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StoryMap Website

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1 INTRODUCTION

The City of Rochester is located in southeastern New Hampshire in Strafford County on the northern end of the Gulf of Maine Coastal Plain ecoregional subsection,[i] which extends northeast into coastal Maine and south into Massachusetts (Figure 1)[1]. The city is located within New Hampshire's coastal watershed and borders the State of Maine along the Salmon Falls River. Its diverse land uses and landscapes including rivers, streams, forests, conservation lands, open lands, and farmlands provide wildlife habitat, are part of regional ecological networks, and contribute to a high quality of life for Rochester residents.

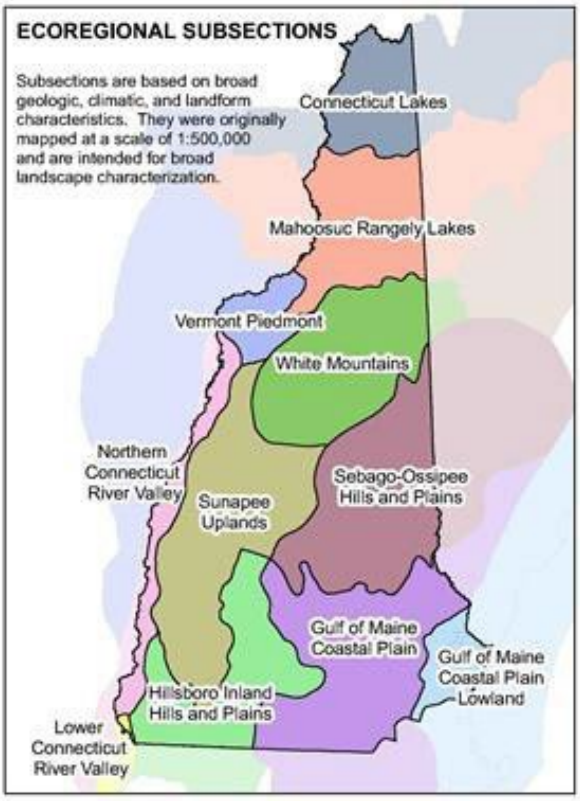


Figure 1. Ecoregional subsections of New Hampshire (Source NH WAP)

This Natural Resources Chapter is a description and analysis of natural resources and water resources found in Rochester. This information is intended to be a resource for landowners, City staff and officials, and citizens who are the long-term stewards of Rochester's natural resources. Specifically, it can be used to:

- Understand current conditions and document and assess changes over time.
- Develop land conservation priorities and an open space plan for Rochester.
- Educate and promote awareness about Rochester's natural resources.
- Provide a basis for long term planning and the development and revision of ordinances and regulations.
- Support proposals for funding and technical assistance.

1.1 Structure of this Chapter

This chapter is organized into sections that encompass various natural resources topics. Each section includes a discussion of the natural resource followed by goals and recommendations. A complete list of all recommendations in the chapter is included in Section 22. The chapter has several appendices and a large format map set. Public input received during the development of the chapter is integrated into the content of this chapter as well as included in the appendix. Hyperlinks to a number of reports, data, and maps are included throughout the chapter. A StoryMap website was used throughout the project to provide online access to a snapshot of information included in the chapter,

[i] The classification of the Ecoregional Subsections is based on land formations, geology, topography, regional climate, and dominant natural vegetation.

1.2 Summary of Local Protection Measures

Development and human activities can have a negative impact on natural resources. The City regulates land use through its Zoning Ordinance and development regulations. Zoning overlay districts are established as an added layer of protection for certain resources like aquifers, wetlands, and other water bodies. Natural resources that are regulated by local ordinances or regulations are considered "constrained lands" or areas of the city that are not appropriate for development due to sensitive resources and where regulations exist that restrict and/or regulate development. Constrained land includes parcels under conservation easements as well as lands within required setbacks and buffers to natural resources. Regulated resources include: the Cocheco, Salmon Falls and Isinglass Rivers; certain other named streams and surface waters; wetlands including poorly and very poorly drained soils, and vernal pools; floodplains; and aquifers. These protection measures are discussed throughout this chapter and briefly summarized below.

Aquifer Protection Overlay District (Chapter 275, Article 10)

- Designed to preserve, maintain, and protect from contamination existing and potential groundwater supply areas that may be available for use as a current or future source of supply for Rochester's municipal water system.
- Encompasses three areas totaling approximately 1,237 acres called wellhead protection areas. They are based on the areas where contaminants are likely to move toward and potentially reach existing and potential public water supply wells.
- Regulating land use and activity in these areas helps protect the quality of the water below the surface.

Conservation Overlay District (Chapter 275, Article 12)

- Includes rivers, lakes, ponds, perennial streams, vernal pools, all jurisdictional wetlands and the surrounding upland areas of each of these resources.
- Intent is to maintain and enhance quality and quantity of surface waters and groundwater by preserving functions, maintaining essential services and utilities, prevent destruction of wetlands, encourage uses that can be appropriately and safely located there, protect native wildlife habitat and natural vegetation.
- Restricts or prohibits activities within the resource and its buffer. Buffer distance is 75 feet from the Cocheco, Isinglass, and Salmon Falls River and 50 feet from other rivers, streams, and wetlands.

Flood Hazard Overlay District (Chapter 275, Article 13)

- Floodplain is the area with a 1% chance of flooding in any year. Also called the 100-year floodplain.
- Requires new residential construction or substantial improvements to be elevated above the 100-year floodplain.
- Requires new non-residential development or substantial improvements to be floodproofed.
- Prohibits or restricts certain uses such within the floodplain (solid waste, stables, earth excavation, contractor's storage yard).

Image: Gagne Farm (Courtesy of John Gisis)

Stormwater management and Erosion Control Regulations (Chapter 218)

- Design, construction, and post-construction standards for stormwater drainage systems to improve stormwater management, minimize future costs to the City, protect the integrity of the City's water resources, reduce pollution of water bodies, and be compliant with other local, state, and federal regulations.
- Permit required for disturbances of land in critical areas or over 5,000 square feet.
- Stormwater management plan required for larger projects.
- Design standards to minimize impacts associated with stormwater runoff and erosion during and after construction.

Land Conservation

- One of the most effective tools for permanently preserving vital natural resources, wildlife and habitat, and lands of historical and cultural importance.
- Rochester has about 2,458 acres of conservation and public lands, which is equivalent to 8.5% of the area of the City. About 6% is permanently protected (Source: NH GRANIT GIS Clearinghouse).
- The area of conservation and public lands has increased over 120% since 2010.

Current Use Taxation

- Encourages preservation of open space by assessing qualifying land at a lower rate.
- Designed to help landowners reduce their taxes by assessing the land at its present use rather than its potential use, which also benefits the community by keeping lands as open space (i.e., forests, meadows, pastureland, and agriculture).
- Land must be ten or more acres and must be a forest, farm, or unproductive land.
- Approximately 37% of land in Rochester is enrolled in the Current Use Program.

2 VISION & GOALS

2.1 Vision Statement

Natural resources contribute to the quality of life in Rochester through:

- Rural vistas and scenic river views
- Recreational opportunities
- Opportunities for wildlife viewing
- Places for solitude and for congregating with others
- Fresh air and clean water
- Availability of local farms
- Shading and cooling urban landscapes.

84%

Percent of survey respondents *agreed* or *strongly agreed* that natural resources contributed to their quality of life.

These attributes, or ecosystem services, are benefits provided by nature and natural areas. The community benefits from ecosystem services like storage of water in wetlands and floodplains, too, which reduce flood vulnerability, and provide stormwater infiltration, reducing the cost and need to manage urban stormwater runoff.

The City seeks to continue concentrating growth and development within the urban core and areas of existing development while maintaining natural areas, parks, urban forest, and riparian corridors that provide habitat for wildlife and serve as linkages to wildlife corridors and open space in more rural areas of the city and surrounding communities. Rochester's numerous streams, rivers, and the protected buffers around these resources are critical components of this network. Within the rural areas, protection of large tracts of land with important ecological, social, economic, recreational, and agricultural value is important.

The city recognizes that natural resources are vulnerable to pollution, land fragmentation, and climate change. Residents have traditionally supported strong conservation and preservation measures to protect the rich array of natural resources found in the community including adoption and enforcement of regulations and ordinances that protect natural resources and mitigate the impact of development, land protection, and education. Balancing development with natural resources is a priority.

In ten years, Rochester's natural resources should be:

- ✓ **Highest priority**
- ✓ **Well protected**
- ✓ **Balanced with development**

Participants discuss natural resources at a public input event for this Master Plan Chapter (Tom Morgan)

Image: Cocheco River (Tom Morgan)

Input received during the July 2023 Natural Resources Chapter Public Input Event

What natural resources or characteristics are important to you?

- Navigable rivers
- Stormwater management
- Peat bog recognition
- Green space downtown
- Smart access
- Wildlife habitat
- Rare and endangered species
- Invasive species (removal of)
- Open space and farmland
- Open grassland habitat
- Lot size on agricultural land

What are your concerns?

- Over development of wet or poorly drained land
- Fragmented open space
- Stormwater volume waivers
- Air quality
- Urban trees (removal of trees, particularly on City-owned land)
- Loss of trees for solar

View of Salmon Falls Road (Courtesy of John Gisis)

2.2 Overarching Goals

Maintain the functions and services that natural resources provide, which are critical for both ecosystems and people.

Protect and conserve natural resources.

Enhance quality of life for the future.

Strengthen coordination and collaboration among boards and commissions, elected officials, staff, and the public.

Build regional ecosystem reslience.

Educate the community about the importance of natural resources and how to protect these assets.

Anticipate climate change and consider adaptation strategies to protect natural resources.

3 WATERSHEDS

Rochester lies within the Piscataqua-Salmon Falls watershed (Hydrologic Unit Code[ii] (HUC 8)), which encompasses much of southeast New Hampshire, portions of southwest Maine, and extends north to the Town of Wakefield, NH. This coastal watershed is divided into several tiers of subwatersheds or drainage basins, which ultimately drain to the Atlantic Ocean. Nearly 74% of the city is located within the Cocheco River subwatershed (HUC 10) and the remaining 26% lies within the Salmon Falls River subwatershed (Figure 2, Table 1, see also large format Map 4).

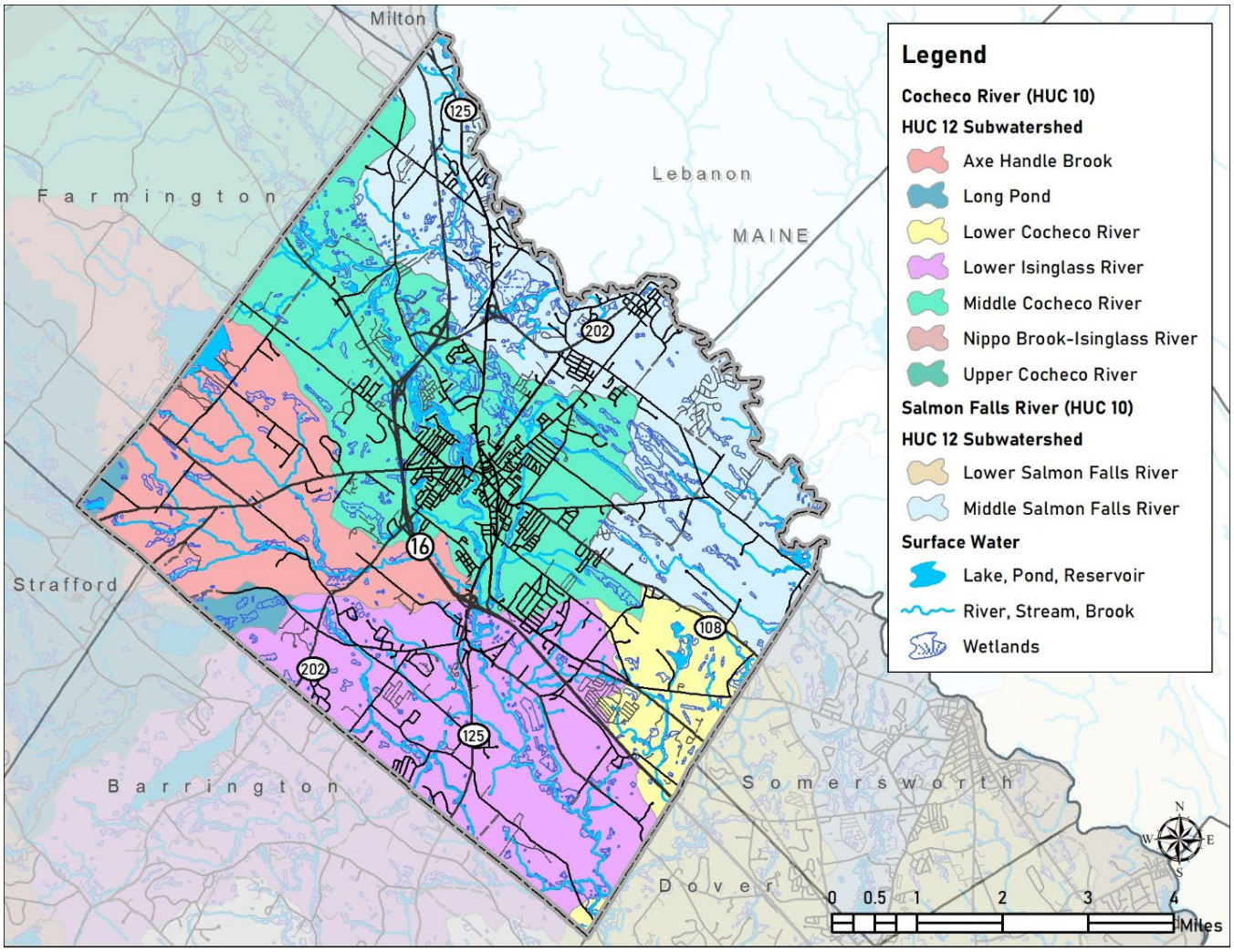


Figure 2. Subwatersheds of the Piscataqua-Salmon Falls watershed (Source: NH Geodata Portal, Watersheds)

[ii] Watersheds are delineated by United States Geological Survey (USGS) using a nationwide system based on surface hydrologic features. This system divides the country into 22 regions (2-digit), 245 subregions (4-digit), 405 basins (6-digit), ~2,400 subbasins (8-digit), ~19,000 watersheds (10-digit), and ~105,000 subwatersheds (12-digit). A hierarchical hydrologic unit code (HUC) consisting of 2 additional digits for each level in the hydrologic unit system is used to identify any hydrologic area (Source: USGS)

Table 1. Acreage of HUC 10 and HUC 12 watersheds (Source: NH Geodata Portal, Watersheds)

HUC 10 Watershed	HUC 12 Watershed	Acres	% of Total City Area
Cocheco River (HUC 106000304)	Middle Cocheco River (HUC 1060030607)	7,898.1	27%
	Long Pond (10600030607)	413.2	1%
	Axe Handle Brook (10600030603)	4,756.5	16%
	Lower Cocheco River (HUC 106000310O1)	1,893.0	7%
	Lower Isinglass River (HUC 10600030608)	6,510.4	22%
Salmon Falls	Middle Salmon Falls River (10600030406)	7,609.5	26%

Although these watersheds extend beyond Rochester's boundaries, the quality of downstream surface waters within these watersheds is influenced by land use and activities in Rochester. Similarly, land uses in upstream areas of these watersheds impacts the quality of surface waters within Rochester. Measures including stormwater management, protection of riparian buffers, reduced application of pesticides and herbicides, and land conservation are important to protecting the quality of the watershed.

3.1 Watershed and Regional Planning

Natural resources like air, surface water and groundwater, ecosystems, and wildlife transcend municipal boundaries and therefore must be considered, protected, and managed at a broad scale. Rochester plays a role in connecting protected landscapes in neighboring communities in New Hampshire and Maine and throughout the coastal watershed (Figure 3). On the regional and watershed level, Rochester's natural resource objectives are to:

- Sustain the natural resource base for future economic, health, and social well-being.
- Preserve the functions and services provided by the natural resource base.
- Protect the quality and volume of public and private drinking water sources.
- Collaborate planning and management actions for shared resources.
- Protect and enhance the region's environmental and biological diversity.
- Disseminate information, data and other technical resources that benefit regional and watershed level initiatives.
- Link natural resource protection and land use to promote an integrated framework to guide growth and development.

The city's location within the coastal watershed opens the door to various funding sources and technical assistance from partners in the region, such as the Piscataqua Region Estuaries Partnership (PREP) and the New Hampshire Coastal Adaptation Workgroup (NH CAW).

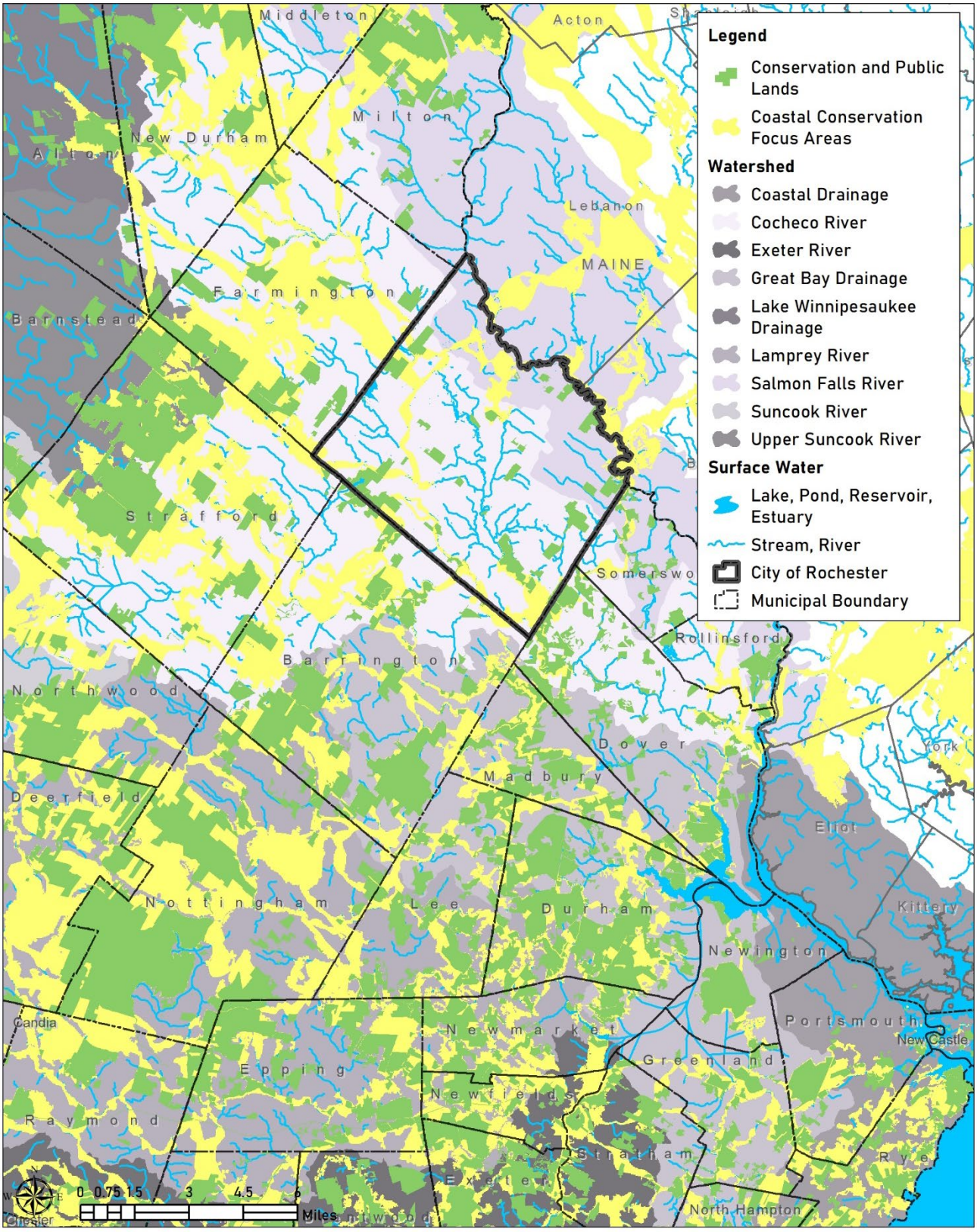


Figure 3. Watersheds, Coastal Conservation Focus Areas, surface waters, and Conservation and Public Lands within and surrounding Rochester (Source: NH Geodata Portal Conservation and Public Lands, Coastal Watershed Conservation Plan, Watersheds)

There is a robust network of organizations, agencies, and groups in the region that Rochester can collaborate with to reach local and regional goals. Partner opportunities for natural resources planning and project implementation include:

Cocheco River Local Advisory Council

Isinglass River Local Advisory Council

Baxter Lake Association

Southeast Land Trust of New Hampshire

Piscataqua Region Estuaries Partnership

Salmon Falls Watershed Collaborative

Strafford Regional Planning Commission

University of New Hampshire Cooperative Extension

New Hampshire Association of Conservation Commissions

The Nature Conservancy

Adjacent and nearby municipalities, including those in Maine

State and Federal Agencies

Schools

Clubs, groups, (Boy/Girl Scouts, camps, snowmobile clubs, hiking groups, religious groups, Nature Groupie), businesses that engage in volunteer work

Regional and Watershed (RW) Recommendations:

RW 1	Establish and maintain partnerships with adjacent communities, watershed groups, natural resource advocacy groups, and other stakeholders to identify shared goals for protection and sustainability of natural resources in the region and local watersheds.
RW 2	Strengthen buffers to increase protection of local and downstream water resources.
RW 3	Assess regional groundwater protection needs and coordinate with adjacent municipalities to protect drinking water supplies for Rochester and other municipalities.
RW 3	Use regional datasets and maps of wildlife coordinators and existing conservation lands when identifying potential land conservation projects.

4 TOPOGRAPHIC FEATURES

The topography of Rochester consists of moderately sloping landscapes dominated by low hills and the broad floodplain of the Cocheco River valley, which trends north to south through the central portion of the city. Gently sloping hills gradually rise toward the eastern and western boundaries of the city. The elevation ranges from around 220 feet above sea level to approximately 660 feet above sea level at an unnamed hill to the west of Route 16 and east of Cross Road. The highest points in the city are listed in Table 2.

Table 2. Highest elevations in the city (Source: 2009 Natural Resources Chapter)

Location	Elevation	Description of Location
Unnamed Hill #1	660 feet (approx.)	West of Route 16 and east of Cross Road
Chesley Hill	588 feet (approx.)	Southeast of Chesley Hill Road
Unnamed Hill #2	573 feet	Northeast of Round Pond at Barrington boundary
Gonic Hill	500 feet (approx.)	Southeast of Route 108 and Tebbetts Road
Unnamed Hill #3	500 feet (approx.)	East of Little Long Pond at Barrington boundary
Hayes Hill	497 feet	Southwest of Route 202 and Chesley Hill Road

4.1 Steep Slopes

Slopes that are 15 percent or greater are considered steep slopes by the Strafford County Soil Survey, based on specific properties of the overlying soil including erodibility, grain size and composition, aspect, slope and elevation.[2] Based on the NRCS Strafford County Soil Survey (1973), there are approximately 1,118 acres of land with steep slopes or about 4% of the area of the city. Slopes of 20% and greater are concentrated to the west of NH Route 125 between NH Routes 202A and 125. Isolated areas of slopes greater than 20 percent are located in the northern tip of the city west of NH Route 16 near the Farmington border and between NH Routes 16 and 108 south of Tebbetts Road. Less than 800 acres of Rochester have steep slopes greater than 25%, which is the threshold the City considers steep in its Zoning Ordinance (City Code Chapter 275). Refer to large format Map 3 for a depiction of representative slope.

4.1.1 Topographic (TP) Recommendations:

TP 1	Strengthen regulation of steep slopes by lowering the threshold of what is considered a steep slope under the City Code from 25% to 15%.
TP 2	Support enforcement and implementation of the provisions of City Ordinance Chapter 218 as they relate to erosion and sedimentation control and stormwater best management practices for development on steep slopes to protect the quality of surface waters and wetlands.

5 SOILS

Soil is the unconsolidated mineral and organic matter on the immediate surface of the earth that serves as a natural medium for the growth or land plants. Nearly 90 types of soils are found in Rochester. The predominant soil types — accounting for approximately 25% of soils in city — include:

- Windsor loamy sand, 0 to 3 percent slope
- Saugatuck loamy sand
- Hinckley loamy sand, 3 to 8 percent slope
- Gloucester very stony fine sandy loam, 3 to 8 percent slopes
- Charlton very stony fine sandy loam, 3 to 8 percent slopes.

Understanding the nature and properties of soils is critical to managing and conserving natural resources. Soil surveys contain predictions of soil behavior for selected land uses and highlight limitations and hazards inherent in the soil and the impact of selected land uses on the environment. Soils are classified into several categories according to characteristics including drainage, potential for forestry, and suitability for farmland. These classifications are mapped in Figure 4 and large format Maps 6, 7, and 8, and explained in further detail in the following sections.

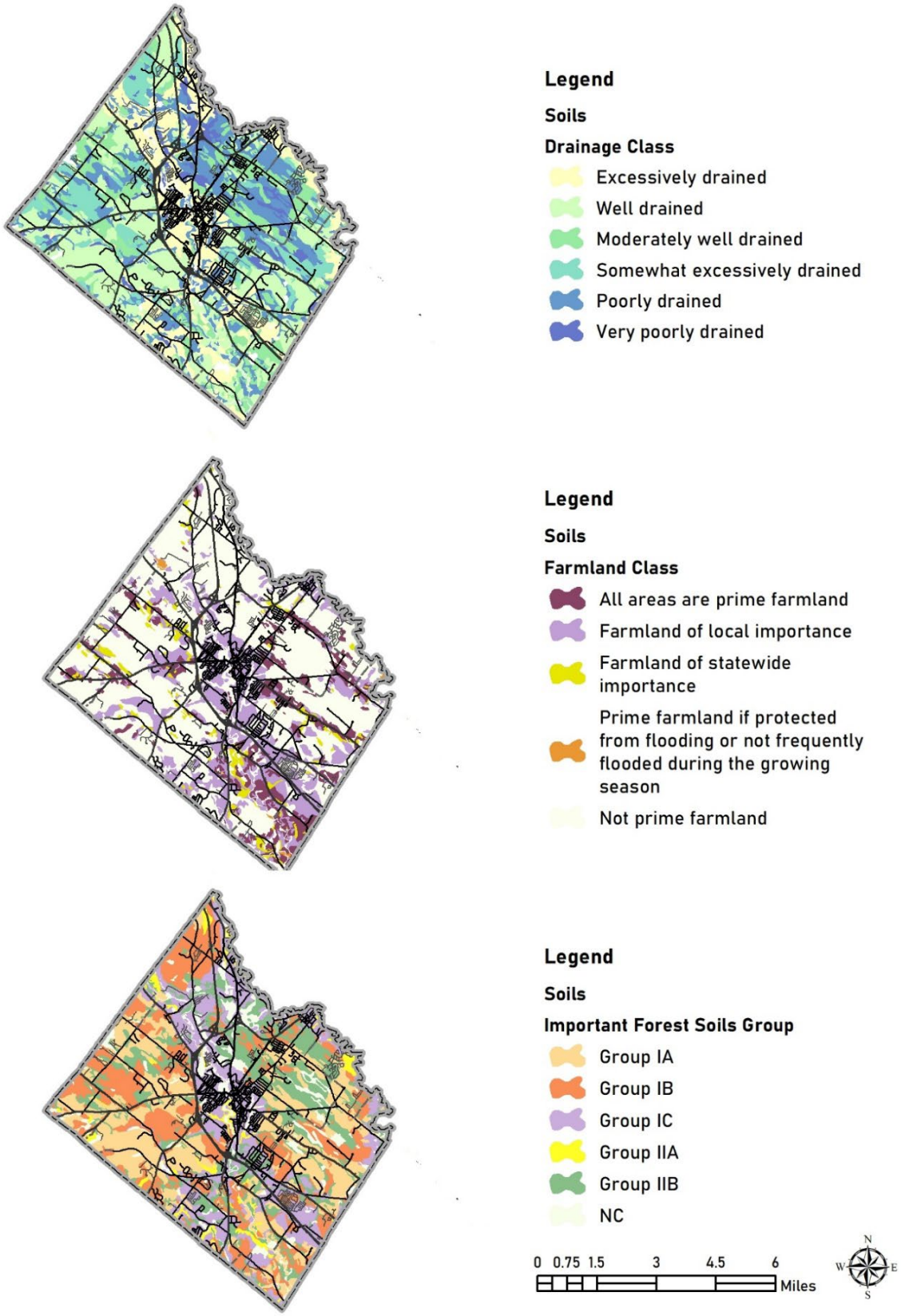


Figure 4. Soils data: Drainage Class, Farmland Class, and Important Forest Soils Group (Source: NRCS SSURGO)

5.1 Drainage Class

Soils are classified into drainage classes based on the landscape and soil morphology.[3] There are seven drainage classes: excessively drained soils, somewhat excessively drained soils, well drained soils, moderately well drained soils, somewhat poorly drained soils, poorly drained soils, and very poorly drained soils. Figure 5 displays the percent of the city's area within each drainage class.

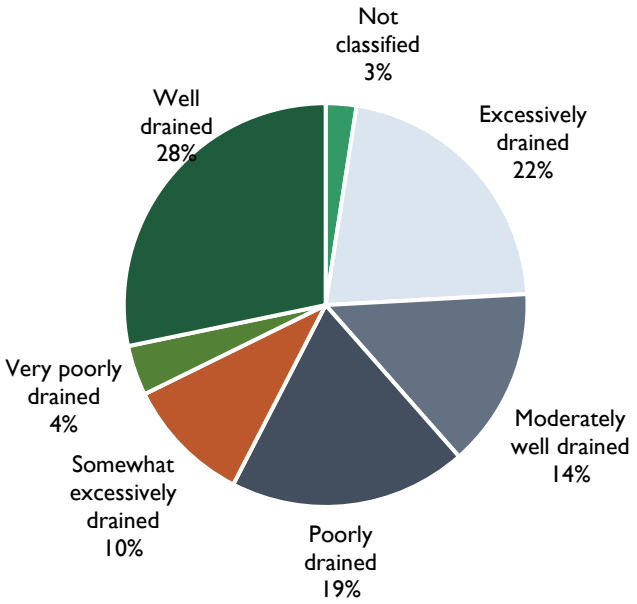


Figure 5. Soil drainage class (Source: NRCS SURGGO)

5.2 Farmland Soils

The criteria for defining farmland soils in New Hampshire was established following the enactment of the Farmland Protection Policy Act of 1981.[4] Approximately 10% of the city, or about 2,960 acres, is classified as prime farmland and 23% (6,768 acres) is farmland of local importance (Figure 5) Refer to Appendix 1 for a description of farmland soil classes.

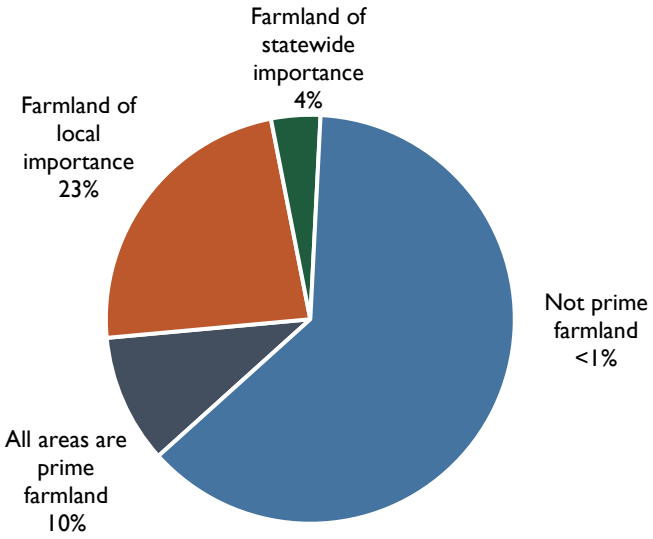


Figure 5. Farmland soil class (Source: NRCS SURGGO)

Nearly half of soils identified as prime farmland, soils of statewide importance, and farmland of local importance have been developed. Undeveloped prime farmland accounts for only about 4% of the land area of Rochester. Much of this land is located in scattered pockets in the southern corner of the city between NH Route 16 and NH Route 125, as well as along Salmon Falls Road. Similarly, undeveloped farmlands of local importance are interspersed among the prime farmland soils in the suburban fringe areas with most occurring in the southern quadrant of the city. There are small pockets of undeveloped farmlands of statewide importance scattered throughout the city, with increased prevalence in the vicinity of Four Rod Road and Meaderboro Road and in the southern corner of the city. Farmland soils are often found in areas that are flat and open, which make them particularly vulnerable to development. It is important to preserve these productive soils for agricultural use.

Hayfield off Haven Hill Rd (Tom Morgan)

5.2.1 Agriculture

Although agricultural land is less prevalent today than it was historically in Rochester, it still contributes significantly to the community's rural character. Today, approximately 1,619 acres of land are classified as agriculture land use (Figure 6).[5] There are several active farms (Table 3) and numerous other lands which are used for food production, growing hay, raising poultry and livestock, flowers, maple syrup, and other products. A comprehensive inventory has not been conducted to identify these small scale and diverse activities. A the southwest struggles to find water for irrigation, agricultural land in New England, and in Rochester, will become increasingly important.

Table 3. Farms in Rochester

Property Name	Location	Property Name	Location
Ten Rod Farm	Ten Rod Road	**Gagne Farm**	Rochester Hill Road
Sanborn Hope Farm	Peaslee	**Barden Tree Farm**	
Vickery Orchard Apples	Meaderboro Road	**Laverdiere property**	Ten Rod Road
Parcell Farm	Pickering Road	**Meader property**	Meaderboro Road
Great Elm Farm	Pickering Road	**Jacob property**	Portland Street
Folwer Farm	Salmon Falls Road	**Cameron Farms**	Salmon Falls Road

Farms, defined in the City's Zoning Ordinance as all uses and activities articulated in NH RSA 21:34-a and including animal husbandry and livestock, are permitted by right or special exception in the following zoning districts:

- Residential-1
- Agricultural
- Office Commercial
- Highway Commercial
- Recycling Industrial
- Airport Special.

Combined, these districts account for approximately 84% of the land area of the city. Additionally, crop production farms are permitted by special exception in the Residential-2 District and by right in the Recycling Industrial District.

Preserving existing farms and promoting expansion of agricultural activity are objectives of Residential Zoning Districts (275.5). Within the Agricultural District, the establishment of recreational, resort, and tourism facilities based on natural and cultural resources is encouraged. The City's regulations also permit urban agriculture, or the noncommercial growing of food and limited animal husbandry in residential neighborhoods to support the individual grower and/or their family. These regulations help to support viable commercial agricultural activities as well as noncommercial agricultural uses and activities.

Refer to Section 16.6 for a discussion of priority agricultural lands identified in the Coastal Watershed Conservation Plan.

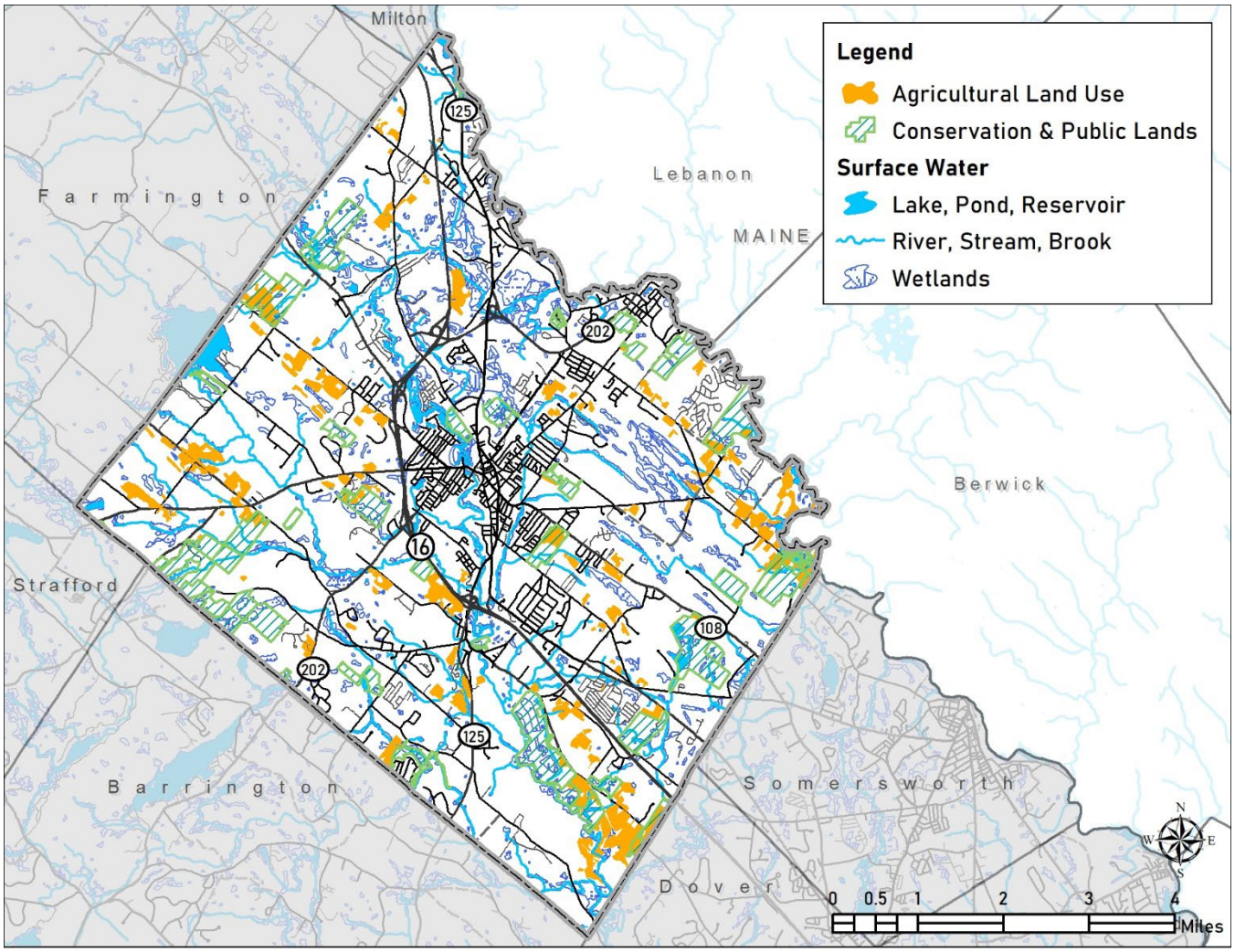


Figure 6. Agricultural land use in Rochester (Source: NH Geodata Portal, 2015 Land Use Layer, Conservation & Public Lands)

5.3 NH Forest Soils Groups

Forest Soil Groups categorize soil map units that are similar in their potential for commercial forest products, suitability for native tree growth, and use and management. This information is helpful for evaluating the productivity of soils and understanding plant succession.[6] Group IA soils, which are deep, loamy, and moderately well drained to well drained soils, account for just over 25% of the city's area (Figure 7). These fertile soils have the most favorable soil moisture relationships and are most suitable for tree growth. Refer to Figure 7 for a map of the distribution forest soil groups and Appendix 2 for a brief description of each soil group.

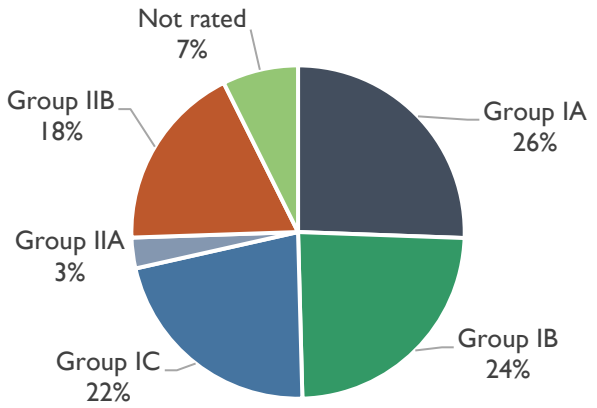


Figure 7. Forest soil group (Source: NRCS SURGGO)

5.3.1 Soils and Agriculture (SLA) Recommendations

SLA 1	Encourage preservation of farmland soils via the Conservation Subdivision regulations (Zoning Ordinance Chapter 275 Article 33).
SLA 2	Continue to include preservation of farmland soils as criteria for prioritization and acquisition of lands for conservation. Utilize the priority agricultural lands identified in the Coastal Watershed Conservation Land as a guide.
SLA 3	Incorporate measures to protect agricultural and forestry soils into future land use regulations, such as a solar ordinance.
SLA 4	Educate landowners about best management practices for forestry.
SLA 5	Periodically review zoning and land use regulations to ensure agricultural uses and accessory uses that help make agriculture economically viable.
SLA 6	Consider using tools like transfer of development rights to increase the economic viability of farming.
SLA 7	Support local and regional farmer's markets.

6 AQUIFERS & GROUNDWATER RESOURCES

6.1 Stratified-Drift Aquifers

Receding glaciers left two major types of deposits: stratified-drift and till. Stratified-drift aquifers consist of layers of sand and gravel that were deposited by water from melting glacier, while till consists of unsorted sediment deposits deposited directly by melting ice. Stratified-drift aquifers that are saturated can yield water to wells or springs.[7]

Approximately 11,285 acres of stratified-drift aquifer — equivalent to about 39% of the area of the city — underlies Rochester (Table 4, Figure 8, see also large format Map 10 Water Resources). This is considerably more than the percentage of the state (14%) underlain by this water-bearing material.[8]

The size and placement of spaces between the sediment particles determines the ability of the aquifer to store and transmit groundwater. The transmissivity of stratified-drift aquifers in Rochester ranges from less than 2,000 square feet per day to greater than 4,000 square feet per day (Figure 8). Along portions of the Cocheco River and in the vicinity of Hansonville Road, the transmissivity of underlying stratified-drift aquifer exceeds 8,000 square feet per day.

Table 4. Acres of stratified-drift aquifer by transmissivity (Source: NH Geodata Portal, Aquifers)

Transmissivity (feet sq./day)	Acres
< 2000	9,797.6
2000-4000	9,61.2
>4,000	408.9
Unknown	117.4
Total	11,285.1

TERMINOLOGY

Aquifer – A geologic unit or formation that contains a usable supply of water; An aquifer is a subsurface zone capable of yielding a significant volume of groundwater through wells or springs.

Ground water - subsurface water below the water table in soils and geologic formations that are fully saturated[i]

Unconsolidated - refers to a deposit in which the particles are not firmly cemented together, such as sand in contrast t sandstone

Stratified drift - sorted and layered unconsolidated material deposited in meltwater streams flowing from glaciers or se from suspension in quiet-water bodies fed by meltwater streams.

Transmissivity - the rate at which water is transmitted through a unit width of aquifer under a unit hydraulic gradient.

Source: Groundwater Resources in New Hampshire: Stratified-Drift Aquifers, USGS

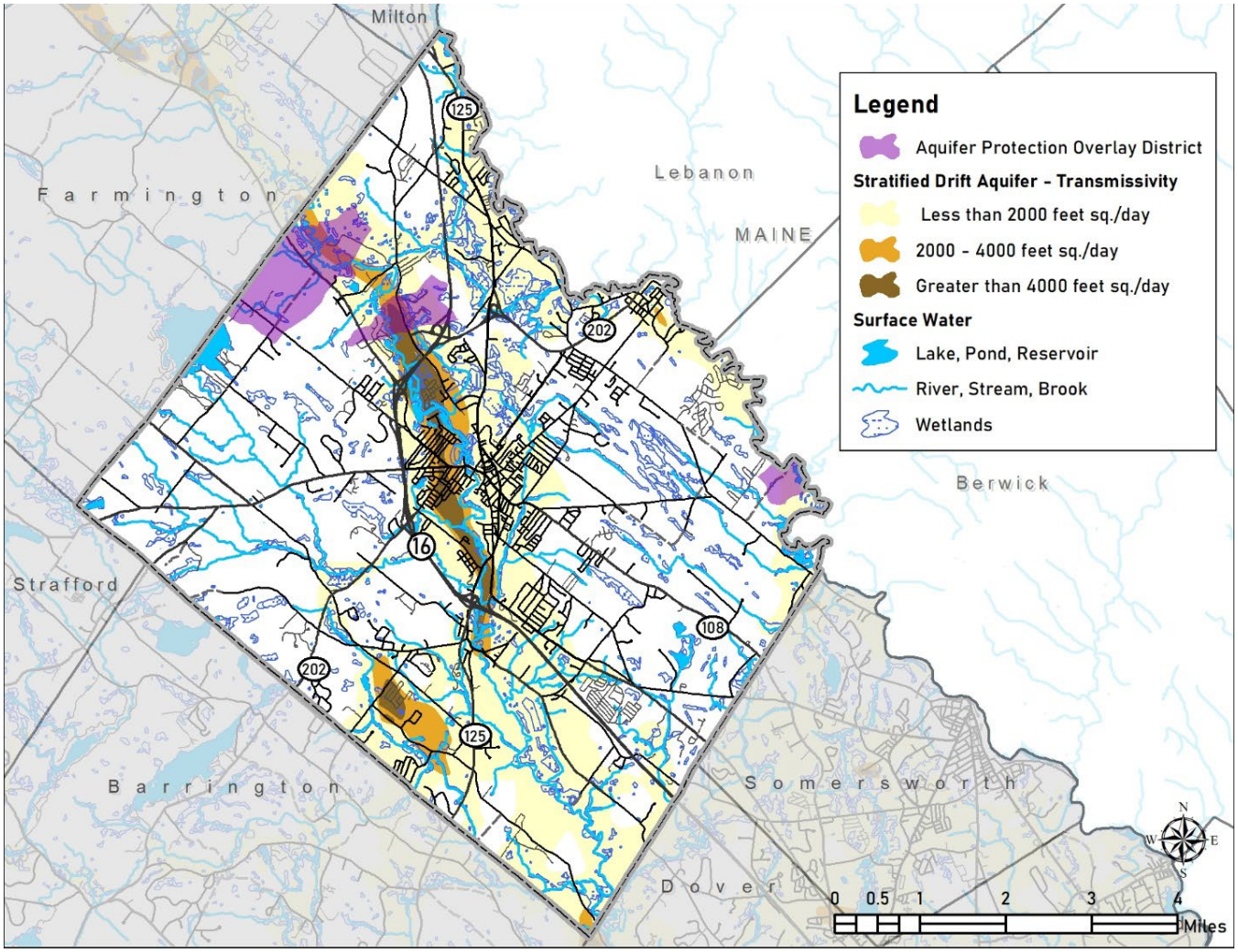


Figure 8. Location of stratified drift aquifer and transmissivity with the Aquifer Protection Overlay District (Source: NH Geodata Portal, City of Rochester)

To learn more about stratified-drift aquifers in New Hampshire, refer to Ground-Water Resources in New Hampshire: Stratified-Drift Aquifers, prepared by the U.S. Geological Survey and NHDES. NHDES has guidance for using stratified drift aquifer maps to plan for potential future community wells.

6.2 Bedrock Aquifer

Bedrock aquifers consist of fractured bedrock and ledge, or highly fractured shallow bedrock. Interconnected fractures form fracture systems, which are highly variable in their occurrence, connectivity and potential water yield. Groundwater may be stored within fractures, and wells drilled into large fractures or extensive fracture systems may yield high amounts of groundwater. Test wells are necessary to quantify potential water yield. In Rochester, areas not covered by stratified drift deposits are underlain by bedrock capable of producing sufficient water yield for residential and commercial purposes.

6.2.1 Aquifer (AQ) Recommendations

AQ 1	Utilize ordinances and regulations to preserve aquifer recharge volumes and protect aquifer recharge areas.
AQ 2	Require low impact development stormwater management techniques to provide aquifer recharge on all development sites.
AQ 3	Incorporate presence of high transmissivity aquifers into conservation lands acquisition criteria.
AQ 4	Reduce impervious cover in aquifer recharge areas.

Note: Refer to Section 0 for additional recommendations related to drinking water protection.

7 SURFACE WATER RESOURCES

7.1 Rivers, Streams, Lakes, Ponds, and Reservoirs

Rochester has a dense network of surface waters consisting of rivers and tributary streams connected by large wetland complexes, and lakes and ponds (Figure 9,

Table 5). The Cocheco River, Salmon Falls River, and Isinglass River are among the city's greatest natural resource assets, providing habitat for wildlife, recreational opportunities, and scenic value for the community. The most intensive development in Rochester, historically and today, is located along the banks of the Salmon Falls River and Cocheco River, which were important historic power sources and transportation corridors for the numerous mills that lined its banks from the 1700's to the early 1900's.

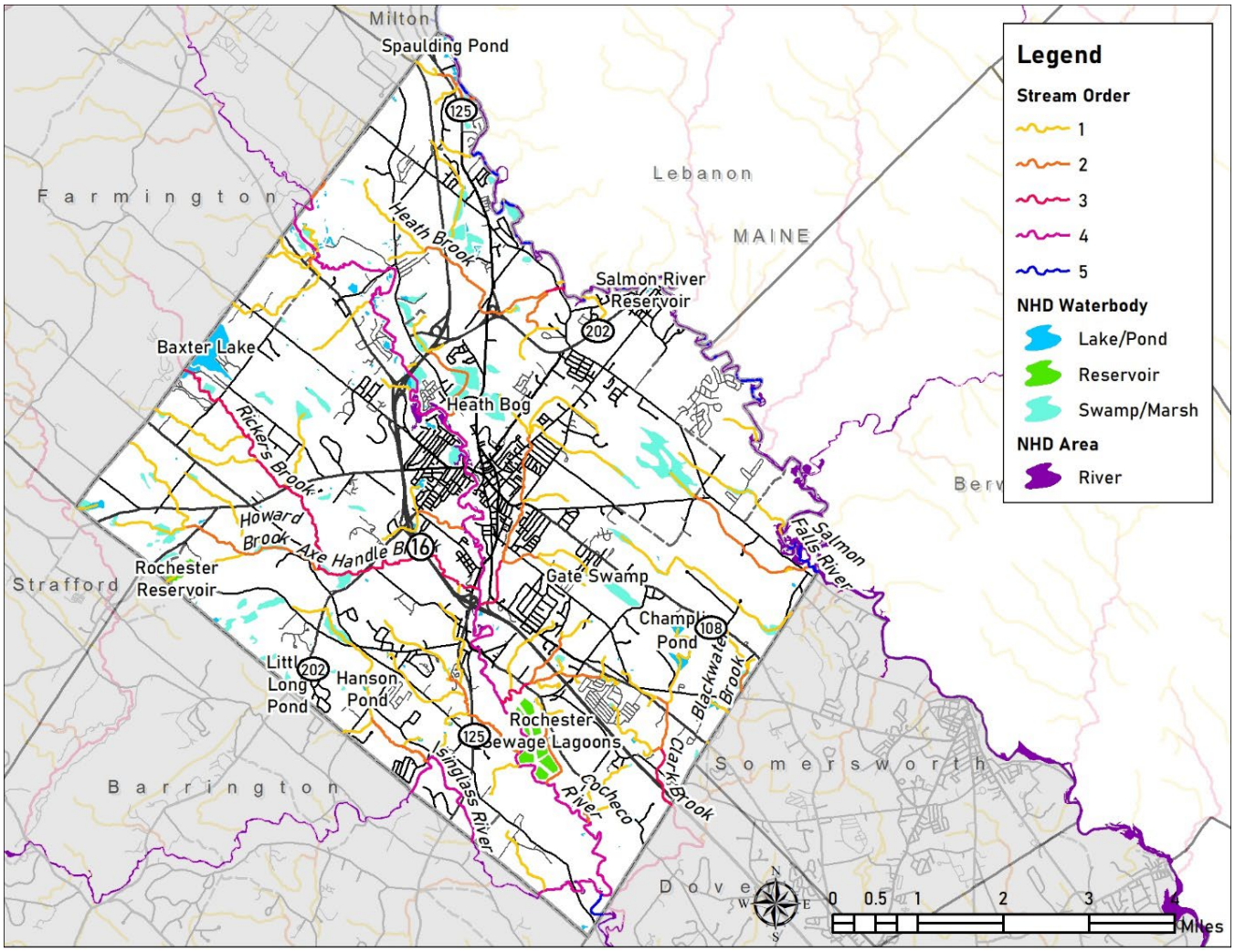


Figure 9. Water bodies and stream and rivers (Source: NH Geodata Portal, National Hydrography Dataset)

Within city limits, there are nearly 100 miles of streams and rivers. Approximately 21 miles or 23% of streams and rivers in Rochester of are classified as perennial streams that flow year-round, while 43 miles (45%) are intermittent (Figure 10). Headwater streams, or first order streams, comprise 53% of the total stream miles in

Rochester (Table 6). These streams are small streams and wetlands located at the highest end of a watershed.[9] Headwater streams provide critical habitat and have a large impact on the health and integrity of rivers downstream.[10] Headwater streams that occupy a watershed that is less than one square mile are considered primary headwater streams. These streams can be perennial, intermittent, or ephemeral (flowing only during and after precipitation events).

Table 5. Size of named waterbodies within Rochester (Source: NH Geodata Portal, National Hydrography Dataset)

Water Body	Name	Acres
Lake/Pond	Baxter Lake[a]	99.3
	Champlin Pond	8.0
	Hanson Pond	7.9
	Little Long Pond	1.2
	Rochester Sewage Lagoons	0.6
	Salmon River Reservoir	0.3
	Spaulding Pond	12.2
Reservoir	Rochester Reservoir	27.2
Swamp/ Marsh	Gate Swamp	42.5
	Heath Bog	58.1

Water Body	Name	Miles
Streams & Rivers	Axe Handle Brook	2.4
	Blackwater Brook	0.3
	Clark Brook	2.6
	Cocheco River	14.7
	Heath Brook	3.5
	Howard Brook	1.6
	Isinglass River	2.9
	Rickers Brook	3.3
	Salmon Falls River	14.1

a The total area of Baxter Lake is 302.1 acres

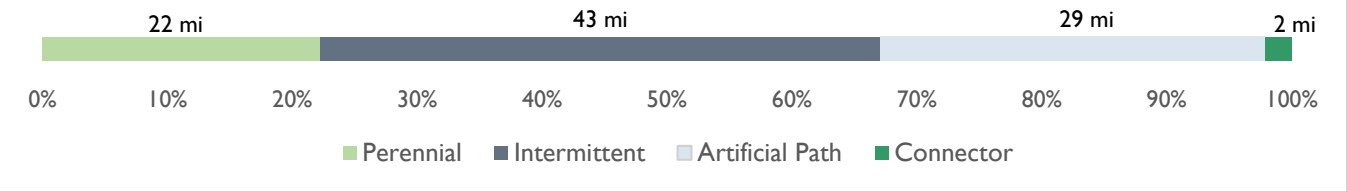


Figure 10. Stream miles within Rochester by type of stream (Source: NH Geodata Portal, National Hydrography Dataset)

Table 6. Miles of streams and rivers by stream order (Source: NH Geodata Portal, National Hydrography Dataset)

Stream Order	Miles	% of Total Stream Miles
1	50.2	52.7%
2	17.7	18.6%
3	8.2	8.6%
4	17.3	18.1%
5	1.3	2.0%
Total	95.2	100%

The Salmon Falls River, a tributary to the Piscataqua River, forms the border between Rochester and Maine. From the source waters at Great East Lake in the Town of Wakefield, the river flows south-southeast for approximately 38 miles to the Piscataqua River. The river provides hydroelectric power in north Rochester and is a popular local fishing spot. The Salmon Falls River is a public drinking water source to downstream communities including Somersworth and its water quality strongly influences the water quality for public wells downriver in the Seacoast Region.

Flow within the Cocheco River and the Isinglass River is monitored via gage stations maintained by the United States Geological Survey (USGS) and typically follow an annual cycle of higher winter flows and lower summer flows. A summary of peak and low flow and gage heights for the Isinglass River at Rochester Neck Road Station and Cocheco River Station Near Rochester for the last five years is shown in Table 7. Figure 11 displays the average annual discharge at each station. Detailed information about current conditions and historical data at gage stations is available from the US Geological Survey stream flow site.

Benefits provided by Primary Headwater Streams

- Reduction of sediment delivery downstream
- Reduction in nutrient loading (nitrogen and phosphorous)
- Flood storage and control
- Wildlife habitat corridors and aquatic habitat
- Protection of public drinking water sources
- Maintenance of recreational uses of lakes, ponds and rivers
- Minimizing damage to infrastructure (bridges, culverts, dams) and property
- Maintaining channel morphology and land stability.

Learn about stewardship guidelines for headwaters streams from the NH Wildlife Action Plan.

Changes in precipitation will impact the flow and water quality of these rivers. Annual precipitation has increased by 8.1 inches in the last 120 years (since 1901). Total annual precipitation is projected to increase further, largely due to seasonal increases during winter and spring. The frequency and intensity of extreme precipitation is also protected to increase (Source: NH State Climate Assessment 2021). These larger storm events will lead to increased stormwater runoff from urban and agricultural areas into rivers and streams. Increased stormwater runoff, as well as increased air temperatures, can lead to higher water temperatures. This can cause more frequent algal blooms and lower dissolved oxygen levels, thus impacting the ecosystem and aquatic life.

Concurrently, there is also a risk of drought. Refer to the NH Department of Environmental Services' Drought Guidance for Municipalities for steps to take to reduce vulnerability to drought.

Table 7. Summary of high and low flow at stations on Isinglass and Cocheco Rivers (June 8, 2018 – June 8, 2023)

River	Isinglass River	Cocheco River
Station ID	#01072870	#01072800
Location	Rochester Neck Road	Near Rochester
Drainage area	73.6 square miles	85.7 square miles
Peak discharge	1,400 ft³/second on May 2, 2023	2,593 ft³/second on May 2, 2023
Lowest discharge	0.76 ft³/second on August 28, 2020	3.6 ft³/second on August 17, 2020
Peak gage height	12.79 ft on December 24, 2022	13.68 ft on May 1, 2023
Lowest gage height	2.51 on August 16, 2022	2.24 on September 22, 2020

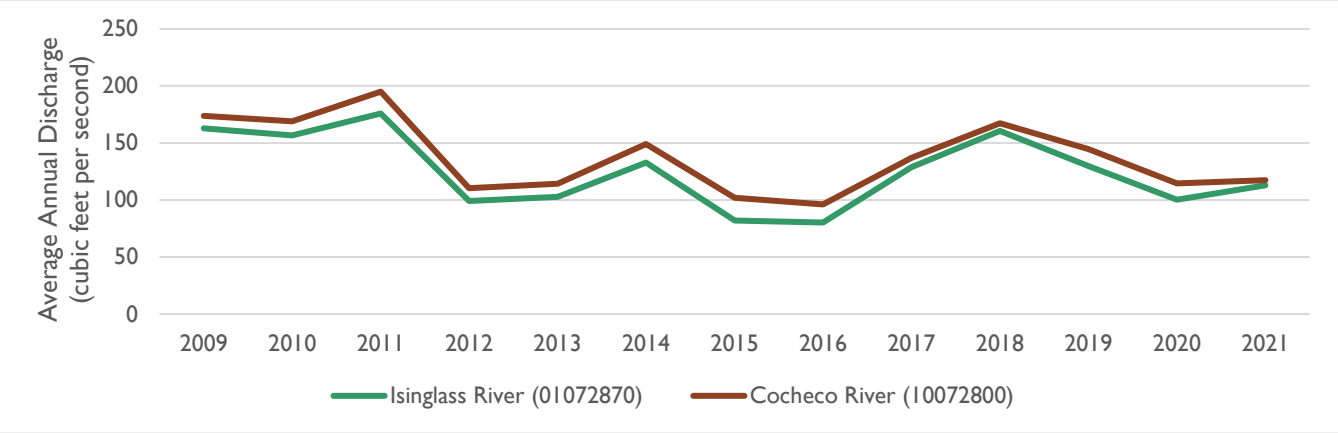


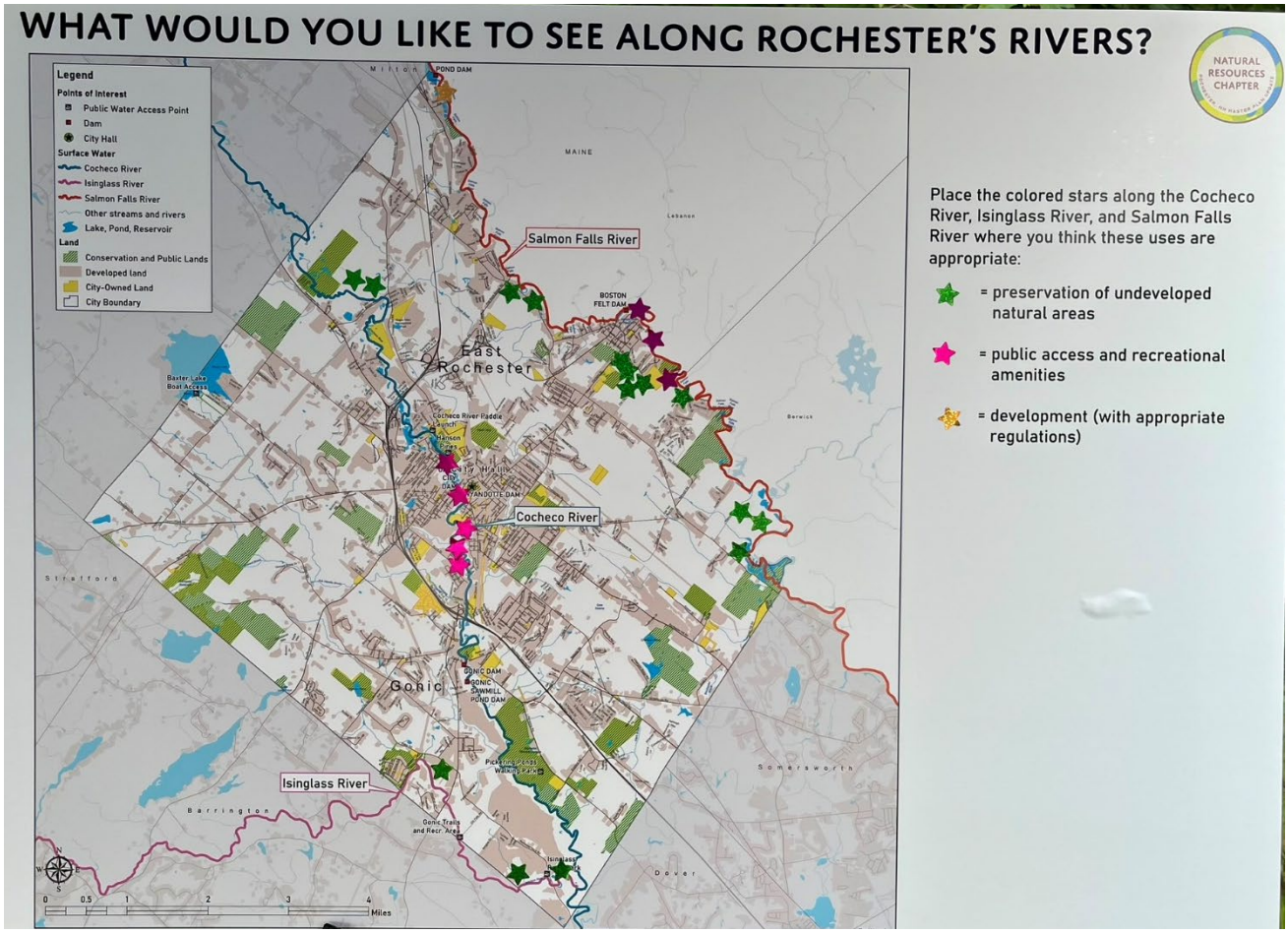
Figure 11. Average annual discharge (2009-2021 water years, Oct 1 – Sept 30) (Source: USGS National Water Information System: Web Interface)

The 2021 update to The Land Conservation Plan for New Hampshire Coastal Watersheds (2006), which incorporates the Water Resource Protection Areas supplement, identifies land conservation opportunity areas that provide the greatest benefits to water resources with respect to mitigating threats associated with existing and future development. Maps and additional information about these resources are included in Sections 16.6 and 16.7 of this chapter.

7.1.1 Land Use Along Rivers

Participants in the Natural Resources Survey for this Master Plan Chapter update identified several areas along Rochester's rivers that they would like to see: preservation of undeveloped natural areas, public access and recreational amenities, and development. These areas are shown in the map below (Figure 12).

Refer to Section 9 for recommendations related to surface waters.



KEY

Green star = preservation of undeveloped natural areas

- Cocheco River
  - North of Little Falls Bridge Road (x2)
- Salmon Falls River
  - South of Flat Rock Bridge Road (x2)
  - Southeast of Portland Road and west of Crow Hill Rd (x2)
  - Crow Hill Rd (x2)
  - North of Eagle Drive
  - North of Salmon Falls Road near Sullivan Drive
  - North of Salmon Falls Road south of Walnut Grove Road (x2)
- Isinglass River
  - South of Flagg Road and west of Rt 125
  - Southwest of Rochester Neck Rd at city line
  - East of Rochester Neck Road near convergence with Cocheco

Pink star = public access and recreational amenities

- Cocheco River
  - South end of Hanson Pines
  - Wyandotte Dam
  - Between William Allan School and fairgrounds
  - West of Wilson Street (x2)
- Salmon Falls
  - Mill Street
  - Near Cold Springs Cemetery and Green Street
  - Near the City Forest off Cooper Lane

Yellow star = development (with appropriate regulations)

- Salmon Falls River
  - North of Spaulding Ave

Figure 12. Desired land use along rivers as identified by participants in the Natural Resources Public Input Event for this Master Plan chapter update (July 2023).

7.2 Water Quality

Water quality impairment is detrimental to aquatic and terrestrial species as well as the community's use of waterbodies and consumption of fish and shellfish. Water quality is monitored and evaluated using a set of standards that are included in the State's water quality regulations (Env-Wq 1700) and in New Hampshire state statute RSA 485-A:1-22.

The standards are composed of three parts;

- Designated uses - desirable uses that surface waters should support. There are 6 designated uses: Aquatic Life Integrity, Fish Consumption, Shellfish Consumption, Potential Drinking Water Supply, Swimming and Other Recreation In and On the Water, and Wildlife (see Env-Wq 1702.17).
- Criteria - designed to protect the designated uses of all surface waters and may be expressed in either numeric or narrative form. A waterbody that meets the criteria is considered to meet its intended use (see Env-Wq 1700 and RSA 485-A:1-22).
- Antidegradation - designed to preserve and protect the existing beneficial uses and to minimize degradation of the State's surface waters. (see Env-Wq 1708).

The link between development and declining water quality is provided by a range of pathways including:

1) The loss of lands under natural cover that provide important ecosystem services such as water purification, flood water retention, and groundwater recharge.
2) An increase in pollutant loads to surface waters, stormwater runoff, and flood risk to downstream areas.
3) An increase in valuable public and private infrastructure that is both reliant upon and often degrades key ecosystem services such as clean water.

Source: Land Conservation Priorities for the Protection of Coastal Water Resources, The Nature Conservancy

Waters are listed on the 303(d) List[iii] are impaired or threatened by a pollutant(s) and not expected to meet water quality standards. These waters require development and implementation of a comprehensive water quality study called a Total Maximum Daily Load (TMDL), which is the maximum amount of a pollutant that a waterbody can receive while attaining or maintaining water quality standards for designated uses.

Statewide, approximately 50% of waterbodies are impaired by stormwater related parameters and 21% by nutrient-related parameters.[11] All waterbodies are impaired for fish/shellfish consumption due to mercury. Within Rochester, sections of the Isinglass, Cocheco River, Baxter Lake, Spaulding Pond, Axe Handle Brook-Howard Brook, City Dam 1 (impoundment), Gonic Dam Pond, Hatfield Pond, Hurd Brook, Salmon Falls River, Willow Brook, Rochester Reservoir, Berry River, and unnamed brooks are impaired for one or more designated uses. The most prevalent impairment is aquatic life integrity. Rochester Reservoir (NHLAK600030602-03) was listed as impaired for primary contact recreation (i.e., swimming) in 2008 due to cyanobacteria hepatotoxin. While there continues to be a population of cyanobacteria in the Reservoir, there has been no bloom reported and no exceedances of the threshold since 2006. Low cell counts of Anabaena/Dolichospermum were found in recent years but there have been no advisories. The City participated in the NH Department of Environmental Services

[iii] Required by Section 303(d) of the Clean Water Act

(NHDES) Drinking Water and Groundwater Bureau's program for monitoring cyanobacteria. The Rochester Reservoir moved from 5-M in 2018 to 2-M in 2020/2022 and was delisted from the 303(d) list.[12] No waters in Rochester were added to the 2020/2022 303(d) list from the 2018 list.

The 2020/2022 303(d) List of Impaired Waters in Rochester is included in Appendix 3. Visit the Surface Water Quality Assessment mapper, refer to the 2020/2022 Section 305(b) Surface Water Quality Report for New Hampshire, and see the 2020/2022 305(b)/303(d) report cards for additional information about surface water quality and impairments in the state.

Rochester Reservoir (Google Earth)

7.3 Wetlands

NHDES describes wetlands as an "area that, either through surface water or groundwater, is wet enough and wet for a long enough period of time, to support a predominance of vegetation that grows in saturated soil conditions."[13] These conditions must be present for an area to be a wetland:

- Hydric Soils – Soils that are saturated or flooded during the growing season sufficient to produce anaerobic conditions in the upper soil layers.
- Hydrophytic Vegetation – Greater than 50% of the vegetation present is adapted for life in saturated soil conditions.
- Hydrology – Evidence exists that demonstrates the soils in the area are inundated with water either permanently or periodically throughout the growing season.

The National Wetlands Inventory (NWI) maps wetlands using aerial imagery. The NWI identifies approximately 2,870 acres of wetlands within Rochester, which represents almost 10% of the total area of the city. Palustrine wetlands are the most prevalent wetland system in Rochester (Table 8). Approximately one-third of wetlands in Rochester are classified as PFO1E, a palustrine wetland system that is forested with broad-leaved deciduous species and seasonally flooded or saturated. A map of wetland distribution is shown in Figure 13 and large format Map 11.

PFOIE Wetland Classification

System: **P** PALUSTRINE: The Palustrine System includes all nontidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses or lichens, and all such wetlands that occur in tidal areas where salinity due to ocean-derived salts is below 0.5 ppt. It also includes wetlands lacking such vegetation, but with all of the following four characteristics: (1) area less than 8 ha (20 acres); (2) active wave-formed or bedrock shoreline features lacking; (3) water depth in the deepest part of basin less than 2.5 m (8.2 ft) at low water; and (4) salinity due to ocean-derived salts less than 0.5 ppt.

Class: **FO** FORESTED: Characterized by woody vegetation that is 6 m tall or taller

Subclass: **1** Broad-Leaved Deciduous: Woody angiosperms (trees or shrubs) with relatively wide, flat leaves that are shed during the cold or dry season; e.g., black ash (Fraxinus nigra).

Water Regime: **E** Seasonally Flooded/Saturated: Surface water is present for extended periods (generally for more than a month) during the growing season, but is absent by the end of the season in most years. When surface water is absent, the substrate typically remains saturated at or near the surface.

Rochester's freshwater wetlands were last inventoried and documented in "*Rochester Freshwater Wetlands Project: An Inventory and Evaluation*" (1995) by George Bailey. [iv] Additional information is available from the U.S. Fish and Wildlife Service National Wetland Inventory maps and supporting geographic information systems (GIS) database. Based on the freshwater wetlands study and the NWI maps and database, the largest wetlands and wetland complexes in Rochester are located in low-lying areas between the Salmon Falls River and NH Route 16, bounded by Chestnut Hill Road and Sonata Court. Another large wetland complex is dispersed between Salmon Falls Road and Whitehall Road. Many of these wetland complexes are located in the headwater areas and riparian and floodplain areas of the Cocheco River and thus, the effects of regulatory requirements and management policies for these wetlands could impact communities downstream within these larger watersheds, especially with respect to the quality of surface waters, aquifers, and public drinking supplies derived from surface waters.

Table 8. Area of wetlands by wetland type (Source: National Wetland Inventory (NWI))

NWI TYPE	Acres	%	% of Total Area of City
Lacustrine	287.0	10.0%	1.0%
Palustrine	2,501.2	87.1%	8.6%
Riverine	81.8	2.9%	0.3%
	2,870.0	100%	9.9%

Heath Bog is a kind of peatland, a unique type of palustrine wetland found in Rochester. Refer to Section 16.1 to learn more about this habitat.

[iv] Rochester Freshwater Wetlands Project: An Inventory and Evaluation" (1995) by George Bailey. The study incorporated the methodology of "The Method for the Comparative Evaluation of Nontidal Wetlands in New Hampshire" developed by the Audubon Society of NH. Each wetland was evaluated on at least 9 of the 15 functions a wetland may serve; 24 wetlands rated high in functions related to public safety (flood control, sediment trapping and nutrient attenuation).

Heath Bog off Wakefield Street (Google Earth)

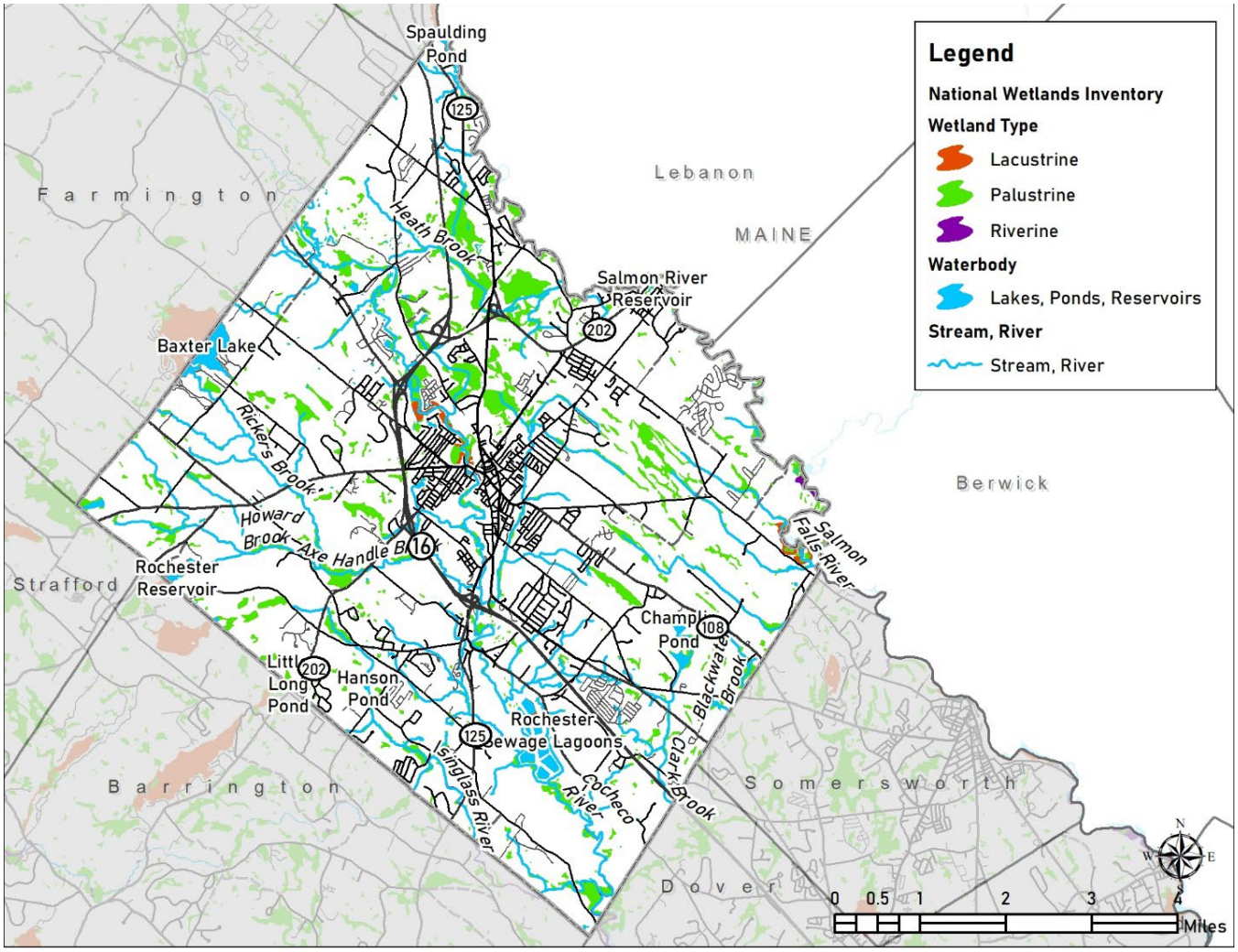


Figure 13. Wetlands in Rochester (Source: National Wetlands Inventory)

7.3.1 Prime Wetlands

NH RSA 482-A:15 authorizes municipalities to designate certain wetlands as being worthy of extra protection due to their size, uniqueness, fragility, unspoiled character, or other relevant factors that make them of substantial significance. Prime wetlands must meet the following criteria:

- Be at least 2 acres in size
- Not consist of a water body only
- Have at least 4 primary wetland functions, one of which shall be wildlife habitat
- Have a width of at least 50 feet at the narrowest point.

The 1995 wetland study evaluated 115 freshwater wetlands ranging in size from 5 to 620 acres for designation as prime wetlands. Eleven candidates for prime wetland status were identified in this report. Of the 4,106 acres of wetlands evaluated, the study recommends 956 acres (23.3%) for prime wetland designation. These wetlands are described in Table 9. In 2009, the Rochester Conservation Commission identified designation of prime wetlands as a goal of particular importance.

Table 9. Wetlands recommended for prime designation in Rochester based on the 1995 wetland inventory and evaluation (Source: Rochester Freshwater Wetlands Project: An Inventory and Evaluation" (1995))

Ward	Wetland ID	Acreage	Location
1	E-17	9	On Wandley Brook between White Hall Road and Franklin Street
	E-31	136	On the Salmon Falls River, northeast of Salmon Falls Road and north of the Somersworth municipal boundary
3	W-13	103	Along the Isinglass River, south of Flagg Road along the Barrington municipal boundary
	W-14	17	At the intersection of Hansonville Road and Flagg Road
	W-17	8	West of Route 202 next to Little Long Pond, along the Barrington municipal boundary
	W-19	19	South of and adjacent to Dry Hill Road and west of Route 202
	W-26	24	Between Route 202A and Sheepboro Road, along the Strafford and Farmington municipal boundaries
4	N-01	125	On the Cocheco River between Route 16, Route 125 and north of Route 202A
	N-33	350	Eastern portion of Baxter Lake on the Farmington municipal boundary
5	N-06	15	North of the intersection of Route 16 and Chestnut Hill Road
	N-15	15	East of Chestnut Hill Road and north of Elmo Lane
Total		821	

Vernal Pools

Vernal pools are wetlands with a seasonal cycle of flooding and drying.[14] Vernal pools are temporary bodies of water that flood each year for a few months during the spring and summer. Vernal or "spring" pools fill up with melting snow and early rains, then usually dry up by mid to late summer. Some relatively deep pools may remain flooded for a few years but become completely dry in seasons with very low rainfall. Autumnal pools fill during the fall with rising groundwater.[15]

Vernal pools are found in forests, fields, shrub swamps, marshes, and gravel pits. They range in size — from several square feet to several acres — as well as their connectivity to larger wetlands. To support life, vernal pools must have enough leaf litter and other debris to provide food sources and cover for the species that breed in them. Because vernal pools are not permanently flooded and do not support fish populations, they provide safe breeding sites for various amphibian and invertebrate species, including wood frogs, spotted salamanders, and fairy shrimp. These species depend upon the hydrology of temporary pools for specific phases of their life cycle.

One easy way to locate vernal pools is to listen for wood frog choruses during the early spring, which are groups of males singing to attract females. Learn more about Identifying and Documenting Vernal Pools In New Hampshire.

Wood frog eggs are almost always laid in vernal pools (Nature Groupie)

Threats to vernal pools include loss of habitat to development and threats to surrounding woodlands that result in changes in water flow, water table, pollution levels, and canopy cover. Higher temperatures associated with climate change may also impact the water level and longevity of a vernal pool.

Refer to Section 9 for recommendations related to wetlands and other surface water bodies.

8 POTENTIAL THREATS TO WATER RESOURCES

8.1 Point Source Pollution

Two primary sources of pollution are point source and nonpoint source pollution. As defined by the Clean Water Act, point sources of pollution are "discernible, confined and discrete conveyances or discharges, such as from a pipe, ditch, channel, tunnel, conduit, fissure, or container, and including vessels or other floating craft from which pollutants can be discharged, and concentrated animal feeding operations." Discharge of pollutants though a point source into waters of the United State is prohibited unless a user has a National Pollutant Discharge Elimination System (NPDES) permit. The permits, which are issued by EPA, generally specify an acceptable level of a pollutant(s) in a discharge.[16] In 2022, there were a total of 76 permits at facilities in Rochester, including one major[v] discharge at the WWTF.[17] Refer to Appendix 5 for a list of all permits.

Point source and nonpoint source pollution are a threat to both surface and groundwater resources.

8.2 Nonpoint Source Pollution

A second source of pollution is nonpoint source pollution, which contributes to approximately 90% of water pollution problems in the state. Non-point source pollution occurs when rainfall, snowmelt, or irrigation runs over land or through the ground, mobilizes pollutants, and deposits them into rivers, lakes, and coastal waters or introduces them into the groundwater. These pollutants can include oil and sand from roadways, agricultural chemicals from farmland, sediments from construction sites, crop and forest lands, and eroding streambanks, and nutrients and toxic materials from urban and suburban areas. The effects of nonpoint source pollutants on specific waters vary and may not always be fully assessed. However, it is well documented in scientific literature that these pollutants have harmful effects on drinking water supplies, recreation, fisheries, and wildlife.

Reduction and prevention of nonpoint source pollution requires a collective effort at federal, state, and local levels. Some activities are federal responsibilities, such as ensuring that water quality standards for waters of the U.S. are protected. State responsibilities include developing legislation to regulate logging and to protect groundwater and public drinking water supplies.

Others are best handled locally, such as by zoning or erosion control and stormwater management ordinances. And each individual — homeowner, business owner, property owner, resource user, and — can play an important role by practicing conservation and by making certain lifestyle adaptations.[18]

Over 90% of individuals who responded to a natural resources survey for this Master Plan update agree or strongly agree that the City should seek grant funding and technical support to identify, clean up, and restore brownfields and other contaminated sites.

[v] Municipal discharges include all facilities with design flows of greater than one million gallons per day and facilities with EPA/State approved industrial pretreatment programs.

Nonpoint Source Pollution and Climate Change

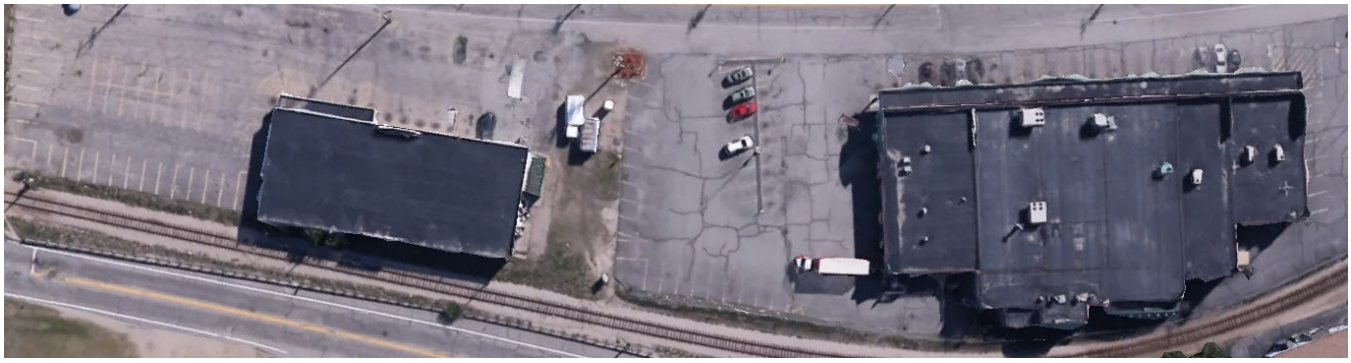
The problems caused by these sources are compounded by the changing climatic conditions that New Hampshire is currently facing. The state has been getting warmer and wetter over the last century, and the rate of change has increased over the last four decades. Annual precipitation has already increased 5-20% and is projected to increase an additional 12-20% by the end of the century. Larger temperature and precipitation increases are expected for winter and spring, raising the concerns of rapid snowmelt, high peak stream flows and flood risk. Extreme precipitation events have also increased, the impact of which is evident in the several large floods that have occurred across New Hampshire over the last several decades. These extreme events are expected to occur more frequently. Of greatest concern is the projected increase in storm events that drop more than four inches of precipitation in 48 hours (Wake, et al., 2014). Local and state stormwater-related infrastructure planning needs to address potential impacts from these events including: stream crossings, erosion control, and stormwater treatment and storage. In addition to increases in precipitation, as sea levels rise, groundwater levels rise too…Existing stormwater infrastructure and BMPs are not designed to accommodate these increases in precipitation and inundation from groundwater, or the associated increase in runoff and pollution. Adaptation strategies to build community resiliency and reduce the impacts of these changes are essential to achieving continued success of the NPS Program in New Hampshire.

Source: Excerpt from the NH Nonpoint Source Management Program

Stormwater runoff, generated by precipitation, surface runoff, and snow melt from land, pavements, building rooftops and other impervious surfaces, is a major source of nonpoint source pollution. Impervious surfaces have more than doubled since the year 1990 (Table 10), while the population increased at a significantly lower rate of 23%. Impervious surfaces exacerbate stormwater runoff by preventing infiltration and allowing water to flow across developed surfaces. The introduction of pollutants can degrade water quality for public drinking water supplies and for aquatic habitat. In addition to overland flow, stormwater runoff makes its way into the groundwater through infiltration. Refer to Section 9.3 for information about stormwater management.

Table 10. Area of impervious surface cover in Rochester (Source: ***Impervious Surface Mapping in Coastal New Hampshire*** (2006) by David Justice and Fay Rubin, Complex Systems Research Center at the University of New Hampshire and 2020 Wildlife Action Plan)

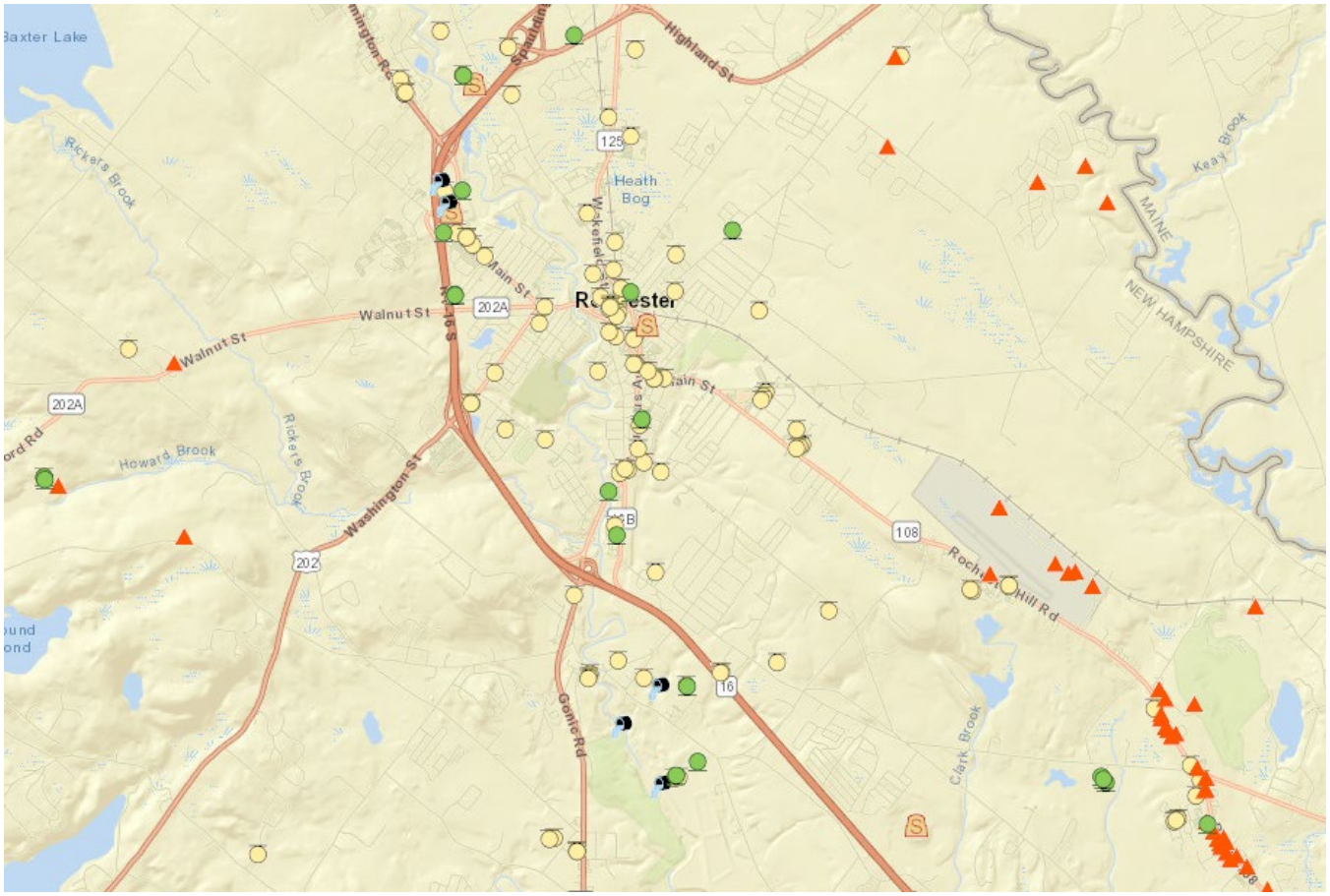
Impervious Surface Cover	**1990**	**2000**	**2005**	**2020**
Acres	2,472	3,403	4,042	4,978.1
% of City's Land Area	8.5%	11.7%	13.9%	17.1%



Impervious surfaces: roads, buildings, and parking lots (Google Earth)

8.2.1 Underground Storage Tanks and Local Potential Contamination Sources

Groundwater is vulnerable to pollution from various land use activities. Pollutants can enter an aquifer from point sources of pollution such as nearby septic systems that are incorrectly sited or maintained. Aquifers are also at risk from underground storage tanks, improperly disposed of household hazardous wastes, from some commercial/industrial facilities, and from landfills and wastewater treatment plants when they are sited or managed improperly.[19] A list of underground storage tanks and local potential contamination sources is available through NHDES Onestop and the Onestop Mapper.



Screenshot of above and underground storage tanks, NPDES outfalls, solid waste facilities, and local potential contamination sites identified in the NHDES Onestop Mapper (Source: NHDES Onestop)

9 SURFACE WATER PROTECTION

9.1 Local Regulation: Conservation Overlay District

Article 12 of the City's Zoning Ordinance (Chapter 275-12), the Conservation Overlay District, includes land use regulations for protecting rivers, lakes, ponds, perennial streams, vernal pools, all jurisdictional wetlands, and the surrounding upland areas of each of these resources. The intent of this overlay district is to maintain and enhance the quality and quantity of surface waters and groundwater by preserving functions, maintaining essential services and utilities, preventing destruction of wetlands, encouraging uses that can be appropriately and safely located there, and protecting native wildlife habitat and natural vegetation. The ordinance restricts or prohibits activities within the resource and its buffer, which is defined as the protected upland areas adjacent to wetlands and surface waters in the Conservation Overlay District other than the wetlands themselves (Table 11).

Table 11. Buffer distance from surface waters in Rochester

Location	Buffer
Cocheco River, Salmon Falls River and Isinglass River from the ordinary high-water mark of the river	75 feet
Named streams and surface water from the ordinary high-water mark listed in Table I below	50 feet
Edge of jurisdictional wetland consisting of very poorly drained soils	50 feet
Edge of jurisdictional wetland consisting of poorly drained soils	50 feet
Vernal pools	50 feet

Buffers can improve water quality, provide flood protection, support wildlife, and allow for natural stream migration to occur.[20] A literature review of the trends, science, and options of buffer management in New Hampshire's Great Bay Watershed determined the minimum recommended buffer widths based on what is necessary to support a particular benefit. These minimum sizes are displayed in Table 12.

Table 12. Recommended minimum buffer width for certain functions (Source: Buffer Options for the Bay)

Buffer Function	Recommended Minimum Width
Influence water temperature	30 feet
Remove pollutants	98 feet
Provide habitat for aquatic macroinvertebrates	98 feet
Reduce runoff & stabilize channel bank	164 feet
Provide habitat for terrestrial wildlife	330 feet
Provide habitat for aquatic macroinvertebrates	98 feet

The Piscataqua Region Environmental Planning Assessment (PREPA) recommends that Rochester:

1) Increase all buffers to 100 feet
2) Adopt 100-foot setbacks for septic systems for all waterbodies
3) Increase fertilizer application setback to 100 feet for 1st-4th order streams, lakes, and ponds
4) Work with landowners to conserve land

Buffers can protect drinking water too. The NH Department of Environmental Services, Strafford Regional Planning Commission, and Rockingham Planning Commission developed the New Hampshire Drinking Water Quality Buffer Model Ordinance in 2021. This ordinance recommends a minimum 100-foot natural buffer from surface waters as well as from wetlands that are contiguous and discharge into a drinking water source.

9.2 State Regulation: Shoreland Water Quality Protection Act

The Shoreland Water Quality Protection Act (SWQPA) (RSA 483-B) and its associated rules (Env-Wq 1400), establish a protected shoreland within 250 feet of the reference line of public waters. Lakes, ponds, impoundments greater than 10 acres, year-round flowing waters, designated rivers and river segments, and coastal waters are subject to the SWQPA. Within this area, vegetation removal, excavation, fill, and development are regulated.

Portions of downtown Rochester lie within the Urbanized Shoreland Exemption area and are therefore exempt from the permitting requirement of the Shoreland Water Quality Protection Act. These areas are visible on NH Department of Environmental Services' interactive mapper.

9.3 Stormwater Management

19% of people who responded to the Natural Resources Master Plan Chapter survey said that they are already very informed about stormwater issues, while 65% are interested in learning more and 16% are not interested in learning more.

Stormwater is regulated by the US Environmental Protection Agency (EPA) under the Clean Water Act through National Pollutant Discharge Elimination System (NPDES) Phase II Stormwater Regulations. Three permits fall under Phase II regulations: Construction General Permit, Multi-Sector General Permit, and Small Municipal Separate Storm Sewer System (MS4) Permit. The 2017 NH MS4 Permit became effective on July 1, 2018 and on September 28, 2018, the City submitted a Notice of Intent (NOI) to comply with the permit. A map of the MS4 regulated area in Rochester is shown in Appendix 4. On June 12, 2019, the City was granted authorization by EPA Region 1 to discharge stormwater from Rochester's MS4 under this permit. The City is responsible for submitting annual reports to EPA. Year 3 efforts, completed in June 2021, included a revision to the City's Stormwater Ordinance Chapter 218, which was presented to the Planning Board in April 2021 and to the Codes and Ordinances Committee in May 2021. It was approved by voted of the City Council in June 2021.[21]

While there are costs associated with the MS4 permit, benefits of the program to the City of Rochester include:

- Ongoing satisfactory compliance with 2017 MS4 requirements
- Improved water quality in receiving waters
- Expanded public education on stormwater management
- Improved tracking and inspection of stormwater assets
- Reduction of illicit discharges to City's storm drain system
- Prioritization for structural stormwater BMP retrofits of City-owned properties.[22]

Refer to the City's Notice of Intent for additional information about meeting MS4 requirements.

The City manages stormwater through City Code Chapter 218, which received a comprehensive update in 2021. The ordinance was revised to strengthen stormwater management in the city and comply with MS4 permit requirements. Amendments include provisions to manage stormwater associated with private development in order to treat discharge prior to it entering the City's stormwater system. The ordinance requires a stormwater permit for land disturbances of 5,000 square feet or more and a stormwater management and erosion control plan for cumulative disturbance exceeding 20,000 square feet, subdivisions of four or more lots, phasing of three or more contiguous lots per year of a subdivision, and any land disturbance activity within a critical area. The local regulations are more stringent than the State's Alteration of Terrain regulations, which are triggered if a project disturbs more than 100,000 square feet of contiguous terrain (50,000 square feet if a portion of the project is in the protected shoreline (RSA 483-B), or if the project disturbs any area having a 25% or steeper land slope and is within 50 feet of any surface water. The ordinance also requires public infrastructure and utilities to meet standards.

Accounting for Extreme Precipitation

The City's Stormwater Management and Erosion Control Ordinance (City Code Chapter 218) requires that design storm depths be based on local rainfall amounts using the extreme precipitation table provided by the Northeast Regional Climate Center. This is important as the last national comprehensive climatology of rainfall events is over 50 years old. Since then, the frequency of 2-inch rainfall events has increased and storms once considered 1 in 100-year events are becoming more frequent in New England, occurring almost twice as often. (Source: Northeast Regional Climate Center Extreme Precipitation Tool).

In 2022, the City's Water Pollution and Flood Reduction Workgroup formed to:

- Learn about the effects of stormwater pollution and methods to reduce it
- Review current practices of Rochester and other communities
- Plan stormwater pollution reduction initiatives in the City
- Set pollutant reduction goals
- Determining needed resources and funding structures, including a stormwater utility, which is a mechanism to generate funding for stormwater management through user fees that are typically based on the impervious surfaces of a property.

As of September 2023, the Workgroup is still active and learning from the City of Dover's process to establish a stormwater utility. It is anticipated that the group will present a report on stormwater funding to City Council for consideration in 2023.

9.3.1 Low Impact Development

Low Impact Development (LID) LID is a site planning and design strategy intended to maintain or replicate predevelopment hydrology through the use of site planning, source control, and small-scale practices integrated throughout the site to prevent, infiltrate, and manage stormwater runoff as close to its source as possible.[23] LID typically mimics and preserves the natural hydrologic features and functions on the developed landscape thereby reducing runoff generated on a site. Through site planning and stormwater treatment practices, LID approaches aim to:

- Lessen the impact of development, and the impact of runoff resulting from that development, on the natural environment.
- Use the land more efficiently.
- Lower capital and operating costs associated with development.

The City encourages LID practices in its Site Plan Review provisions for landscaping (Article III, Section 5) and requires LID site planning and design strategies to the maximum extent practicable to reduce stormwater runoff volume for new development and redevelopment in Section 13 Stormwater Management (Article III, Section 13), as well as in City Code Chapter 218 Stormwater Management and Erosion Control. The Downtown Rochester Master Plan also emphases integrating green infrastructure, which is described as systems designed with vegetation and other natural materials, providing many ecosystem services to the community, including improved air and water quality, reduced heat island effect, and mental and physical benefits.[24]

LID Treatment Practices Include:
- Bioretention, e.g. Rain Gardens
- Dry Wells
- Rooftop Gardens and Green Roofs
- Vegetated Swales, Buffers, and Strips
- Soil Amendments
- Permeable Pavement
- Tree Box Filters
- Rain Barrels and Cisterns

Stormwater Management Education

Educating the community – including residents, property owners, staff, and board, commission, and committee members about methods to reduce nonpoint source pollution is an important part of improving water quality in Rochester's lakes, ponds, rivers, streams, and groundwater.

Programs like Soak Up the Rain New Hampshire (SoakNH) provide education and a variety of ways to voluntarily manage stormwater runoff from residential and small business properties.

The Green SnowPro Certification course offers education to commercial salt applicators on state-of-the-art salt reduction practices. The program also grants limited liability protection from the applicators and property owners who hire them.

Professional Development opportunities through the UNH Stormwater Center include a Stormwater Management Certificate.

Municipal staff, consultants, and others also have access to resources like the UNH Stormwater Center's Credit for Going Green program, which was designed to help NH communities meet water quality standards through the use of buffers. The UNH Stormwater Center also maintains a list of publications on topics like low impact development (LID):

- Economic and Adaptation Benefits of Low Impact Development
- Forging the Link: Linking the Economic Benefits of Low Impact Development and Community Decisions
- Comparison of Maintenance Cost, Labor Demands, and System Performance for LID and Conventional Stormwater Management

9.4 Designated Rivers

Both the Cocheco River and the Isinglass River are designated rivers through the New Hampshire Rivers Management and Protection Program. Under this program, the rivers are protected and managed to maintain and enhance instream river values like water quality and instream flows. The Cocheco River Local River Advisory Committee and the Isinglass River Local Advisory Committee play a key role in developing and implementing river corridor management plans.[vi]

NH Rivers Management and Protection Program

The Rivers Management and Protection Act of 1988 (RSA 483) established a statewide rivers program based on a unique cooperative approach: State designation of significant rivers to manage and protect the river's values and characteristics and local development of river corridor management plans for shorelines and adjacent lands to protect river resources. The program is administered by NHDES and is staffed by a Rivers Coordinator. The act also established the statewide Rivers Management Advisory Committee (RMAC) and the river-specific Local River Management Advisory Committees (LACs). RMAC members represent a wide range of river interests and work closely with NHDES in an advisory capacity on statewide river issues while LAC members focus on grassroots-level protection efforts on each river.

9.4.1 Instream Flow Management

New Hampshire's Instream Flow Program falls within the New Hampshire Rivers Management and Protection Program statute, Section 9-c (RSA 483:9-c). The program determines seasonal flows that are necessary to support natural aquatic habitats and human uses. Under this statute, protected instream flows shall be established and enforced to maintain water for instream public uses and to protect characteristics, including recreational, fisheries, wildlife, environmental, hydropower, cultural, historical, archaeological, scientific, ecological, aesthetic, community significance, agricultural, public water supply, riparian rights, and the resources for which the river or segment is designated.

As of summer 2023, the Lamprey River and Souhegan Rivers are actively managed under the Instream Flow Program. Several other instream flow studies and plans for other rivers, including the Isinglass River, are in progress.[25] The instream flow study for the Isinglass River began in spring 2023.[vii] It is anticipated that the draft Protected instream Flow Study Report – Isinglass River will be ready for public review in 2025 and that the draft Water Management Plan for the Isinglass River will be developed after that.[26]

[vi] Isinglass River Management Plan (2008, updated in 2018).
[vii] Real time flow data for the Isinglass River.

9.5 Surface Water and Wetland (SW) Recommendations

SW 1	Increase required buffer distance in the Conservation Overlay District to 100 feet from all waterbodies, as recommended by the Piscataqua Region Estuaries Partnership.
SW 2	Adopt 100-foot setbacks for septic systems for all waterbodies.
SW 3	Support water quality protection measures to ensure that surface waters meet state standards for their designated uses – aquatic life, drinking water, fish consumption, primary and secondary contact recreation and wildlife.
SW 4	Provide education about and encourage planting and restoration of riparian buffers on municipal and private properties.
SW 5	Develop partnerships with local and regional watershed and river stewardship groups to improve and protect the quality of surface waters, i.e., through land conservation, water quality monitoring, implementing best management practices, forest preservation, etc.
SW 6	Increase fertilizer application setback to 100 feet for all 1st through 4th order streams, lakes, and ponds.
SW 7	Consider establishing pesticide, fertilizer, and herbicide regulations.
SW 8	Identify best practices for minimizing drought impacts, such as the NHDES Drought Guidance for Municipalities, and incorporate measures into City ordinances and policies.
SW 9	Ensure emergency spill response measures are in place to prevent potential contamination of surface water in the event of a spill.
SW 10	Expand upon the previous freshwater wetland study to include wetlands of 2 to 5 acres in size for consideration for prime designation.
SW 11	Designate prime wetlands. Include Heath Bog.
SW 12	Protect remaining undeveloped portions of Heath Bog, a designated Conservation Focus Area in the Coastal Watershed Conservation Plan.
SW 13	Require pre-construction inspections by City staff and Conservation Commission members to ensure that protective fencing or markers are installed at the edge of the wetland buffers prior to construction.
SW 14	Conduct an inventory of and map vernal pools on City-owned lands.
SW 15	Develop a GIS database of vernal pool locations and ecology. Require GIS data to be submitted for vernal pools with all applications for Subdivision and Site Plan Review.
SW 16	Consider establishing a local shoreland protection overlay district.
SW 17	Conduct education and outreach to landowners, businesses, and residents about reduction and proper disposal of yard waste, pet waste and trash, especially in riparian areas, to protect water quality.
SW 18	Require that public and private development utilize the most up to date data for extreme precipitation in stormwater design calculations.
SW 19	Develop signage to place at stream crossings, public property, and access points to increase awareness of the Rochester's rivers.

SW 20	Seek grant funds for a stormwater management pilot / demonstration project on public property.
SW 21	Continue to encourage installation low impact development (LID) stormwater management systems on public and private projects.
SW 22	Participate in the Stormwater Coalition.
SW 23	Eliminate off-street parking minimums and review each parking lot proposal on a case-by-case basis.

Heath Bog (Courtesy of John Gisis)

10 FLOODPLAINS

10.1 Designated Flood Zones

Floodplains are lands that are susceptible to flooding. The Federal Emergency Management Agency (FEMA) designates areas that have a 1% annual chance of flooding in any given year as the Special Flood Hazard Area (SFHA). These areas are also known as the 100-year floodplain and are identified on Flood Insurance Rate Maps (FIRMs)(Table 13). Areas with an 0.2% annual chance of flooding, also known as the 500-year floodplain, are also identified on FIRMs.

There are approximately 2,110 acres within the 100-year floodplain and 179 acres within the 500-year floodplain in Rochester (Table 14). As shown in Figure 14, floodplains are present in wet areas in the north end of the City and along most rivers and streams. Areas susceptible to the 500-year flood are located along the Salmon Falls River. It is important to note that floodplains are identified for regulatory purposes and that other locations can be vulnerable to flooding. Extreme precipitation events can cause flooding to extend well beyond designated floodplains.

Table 13. Flood Insurance Rate Map (FIRM) panels for Rochester

Effective 5/17/2005:	Effective 5/17/2005:	Effective 9/30/2015:
33017C0138D	33017C0190D	33017C0218E
33017C0201D	33017C0211D	33017C0310E
33017C0182D	33017C0212D	33017C0302E
33017C0184D	33017C0216D	33017C0305E
33017C0203D	33017C0217D	
33017C0204D	33017C0219D	
33017C0208D	33017C0214D	
33017C0183D	33017C0213D	
33017C0195D		

Table 14. Acres of designated flood zones (Source: USA Flood Hazard Areas)

Flood Zone	Acres
Special Flood Hazard Areas (100-Year Floodplain, 1% Annual Chance of Flooding)[a]	2,109.9
A[a]	835.3
AE[b]	1,274.6
500-Year Floodplain, 0.2% Annual Chance of Flooding	
X	178.9

[a] Areas with a 1% annual chance of flooding and a 26% chance of flooding over the life of a 30-year mortgage. Because detailed analyses are not performed for Zone A, no depths or base flood elevations are shown within these zones. In Zone AE, base flood elevations are provided on flood maps.

Local Regulation: Flood Hazard Overlay District

The City regulates development and activity within the floodway under Chapter 275-13 Flood Hazard Overlay District (FHOD). This district encompasses the Special Flood Hazard Area. Within this area, all new construction and substantial improvements of residential structures must have their lowest flood (including basement) elevated to or above the 100-year flood level. All new construction and substantial improvements of non-residential structures must have the lowest flood (including basement) elevated to or above the 100-year flood level, or together with utility and sanitary facilities be floodproofed.

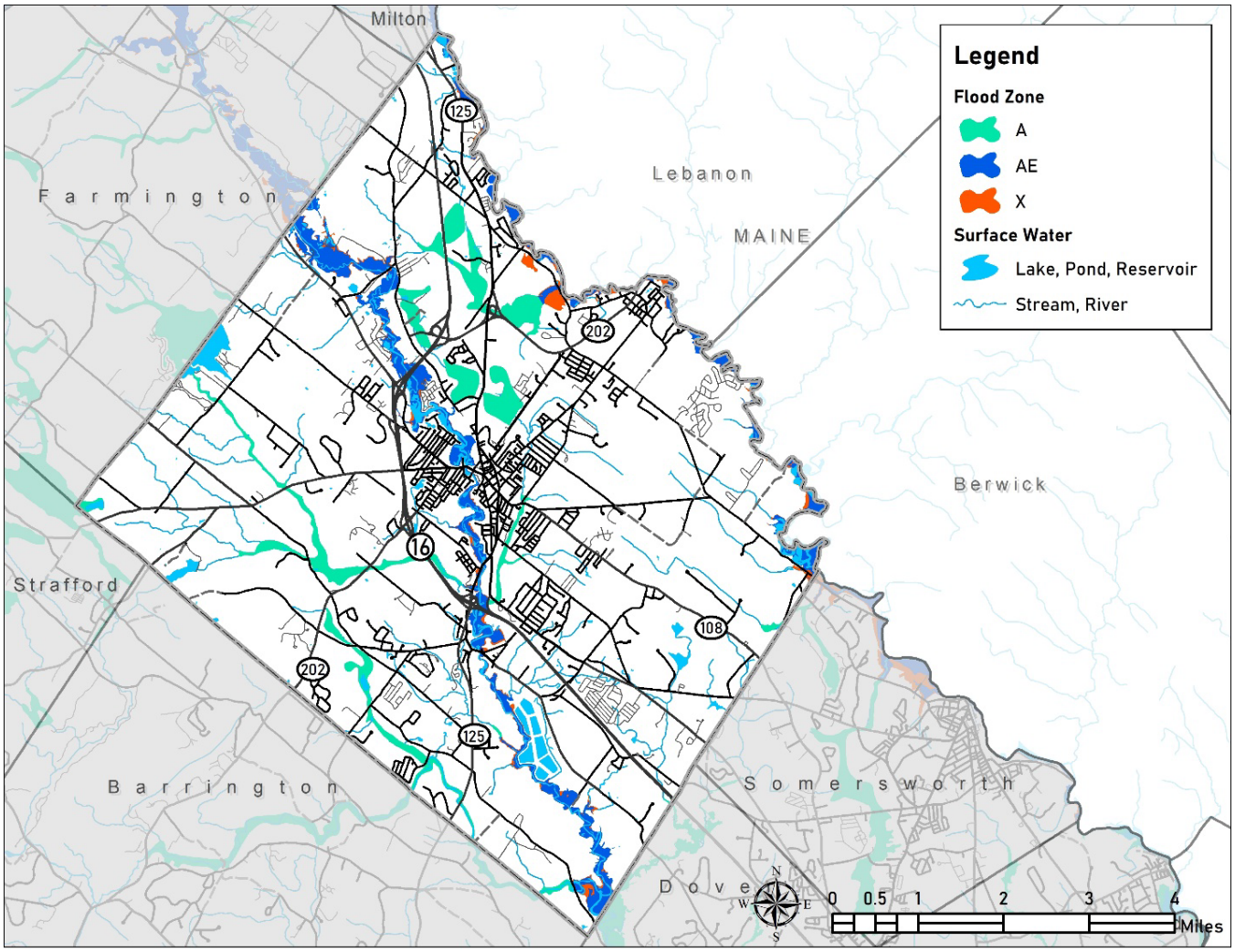


Figure 14. Floodplain map (Source: USA Flood Hazard Areas, NH Geodata Portal)

FHOD Mini Audi Findings:

To strengthen the FHOD, consider:

- Completing a comprehensive review of the Floodplain regulations against the State's model ordinance and see the State's Menu of Higher Standards for options to strengthen regulations.
- Establishing a timeline for changes that constitute substantial improvement. For example, any work within a 5-year period that combined exceeds 50% of the market value of the structure.
- Adding a requirement of one (or more) feet of freeboard above base flood elevation to reduce risk of flooding and help protect against larger precipitation events.

10.1.1 Floodplain (FP) Recommendations

FP 1	Conduct a comprehensive review of Zoning Ordinance Chapter 275 Article 13 against the State's model ordinance and amend Article 13 as needed.
FP 2	Consider incorporating measures from the State's Menu of Higher Standards to strengthen regulations.
FP 3	Educate the community about floodplains, their value in protecting property from flooding, and the importance of minimizing development within floodplains.

11 DRINKING WATER

11.1.1 Drinking Water Sources

The city's municipal drinking water is derived from both surface water (85%) and groundwater (15%). The primary drinking water supply for the city is the Rochester Reservoir. Both the Rochester Reservoir and Round Pond Reservoir are supplied by the Berry River watershed, which is located in Rochester and the Towns of Barrington, Strafford, and Farmington. The Cocheco Well treatment plant also supplies water to the City's drinking water system. The surface water treatment facility, which draws from the Rochester Reservoir, and the Cocheco Well treatment plant, are capable of treating approximately 5.5 million gallons per day.[27] A small portion of the City on Old Dover Road is served by the Consecutive Water System with water purchased from the City of Somersworth and derived from the Salmon Falls River.[28]

The Berry River and a 24-inch transmission pipe connects three major reservoirs: Rochester Reservoir, Round Pond, and Tufts Pond. These waterbodies are protected by state regulation that prohibits any recreational activity on the waters.[29]

The City of Rochester New Hampshire operates an extensive surface water system comprising a total source watershed area of 8.75 square miles. The water system is part of the city's Department of Public Works, which has been a city-owned-and-operated water works since 1892. The city's water supply demand has increased significantly, and because of the system's age, increasing environmental stress and changing regulations, the City of Rochester has deployed a proactive management and infrastructure improvement approach to modernize its surface water sources and improve system resilience and reliability. The Rochester Reservoir has served as the primary drinking water supply for Rochester since the late 1890s. Prior to that, most residents obtained their water from private and personal sources with several quasi-municipal wells available to certain residents. Following growing national awareness of the necessity of safe, public water supplies, the New Hampshire State Board of Health commissioned the study for a new public water supply in Rochester starting in the mid-1880s. Around 1890, The Rochester Aqueduct Company began planning and constructing an earthen dam (the East End Dam) that would form the Rochester Reservoir (pictured on the cover). Sourced from another diversion structure that fed the impoundment from the adjacent Berry's River, the reservoir and dam structures were completed in the mid-1890s. Simultaneously, work began on the transmission mains that would deliver the water approximately six miles from the reservoir in Barrington to downtown and urban portions of the city. An impressive civil engineering feat on its own, the transmission main was completed around 1896 and began a new era of public water in Rochester. By its completion, the water works were run by the newly incorporated city and made Rochester one of only approximately 15 known public and private water systems in New Hampshire.

Source: Excerpt from "Rochester Reservoir and Surface Water Treatment Facility, Rochester Water Department." Journal of the New England Water Works Association. Sept 2021, Vol 135 No. 3

The City owns and maintains four dams associated with the public drinking water supply: at the Rochester Reservoir in Rochester, Round Pond Reservoir in Barrington, Tufts Pond Reservoir in Farmington, and the Berry River in Strafford adjacent to the water supply intake.

Rochester operates a 400-foot bedrock well (WRB 203.1165) at Innovation Drive that provides domestic drinking water and two shallow gravel test/monitoring wells at Pickering Road and Old Dover Road. The Department of Public Works (DPW)'s current large groundwater withdrawal permit (No. LGWP-2008-0001A) was issued 2/23/2018 and will expire on 2/23/2028. The permit allows withdrawal of 1,008,000 gallons over any 24-hour period from Well RCH-IC for a community water supply.

Ongoing Project: Round Pond Reservoir Elevation Project

A State environmental minimum flow mandate for the City to ensure the ecological health of Berry's River means that the effective yield of the watershed which feeds the City is compromised. The City conducted a feasibility study in 2014 that found that increasing the surface elevation of Round Pond reservoir by 5 to 10 feet was a viable option to increase safe yield of surface water supply system. Raising the elevation by 8 to 10 feet will near triple the safe yield of the reservoir available as a water supply to the City. Augmentation of Round Pond would ensure City compliance with the environmental mandate and provide adequate quantities of drinking water for the foreseeable future. As of summer 2023, easements, permitting, and design for this project are moving forward and the project is anticipated to be completed within a few years.

Source: Capital Improvements Program and Department of Public Works

After treatment, finished water is distributed via gravity system to the City of Rochester, East Rochester Village, and parts of Gonic Village and South Lebanon, Maine.

11.1.2 Public Water Supply

A public water supplies (PWS) is defined by the State as a water system that provides piped water for human consumption and has at least 15 service connections or regularly serves an average of at least 25 individuals daily at least 60 days out of the year.

3 Types of Public Water Supply Systems in NH

- A *Community System* serves at least 15 service connections used by year-round residents or regularly serves at least 25 year-round residents.
- A *Non-transient Non-Community* supply serves the same 25 people, or more, over 6 months per year, such as schools, or private businesses that have their own drinking water supply.
- A *Transient Community* water supply is a system that serves less than 25 people for less than 6 months of the year, such as at restaurants, campgrounds, and other types of service-related businesses or facilities.

In Rochester, there are 16 active PWS that have a total of 8,605 connections and serve a population of 28,445 people.[30] Approximately 25,000 people are served by the Rochester Water Department major community water system and 171 people through the Rochester Consecutive Water System, which is a small community water system. The remainder of people that rely on PWS's are served by other community, non-transient non-community, and transient non-community system. A summary of PWS and service statistics is shown in Table 15. Refer to Appendix 6 for additional information about each of the active PWS systems in Rochester.

Table 15. Public Drinking Water Supply systems and service statistics (Source: NHDES OneStop Database, February 2023)

Type	Population Served	Service Connections
Community System	26,215	8,022
Non-Transient Non-Community	45	1
Transient Non-Community	2,185	582
Total	28,445	8,605

The City operates and monitors a drinking water system consisting of 135 miles of water main, 3 storage tanks, 6 pumping stations, and approximately 7,500[viii] service connections.[31] The Surface Water Treatment Facility at 64 Strafford Road can treat and filter 4.5 million gallons per day and produced approximately 645 million gallons of water in FY2021. The Groundwater Treatment Plant at 157 Farmington Road can treat 1 million gallons per day and produced approximately 121 million gallons of drinking water in FY2021.[32] Annually, staff conduct tests for over 175 drinking water compounds and samples are continuously taken throughout the distribution system.[33]

The City's Water Treatment Plant produced approximately 801 million gallons of drinking water in 2022, which is about 7% more than 2018.[34] Operation and delivery statistics for the last five years are shown in Table 16.

Table 16. Rochester Water Treatment Plant operational statistics, 2018-2022 (Source: City of Rochester, 2023)

Operational/Treatment Statistics		Delivery Statistics	
Year Built	1987	Year	Production (MG)
Design Flow	5.0 MGD Surface Water 1.0 MGD Groundwater	2022	801MG
Average Flow	2.2 MGD	2021	844MG
Max Day 2020 Peak Production 2020	3.51 MGD 5.55 MGD	2020	802MG
Surface Water Sources	Round Pond, Berry River, Tufts Pond, Rochester Reservoir	2019	744MG
Groundwater Sources	Stratified Drift Gravel Packed Well	2018	749MG

MG = millions of gallons, MGD = millions of gallons per day

11.1.3 Drinking Water Quality

Drinking water from the Rochester Water Treatment Plant is treated to remove impurities as required by the Safe Drinking Water Act and good health practices. After initial filtration, chlorine is added to the water for disinfection, fluoride is added to promote strong teeth, and sodium bicarbonate is added to increase the alkalinity. The pH of the water is increased, and an inhibitor is added to reduce the corrosion of households plumbing. The Rochester Water Treatment Facility is required by state and federal law to test the drinking water supply for organic contaminants, inorganic contaminants, and microbiological contaminants.

[viii] Includes domestic, commercial, and industrial taps but not fire system connections.

In 2021, DPW sampled water quality continuously throughout the distribution system and tested for and met the standards for 175 drinking water compounds including:

- Microbiological contaminants
- Radioactive contaminants
- Lead and copper
- Inorganic contaminants
- Synthetic organic contaminants, including pesticides and herbicides
- Volatile organic contaminants
- Per- and Polyfluoroalkyl substances (PFAS).[35]

The most recent Source Water Assessment Report for Rochester's water supply, which evaluated vulnerability to contamination, was prepared in 2002. Berry's River received one high susceptibility rating, three medium susceptibility ratings, and eight low susceptibility ratings.[36] Property owners within the watershed are notified and furnished with educational information on an annual basis as required by the Best Management Practices Rule for Source Protection (NHDES, Drinking Water and Groundwater Bureau, Drinking water Source Protection Program).[37]

11.2 Private Drinking Water Wells

According to the NH Department of Environmental Services One Stop Data Center, Rochester has 1,022 private domestic drinking water wells that are registered with the state's private water well database, which reports only new wells drilled and registered from 1984 to the present. Nearly all are drilled bedrock wells.

11.3 Drinking Water Protection

11.3.1 Overview

Rochester utilizes each of the four overarching methods for protecting public and private drinking water resources that are identified in the NH Drinking Water Quality Buffer Model Ordinance:[38]

Drinking water protection is important to community members. Over 95% of the individuals who responded to a natural resource Master Plan survey indicated that they were very concerned or concerned with protection of drinking water sources.

- Local water resource protection and conservation that engage community stakeholders and water users and promote best practices in water management, investments in protective measures, and sound land use planning and policies.
- Land use regulation and management focused on pollution prevention best practices and limiting development and impervious surfaces in drinking water supply watersheds.
- Land conservation practices focused on protecting source waters and their contributing drainage and recharge area.
- Application of best available science on water quality protection, drought, climate change, water conservation, and water resource and demand management.

Rochester is expanding fast and there is a financial and infrastructure impact for this rate of development. As of 2023, the City's drinking water system is currently at about 65% capacity.

The City proposed use of low flow fixtures, water conservation measures, and greenscapes to help reduce the demand for water. These measures are particularly important for new developments with new infrastructure. In existing developments with older infrastructure, water conservation measures may not be as effective due to the minimum flow rates that are necessary to sustain high quality water.

The Department of Public Works has identified approximately 60 or 70 miles of aging infrastructure that should be replaced. The cost to replace these pipes for this is substantial and far exceeds the Department's $100-$500 per year maintenance budget. Additional sources of funding will be necessary to upgrade the system.

Public Works is currently completing a capacity study for water and sewer. Following this, Public Works will undertake a joint planning DPW facilities and services study. Additional information about these studies and the drinking water system will be discussed in detail in the upcoming update of the Facilities Master Plan.

11.3.2 Local Regulation: Aquifer Protection Overlay District

The City has an Aquifer Protection Overlay District (275-10) (APOD) that is designed to preserve, maintain, and protect from contamination existing and potential groundwater supply areas that may be available for use as a current or future source of supply for Rochester's municipal water system.

This district encompasses three areas totaling approximately 1,237 acres (Figure 15). These areas are known as wellhead protection areas and were delineated around existing and potential municipal production water wells. A wellhead protection area delineation identifies the part of the mapped aquifer that actually supplies water to a particular public supply well. This delineation defines the area through which contaminants are reasonably likely to potentially reach the public-supply well. Regulating land use and activity in these areas helps protect the quality of the water below the surface.

Mini Audit Findings

The provisions of the APOD could be strengthened to better protect groundwater resources. For example, the geographic extent of the district could be expanded to encompass not only the established wellhead protection areas, but the land above stratified drift aquifer. Compared to the State's Model Ordinance for Groundwater Protection, Rochester's regulations contain fewer performance standards. The threshold for which a stormwater management plan is less stringent in Rochester than that of the State's Model Groundwater Protection Ordinance, which requires a stormwater management plan for new or expanded uses that render more than 15% or more than 2,500 square feet of any lot impervious.

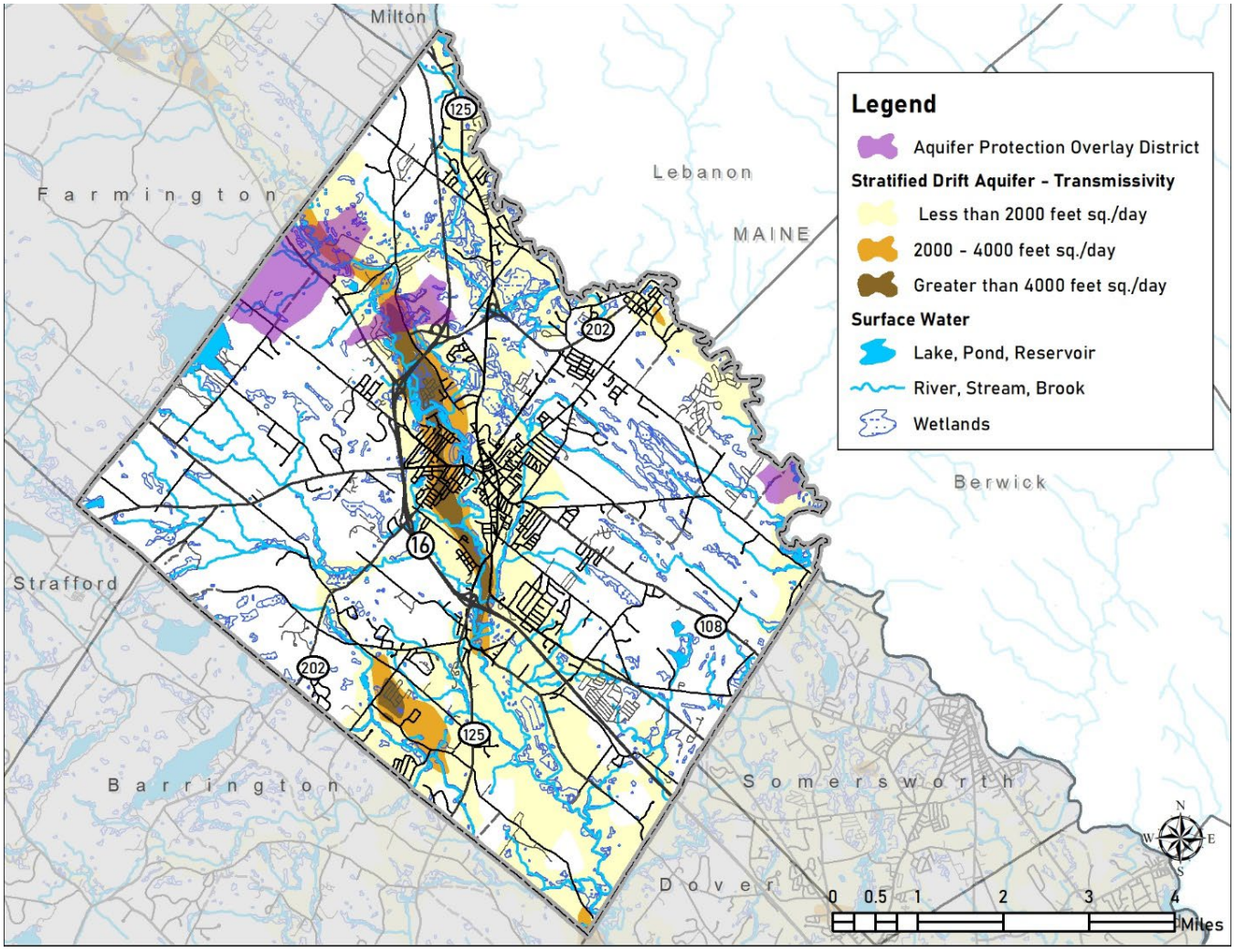


Figure 15. Aquifer transmissivity and boundaries of the Aquifer Protection Overlay District (Source: City of Rochester, NH Geodata Portal Aquifers)

11.3.3 Buffers

Regulating land use and activities within proximity of surface waters is one method to protect drinking water quality. The New Hampshire Drinking Water Quality Model Ordinance recommends maintaining a 100-foot natural buffer from all surface water sources.

11.3.4 Large Groundwater Withdrawal Policy

While new large groundwater withdrawals are not allowed within the Aquifer Protection Overlay District, Rochester does not have a policy for large groundwater withdrawals. Consideration should be taken to avoid potential future large bottling, industrial, or other water usage that impacts the sustainability of groundwater resources. The Town of Nottingham, for example, does not allow extraction of groundwater where the methods used in the extraction do not allow for adequate recharge and prohibits non-municipal wells that may result in an aquifer volume reduction that exceeds the recharge rate within the their Aquifer Protection District. Nottingham

also requires hydrogeologic studies for subdivisions of three or more lots to evaluate the development's impacts to groundwater within the parcel to be developed and the surrounding land.[39]

11.3.5 Conservation

Land conservation is an effective strategy to protect drinking water sources. The City uses its Enterprise Fund to acquire land for the purpose of drinking water protection.

In 2005, the City purchased a 166-acre property known as the Henderson Property to protect the municipal drinking water supply well. This property also has over half a mile of frontage on the east and west banks of the Cocheco River. A portion of this property (17.5 acres) is permanently protected via a conservation easement.

More recently, the City has purchased land and partnered with the Southeast Land Trust (SELT) to protect land around the Rochester Reservoir and Round Pond, as well as Tuffs Pond Reservoir, Whaleback Pond, and Berry River in Farmington, which feed the Rochester Reservoir. The City has also discussed conservation projects with property owners in Strafford and Barrington. Additionally, the City has also protected land along the Salmon Falls River, which is a drinking water source for other municipalities and may be a future drinking water source for Rochester.

The City has benefited from the NH Department of Environmental Services' Drinking Water Source Protection Grants.

1998 - Development of a GIS map of the Berry River watershed based on an aerial survey and existing sources. Also, development of database to assess potential risks to the water supply.

2002 - Develop a spill response plan in order to reduce contamination from Route 202A which is in close proximity to the Reservoir. The plan will include a vulnerability assessment and implementation recommendations. Recommendations will then be implemented.

2007 - Source Security Enhancement Project

2014 - Work with the City of Rochester to review and revise the City's Aquifer Protection Ordinance

2017 - SELT will use funds for transaction costs related to purchasing a conservation easement on a 60 acre property in the Berry River watershed, a primary source for the City of Rochester's public water supply.

2017 - SRPC will work with the City of Rochester and the City of Dover on preparing new water conservation regulations for consideration to improve their existing water conservation regulations through the inclusion of various components of the state's model regulations for water efficient landscaping and water use restriction ordinance.

Refer to Section 18.1 for additional information about land conservation.

11.3.6 Drinking Water Protection (DW) Recommendations

DW 1	Conduct a comprehensive review of Zoning Ordinance Chapter 275 Article 10 against the State's model ordinance and amend Article 10 as needed.
DW 2	Provide information to owners of private drinking water wells about the health benefits of water quality testing. Encourage private well water testing.
DW 3	Identify and mitigate potential sources of surface water and groundwater contamination.

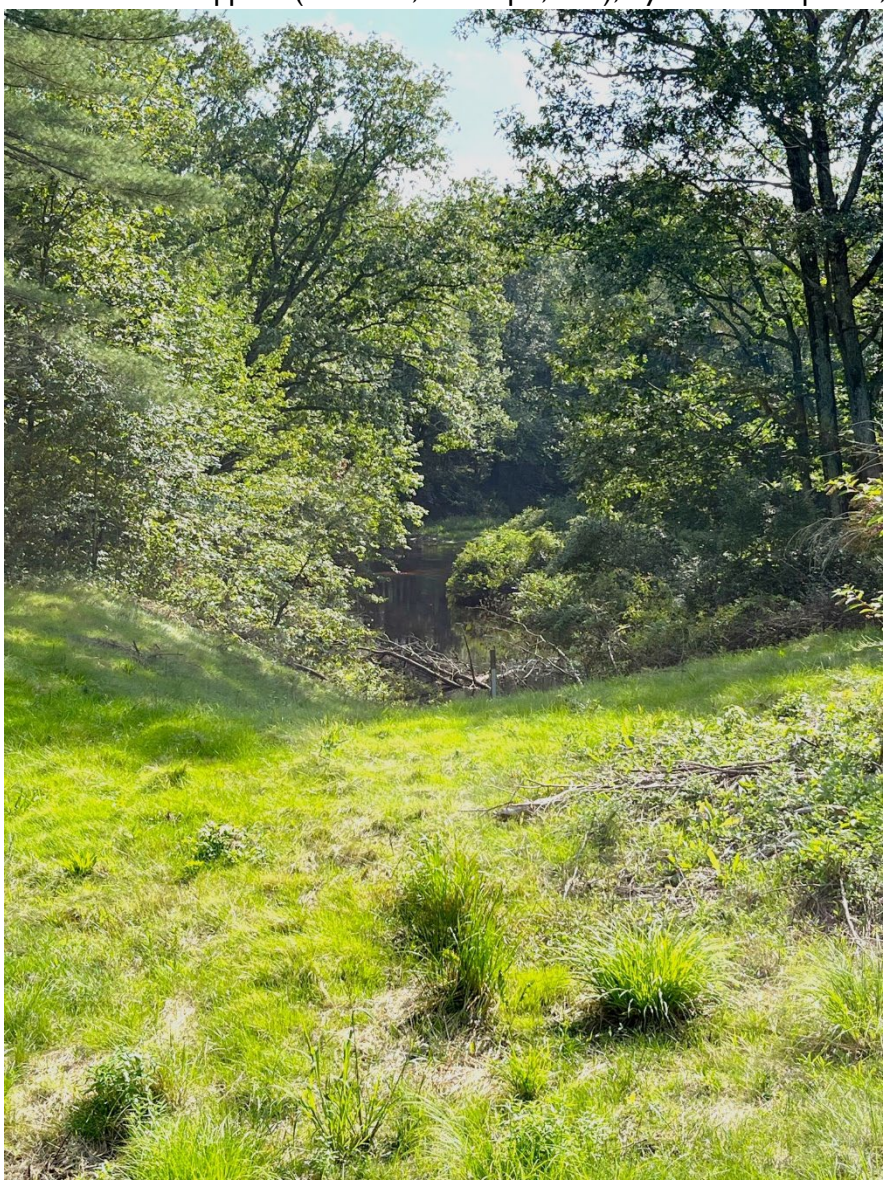
DW 4	Develop water conservation programs and raise public awareness about the importance of conservation measures.
DW 5	Maintain an enterprise fund allocated to conservation for drinking water protection purposes.
DW 6	Increase rate of replacement of aged drinking water infrastructure.
DW 7	Develop a City policy for large groundwater withdrawals to address the potential effects on future public drinking water supplies.
DW 8	Continue use of land acquisition and conservation as a strategy to protect current and future drinking water sources.
DW 9	Evaluate the long-term impacts of climate change, including drought, increased precipitation events, and increased temperature, on public and private drinking water sources.
DW 10	Consider requiring a 100-foot natural buffer from all surface water sources.

12 REGISTERED WATER USERS

Facilities that use an excess of 20,000 gallons of water per day averaged over any seven-day period, or more than 600,000 gallons of water over any 30-day period from surface or groundwater sources, transfer from one location to another, or return water to the environment are required to register with the Water Use Registration and Reporting Program and report water use to NHDES (Refer to NH RSA 488 and Env-Wq 2102 for additional information).[40]

There are 14 active registered water users in the city, including the Department of Public Works, Rochester Water Works, and the Rochester Wastewater Treatment Facility (WWTF) (Appendix 8).[41] Water usage by registered water users in Rochester includes water supplies (domestic, municipal, etc.), hydroelectric power, sewage treatment, mining, irrigation, industrial, commercial, and institutional uses. In 2022, 41.3 thousand gallons of water were withdrawn by registered water users according to the NHDES OneStop database. The largest annual water user, Spaulding Pond Hydro, withdrew an average of 37,069 thousand gallons per day from the Salmon Falls River in 2022. Refer to Appendix 8 for a summary of water usage by registered water users.

The City of Dover maintains the only registered water withdrawal (>20,000 gallons per day) on the Isinglass River. Dover withdraws an average of 830,000 gallons of water per day from the Isinglass River from a point just downstream of the Rochester Neck Road bridge in the City of Rochester. The water is pumped to a recharge well in Dover (which recharges groundwater to the Cocheco) and serves as public water supply.[42]



View of Isinglass River from the Rochester Neck Road bridge (Liz Durfee)

13 ACTIVE DAMS

Within Rochester there are 22 active dams, including four on the Cocheco River, two on the Salmon Falls River, and one on TR Rockers Brook. The City owns the Wyandotte Dam and Upper City Dam, both located on the Cocheco River, as well as the Rochester Sewage Lagoon Dam and Pickering Ponds Dam. Three dams, the Wyandotte Dam on the Cocheco River and the Spaulding Pond and Boston Felt dams on the Salmon Falls River, are used for hydroelectric power. Other uses for the dams include recreation, runoff detention, conservation/agriculture and lagoons. Two dams on the Cocheco River in Gonic are slated for removal.[43] A complete list of active dams in Rochester can be found in Appendix 7. See large format Map 18 for the location and use of active dams.

Upper City Dam on the Cocheco River (Tom Morgan)

14 WASTEWATER TREATMENT

Rochester's Wastewater Treatment Facility operates under the strict effluent limitations and monitoring requirements contained in the July 23, 1997 permit issued by the EPA. The City's advanced Wastewater Treatment Facility is designed to treat an average flow of 5.030 million gallons per day (MGD) with a peak design flow of 16 million gallons per day (mgd).[44] An estimated 972.61 million gallons of wastewater were treated at the facility in FY21. The average daily effluent flow was 2.67 million gallons. A total of 337,199 pounds of CBOD (97.7%) and 545,619 pounds of total suspended solids (TSS) (98.6%) were removed from wastewater. The facility also treated 1.67 million gallons of septage.[45]

The WWTF has a National Pollutant Discharge Elimination System Permit (NPDES permit NH010668) that allows discharge from the WWTF at 175 Pickering Road to the Cocheco River. The average effluent flow is limited to 5.03 million gallons per day. Several water quality parameters ensure that effluent limitations are not exceeded.

NPDES Permits - Wastewater Treatment Facility

In November 2020, USEPA Region 1 published a final General Permit for total nitrogen (TN) loading in the Great Bay Estuary watershed. Rochester submitted a Notice of Intent (NOI) to "opt in" to this permit in March 2021. The City has also entered into an Administrative Order on Consent (AOC) with the USEPA that allows for an interim effluent limit and certain nitrogen reduction project deadlines. USEPA has issued Rochester an Authorization to Discharge with an effective date of coverage of May 1, 2021; the City submitted to EPA & NHDES its first semi-annual AOC compliance report on June 1, 2021, for the reporting period of May 1-31, 2021. In addition, Rochester, along with Dover and Portsmouth, has entered into an agreement with an environmental stakeholder that commits to certain TN reduction efforts in exchange for a commitment from the stakeholder to refrain from appealing the General Permit.

Source: City of Rochester 2020/2021 Annual Report

15 GROUNDWATER DISCHARGE

NHDES regulates groundwater discharge of domestic volumes exceeding 20,000 gallons per day and nondomestic discharge of wastewater that includes a groundwater contaminant(s) listed in the Ambient Groundwater Quality Standards (Enc-Wq 402).[46] There are eight groundwater discharge permits listed in the NHDES Onestop Database in Rochester, seven are expired. One unlined wastewater lagoon on Chestnut Hill Road (GWP-198405009-R-002) is not expired.

16 HABITAT AND AREAS OF ECOLOGICAL SIGNIFICANCE

16.1 Habitats Found in Rochester

The 2015 Wildlife Action Plan, updated in 2020, provides a comprehensive picture of habitat types across the state. The most prevalent habitat in Rochester is Appalachian oak-pine forest, which accounts for approximately one third of the area of the city (Table 17, Figure 16, see also large format Map 13). This habitat is commonly found in lower elevations in southern New Hampshire and along the Connecticut River. Typical vegetation present in this habitat includes oak, hickory, mountain laurel, and sugar maple. Development in the southeast portion of the state has significantly reduced the prevalence of this habitat. Approximately 1% of this habitat type coincides with conservation and public lands in Rochester and therefore largely protected from development.[47]

Hemlock-hardwood-pine accounts for approximately 14% of the city's area, and nearly 50% of the state. This habitat is a transitional forest that is comprised of hemlock, white pine, beech, and oak trees and home to a range of wildlife species. Due to its prevalence statewide, hemlock-hardwood-pine can be overlooked in conservation efforts; in Rochester, about 14% of this habitat type coincides with conservation and public lands. Similar to Appalachian oak-pine habitat, development and fragmentation are a threat to this habitat type.[48]

There are approximately 2,200 acres of grassland habitat within Rochester, 13% of which coincides with conservation and public lands. Grasslands, which are comprised of grasses, sedges, and wildflowers and few to no shrubs or trees, must be maintained to prevent natural forest succession. Succession, along with development, contributes to loss of this habitat statewide.[49]

Hanson Pines (Tom Morgan)

Detailed information about each type of habitat, the species found in each habitat, habitat threats, and conservation strategies for each habitat identified in the state is available on the Habitat Types and Species page of the NH Fish and Game website.

Field and edge habitat off Pickering Road (Liz Durfee)

Table 17. Acres of habitat types in Rochester and the percentage of each type that coincides with conservation and public lands. (Source: NH Geodata Portal, 2020 WAP, Conservation and Public Lands)

Habitat Land Cover[1]	Acres	% of Area of City	Acres that Coincide with Conservation & Public Lands	% Coinciding with Conservation & Public Lands
Appalachian oak-pine forest	9,048.3	31.1%	901.2	10.0%
Developed Impervious	4,978.1	17.1%	23.2	0.3%
Developed or Barren land	4,959.4	17.1%	153.3	1.7%
Hemlock-hardwood-pine	4,060.5	14.0%	563.2	6.2%
Grassland	2,199.5	7.6%	290.4	3.2%
Wet meadow/shrub wetland	1,447.8	5.0%	209.3	2.3%
Temperate swamp	900.7	3.1%	64.7	0.7%
Open water	456.1	1.6%	113.0	1.2%
Floodplain forest	389.4	1.3%	55.2	0.6%
Sand/Gravel	337.2	1.2%	40.8	0.5%
Peatland	281.9	1.0%	43.1	0.5%
Rocky ridge	5.2	0.0%	0	0.0%
Lowland spruce-fir	0.02	0.0%	0	0.0%
	29,064.0	100.0%	2,457.4	27.2%

[1] Where available, links to the Habitat Stewardship Series Brochures, which contain information about species of concern and stewardship and are designed to help landowners learn about and conserve important wildlife habitats found on their land, are included.

Wet meadows, emergent marshes, and scrub-shrub wetlands account for approximately 5% of the area of the city. Wetlands provide important habitat for wildlife as well as important ecosystem services, or benefits to people. For example, wetlands filter pollutants, minimizing contamination to surface and groundwater, and absorb floodwaters. Development associated with driveways and roads and invasive species such as purple loosestrife and

Japanese knotweed, which outcompete native species, are threats to this habitat type.[50] Marsh and shrub wetlands are also critically import ant for species including Blanding's turtles spotted turtles and pied billed grebes.[51]

Rochester has approximately 282 acres of peatland. Peatland is a unique habitat characterized by low nutrients and high acidity, resulting in conditions that draw out plant and animal decomposition. Because of this, peatlands provide a critical role sequestering carbon. This habitat type, where sphagnum moss, leather leaf, northern white cedar, and American larch are typically found, also supports many rare plant and wildlife species. Altered hydrology, unsustainable forest harvesting, and non-point source pollutants threaten New Hampshire's peatlands. Heath Bog in Rochester, pictured in Section 7.3, is adjacent to large, paved areas in the vicinity of the Lilac Mall and vulnerable to stormwater runoff.

Property owners can contribute to the wildlife habitat in Rochester. NH Fish and Game has guidance for creating a backyard wildlife habitat at: https://www.wildlife.state.nh.us/habitat/backyard.html.

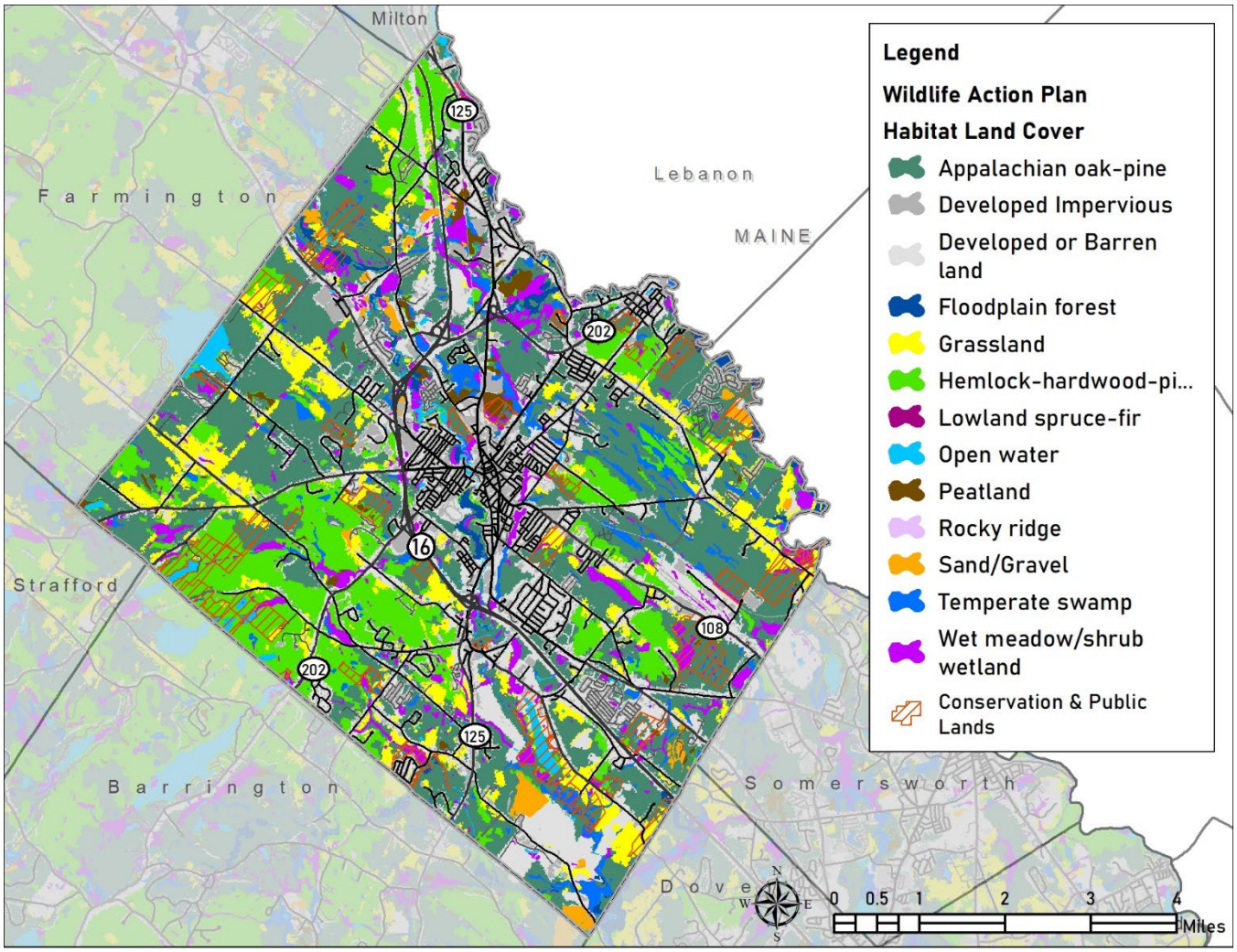


Figure 16. 2020 Wildlife Action Plan (WAP) habitat land cover (Source: NH Geodata Portal, 2020 WAP)

16.2 Forests and Their Benefits

Forests are often comprised of multiple species and several forest types. Forest types are distinctive associations or communities of trees, shrubs, and herbaceous plants. A forest type may be dominated by a single tree species (called a monoculture as often seen in pine forests) or it may be dominated by several species growing together to form a complete vertical forest structure or any combination of canopy, understory and groundcover.

Carbon Sequestration

Forests can sequester carbon over decades or even centuries, when the forest ecosystem reaches maturity and eventually a stage of carbon saturation. Carbon from forests can also be stored in wood products such as furniture and housing lumber for years to decades. Natural decay and disturbances such as fire or harvesting can release carbon back into the atmosphere as CO_2.

The protection of forests through land conservation allows the maximum period of carbon sequestration by allowing forests to remain intact until maturity. Even if actively timbered, afforestation continues the sequestration cycle. Additionally, preservation of riparian and wetland buffers serve the same purpose, on a smaller scale, by retaining forests and trees in developing suburban and developed urban areas. [52]

Shagbark hickory (*Carya ovata*), Pickering Rd (Liz Durfee)

Removing Pollutants From Runoff

Forests, the urban tree canopy, and other vegetation play a role in managing stormwater. Trees and other types of vegetation remove dissolved and particulate forms of pollutants from stormwater runoff where they are stored in biomass (which includes their roots and above ground parts). Thus, natural vegetation on the landscape, particularly near surface waters and wetlands, provide benefits to the community by performing stormwater management functions that protect water quality. [53]

Aesthetic and Scenic Quality and Rural Character

The forested landscapes of New Hampshire help define and enrich our quality of life by providing social, ecological and economic benefits. Forested landscapes are inspiration for artists, writers and naturalists, and local residents and tourists that observe the spectacular fall foliage display each year. Forests are also a living landscape in our region where managed woodlands, farms, pastures, meadows and fields are an integral part of the landscape.

"Forestry and woodlot management" followed by "urban forestry" ranked highest in topics that survey respondents are interested in learning about.

Between July 2021 and June 2022, the Conservation Commission reviewed seven "intent to cut" applications, which was double the amount of the previous year.

(Source: 2023 Natural Resources Master Plan Survey and 2021/2022 City of Rochester Annual Report).

Forested lands help sustain dynamic communities with clean water and air, forest and agricultural products, habitat for native plants and animals, scenic beauty, jobs, and recreational opportunities. [54]

16.2.1 The Urban Forest & Street Trees

The urban forest is commonly defined as an ecosystem that consists of all the trees, associated vegetation, wild animal life, and other natural resources extending from the city center to the edges of the suburban fringes. Trees in parks, landscaped streets, gardens, greenways, river corridors, wetlands, preserves, and trees on residential, commercial, and industrial property are all part of the urban forest. Over time, the science and practice of urban and community forestry has evolved into a comprehensive effort to manage, conserve, and enhance forest and tree resources in and around cities, towns, and suburban areas. Unlike traditional forestry, urban and community forestry focuses on managing trees and forests for a variety of societal benefits, primarily in response to population growth and development.

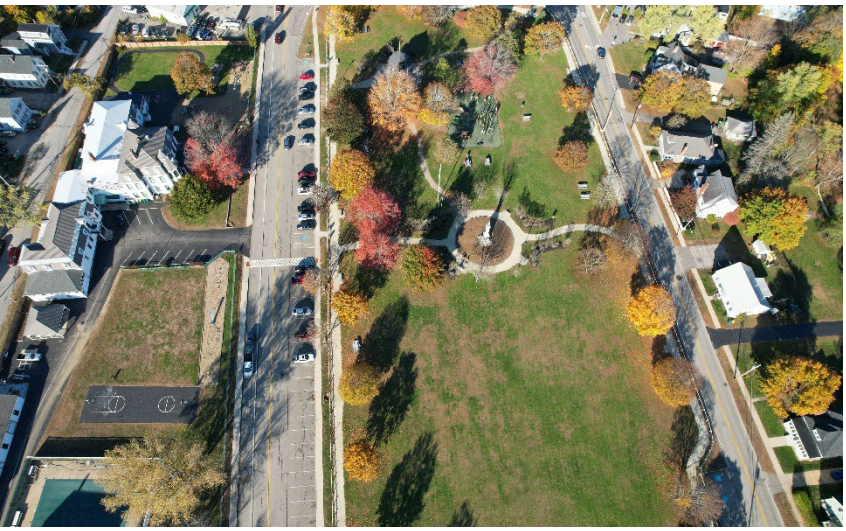
Air Temperature and the "Heat Island" Effect

For many urbanizing areas and cities, the "heat island effect" is of growing concern. This phenomenon describes urban and suburban temperatures that are 2 to 10°F (1 to 6°C) hotter than nearby rural areas and the surrounding natural land cover. Elevated temperatures result from the conversion of natural land cover to impervious surfaces such as parking lots, structures and roads. Natural lands such as parks, open land, trees and bodies of water can create cooler areas in an urban setting. Elevated temperatures can impact communities by increasing peak energy demand, air conditioning costs, air pollution levels, and heat-related illness and mortality.

Strategies to mitigate and reduce the heat island effect include:

- Energy Savings – reduce energy demand by installing cool roofs (light colored to reflect sunlight) and cool pavements, planting shade trees and vegetation (evapotranspiration cools air), installing energy efficient appliances and light bulbs, and constructing energy efficient buildings.
- Heat, Health and Environment – develop community strategies to address excessive heat events and heat-response programs to coordinate a comprehensive community wide action plan.
- Research – incorporate in planning initiatives national research on new technologies and building materials and evaluate the local effects of heat and land cover conversion.
- Community Action – implement education and outreach about heat reducing techniques such as tree planting, landscaping and energy conservation methods.

Source: Excerpt from the 2009 Natural Resources Chapter, which references U.S. Environmental Protection Agency, Heat Island Reduction Initiative



Rochester Common (Tom Morgan)

Eleven large trees in Rochester are listed in the state's current list of Big Tree Champions in accordance with the American Forests' National Register of Big Trees. Refer to Appendix 9 for a list of these trees.

Benefits of Street Trees

Street trees are a public resource that provide a wide range of ecological, social, and economic benefits. In addition to creating habitat for birds, insects, and wildlife and supporting conservation of urban biodiversity, street trees provide ecosystem services, or benefits that people obtain from ecosystems.

Street trees:

- Regulate temperatures, helping to cool summer temperatures through shading and evapotranspiration as well as reduce winter heating bills by acting as a wind break In the winter, street trees act as a wind break, helping to reduce winter heating bills by 20-50%.[55]
- Manage stormwater and improving surface water and groundwater quality by intercepting rainwater and reducing and filtering runoff in the canopy and root zone. [56,57] Street trees enhance permeability of soils and the soil water capacity during storm events.[58] Greater infiltration reduces stormwater runoff, helps to mitigate flooding, and promotes groundwater recharge.
- Improve local air quality and mitigating greenhouse gas emission by filtering air pollutants and capturing and storing carbon dioxide.[59]
- Shade parking lots and streets, which reduces evaporative emissions of volatile organic compounds from gas tanks.[60]
- Remove air pollutants including such as particulate matter, nitrogen oxides, sulfur dioxide, carbon monoxide, and ground-level ozone through dry deposition.[61,62]
- Reduce the negative health consequences of poor air quality,[63] heat-related illness,[64] and exposure to ultraviolet rays
- Improve social equity and access to the benefits of street trees.
- Contribute to sense of place and aesthetic quality of a downtown or street.
- Reduce urban noise.[65]
- Soften the built landscape.[66]
- Slow traffic and create safer conditions for motorists and pedestrians.[67]
- Improve urban residents' connection with nature.

Cocheco River (Tom Morgan)

16.3 Aquatic Habitats

Warmwater streams, rivers, and warmwater lakes and ponds occur in Rochester. High quality streams and rivers are identified in the WAP according to four attributes classified based on four attributes:

- Linear connectivity (length of functional stream network),
- Low riparian development and agriculture,
- No active dams and upstream dam water storage less than 10% of mean annual flow
- Low impervious surfaces (less than 2%) in the watershed.

A total of over 10 miles (53,617 ft) of stream and river reaches (segments) in Rochester are identified as having species of concern (Table 18). These include portions of the Isinglass River, Axe Handle Brook, Rickers Brook, Cocheco River, Willow Brook, and unnamed tributaries.

Table 18. River and stream reaches with species of concern (Source: NH Geodata Portal, WAP Aquatic Habitats)

River/Stream	Description	WAP Species	Length of Segment (ft)
Unnamed	Artificial Path	American eel	648.4
Isinglass River	Artificial Path	American eel, Burbot	2,516.0
Axe Handle Brook	Perennial Stream/River	American eel, Burbot	3,570.4
Rickers Brook	Perennial Stream/River	Eastern Brook Trout	2,694.4
Unnamed tributary of Cocheco River	Intermittent Stream/River	Eastern Brook Trout	3,373.6
Unnamed tributary of Cocheco River	Intermittent Stream/River	Eastern Brook Trout	3,325.0
Cocheco River	Artificial Path	American eel, Burbot	10,384.9
Cocheco River	Artificial Path	Redfin pickerel	6,516.0
Willow Brook	Perennial Stream/River	Eastern Brook Trout	4,227.9
Rickers Brook	Perennial Stream/River	Eastern Brook Trout	6,458.1
Isinglass River	Artificial Path	American eel, Burbot	4,894.9
Cocheco River	Artificial Path	American eel, Burbot	37.2
Cocheco River	Artificial Path	American eel, Burbot	4,793.1
Rickers Brook	Perennial Stream/River	Eastern Brook Trout	177.7

Warmwater river and stream habitat is vulnerable to stormwater runoff from impervious surfaces, altered flow regimes to due water level management, stream crossings, point source pollution, and aquatic herbicide application, agricultural runoff, nutrient loading from lawn fertilizers and contaminated runoff, fragmentation associated with dams, water withdrawals for irrigation or drinking water, and flood control or erosion control, among other threats.[68]

Baxter Lake also provides habitat for species of concern, the American eel. The lake is classified as a warm to cool, acidic pond characterized by low to moderate levels of biological productivity.[69]

16.3.1 Fisheries

The Isinglass River is a coldwater fishery that provides habitat for approximately 20 resident warm and coldwater fish species, including small and largemouth bass, bluegill, common shiner, fall fish, brown bullhead, and the common sucker. Blacknose shiner, which is an uncommon, nongame species, has limited distribution in New Hampshire but is found in the Isinglass River. Brook trout and rainbow trout are introduced game species that are stocked annually by the NH Fish & Game Department in Barrington between Routes 126 and 202 and by Three Rivers Stocking Association and Waste Management near Locke Falls.[70]

Visit NH Fish & Game's Fish Stocking Map to learn more about stocking locations and statistics: https://nhfg.maps.arcgis.com/apps/webappviewer/index.html?id=ce89fbd1ba0c4205ae6794dfb4c9f088

The Cocheco River supports a warm water finfish population including American eel, Lamprey white sucker, yellow perch, Eastern chain pickerel, Eastern brook trout, small-mouth bass and common shiner. Seventeen species, including red river herring, have been identified by the NH Fish and Game Department at the fish ladder at Cocheco Falls in Dover. The upper reaches of the river are stocked with rainbow and brook trout in the spring to early summer.[71]

The Statewide Target Fish Community Assessment for the Cocheco River model was developed for the Cocheco River using fish community data and the best available reference rivers that would characterize a feasible and currently relevant fish community. This information on the expected fish community given relatively low direct anthropogenic impact on instream habitat can be compared with the existing fish community.

Source: Cocheco River Target Fish Report

The Salmon Falls River is stocked with brown and rainbow trout just upstream of Rochester in Milton. The 2006 Great Bay Estuary Resource Compendium noted that historically, the Salmon Falls River sustained the most productive diadromous fish runs in the region, including an abundant Atlantic Salmon population, prior to the construction of dams. Fishways and passages that allow for passage of species like shad, river herring, and eels aid passage. The hydroelectric dam facility in Rollinsford does not have a fishway and serves as an upstream barrier to all species other than American eels. Intra- and inter-basin transfers of river herring occur in the Lamprey, Cocheco, Winnicut, and Salmon Falls river systems. American shad, although larger and better able to swim and jump over larger barriers than river herring, has very specific spawning habitat requirements and only a trace of a natural spawning run persists in the Salmon Falls River.[72]

16.3.2 Stream Crossings

Stream crossings are structures such as culverts or bridges located where a road, railroad, or trail crosses over a stream, river, lake, or wetland. Stream crossings that pose a barrier to fish and wildlife movement impact species' access to breeding, nesting, and overwintering sites. They can also influence the nutrient, sediment, and organic material transport within rivers and streams, which can impact water quality and the structure of banks.[73]

There are 112 stream crossings in Rochester that have been comprehensively assessed through the NH Stream Crossing Initiative. The location of these crossings is available to view on the NH Aquatic Restoration Mapper. Each crossing has been scored for aquatic organism passage and geomorphic compatibility, or long-term compatibility of a stream crossing with river channel form and sediment transport. A summary of these scores is displayed in Figure 17. Sixty-eight percent (76 crossings) have either no aquatic organic passage or reduced passage while only 22% had allowed full passage for aquatic organisms. Thirteen percent of stream crossings were mostly incompatible with respect to geomorphic compatibility, while 30% were mostly compatible and 12% were fully compatible.[74]

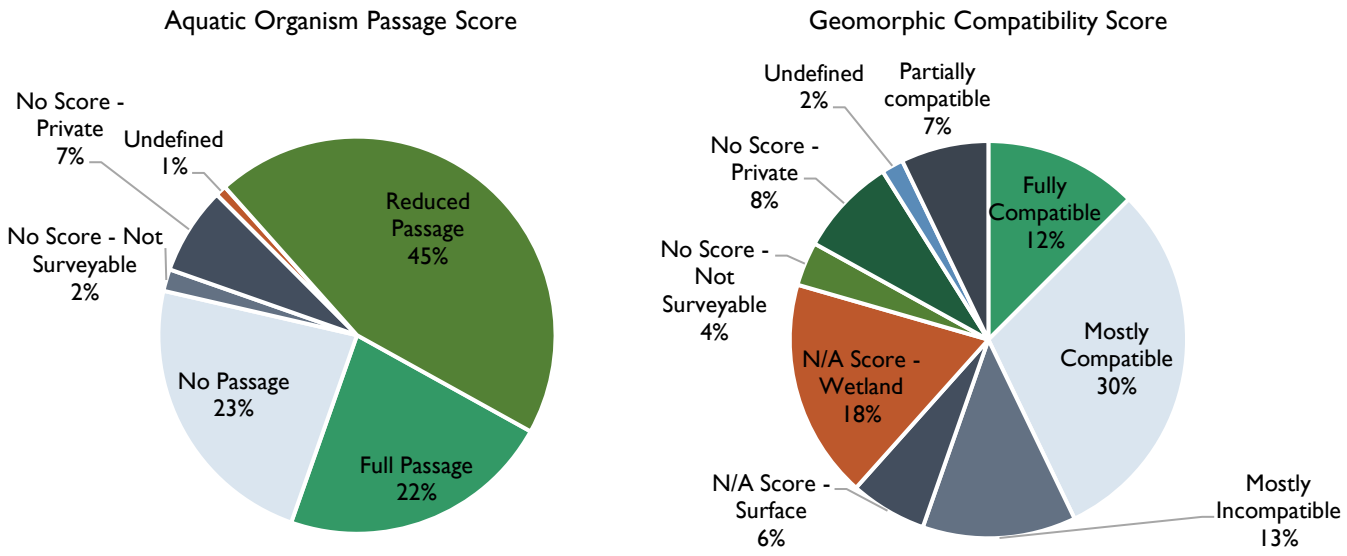


Figure 17. Stream crossing initiative Aquatic Organism Passage and Geomorphic Compatibility scores for 112 stream crossings in Rochester (Source: Aquatic Restoration Mapper, NH Stream Crossing Initiative)

16.4 Wildlife Action Plan Habitat Ranking

Refer to the Wildlife Action Plan Map Analysis Information to learn more about the process of ranking habitat.

Habitat types are ranked in the New Hampshire Gish and Game Wildlife Action Plan according to one of four categories based on the condition of the habitat relative to other areas of that habitat in the state and in the biological region. This analysis helps identify the most ecologically intact wildlife habitat areas. [75] Table 19 displays the acres of each of these rankings within Rochester. As shown in Figure 18 and large format Map 14, many blocks of ranked habitat coincide with existing conservation land, particularly along the west side of Pickering Road, between Crown Point Road and Washington Street, and northeast of Salmon Falls Road.

Table 19. Wildlife Action Plan 2020 habitat ranking (NH Geodata Portal, 2020 WAP)

WAP Tier	Acres	% of Area of City
Tier 1 Highest Ranked in the State by Ecological Condition	1,506.1	5.2%
Tier 2 Highest Ranked in the Biological Region by Ecological Condition	1,362.51	4.7%
Tier 3 Supporting Landscapes	6,273.8	21.6%
Not top ranked (all the rest)	19,921.5	68.5%
Total	29,064.0	100.0%

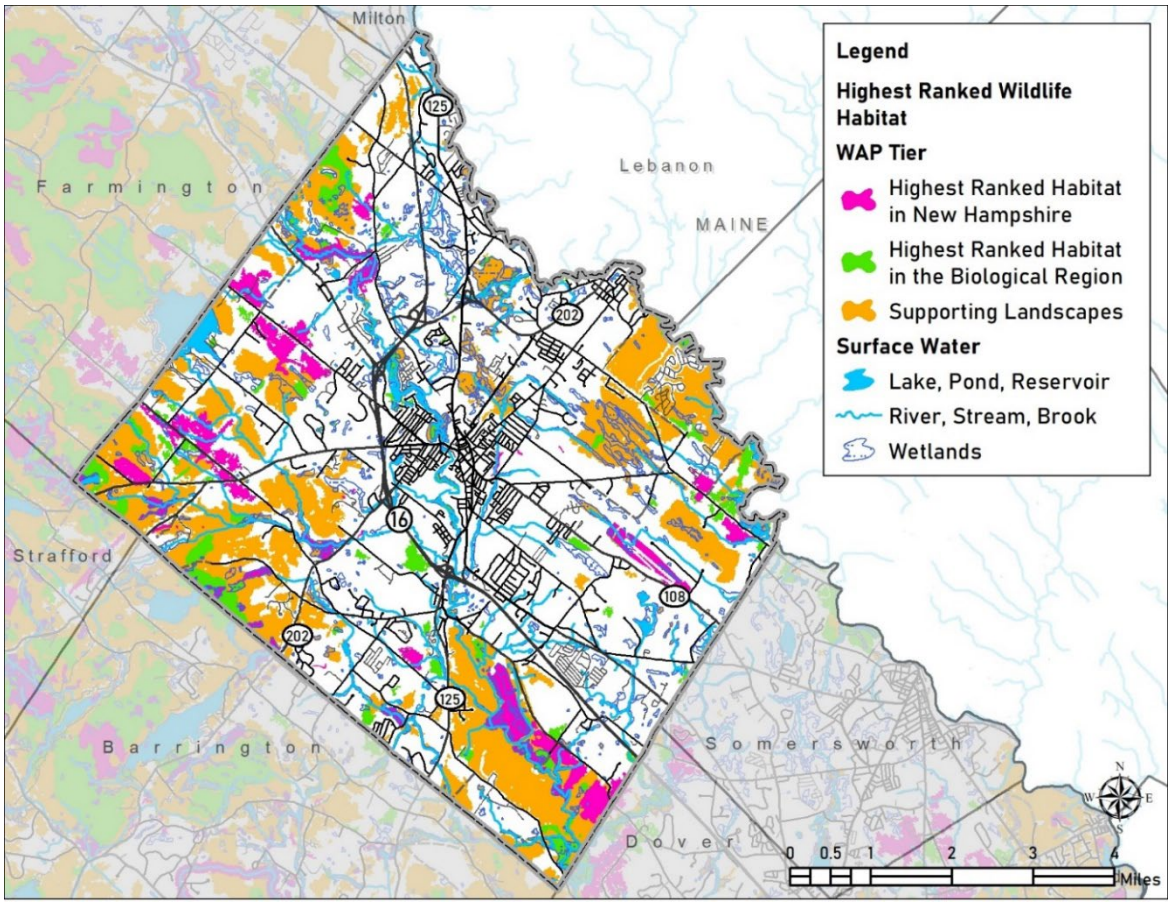


Figure 18. 2020 Wildlife Action Plan (WAP) highest ranked habitat (Source: NH Geodata Portal, 2020 WAP)

16.5 Prioritized Habitat Blocks and Wildlife Corridors

Connected landscapes are critical for wildlife habitat and movement. Within New Hampshire's coastal watershed, there is a risk that conserved land will become isolated habitat islands separated by roads and development. Maintaining connections and migration pathways between habitat areas is essential for long-term sustainability of wildlife population.[76] This will be particularly important as changes in temperature and precipitation alter the distribution of habitat, driving wildlife to navigate and occupy new landscapes over time.

> "Connect The Coast priorities provide the necessary information for stakeholders, whether land trusts, town planning and conservation boards, state regulators, road managers, project funders, or landowners, to identify the places to protect that will maintain opportunities for wildlife to move across the landscape, both now and into the future."
>
> Source: Connect the Coast

Connect the Coast identified connecting lands for wildlife across the portion of the Piscataqua-Salmon Falls watershed that drains through New Hampshire using spatial models. Within this area, wildlife corridors, or connected lands and waters with suitable and intact dispersal habitat, comprise 10% of the landscape, while 19% is prioritized as unfragmented habitat for wildlife. Land identified as wildlife corridors accounts for approximately 6.5% (1,896.3 acres) of the total area of Rochester. Eight prioritized habitat blocks are located in Rochester (Table 20), totaling 2,438.4 acres or 8.4% of the area of the city. The location of these wildlife corridors and prioritized habitat blocks is shown in Figure 19 (see also large format Map 17). A total of 225.4 acres of wildlife corridors, or about 13.5% of the area of these suitable corridors, coincide with existing conservation and public lands, Approximately 833.3 acres of prioritized habitat blocks coincide with existing conservation and public lands, indicating that over one third of these areas are already protected.

Table 20. Prioritized habitat blocks identified in Connect the Coast (Source, NH Geodata Portal, Connect the Coast)

Name	Source	Acres	Percent of City
Rochester Neck (Cocheco / Isinglass confluence)	CWLCP[1]	825.2	2.8%
Preston Pond	CWLCP/WAP[2]	555.0	1.9%
Rochester Heath Bog 4	CWLCP	245.7	0.8%
Rochester Heath Bog 5	CWLCP	67.3	0.2%
Rochester Heath Bog 2	CWLCP	53.6	0.2%
Rochester Heath Bog 3	CWLCP	229.5	0.8%
Rochester Heath Bog 1	CWLCP	84.7	0.3%
Stepping Stone Add-in	Stepping Stone[3]	377.4	1.3%
	Total	2438.4	8.4%

[1]Coastal Watershed Land Conservation Plan (2006)
[2]NH Wildlife Action Plan (2015)
[3]Stepping stone nodes were added in areas where long distances separated nodes from the course conservation plan based on larger assemblages of conservation land, Wildlife Action Plan tier one and two areas in New Hampshire, or unfragmented habitat blocks

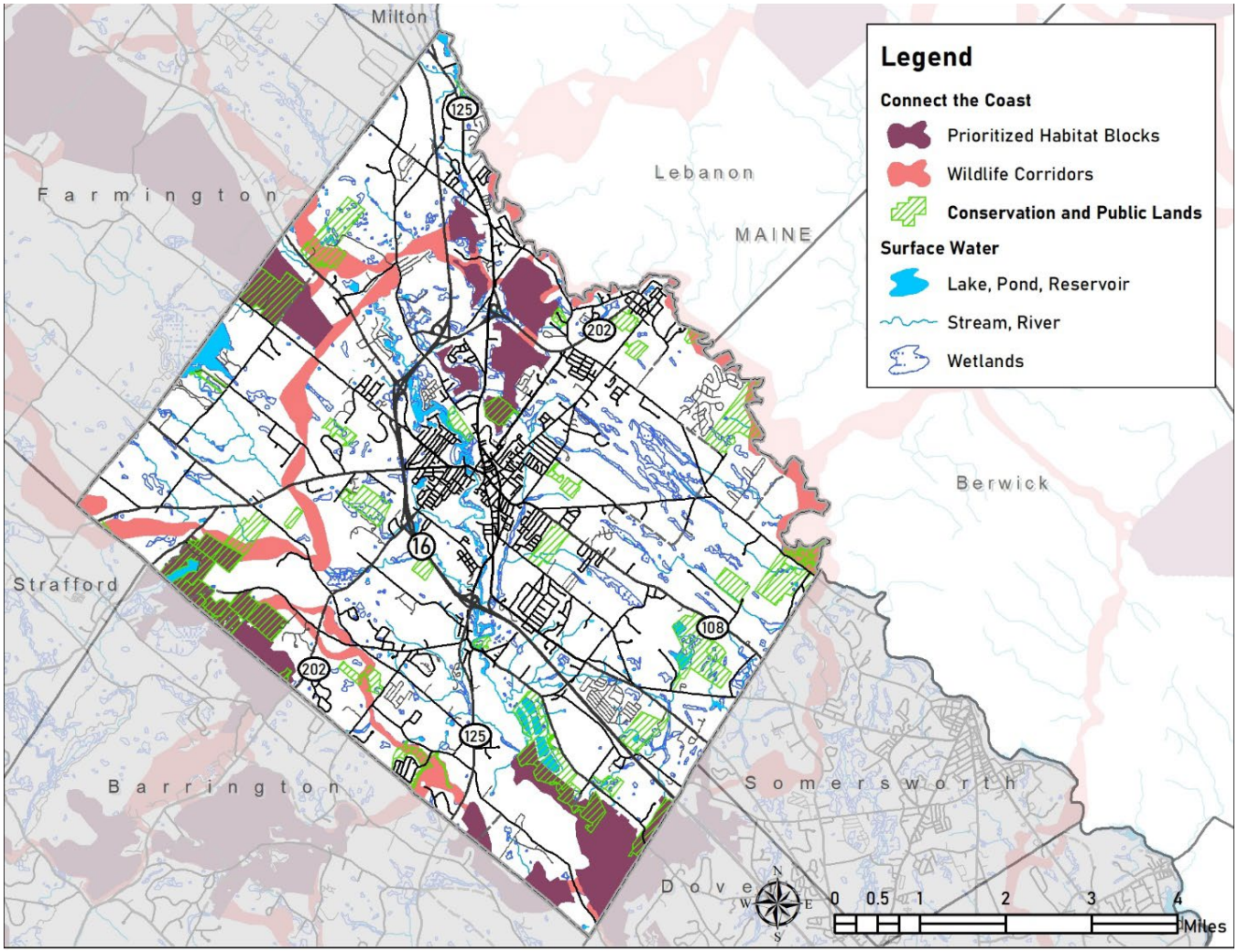


Figure 19. Connect the Coast Prioritized Habitat Blocks and Wildlife Corridors (Source: NH Geodata Portal, TNC Connect the Coast)

Geographic data from the Wildlife Action Plan, Connect the Coast, and New Hampshire's Coastal Watershed Conservation Plan (described below) can be viewed online — along with parcels and roads, surface waters, conservation land, and other data — through the NH Geodata Portal. These datasets can provide landowners with information about the natural resources in the vicinity of their property and can guide future land acquisition and protection efforts.

16.6 Conservation Focus Areas

New Hampshire's Coastal Watershed Conservation Plan identifies key conservation priorities across the coastal watershed that drain to the Atlantic Ocean via the Piscataqua River and through the Hampton-Seabrook Estuary. The plan, which is an update of the original 2006 Coastal Watershed Conservation Plan and 2016 Water Resources Focus Area Supplement, identifies coastal conservation focus area as well as priority agricultural resources. The plan identifies and prioritizes high value natural resources to conserve and restore through land protection, land use decision making, and management.

Coastal Conservation Focus Areas encompass conservation priorities to maintain ecological function and integrity across a landscape that is under threat from habitat loss, habitat degradation, and the impacts of climate change.

Coastal Priority Agricultural Resources represent the highest priority agricultural lands based on their productivity, versatility, and resilience.

A map of the conservation focus areas identified in the Coastal Watershed Conservation Plan shown in Figure 20 and in large format Map 16.

In 2023, the Conservation Commission, with support from the Piscataqua Region Estuaries Partnership, reviewed this dataset and determined that it was an appropriate guide for future land conservation efforts. The Conservation Commission integrated the data from the Coastal Watershed Conservation Plan into its Land Acquisition Criteria Evaluation (LACE) form.

Table 21 displays the acreage of conservation focus areas within the state and Rochester. In Rochester, a total of 4,532.2 acres of land (16% of the area of the city) scored at least 4.5 on a scale of zero to eighteen, which is the threshold at which an area of land was considered a conservation focus area. At a watershed scale, the percentage of land identified as a conservation focus area (41%) is over twice that of Rochester. Approximately 1,077.7 acres (23.8%) of the conservation focus areas coincide with existing conservation and public lands, which is similar to the portion of conservation focus areas conserved at a watershed scale (28.4%).

The Coastal Watershed Conservation Plan also identifies priority agricultural resources. Watershed-wide, coastal priority agricultural resources account for under five percent of the watershed. Within Rochester, there are approximately 1,966.3 acres of priority agricultural resources, accounting for 6.8% of the land area of the city (Figure 20).

Refer to Appendix 10 for a list of the spatial datasets prioritized in NH's Coastal Watershed Conservation Plan.

Table 21. Acres of Coastal Conservation Focus Areas and percent of total area (Source: NH Geodata Portal, 2021 Coastal Watershed Conservation Focus Areas)

Location	Conservation Focus Areas	
	Acres	Percent of Total Area
New Hampshire	216,889	40.8
Rochester	4,532.2	16.0

"The [Coastal Watershed Conservation] plan results in a vision that prioritizes the protection and integrity of natural systems and natural infrastructure to support resilient human communities. Through its prioritization, the plan also balances these protections with opportunities for economic growth and development."

Source: Excerpt from NH's Coastal Watershed Conservation Plan

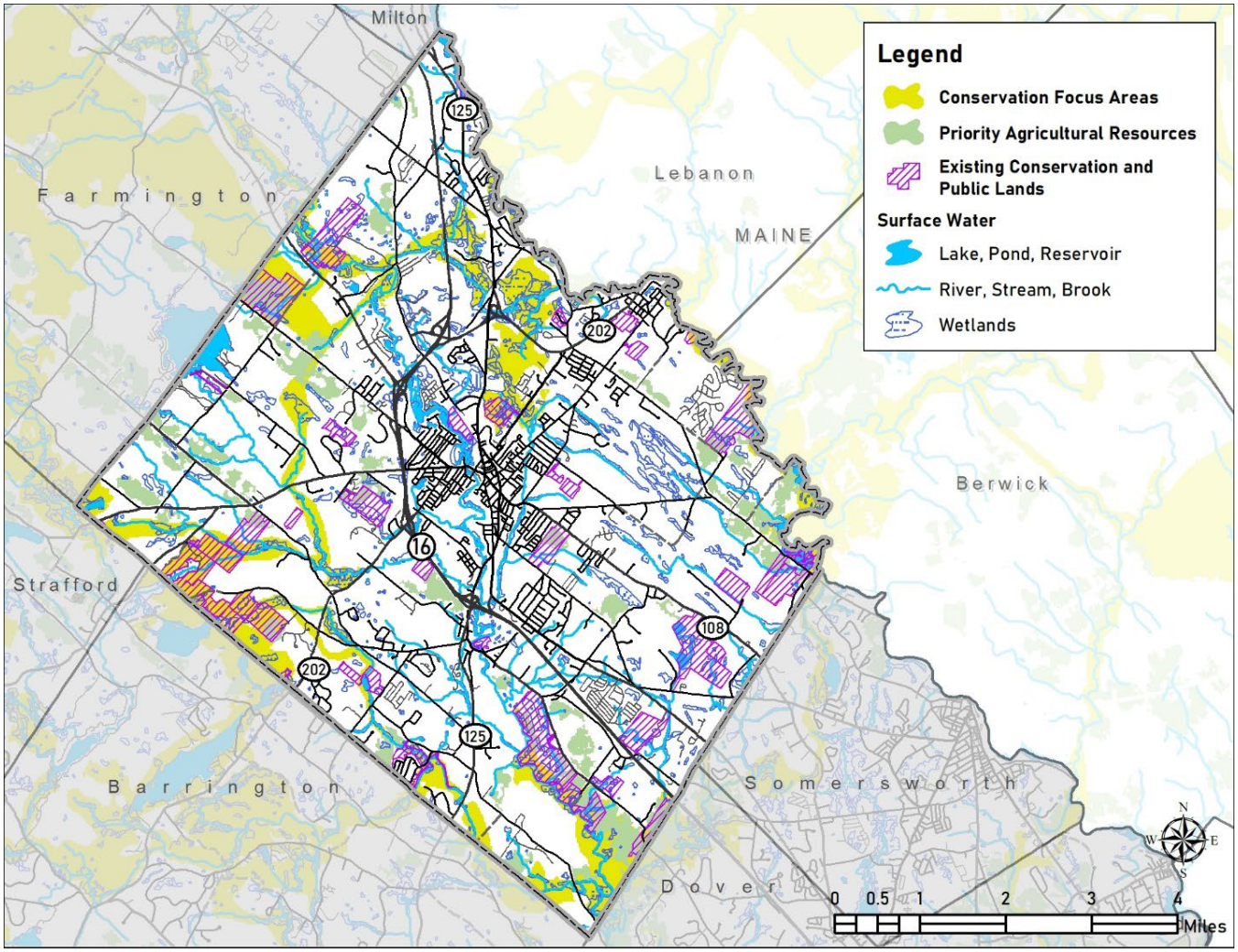


Figure 20. Conservation focus areas and priority agricultural resources (Source: NH Geodata Portal, 2021 Coastal Watershed Conservation Focus Areas, Priority Agricultural Resources)

16.7 Water Resource Protection Areas

The 2016 supplement to The Land Conservation Plan for New Hampshire's Coastal Watersheds (2006), The Land Conservation Priorities for the Protection of Coastal Water Resources: A Supplement to The Land Conservation Plan for New Hampshire's Coastal Watersheds, identified land conservation opportunity areas that provide the greatest benefits to coastal water resources with respect to threats associated with existing and future development including. This dataset informed the Coastal Watershed Conservation Plan, described in the previous section, but also warrants attention as it provides a unique look at water resource benefits. Three categories are identified:

- Pollutant attenuation and removal: riparian buffers that intercept stormwater runoff and at the same time maintain natural cover adjacent to surface waters, and riparian wetlands that are highly efficient at treating pollutants already in surface waters;
- Flood storage and risk mitigation: areas across the watershed with high flood storage capacities that reduce flood risks to downstream infrastructure, and natural areas that will accommodate sea level rise and salt marsh migration; and
- Public water supply: lands that safeguard surface and groundwater resources for human consumption. [77]

> The link between development and declining water quality is provided by a range of pathways including:
>
> 1. The loss of lands under natural cover that provide important ecosystem services such as water purification, flood water retention, and groundwater recharge
>
> 2. An increase in pollutant loads to surface waters, stormwater runoff, and flood risk to downstream areas
>
> 3. An increase in valuable public and private infrastructure that is both reliant upon and often degrades key ecosystem services such as clean water.
>
> Source: Excerpt from Land Conservation Priorities for the Protection of Coastal Water Resources

A total of approximately 8,294 acres of land provide one or more of these benefits. These areas are shown in Figure 21 and large format Map 12 and quantified in Figure 22. The water resource priority map can be used to identify potential areas to protect or conserve that provide benefits to aquatic systems as well as people and development. The mapped areas that safeguard surface and groundwater resources cand be used to guide aquifer and drinking water protection regulatory updates. It will become increasingly important to preserve the flood storage capacity of lands near the city center that provide flood storage and risk mitigation as extreme precipitation events become more prevalent with climate change.

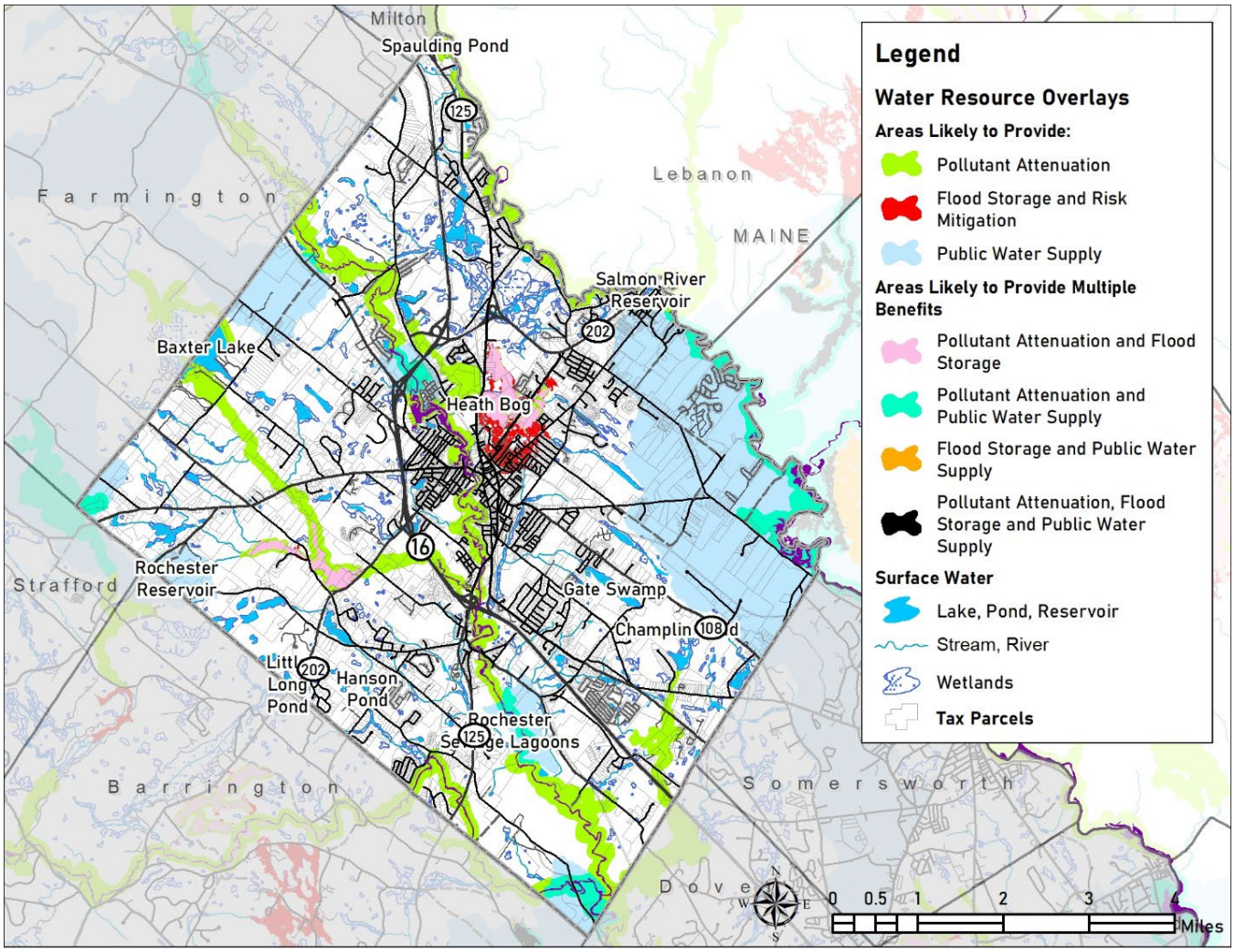


Figure 21. Land providing one or more benefits to water resources (Source: NH Geodata Portal, Water Resource Conservation Areas)

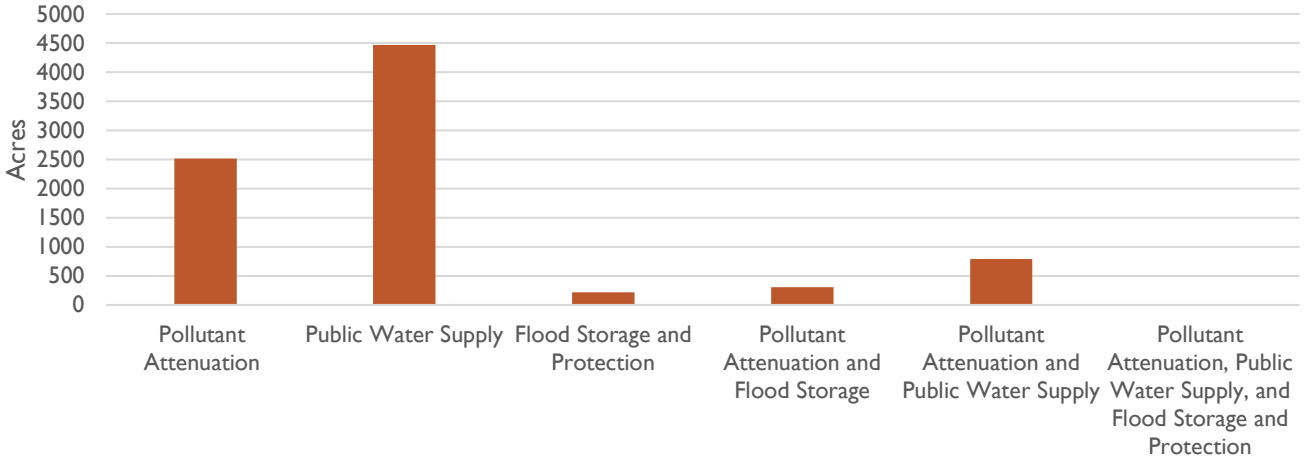


Figure 22 Acres of land providing one or more benefits to water resources (Source: NH Geodata Portal, Water Resource Conservation Areas)

16.8 Habitat Vulnerability

The rapid increase in human population and rate of development in New Hampshire places significant stress on native wildlife populations. The development of land and related activities impact both the availability and quality of wildlife habitat. Rochester contains several ecologically significant areas that provide habitat for both rare and common species of wildlife. These important wildlife habitats and corridors can be protected through measures including conservation and through regulating site design and development practices.

The loss of habitat through the conversion of land from its natural state to a developed landscape threatens native wildlife. Development can eliminate or significantly change many important habitat features found in a natural area, thereby reducing or eliminating the habitat value of that area. The impact of human activity on wildlife extends beyond the actual area of development. For example, development increases impervious surfaces and stormwater runoff, which carries pollutants to nearby streams and results in warmer water temperatures. Development also divides habitat. The preservation of wildlife corridors is particularly important to minimizing the impact of habitat fragmentation. Wildlife corridors are areas with very-low development density that connect large unfragmented lands that provide wildlife with habitat for food and shelter, as well as a place for migration and reproduction. Impacts of human activity on wildlife include permanent disturbances such as roads, utility lines, cleared areas for lawns and landscaping, and structures. For example, roads can disrupt or prevent passage across the disturbed area, provide an entrance for exotic species or predators, increase mortality, and increase unnatural disturbances from sources such as pollution and fire.[78]

Climate change is also a threat to habitats and species in New Hampshire. Hotter temperatures, periods of drought, and larger and more frequent rain events will impact the growing conditions for plants and alter the habitat for birds, mammals, fish, and insects. Conditions will become more favorable for non-native species and for invasive species. Preserved land may no longer support the ecosystems that it was intended to protect as species migrate north to find more suitable habitat and conditions. Maintaining wildlife corridors and connected habitat blocks, which provide pathways for movement, is critical to allowing for this movement.

Climate Change in New Hampshire

Over the next 20 years, average annual temperatures are expected to increase by 2.2 to 2.4°F compared to that of 1980 to 2009. Under a high emissions pathway, annual temperatures could increase as much as 9.5°F, though an increase of 5.4°F is more likely. Extreme temperatures and the number of days above 90°F are also anticipated to increase.

Total annual precipitation and the frequency and intensity of extreme precipitation are projected to increase. Seasonal increases during winter and spring will be greatest. Snowfall is projected to decrease by 20-50% by the end of the century.

Source: NH State Climate Assessment 2021

16.8.1 Habitat and Ecological Areas of Significance (HE) Recommendations

HE 1	Conduct a comprehensive natural resources inventory (NRI).
HE 2	Require subdivision and site plan review applicants to identify areas of ecological significance, including those identified through the Wildlife Action Plan, Connect the Coast, and The Coastal Watershed Conservation Plan.
HE 3	Continue to use regional datasets that identify ecological areas of significance as a tool for identifying and prioritizing land acquisition, conservation, and preservation efforts.
HE 4	Protect large unfragmented blocks, wildlife corridors, natural communities, and rare, threatened and endangered species as part of land conservation and open space planning.
HE 5	Make Wildlife Action Plan guidance on habitats and their protection readily accessible to landowners and provide education about protection and conservation.
HE 6	Work with NHDES to remove and upgrade culverts that allow reduced or no aquatic organism passage and culverts with low geomorphic compatibility.
HE 7	Work with NHDES to remove dams that are obsolete or in disrepair to restore river flow.
HE 8	Collaborate with Nature Groupie to plan volunteer opportunities to educate and engage the community in habitat management.
HE 9	Amend Conservation Subdivision Regulations to require that a minimum of 50% of developable land be protected.
HE 10	Consider utilizing tools like transfer of development rights to encourage conservation and protection of areas of ecological significance.
HE 11	Require to the extent possible the retention and planting of trees within the urban core areas as part of the design of development projects.
HE 12	Require that protective fencing or markers are installed around trees that are to be preserved on a development site.
HE 13	Develop an urban forestry plan and program for the City.
HE 14	Conduct an urban street tree inventory. Recruit community members to assist with the inventory.
HE 15	Develop a street tree removal policy.
HE 16	Establish a City Tree Committee to advise elected officials and land use boards about retention of existing forest cover, and the maintenance and planting of City trees.
HE 17	Develop management plans for City-owned forest land.
HE 18	Implement recommendations from the Management Plan for Hanson Pines.

Nature Groupie, formerly known as The Stewardship Network: New England, started as a collaborative project between the University of New Hampshire Cooperative Extension and The Stewardship Network (TSN) in the Great Lakes. Nature Groupie is a collaborative stewardship and volunteer networking organization that helps match organizations with volunteers. Nature Groupie empowers generations of outdoor enthusiasts to volunteer for nature in New England.

17 WILDLIFE, PLANTS, AND INVASIVE SPECIES

17.1 Wildlife

Over 500 vertebrate animal species and many more invertebrates are found in New Hampshire. Approximately 75% of animal species are nongame wildlife. Within the state, there are 27 species that are listed as state or federally endangered and 14 that are threatened.[79] Table 22 summarizes the number plants, birds, reptiles, amphibians, and fish species tracked and their status. For a complete list of the NH Natural Heritage List of natural communities and plants and vertebrates that are of special concern, endangered, or threatened, refer to Appendix 11.

Rochester is home to one of six red maple floodplain forest natural communities reported in the last 20 years in the state. This is a palustrine (wetland) natural community that is considered of very high importance. Another important natural community identified as the poor level fen/bog system historically occurred in Rochester. It is still present in New Hampshire but has not been reported in the city within the last 20 years.

Rare Plants, Rare Animals, and Exemplary Natural Communities in New Hampshire Towns, July 2020

New Hampshire Natural Heritage is a bureau of the NH Division of Forests & Lands that finds, tracks, and facilitates protection of rare plans and exemplary natural communities.

NH Natural Heritage studies 686 plant and animal species, 197 natural communities, and 45 natural community systems and maintains a database of more than 7,300 species, natural communities, and system occurrences throughout the state.

Sora (*Porzana Carolina*) (D Lester/Wikimedia)

State listed endangered plant species that have been reported in Rochester in the last 20 years are Button sedge *(Carex bullata)*, Long's bulrush *(Scirpus longii)*, and variable *sedge (Carex polymorpha)*. Dwarf huckleberry *(Gaylussacia bigeloviana)* is the only state listed threatened species that has been reported in Rochester in the last 20 years.

The bald eagle *(Haliaeetus leucocephalus)* is the only federally listed endangered or threatened species found in Rochester. The bald eagle and sora *(Porzana carolina)* are bird species of concern that have been reported in the last 20 years. Threatened and recently reported birds include the Common loon *(Gavia immer)*, eastern meadowlark *(Stumella magna)*, and pied-billed grebe *(Podilymbus Podiceps)*.

There have been 15 reports of Blandings turtle *(Emydoidea blandingii)*, a state listed endangered species, in Rochester in the last 20 years. Two threatened reptile species, the Northern Black Racer (Coluber constrictor constrictor) and spotted turtle *(Clemmys guttata)*, as well as two reptiles species of concern, the smooth green

snake (Opheodrys vemalis) and wood turtle *(Glyptemys insculpta)*, have also been reported in the city in the last two decades.

The Jefferson/blue-spotted salamander complex (*Ambystome* pop. 3) was reported once within the last 20 years in Rochester and only 19 times in the state. The redfin pickerel (*Esox americanus americanus*) is the only fish of special concern that has been reported in recent years in Rochester. Historically, the American eel (*Anguilla rostrata*) was present. Species currently listed in the Wildlife Action Plan as *species of greatest conservation need* in Rochester are included in Table 23. Refer to Species of Greatest Conservation Need, compiled with the Wildlife Action Plan, for a state-wide listing of species of greatest conservation need.

Visit the NH Wildlife Action Plan website for Resources for Protecting Wildlife

Table 22. Summary of NH Natural Heritage documentation of listed and species of concern and importance in Rochester (Source: NH Natural Heritage, July 2020)

	Plants	Birds	Reptiles	Amphibians	Fish	Total
Total # of Species Tracked	10	9	5	1	2	27
State Listed Species						
Endangered	6	1	1	-	-	8
Threatened	4	4	2	-	-	10
Special Concern	-	3	2	-	2	7
Flags[a]						
Highest importance	-	-	-	-	-	0
Extremely high importance	1	-	1	-	-	2
Very high importance	2	6	4	1	1	14
High importance	1	-	-	-	-	1
Historical Record	6	3	-	-	1	10
Species Reported in Last 20 Years[b]						
In Rochester	4	6	5	1	1	17
In New Hampshire	10	9	5	1	2	27

[a] Flags are based on a combination of (1) how rare the species is and (2) how large or healthy its examples are in that town.

[b] Refer to Appendix 11 for the count of each species reported within the last 20 years.

Table 23. Species reported in Rochester in the last 20 years that are identified as ***species of greatest conservation need*** in the NH Wildlife Action Plan (Source: NH Wildlife Action Plan)

Species of Greatest Conservation Need	
Bald eagle	Blanding's turtle
Common loon	Smooth green snake
Eastern meadowlark	Spotted turtle
Marsh wren	Wood turtle
Pied-billed Grebe	Blue-spotted/Jefferson salamander complex
Sora	Redfin pickerel

17.2 Native and Beneficial Plant Species

New Hampshire's existing native plant communities have developed and evolved since the end of the last ice age, adapting to variations in climate and nature succession. Native plants form the structure of our natural landscapes – the canopy, understory and groundcover of forests, riparian areas adjacent to rivers and streams, and open meadows. Native plant communities provide vital and specific habitat for wildlife that depend on them for food and shelter.

Common milkweed (*Asclepias syriaca*) (Liz Durfee)

Native plants have several advantages over exotic or introduced species, including seasonal hardiness, resistance to pests (fewer chemical treatments), and low maintenance needs (less water and fertilizer). These advantages are due to the adaptation by native plants to local climate and environmental conditions.

Through the Native Plant Protection Act, the NH Natural Heritage Bureau compiles data and maintains lists protect threatened and endangered plant species and develops recommendations to ensure that populations are recovered and sustained. Native and beneficial species commonly found in certain habitats and environmental settings are identified in Table 24. Refer to Appendix 11 for a complete list of natural communities and plants that are of special concern, endangered, or threatened.

Table 24. Native and beneficial species by habitat and environmental conditions (Source: 2009 Natural Resources Chapter, US Department of Agriculture, NH Natural Resources Conservation Service)

Habitat-Environmental Conditions	Native Plants
Dry Sites	Pitch Pine, Native Lupine, Bayberry, Butterfly-weed, Stiff Aster, Red Pine, Scrub Oak, Lowbush Blueberry, Bracken Fern, Sweetfern, Little Bluestem, Switch Grass, Big Bluestem, Wild Rye
Moist Sites	White Pine, Beech, Red Oak, Hemlock, White Ash, Sugar Maple, Yellow Birch, Flowering Dogwood, Sassafras, Basswood, Solomon's Seal, Black Cherry, Elderberry, Wood Fern, Wild Yellow Lilly, Virgin's-bower, Highbush Blueberry, Bee-Balm, Columbine, Jewelweed
Wet Sites	Jack-in-the-pulpit, Cardinal Flower, Prairie Cordgrass, Ostrich Fern, Rushes, Sedges, Red Osier Dogwood, Silky Dogwood, Turtlehead, Balsam Fir, Red Spruce, Red Maple, Hemlock, Northern Arrowwood, Winterberry, Atlantic White Cedar, New England Aster, Blue Flag Iris, Sweet Flag
Streambanks and Shorelands	Willow, Silver Maple, Speckled Alder, Smooth Alder, Sycamore, Monkey Flower, Switch Grass, Pussy Willow
Shallow Ponds	Bur-reed, Buttonbush, Pondweed, Sedges, Rushes, Duck Potato, Fragrant Water Lily, Yellow Water Lilly, Pickerelweed, Wild Rice, Duck Weed

17.3 Invasive Species

An invasive species is a plant, insect, or fungal species that is not naturally present in a particular region and has the ability to thrive and spread aggressively outside its natural habitat or climatic range. Invasive species typically possess certain traits that give them an advantage over many native species, including the production of many offspring, early and rapid development, easily and efficiently spread, adaptability, tolerance of a broad range of environmental conditions, resistance to disease, and absence of natural controls to keep them in check (disease, competition, predators). These traits allow invasive species to be highly competitive and, under certain conditions, suppress or completely replace native species. In this manner, invasive species can reduce natural diversity, impact endangered or threatened species, reduce wildlife habitat, create water quality impacts, stress and reduce forest and agricultural crop production, damage personal property, and cause health problems.[80]

The State's Invasive Species Program aims to prevent and rapidly respond to exotic aquatic species that threaten freshwater systems in New Hampshire. The five focal areas of the program are:

1) Prevention of new infestations

2) Monitoring for early detection of new infestations to facilitate rapid control activities

3) Control of new and established infestations

4) Research towards new control methods with the goal of reducing or eliminating infested areas

5) Regional cooperation.

Grants are available to municipalities and lake associations for control and prevention of state-listed exotic aquatic plants.

Invasive species impact terrestrial and aquatic ecosystems. Nearly 100 waterbodies across New Hampshire are impacted by aquatic exotic/invasive species. NHDES maintains a list of impacted waterbodies, many of which are under active management.[81] According to the NHDES Lake Information Mapper[ix], there are no known invasive species in the Rochester Reservoir, Baxter Lake, Round Pond, or Hanson Brook. Variable milfoil was discovered in the Cocheco River upstream of the Wyandotte dam in 2000.[82]

Public education is an important part of controlling existing invasive plants and preventing new infestations. The NH Guide to Upland Invasive Species is one educational resource available to the City staff and officials, residents, and developers. to Educational material on a variety of aquatic invasives is also available through NHDES. Zoning and land use regulations can play a role in preventing invasive species. The City's Zoning Ordinance prohibits installation of any plants clearly determined to be invasive or destructive and references the prohibited invasive species list maintained by the NH Department of Agriculture, Markets, and Food. Appendix 2 of the Site Plan Review Regulations identifies a list of prohibited invasive plants.

There are several grants and funding opportunities available to control invasive species.

[ix] Accessed August 9, 2023

Wildlife, Plants, and Invasive Species (WI) Recommendations

WI 1	Encourage pollinator habitat.
WI 2	Continue to encourage the use of native plants and trees in landscaping plans as part of subdivision and site plan review approvals.
WI 3	Collaborate with wildlife specialists to develop wildlife management policies to protect migratory wildlife (such as signage at common crossing locations).
WI 4	Improve management of invasive species in the maintenance area surrounding municipal stormwater management structures (basins, swales, access ways) and within wetland buffers if nearby these structures.
WI 5	Encourage removal of invasive species as part of all development projects as a condition of approval, where applicable and beneficial.
WI 6	Collaborative with scout groups, Nature Groupie, schools, religious organizations, businesses, and others to conduct invasive species removal workdays.
WI 7	Develop and implement invasive species remediation plans to remove significant populations of invasive species, including Phragmites, Purple Loosestrife, Burning Bush, Bittersweet, Buckthorn, Japanese Barberry and Japanese Knotweed.
WI 8	Educate landowners and business owners about the benefits of native plans and the negative impacts of invasive species on native ecosystems.
WI 9	Educate landowners about how to manage or eliminate invasive species and encourage voluntary removal of invasive species.
WI 10	Expand the list of prohibited invasive plans in Appendix 2 of the Site Plan Review Regulations to include all prohibited plants maintained by the NH Department of Agriculture, Markets, and Food.
WI 11	Evaluate City management and maintenance practices to eliminate sources and distribution of invasive species contained in road sand and fill, and during municipal construction projects.

18 RESOURCE CONSERVATION AND PROTECTION

18.1 Land Conservation and Preservation

Land conservation is one of the most effective tools for preserving permanently vital natural resources, wildlife and habitat, and lands of historical and cultural importance.

94% of respondents to the Natural Resources Survey for this Master Plan Chapter updated indicated that the City should work with interested and willing property owners to conserve a greater percentage of land area in the City.

Open space preservation was identified as one of the top areas that survey respondents think the City should focus on.

Over 85% of respondents said they were interested or very interested in learning more about land conservation.

According to the New Hampshire GRANIT GIS Clearinghouse, which maintains a statewide database of *Conservation and Public Lands* available on the NH Geodata Portal, there are 2,990.4 acres of conservation and public lands in Rochester. This figure includes land that that has varying levels of protection, including permanently protected land and land that is owned by the municipality and used in such a way that it is unlikely to be developed further. Today, 10.2% of the area of the city is conserved or public lands, which is over twice as much land as was protected in 2010. The total area of permanently protected land is 2,233.8 acres of land or 7.7% of the city's area.

Conservation and public lands are protected through a variety of mechanisms. In Rochester, most acreage is protected via conservation easement (59.3%) or fee ownership (37.2%) (Table 25). Figure 23 displays a map of conservation and public lands by type of protection. For information about the types of conservation methods available to property owners, see Conserving Your Land, Options in New Hampshire. A complete list of conservation and public lands is included in Appendix 12. Refer also to large format Map 9.

Table 25. Type of protection of conservation and public lands (Source: NH Geodata Portal)

Type of Protection	Number of Parcels	Acres	% of Conservation and Public Lands	% of Total Area of City
Conservation Easement	38	1,772.3	59.3%	6.1%
Deed Restriction	1	0.4	0.0%	0.0%
Flowage Rights or Easement	2	61.5	2.1%	0.2%
Fee Ownership	25	1,113.4	37.2%	3.8%
Set Aside Open Space Areas of Development	1	42.8	1.4%	0.1%
Total	67	2,990.4	0.0%	0.0%

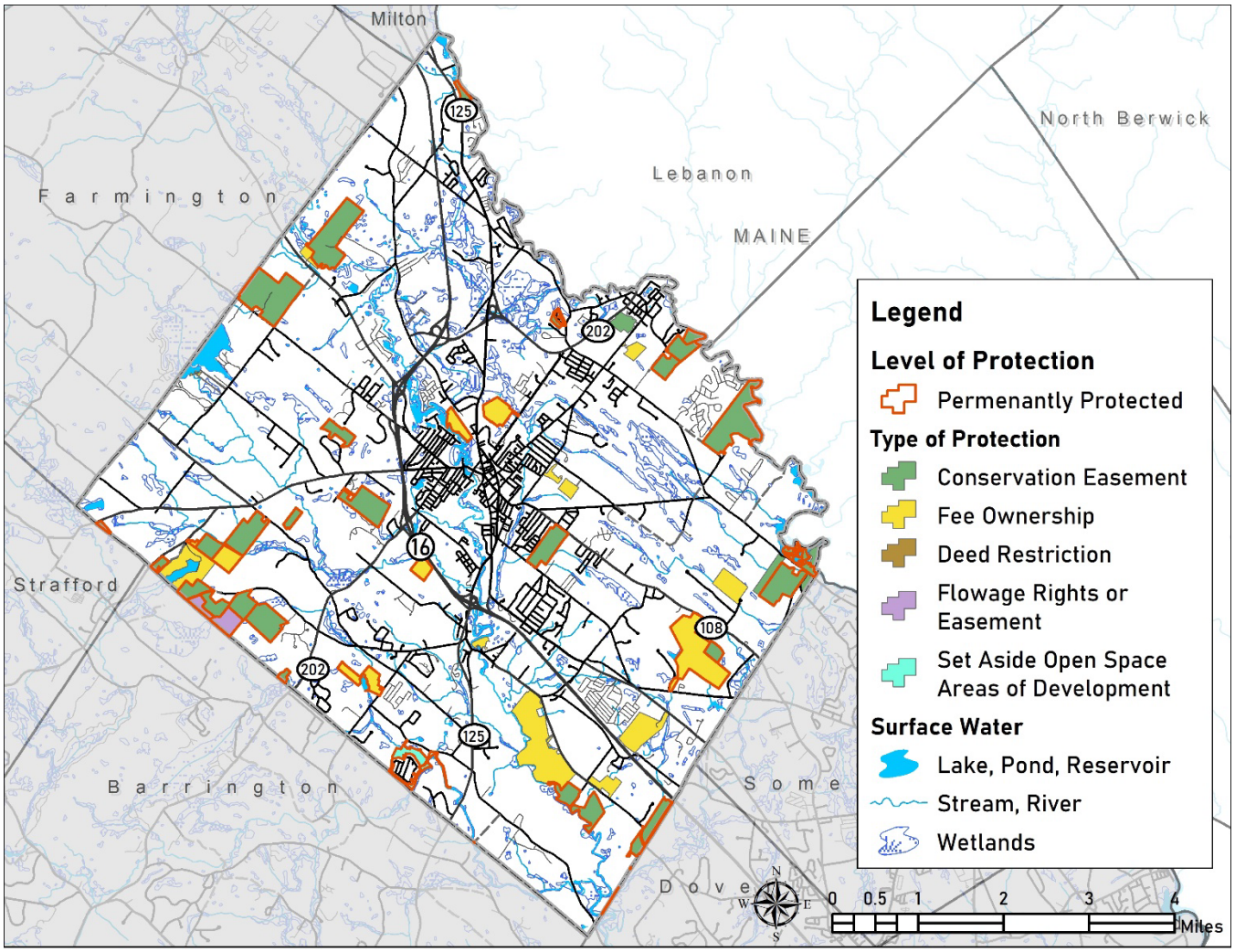


Figure 23. Existing conservation and public lands classified by the parcel's type of protection (Source, NH Geodata Portal, Conservation and Public Lands, updated March 2023).

Table 26 displays conservation and public lands by level of protection. The City owns nearly 20 acres of land that is designated as developed public land, including the Henderson Property and boat access areas on Baxter Lake. Unprotected water supply lands include the City Well Parcel and Department of Public Works-owned land surrounding the Rochester Reservoir.

Table 26. Level of protection of conservation and public lands (Source: NH Geodata Portal)

Level of Protection	Number of Parcels	Acres	% of Conservation and Public Lands	% of Total Area of City
Permanent Conservation Land	46	2,233.8	74.7%	7.7%
Unofficial Conservation Land	12	508.7	17.0%	1.8%
Unprotected Water Supply Land	2	174.4	5.8%	0.6%
Developed Public Land	4	19.8	0.7%	0.1%
Unknown	3	53.9	1.8%	0.2%
Total	67	2,990.4	100.0%	10.3%

The city of Rochester is identified as a "priority urban landscape" by the state Division of Forests and Lands, meaning it sees high population density, low tree canopy cover, and potential for future urban expansion.

Source: Rochester's Champlin Forest, A Rare Expansion of Protected Forest, The Rochester Post

A vast majority of conservation and public lands are protected by the City of Rochester (39.8% or 1,190 acres) or private landowners or entities such as the Southeast Land Trust (33.5%) or the Society for the Protection of New Hampshire Forests (6.9%) (Table 27). Other lands are protected by other municipalities, or state or federal government. These entities are responsible for protecting parcels from development.

Table 27. Primary protecting agency of conservation and public lands (Source: NH Geodata Portal)

Primary Protecting Entity	Number of Parcels	Acres	% of Conservation & Public Lands	% of Total Area of City
Rochester	30	1,190.1	39.8%	4.1%
Barrington	2	7.0	0.2%	0.0%
Dover	2	92.8	3.1%	0.3%
Somersworth	1	24.6	0.8%	0.1%
USDA NRCS	5	256.3	8.6%	0.9%
NH Fish & Game	3	5.4	0.2%	0.0%
Strafford County Conservation District	4	201.6	6.7%	0.7%
Bear Paw Regional Greenways	1	5.7	0.2%	0.0%
Society for the Protection of New Hampshire Forests	2	204.9	6.9%	0.7%
Southeast Land Trust	17	1,002.0	33.5%	3.4%
Total	67	2,990.4	100.0%	10.3%

Funding for Land Conservation

In New Hampshire, there are several programs that fund conservation projects such as:

Forest Legacy Program

NH Land and Community Heritage Investment Program (LCHIP)

NH Conservation and Heritage License Plate Program (Moose Plate)

Aquatic Resource Mitigation Fund

NHDES Local Source Water Protection Grant Program

Land conservation is often opportunistic as it requires landowner interest and willingness to sell or donate their development rights. Rochester's Conservation Commission uses a Land Acquisition Criteria Evaluation (LACE) form to evaluate any property that it considers purchasing or holding an easement for. In 2023, the Conservation Commission worked with the Piscataqua Region Estuaries Partnership to review Geographic Information Systems (GIS) datasets and plans that provide information on land that provides important habitat or connectivity to other conserved lands. The Conservation Commission now uses lands identified in the New Hampshire Coastal Watershed Conservation Plan to identify corridors potential conservation projects and has updated its LACE accordingly. Refer to Figure 20 for a map of the lands identified in the Coastal Watershed Conservation Plan.

Survey input collected during the update of this chapter can also guide land protection efforts. Nearly three-quarters of survey respondents said that 'land that provides high quality wildlife habitat' should be considered when evaluating whether to conserve or permanently protect a property (Figure 24).

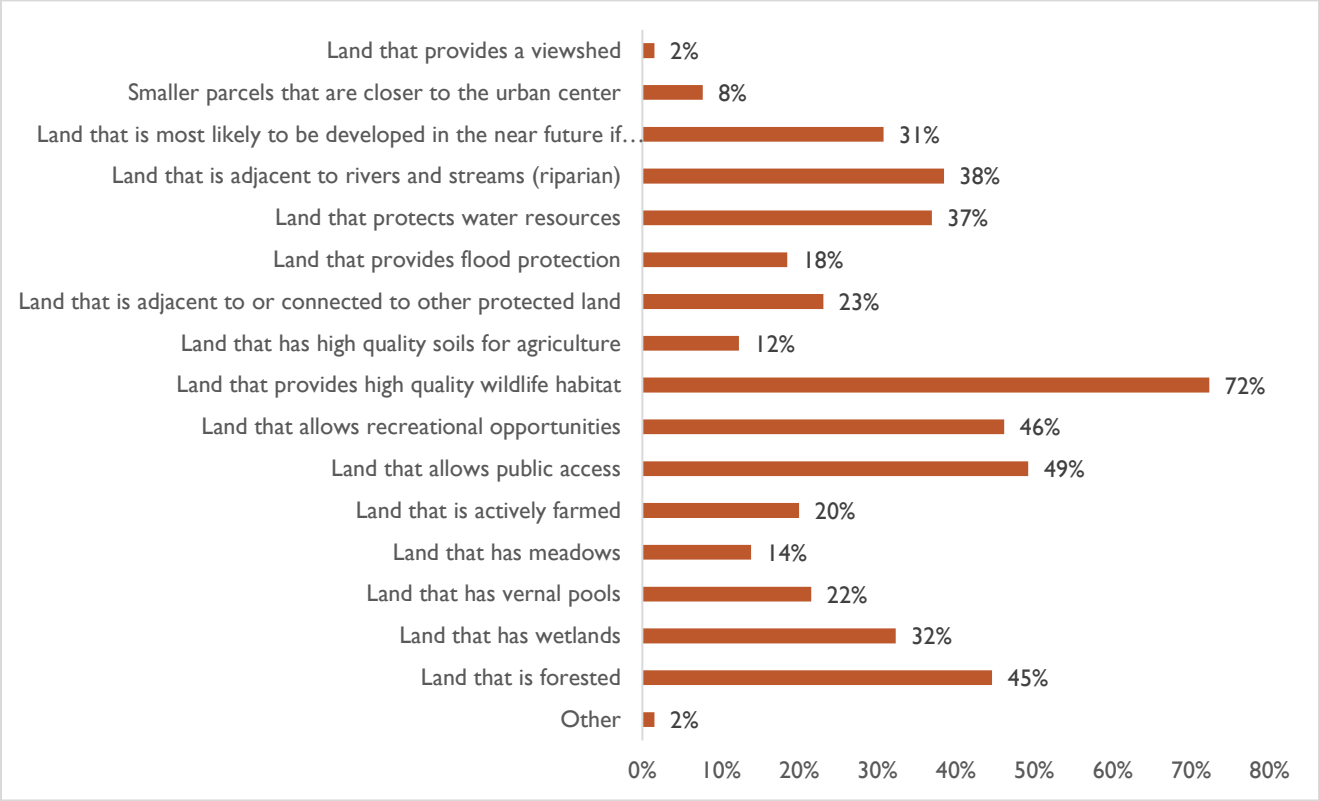


Figure 24. Values or characteristics that the Conservation Commission should they consider when evaluating whether to conserve or permanently protect a property from development (Source: Natural Resources survey for the Master Plan Chapter update, 2023).

Survey respondents also valued land that allows recreational opportunities and public access, and land that is forested, among other characteristics. When asked about what the City should focus on with respect to natural resources, 'open space protection' was among the top responses.[83]

18.1.1 Conservation Subdivision Regulations

Rochester's Conservation Subdivision Regulations (Zoning Ordinance 275-33) contain provisions for allowing subdivisions with smaller lot sizes and frontage requirements than a conventional subdivision provided areas of open space are maintained. In 2023, the Planning and Development Department initiated a comprehensive review and update of these regulations to improve the effectiveness of these regulations to serve as a land protection tool.

18.1.2 Agricultural Preservation

Agriculture is an important element of open space in Rochester. Preservation of agricultural lands is an effective means of preserving open space and natural resources due to the very nature of farmland use and management, and the large size of these undeveloped agricultural parcels. Managed forests, fields, orchards, and meadows provide important wildlife habitat, while row crops are sources of food and cover. Communities that encourage agricultural and forest-based business activities benefit by preserving rural character, scenic landscapes, natural resources and open space.

18.2 Current Use Property Assessment

Detailed information about Current Use can be found in the *Current Use Criteria Booklet* available from the Department of Revenue Administration.

Current use taxation, enabled under NH RSA 79-A, encourages preservation of open space by assessing qualifying land at a lower rate. Current Use is designed to help landowners reduce their taxes by assessing the land at its present use rather than its potential use, which also benefits the community by keeping lands as open space (i.e., forests, meadows, pastureland, and agriculture). To qualify, land must be ten or more acres and must be a forest, farm, or unproductive land. Learn more about this program from NH Fish and Game.

Approximately 37% of land area (10,594.9 acres) of Rochester is enrolled in the Current Use Program now (Table 28). While the total acres of land in current use have changed little in recent years, the number of parcels and property owners participating in the program has declined. Of the five current use categories – farm land acres, forest land acres, forest stewardship acres, unproductive land, and wetlands – forest land acres is the most prevalent type of land in current use, accounting for about 65% of land in the program (Figure 25).

Table 28. Current Use Program statistics (Source: NH Department of Revenue Administration)

Year	Acres in Current Use	Percent of Land Area in Current Use	Number of Owners	Number of Parcels
2021	10,595	37%	255	431
2020	10,630	37%	300	865
2019	10,662	37%	304	935

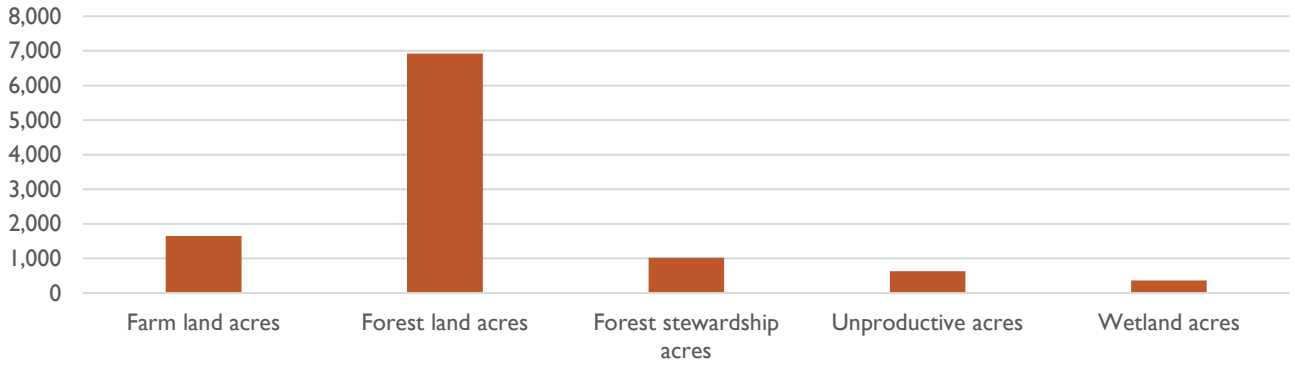


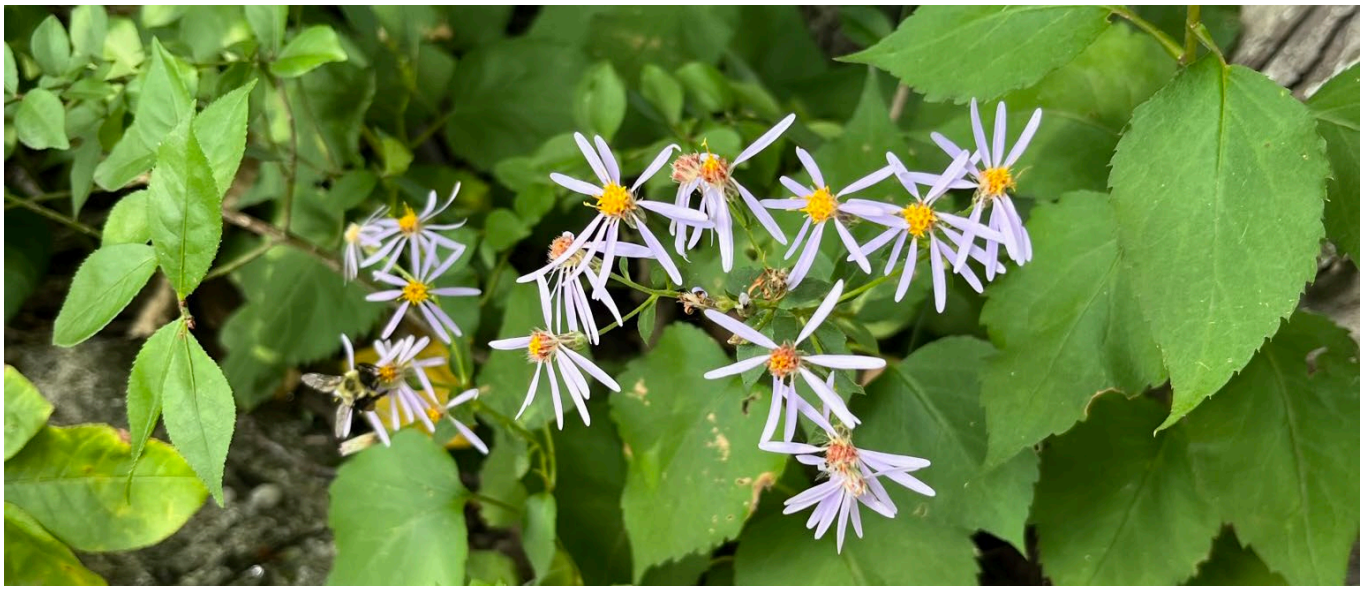
Figure 25. Acres of land in current use by current use category (2021) (Source: NH Department of Revenue Administration)

Current Use is not a method for permanent protection of open space. Land placed in Current Use can be removed from the program by the landowner when a change in land use occurs, at which time a penalty called the Land Use Change Tax is assessed. Many communities use this tax revenue to fund purchase of easements and fee simple acquisition of lands for preservation of open space and significant habitat and resources.

The Rochester City Council apportions a percentage (determined annually) of the Current Use Tax collected to the Conservation Commission. These funds are commonly used for conservation and protection of lands through fee simple acquisition, placement of easements on private lands, and outreach.

In FY22, the total tax valuation of land in current use was $1,145,516, or approximately 0.12% of the total land value.

(Source: 2021/2022 City of Rochester Annual Report)



(Liz Durfee)

18.2.1 Resource Conservation (RC) Recommendations

RC 1	Prioritize conservation of forests, woodlands, and agricultural.
RC 2	Encourage land use boards to engage the Conservation Commission early in the application and development review process to gain recommendations on natural resource conservation and protection.
RC 3	Partner with regional land trusts and watershed groups to identify shared goals and priorities for natural resource protection and land conservation.
RC 4	Develop a comprehensive management plan and natural resource protection strategies for City owned lands.
RC 5	Establish a stewardship program to monitor existing and future conservation easements held by and natural areas owned by the City.
RC 6	Provide volunteer opportunities related to natural resources such as river cleanups, water quality monitoring, trail maintenance, stewardship, or other opportunities.
RC 7	Develop a database of lands protected as part of subdivision and site plan approvals. Require the submission of GIS information for protected lands and open space as part of these applications.

Footbridge over the Cocheco River with Hanson Pines on the right (Courtesy of John Gisis)

19 PUBLIC AND RECREATIONAL RESOURCES

19.1 Natural and Scenic Recreation Areas

The following locations were identified in the 2009 Master Plan and through public input provided during the 2023 update of this chapter.

Hanson Pines Park

Over one-quarter of the individuals who responded to a natural resources survey for this Master Plan Chapter update indicated that Hanson Pines is a favorite place to enjoy nature in Rochester.

Hanson Pines, also called Dominicus Hanson Park, is a 30-acre natural area that reaches a half-mile along the banks of the river in the heart of Rochester. Long ago, this section of the river was channeled and dammed for the mills downstream. Today, it is a managed forest[x] with recreational features including footpaths, picnic tables and benches throughout the park. A footbridge crossing the river to Dewey Street provides a vantage point for wildlife and scenic viewing. The Cocheco River paddle launch is located just north of the park.

[x] The 2021 Forest Management Plan for Hanson Pines is available at https://www.rochesternh.gov/sites/g/files/vyhlif9211/f/uploads/hanson_pines_forest_management_plan_2021-09-10.pdf

Gonic Waste Management Trails & Mount Isinglass Recreational Area

Sign at the Gonic Trails (Liz Durfee)

The Mount Isinglass Recreational Area is a system of walking and biking trails through Rochester and Barrington. The trails wander alongside the Isinglass River with views of a small waterfall and through woodland areas, offering many opportunities for wildlife viewing. Fishing is also popular in the Isinglass River including fly-fishing and trout fishing in the fall. In winter the trails are groomed for cross-country skiing and the hike is very scenic.

The Gonic Trails at the Mount Isinglass Recreational Area off Rochester Neck Road is also popular for exploring and enjoying natural resources. Waste Management maintains several trails for walking, hiking, biking, snowshoeing, and cross-country skiing. The natural area includes a mix of deciduous and evergreen trees as well as historic sites such as stone walls, roads, a mill site, and the Watson Homestead. Hardwood mast trees including red oak, white oak, black oak, shagbark hickory, pignut hickory, beaked hazelnut, and beech provide food and habitat for wildlife. Other sections of the natural area include 100-year-old pines, hemlock, and managed forests. A 1/8-acre vernal pool is often present in the spring.[84]

Pickering Ponds

South of the intersection of Tebbetts Road and Pickering Road, Pickering Ponds in Gonic has trails that follow the dikes around two settling ponds and loop down along the river. The dikes are a vantage point for wildlife viewing in and around the ponds and river. Wildflowers and other wildlife are abundant in this mix of habitat areas. This is a favorite birding spot for sighting gulls, waterfowl, shorebirds, songbirds and raptors. In the winter, this area is excellent for cross-country skiing.


View of Picking Ponds (Liz Durfee)

Riverwalk

The river walkway behind the buildings on River Street and Bridge Street in downtown Rochester is a wonderful place to walk, picnic, watch for fish and wildlife, and learn about the history of Rochester. Many of the historic homes on River Street back onto the river. From Bridge Street to the Wyandotte Falls buildings, the falls are prominent and past the end of the buildings view the river downstream as it flows past the site of the historic box mill toward the fairgrounds. From the walkway the arches of the North Main Street Bridge are visible. The upper dam and the dam downstream of Bridge Street at Wyandotte Falls are relics of the manufacturing mills once powered by the river.

Four Phases of the Riverwalk Master Plan:

Phase 1. Hanson Ponds trail work

Phase 2. Downtown Riverwalk improvements

Phase 3. Work north of the Main Street Bridge

Phase 4. The Intervale and Future Projects

The 2018 Riverwalk Master Plan, which is a refined version of the 2007 plan, provides a base for future construction of the Riverwalk. The three primary purposes of the plan are:

1. Enhancement of Pedestrian Mobility and Circulation
2. Connection of the Urban Center to the River Corridor
3. Provide Opportunities for Recreation, Education, and Healthful Outings.

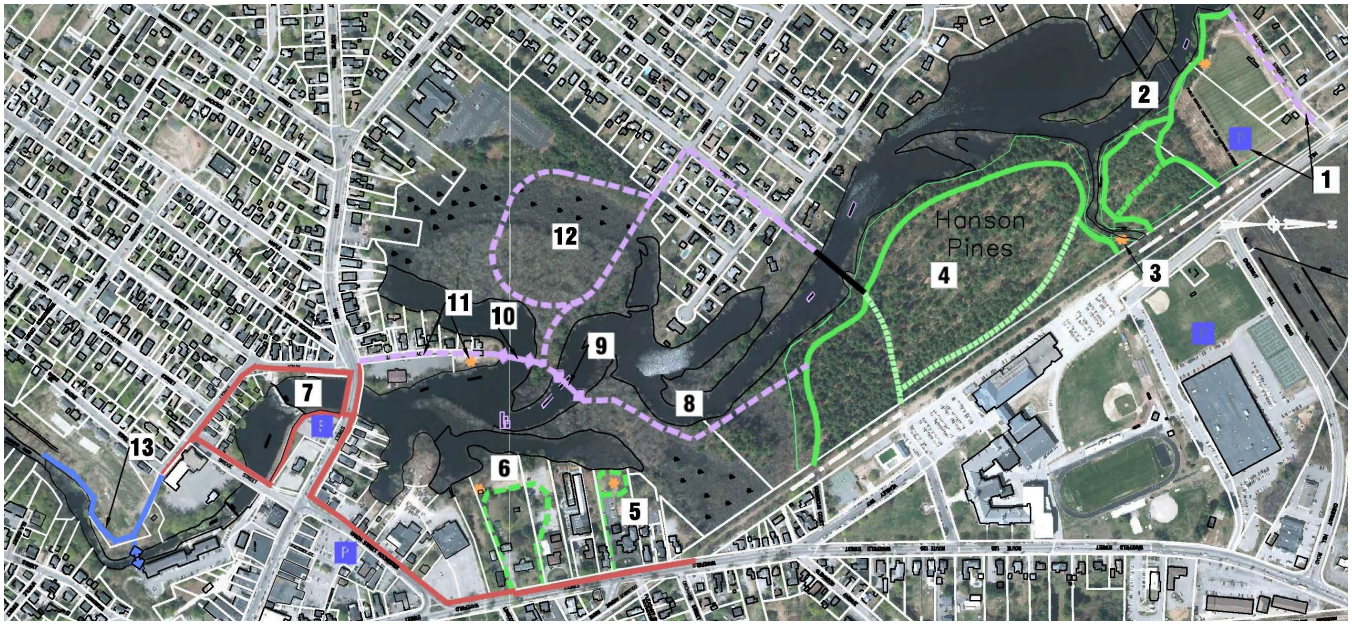


Image from The Riverwalk Master Plan

William H. Champlin Jr. Forest

Located off Route 108, Champlin woods offers extensive walking trails and excellent opportunities for wildlife viewing. Half of the property consists of well-managed, productive woodlands, containing marketable timber along with a diversity of wildlife habitats, consisting of a field, varied woodland types, vernal pools, and wetlands.[85] The Society for the Protection of New Hampshire Forests, which recently conserved an additional portion of the forest, also notes that the property serves as the headwaters of Clark Brook and contributes to two nearby public

water supplies. The addition to the Champlin Forest results in a connected habitat for wildlife and contributes to wetland mitigation goals to protect water quality of the Cocheco River watershed.[86]

Other Locations

Other areas for enjoying nature that were identified in the 2009 plan and public engagement efforts for the 2023 update include:

- Axe Handle Brook
- Henderson Farm
- Gagne Farm
- The kayak launch on the Cocheco River
- The Commons
- Areas behind Governor's Inn
- Central Square Park
- Prescott Park
- Rochester Hill
- Streets with sidewalks
- Backyards

Areas Outside of Rochester that Residents Like to Visit to Enjoy Nature:

- Blue Job Mountain
- Willand Pond
- Ayers Pond
- Bow Lake
- White Mountains
- Green Mountains, VT

Aerial view of Gagne Farm on Rochester Hill Road (Courtesy of John Gisis)

While there are many recreational opportunities at these locations, members who responded to the natural resources survey for this Master Plan Chapter update expressed interest in more opportunities for trail running and walking; canoeing, kayaking, and paddleboarding; snowshoeing; and swimming, in particular (Figure 26). Other recommendations included a community trail similar to and connecting to Dover and surrounding towns. Seventy percent of survey respondents indicated that they either agree or strongly agree that natural resources are accessible to them (Figure 27). Building a sense of accessibility to natural areas and recreational opportunities in these natural areas in important to cultivating a sense of appreciation and value and desire to preserve and protect the integrity of natural resources.

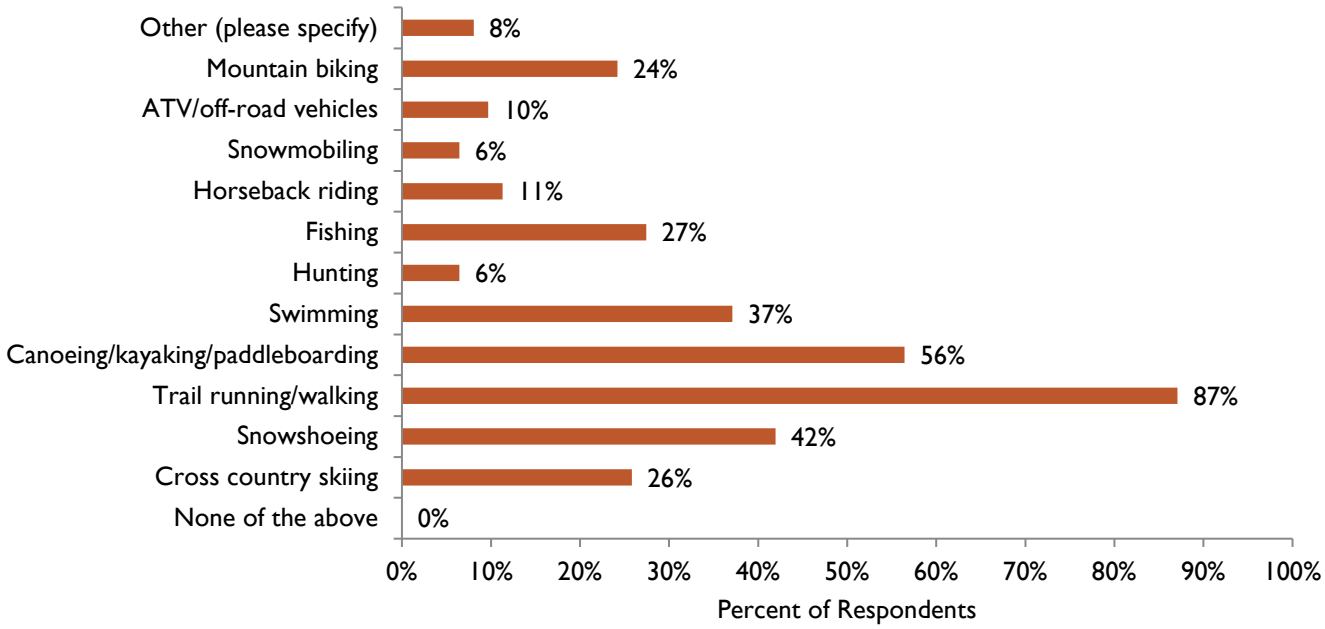


Figure 26. Types of recreational opportunities that survey respondents would like to see more of in Rochester (Source: Natural Resources Survey for this Master Plan Chapter update, 2023).

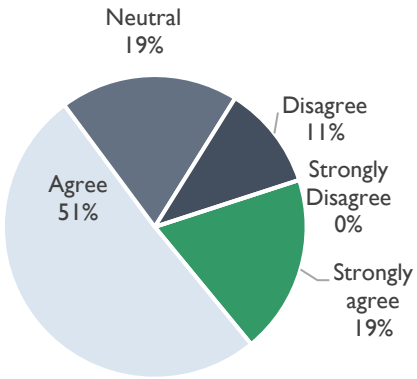


Figure 27. Responses to the Natural Resources Survey prompt: "Rochester's natural resources are accessible to me" (Source: Natural Resources Survey for this Master Plan Chapter update, 2023)

19.1.1 City Parks

Numerous city parks offer residents and visitors with access to nature and greenspace. These areas also provide important habitat for birds, insects, and other wildlife and play a role in infiltrating stormwater and reducing temperatures. Allocating space within these parks to gardens with native species enhances their value as pollinator habitat. The map in Figure 27 shows the location of seven parks within the vicinity of downtown. Rochester Common, located just south of the city center, is the largest city park with five acres of open space.

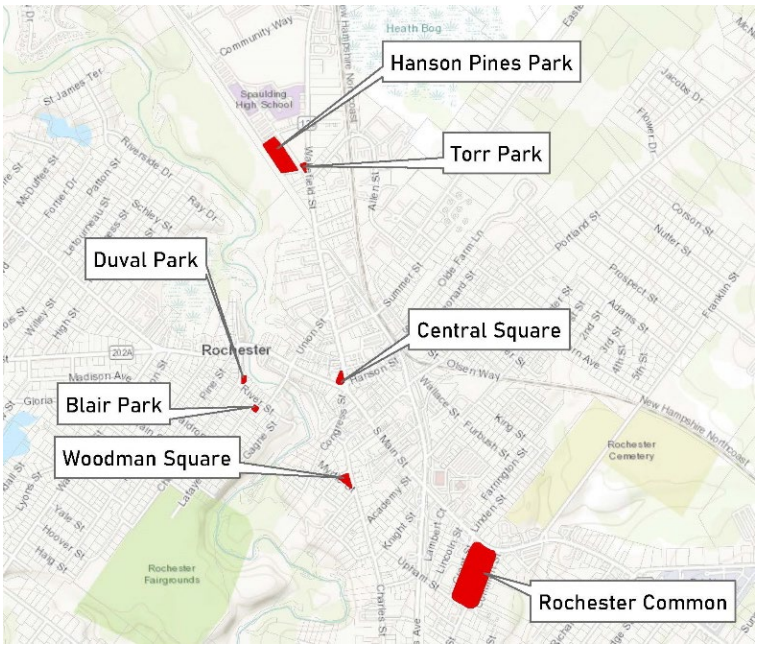


Figure 28. City parks within the vicinity of downtown Rochester (Source: GIS data provided by the City of Rochester)

Pathways to Play

An interactive map of recreational areas, conservation areas, and recreational facilities that was developed as part of the Pathways to Play project by Strafford Regional Planning Commission is available at: https://strafford.org/uploads/maps/pathwaystoplay/20200107_pathwaystoplay_postermap_rochester.pdf.

Aerial view of Rochester Commons (Courtesy of John Gisis)

19.2 Water Access

Boat launches, trail systems, and parks provide access to rivers, ponds, and lakes in Rochester for boating and fishing (Table 29).

Table 29. Public access sites (Source: NH Geodata portal)

Waterbody	Facility	Ownership	Access Type	Fishing	Boating	Picnicking
Baxter Lake	Baxter Lake Boat Access	State - NHFG	Ramp	Yes	Yes	Yes
Isinglass River	Gonic Trails and Recr. Area	Other - Waste Mgmt of NH	Park/Walk-in	Yes	No	Yes
Isinglass River	Isinglass River Park	Other - Waste Mgmt of NH	Park/Cartop	Yes	Yes	Yes
Cocheco River	Pickering Ponds Walking Park	City - Rochester	Park/Trails	Yes	No	No
Cocheco River	Hanson Pines	City - Rochester	Park/Cartop	Yes	Yes	Yes
Cocheco River	Cocheco River Paddle Launch	City - Rochester	Cartop	Yes	Yes	No

Popular boating, canoeing, and kayaking locations recognized in the 2009 Natural Resources Chapter and identified in a 2003 Access Guide to the Cocheco River include Little Falls Bridge Road, Hanson Pines Park, and Ironwood Park at the end of England Road near the confluence of the Cocheco and Isinglass Rivers. There is public access to the Salamon Falls River just south of Rochester in Somersworth.

A notable addition to public access points is the Cocheco River Boat Launch, which opened in 2020. The launch is located at the end of Hillsdale Street off Chestnut Hill Road and accommodates canoes and kayaks via an accessible EZ launch. The launch was funded with private donations and a grant from the Rochester Community Development Block Grant program.

The Riverwalk, incremental development of which is underway, will provide extensive access to the Cocheco River once the Rochester Riverwalk Master Plan is fully implemented.

The over 300-acre Baxter Lake, which straddles the Rochester-Farmington border, is a significant yet often overlooked asset to the community, providing swimming, boating, and fishing opportunities.

Image: Baxter Lake boat ramp (Source: paddling.com)

Participants in a public input workshop for this Master Plan Chapter update noted the need to balance the navigability of the Isinglass and Salmon Falls Rivers with aquatic habitat needs, such as downed trees. Similarly, non-essential dams such as the Gonic Dam, which is planned for removal, should be removed to improve habitat for aquatic species.

19.3 Scenic Views

Scenic views contribute to the character of Rochester's landscapes and the city as a whole. Scenic views are a type of cultural ecosystem system service, or a benefit that ecosystems provide to people. A description of scenic views identified in the 2009 Natural Resources Master Plan Chapter include:

- *Gagne Farm* - Open fields, stone walls and a broad view into the lowlands of the Cocheco floodplain, northbound on the left toward Rochester on Route 108 before Frisbee Memorial Hospital
- *Ten Rod Road* - Open meadows, dense forests and historic farmsteads west toward Farmington
- *Salmons Falls Road* - Open meadows, hay fields, active farms and broad scenic vistas crossing the Salmon Falls River into Maine
- *Meaderboro Road* - Open meadows, hay fields, active farms and broad scenic vistas across the highlands north of the City. In 2023, survey respondents noted that development had impacted the viewshed on Meaderboro Road.
- *Salmon Falls River* – Rural floodplain, forested buffers, and active farms along the river.
- *Cocheco River* - The Cocheco River through Rochester offers many spectacular scenic views from both land and from the river. From Little Falls Bridge to the North Main Street Bridge, a surprisingly green river corridor slips right into the urban center of Rochester. On the east bank, Hanson Pines Park with its large stand of white pines is a haven within the City. The arched bridge at North Main Street is a focal point in the urban downtown. The City Dam and Hatfield Dam just downstream at Wyandotte Falls are popular viewing points. Just downstream of the Wyandotte Mill RHA Housing is a little-known view down around a bend in the river and up at a white church steeple, one block from the center of urban downtown Rochester. The corridor from the Rochester Fairgrounds to Route 125 provides scenic canoeing. Snow's Intervale by the Allen School is a city-owned park in the forested floodplain with quiet paths for walking. Pickering Ponds are functional wetlands that once were aeration ponds for the WWTF. Trails around the levees that parallel the river offer views for birding as well as good walking.

Cocheo River (Courtesy of John Gisis)

Additional scenic views identified during the 2023 update of this chapter include:

- Baxter Lake
- Top of Chesley Hill Road, overlooking downtown, though development has impacted the view
- Top of Dry Hill Road
- Hansonville Road, and Hanson Pond off Hansonville Road
- Isinglass River, including the river along Stillwater Circle and other sites in Gonic
- First portion of Blackwater Road
- Haven Hill Road
- The Farm in front of Secretariat Estates
- Wetlands off of Dry Hill Road
- Fields across Route 125 from the golf course
- Landfill from Pickering Ponds
- Rochester Hill
- Undeveloped land off Gear Road
- Duval Park overlooking the dam on the Cocheco River
- Mill property in Gonic adjacent to the Cocheco River.

When asked how to allocate $10 to natural resources, survey participants allocated most funds to *cleanup and trash removal of rivers, streams, and natural areas, maintenance of existing trails and amenities, purchasing more land to be permanently protected,* and *construction of new trails and amenities* (Figure 29).

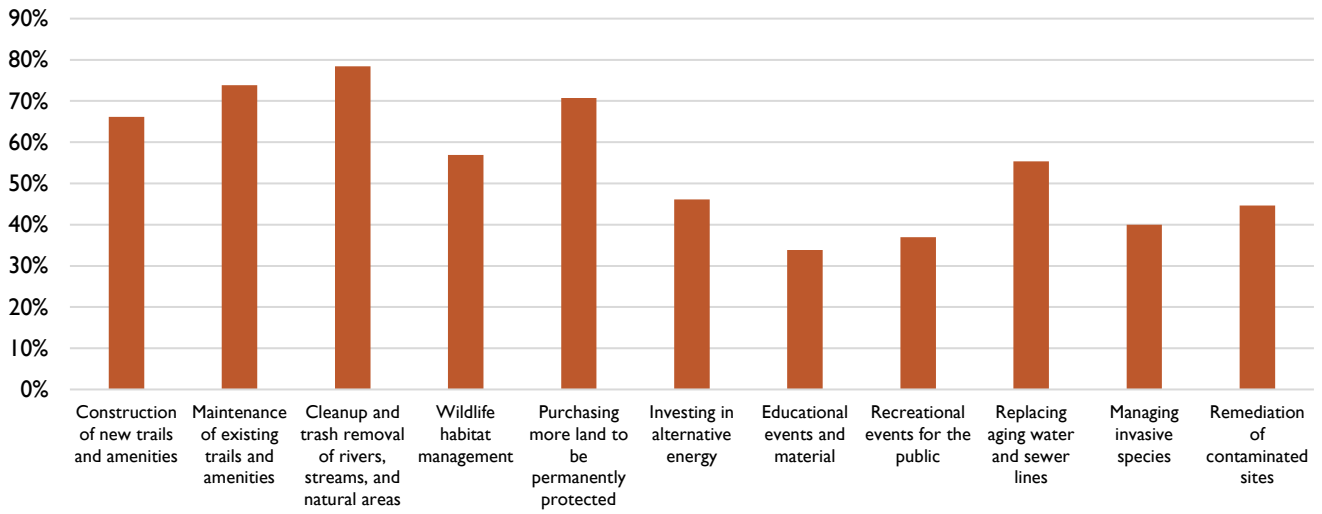


Figure 29. How would you allocated $10 to natural resources? (Source: 2023 Natural Resources public input survey)

19.3.1 Public and Recreational Resources (PR) Recommendations

PR 1	Coordinate with the Recreation Department to develop a comprehensive list and map of publicly accessible parks and open space. Create a brochure and post material on the City's website.
PR 2	Support water quality protection measures to ensure that surface waters meet state standards for their designated uses that support recreation including aquatic life, fish consumption, primary and secondary contact recreation, and wildlife.
PR 3	Continue implementing the Riverwalk Master Plan.
PR 4	Support establishment of recreational trails for public use on public lands.
PR 5	Establish and Open Space committee to comprehensively evaluate existing and future opportunities to conserve open space and address management of open space for public enjoyment and use.

20 RENEWABLE ENERGY

The US Energy Information Administration (EIA) defines *renewable energy* as energy from sources that are naturally replenishing but flow-limited; renewable resources are virtually inexhaustible in duration but limited in the amount of energy that is available per unit of time.[87] The major types of renewable energy sources are biomass, hydropower, geothermal, wind, and solar.

Renewable resources provided about 16% of the in-state electricity generation in New Hampshire in 2021. Hydroelectric power and biomass are the predominant sources of renewable energy in the state. Wind energy, supplied by five wind farms located on mountain ridges on the western side of the state, accounted for 3% of in-state electricity generation. The state's solar resources support small scale (less than 1 megawatt) and utility-scale (1 megawatt or larger) projects.

New Hampshire's Renewable Portfolio Standard (RPS) (RSA 362-F), enacted in 2007, establishes the State's renewable energy policy. This policy set a goal of achieving 25.2% renewable energy by 2025 and thereafter, compared to 4% in 2008. The RPS requires each electricity provider to meet customer load by purchasing or acquiring certificates representing generation from renewable energy based on total megawatt-hours supplied.

(Source: New Hampshire Department of Energy)

In 2022, renewable energy accounted for approximately 13% (13.18 quadrillion Btu) of energy consumption in the US.

(Source: U.S. Energy Information Administration, Monthly Energy Review, Table 1.3 and 10.1, April 2023, preliminary data).

20.1 Solar Energy

Solar energy plays a key role in reducing greenhouse gas emissions and mitigating climate change. Solar energy accounted for approximately 1% of New Hampshire's total net generation in 2021. In mid-2022, the total capacity of small-scale solar facilities was about 165 megawatts. The EIA reports one 2.4 megawatt (MW) utility-scale system came online in the state in 2019, with new utility-scale solar projects in development. Solar power is rapidly growing in the region. ISO New England anticipates 11,520 MW of nameplate[xi] PV capacity by 2030, which is about double of that in 2022 (5,548 MW).[88]

In Rochester, community solar, commercial solar, solar utility systems, and solar arrays accessory to residential, commercial, or industrial uses are regulated in Rochester through the conditional use permit and special exception process, or in some zoning districts, are permitted uses. Ground or roof-mounted solar collection systems that are accessory to commercial and industrial uses are limited to 100 kW kilowatt AC (alternating current) or less, while residential applications are limited to 25 kW or less. Principle commercial solar collection systems may be up to 1 MW. Community solar collection systems are one or more free-standing, ground-mounted, or roof-

[xi] Maximum rated alternating current ("AC") output of solar collection system based on the design output of the solar system.

mounted solar collection systems up to 250 kW. Free-standing, ground-mounted solar collection systems larger than 1 MW are regulated as solar utilities under the City's Zoning Ordinance.

The New Hampshire Sustainable Energy Association has developed Model Solar Zoning Ordinance for New Hampshire, which may be a useful resource for crafting language for Rochester's Zoning Ordinance to regulate solar arrays.

20.1.1 Land Use Planning Considerations

Size Considerations

Size of Residential solar photovoltaic (PV) installation is generally between two and 20 kilowatts (kW).[89] A 250 kw ground mounted array with about 833 panels generally takes up about one acre of flat ground, while larger arrays require significantly more land (Table 30).

Farms, Forests, and Solar

Over 10 million acres of land may be needed to scale up solar energy in the US by 2050. Rochester's agricultural land is attractive to residential developers and to solar developers; in contrast to residential development, solar development provides the opportunity to preserve the farmland. The American Farmland Trust projects that over 80 percent of this could be located on agricultural lands, creating both opportunities for farmers and threats to farmland.[90] The American Farmland Trust identified four principles to guide smart solar development:

1. Prioritize solar siting on building and land not well suited for farming, like rooftops, carports, irrigation ditches, brownfields.
2. Safeguard the ability for land to be used for agriculture, such as through policies and practices that protect soil health and to ensure opportunities for farming in the future.
3. Grown agrivoltaics for agricultural production and solar energy, land under solar panels or in between rows of panels is used for agriculture.
4. Promote equity and farm viability through inclusive stakeholder engagement to ensure project strengthen farm viability and reflect farmer interests.[91]

The Maine Department of Agriculture, Conservation and Forestry (DACF) has developed technical guidance document regarding the siting of utility-scale solar projects with consideration for valuable agricultural land, forest resources, and rare or unique natural areas. This resource includes best practices that are applicable in other states.

Table 30. Minimum acreage required for solar arrays of varying capacity (Source: NHSEA Model Solar Zoning Ordinance)

Capacity	Minimum Acreage
250 kw	1 acre
1 mw	4 acres
5 mw	20 acres
10 mw	40 acres
30 mw	120 acres

The AgriSolar Clearinghouse is a nationwide hub to connect businesses, landowners, and researchers with resources to support the growth of co-located solar and sustainable agriculture. AgriSolar encourages expansion of agrivoltaics on solar-appropriate lands to allow agricultural and solar producers to maximize the use of land, increasing pollinator habitat, diversifying ecosystem services, and increasing revenue. Learn more about innovative financing options, best practices, and sustainable agri-solar opportunities at: https://www.agrisolarclearinghouse.org/about/

(Source: AgriSolar Clearinghouse)

Learn more about renewable energy at: https://www.eia.gov/energyexplained/renewable-sources/

Historic Districts and Solar

In Rochester, solar arrays are permitted within the Historic District with approval from the Historic District Commission. The NH Sustainable Energy Association (NHSEA)'s Model Solar Ordinance contains several considerations for allowing solar collection systems within historic districts.

20.2 Other Local Sources

20.2.1 Hydroelectric Power

There are three active dams used for hydroelectric power generation in Rochester: Wyandotte, Spaulding Pond Dam, and Boston Felt Dams (Table 31).

Table 31. Hydropower dams in Rochester (Source: NHDES OneStop)

Name	River	Hazard Class	Owner
Wyandotte Dam	Cocheco River	L	City of Rochester
Spaulding Pond Dam	Salmon Falls River	S	Spauling Avenue Industrial Complex
Boston Felt Dam	Salmon Falls River	L	Salmon Falls Power and Light Company LLC

20.2.2 Landfill Gas

Waste Management has worked with the University of New Hampshire on environmental sustainability initiatives, including the ECOline project. The project, which began in 2009, provides landfill gas to the UNH campus from the Turnkey facility. The ECOline processes landfill gas and pipes it 12.7 miles to the UNH campus. The methane in the landfill gas provides for the majority of the campus's energy needs, which helps make UNH one of the "greenest" colleges in the country.[92] When the landfill is decommissioned, it may be a prime location for large scale solar.

20.2.3 Renewable Resources (RR) Recommendations

RR 1	Develop regulations to ensure compatibility between using land for agriculture and solar energy generation.
RR 2	Use the NHSEA's Model Solar Ordinance as a guide to developing regulations to allow solar collection systems within the historic district.
RR 3	Encourage solar collection systems on rooftops and in parking lots while discouraging deforestation for the purpose of installing solar arrays.
RR 4	Encourage community solar on City-owned land.
RR 5	Develop a comprehensive energy strategy for the City and set goals for renewable energy.
RR 6	Prepare an energy master plan chapter.
RR 7	Coordinate with Waste Management to investigate the feasibility of installing a solar array at the Turnkey Landfill.

21 RECOMMENDATIONS TABLE

22 IMPLEMENTATION MATRIX

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