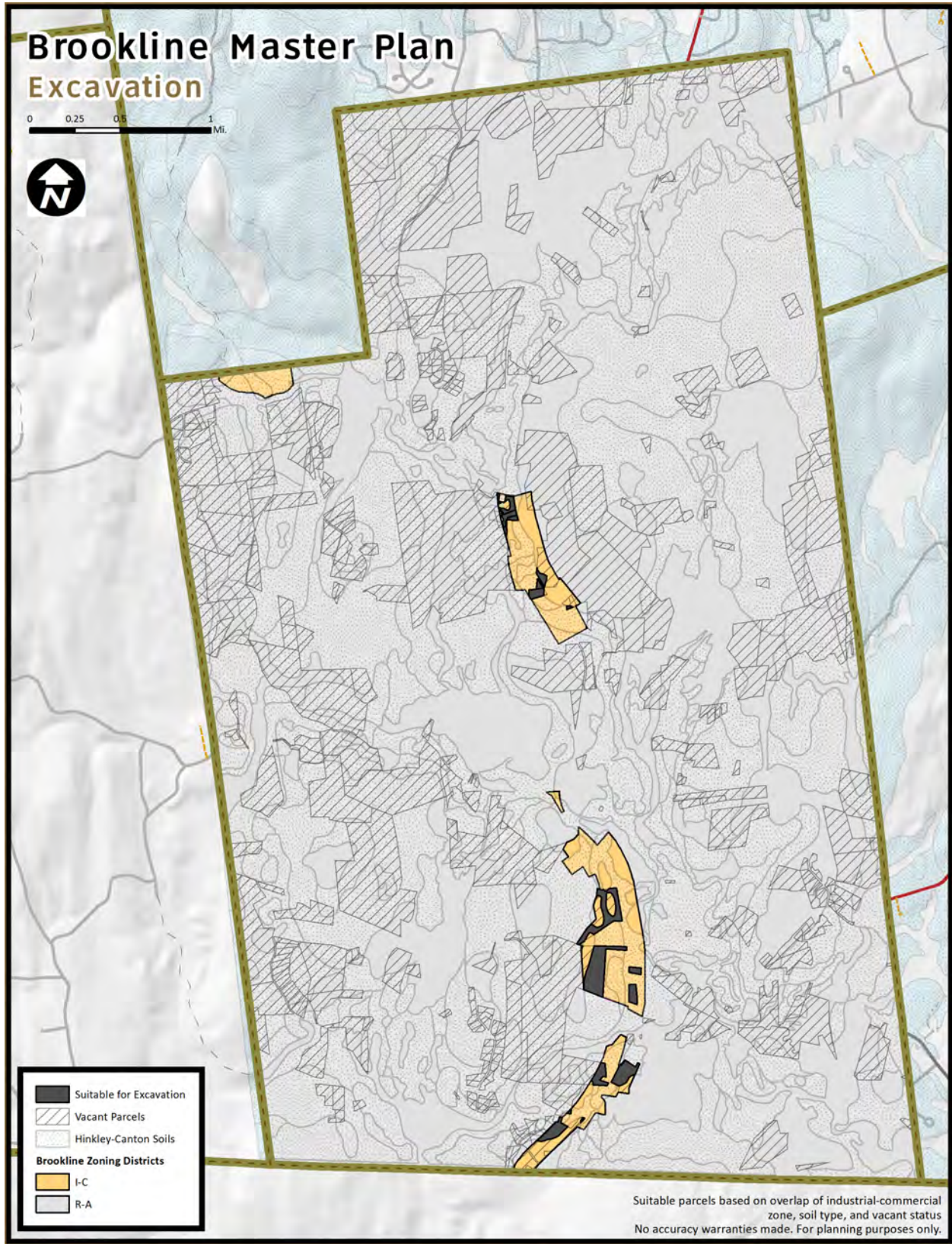
0% to 8% Slopes—land in this category is typically best for supporting active development, provided that the soil types are suitable and other site characteristics do not impose constraints. One notable area not suited for development in this category is wetlands or land of 0-3% slope at low elevations with poorly or very poorly drained soils.

### **5.5 ~ Excavation Materials**

#### *Likely Locations for Excavation Materials*

Excavation materials, such as sand and gravel, are typically found in areas with stratified drift deposits. Canton and Hinckley soils, which are found throughout most of Brookline, are also good indications of the presence of sand and gravel.

*Excavation Map*



Local Ordinances Regulating Excavation Materials

In November 1989, the Brookline Planning Board adopted Excavation Site Plan Review Regulations. Before 1992, excavation was permitted anywhere in Town by special exception granted by the Zoning Board of Adjustment. At 1992 Town Meeting, Brookline residents submitted and approved a petition to limit excavation to the Industrial-Commercial zone. The 1997 Master Plan recommend that the Town submit an amendment at Town Meeting to reverse the 1992 vote. **Where do things stand now?**

Anticipated Future Demand for Excavation Materials**5.7 ~ Wildlife**Summary of species found in Brookline listed as threatened or endanger by NH Natural Heritage Inventory

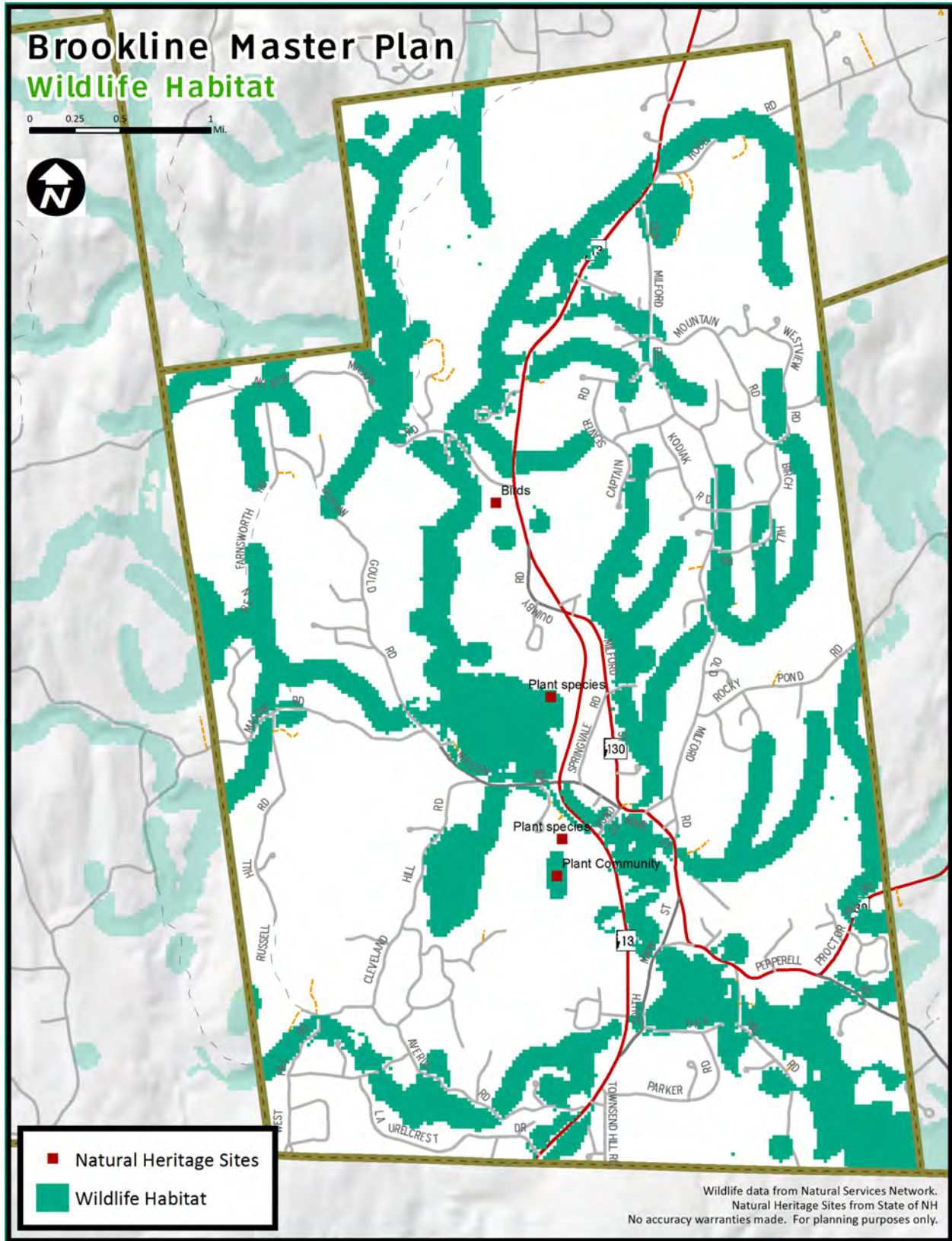
The NH Natural Heritage Bureau is part of the Division of Forests and Lands. Its mission is to find, track, and facilitate the protection of New Hampshire's rare plants and exemplary natural communities. The Natural Heritage Bureau provides information to facilitate informed land-use decision making to help protect the State's natural heritage while meeting land use needs. As of January 2011, the NH Natural Heritage database contained information on more than 6,000 species or natural community occurrences throughout the state. The following table is derived from the NH Natural Heritage Bureau's January 2011 publication "Rare Plants, Rare Animals, and Exemplary Natural Communities in New Hampshire Towns" for Brookline.

Name	Flag <sup>1</sup>	Federal Listing	State Listing	# reported in Brookline in past 20 years	# reported in NH in past 20 years
Natural Communities					
Chestnut oak forest/woodland	none	No	No	Historical (not reported in past 20 years)	6
Plants					
Fringed Gentian ( <i>Gentianopsis crinita</i> )	None	No	Threatened	Historical (not reported in past 20 years)	27
Piled-up Sedge ( <i>Carex cumulate</i> )	None	No	Threatened	Historical (not reported in past 20 years)	16
Prostrate Tick Trefoil ( <i>Desmodium rotundifolium</i> )	None	No	Threatened	Historical (not reported in past 20 years)	12
Sickle-pod ( <i>Boechna canadensis</i> )	None	No	Threatened	Historical (not reported in past 20 years)	8
Vertebrates—Birds					
Great Blue Heron (Rookery) ( <i>Ardea herodias</i> )	None	No	No	Historical (not reported in past 20 years)	39

Vertebrates—Reptiles					
Blanding's Turtle ( <i>Emydoidea blandingii</i> )	Very High Importance	No	Endangered	2	469
Eastern Hognose Snake ( <i>Heterodon platirhinos</i> )	Very High Importance	No	Endangered	3	36
Northern Black Racer ( <i>Coluber constrictor constrictor</i> )	Very High Importance	No	Threatened	1	44
Spotted Turtle ( <i>Clemmys guttata</i> )	Very High Importance	No	Threatened	2	94
Vertebrates—Fish					
Banded Sunfish ( <i>Enneacanthus obesus</i> )	Very High Importance	No	Special Concern	1	30
Swamp Darter	Very High Importance	No	Special Concern	1	13

1. Flags are based on a combination of how rare the species or community is and how large or healthy its examples are in the Town.

Map of Wildlife Habitat



### Strategies for Managing Land for Wildlife

Since many animals require a large territory to find food and adequate breeding grounds, wildlife habitat protection should occur at the largest scale possible. Small, isolated segments of habitat may not contain enough resources to sustain a species, resulting in its decline. Maintaining contiguous habitat blocks as development occurs will protect wildlife and create a network of viable habitats.

## **SECTION 6—LAND-BASED RESOURCES CONSERVATION AND PROTECTION**

### **6.1 ~ Special Areas of Focus**

#### Conservation Land

#### Undeveloped and Marginal Land

### **6.2 ~ Implications for Land Use**

- The 2008 “Vision Plan for Rt. 13 & 130” calls for the Town of Brookline to maintain its natural features to the greatest extent possible, including trees, conservation areas, lakes, farm lands, and wildlife.

#### Slopes

- As flat land becomes more built up there is increasing pressure to develop land at higher elevations and steeper slopes. Development of these parcels can impact scenic views and cause erosion and runoff. Surface water bodies near developed slopes are particularly vulnerable. Development on steep slopes is also more costly.

#### Excavation Materials

- Commercial sand and gravel operations can alter the ability of these areas to filter and recharge groundwater, which can lead to decreased quantity and degraded quality. Excessive removal of materials overlying aquifers increases the potential for groundwater contamination. The soil above groundwater acts as a filter by removing suspended contaminants as the water percolates down. If too much material is removed, the filtering capacity of the soil is diminished.
- Consider and mitigate erosion, traffic, noise, and airborne particulates that abutters are exposed to.

#### Soils

- Soil characteristics, such as depth, permeability, wetness, and slope play a significant role in determining development cost, suitability, and density.

#### Forest Land

- Forests are a valuable resource for Brookline; they provide habitat, control erosion, improve water quality, regulate temperature, and can be a source of income.
- Timber harvesting is a renewable resource that can contribute to the local economy and provide access to local forest products.
- Timber harvests that do not follow best management practices can result in erosion, non-point source pollution to water bodies, and harm to abutters.

Conservation Land

- Conservation land provides critical natural services and valuable wildlife habitat. It also plays a key role in the community's quality of life.
- Once open space is developed it cannot quickly or easily be returned to its natural state.
- Fragmented conservation land cannot support wildlife as well as contiguous parcels can.

**6.3 ~ Land-based Resources Goals/Recommendations**Slopes

- Ensure corridors and connections between elevations remain intact. Varied elevation is necessary for wildlife habitat and biodiversity.
- Consider adopting innovative land use ordinances such as Steep Slope and Ridgeline Protection and/or Erosion and Sediment Control During Construction to protect these lands as development pressure increases. Model ordinances for these topics are outlined in the Innovative Land Use Planning Techniques Handbook.
- Investigate land protection opportunities between elevations to ensure contiguous habitat.
- Create a scenic viewpoint and viewshed analysis of land in Brookline. Protect land in designated scenic view areas by providing incentives in site plan and subdivision regulations and by encouraging private property owners to put easements on land with views.

Excavation Materials

- Revisit regulations with regard to extraction to ensure they adequately protect natural resources.
- Pursue recreation opportunities and/or conservation easements on inactive and former excavation sites after reclamation activities are complete.

Soils

- Encourage open space development to conserve valuable soils by clustering development in the most appropriate, least impactful areas.
- Ensure lot size is based on suitability of soil for required septic capacity.

Forest Land

- Have a licensed forester inspect all timber harvests to ensure compliance with applicable regulations.
- A majority of Master Plan Survey respondents are in favor of selective cutting and maintaining current forestry practices on Town land.

Conservation Land and Recreation

- A majority of Master Plan Survey respondents and Forum participants are satisfied with the current level of town owned conservation land.
- Pursue protection of land adjacent to parcels already in protection to create contiguous blocks of conservation land.
- Budget for land acquisition of valuable conservation parcels. Larger tracks of presently undeveloped land were identified as a conservation priority during the Master Plan Forum.
- Encourage private landowners to consider land protection measures such as conservation easements. Lead by example and place conservation easements on environmentally sensitive Town lands.

- Create signage and develop recreational amenities such as parking on certain conservation lands. Ensure these amenities are maintained. Keep other parcels of conservation land in a completely natural state with no amenities or recreational development.
- Work with the Conservation Commission or establish a sub-committee to work with land owners on voluntary land protection efforts.
- Encourage developers to utilize open space development and conservation subdivisions that cluster development, leaving more contiguous open space.

#### Wildlife

- Manage Town land for wildlife habitat and encourage private land owners to do the same.
- Create design guidelines for new development that provide specific criteria for protecting wildlife habitat.
- Concentrate land acquisition for habitat protection on preserving corridors and providing access to water, food, and breeding grounds.
- Consider adopting a Habitat Management ordinance, similar to that outlined in the Innovative Land Use Planning Techniques Handbook.
- Investigate the impacts of recreational fishing, including ice fishing, on local fish stocks and develop a plan to ensure that the practice remains sustainable.
- Work with neighboring communities to manage and protect wildlife habitat that crosses town lines.

#### **6.4 ~ Land-based Resources Implementation Steps**

- Complete an analysis of undeveloped parcels and identify any with significant natural resources. Prioritize parcels accordingly. Develop a plan to acquire and/or protect these parcels.

## **SECTION 9—REFERENCES**

### **9.1 ~ Definitions**

#### **9.2 ~ Relevant state statutes and model ordinances**

- RSA 674:21 *Innovative Land Use*—innovative land use controls to address development density, environmental characteristics, and site level design. *Model ordinances are available for each innovative land use technique.*
- Permanent Stormwater Management—Innovative Land Use Guidebook chapter and model ordinance available
- Steep Slopes and Ridgeline Protection—Innovative Land Use Guidebook chapter and model ordinance available
- Habitat Management—Innovative Land Use Guidebook chapter and model ordinance available
- Shoreland—Innovative Land Use Guidebook chapter and model ordinance available
- Erosion and Sediment Control During Construction—Innovative Land Use Guidebook chapter and model ordinance available
- Maximum Impervious Surface—model ordinance developed by NRPC

### 9.3 ~ Tools

- Innovative Land Use Planning Techniques Handbook—to address the need for guidance and technical assistance on Innovative Land Use Controls authorized by RSA 674:21, DES and its partners, the NH Association of Regional Planning Commissions, the NH Office of Energy and Planning, and the NH Local Government Center, produced *Innovative Land Use Planning Techniques: A Handbook for Sustainable Development*. The handbook includes sections dealing with development density, environmental characteristics, and site level design. Each of the 23 chapters includes model ordinances and regulations for use by municipalities interested in implementing the innovative land use techniques.

[http://des.nh.gov/organization/divisions/water/wmb/repp/innovative\\_land\\_use.htm](http://des.nh.gov/organization/divisions/water/wmb/repp/innovative_land_use.htm)

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