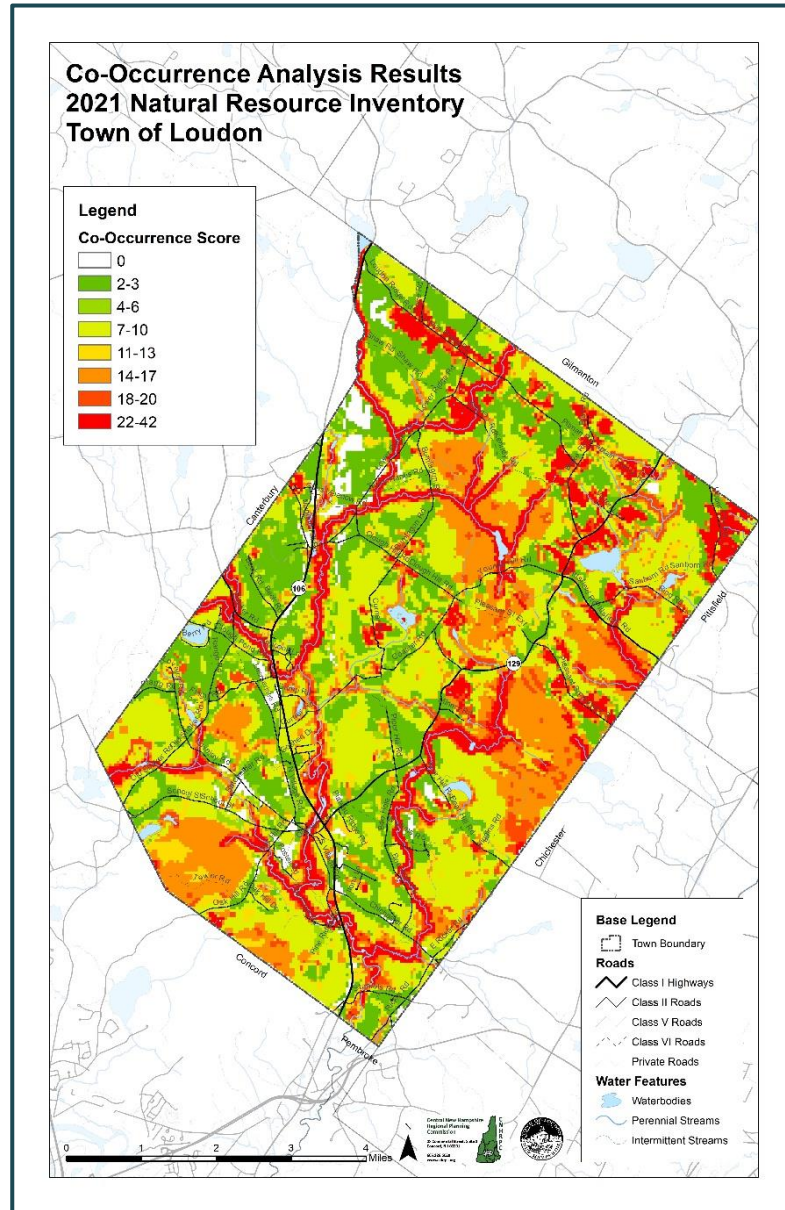




2021

Natural Resources Inventory and Assessment with Co-Occurrence Analysis Mapping

Town of Loudon, New Hampshire



Prepared for the Loudon Conservation Commission
December 2021

Adopted by the Conservation Commission 02-07-22

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December 2021

Prepared by:

Central NH Regional Planning Commission for the
Loudon Conservation Commission and the

Town of Loudon

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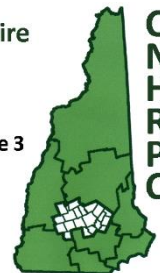


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APPENDIX

A. NRI Survey Results (Survey Monkey and Tabulated)	<i>attached</i>
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2021 CO-OCCURRENCE RESOURCE MAPS

Drinking Water Weighting Map

- Water Supply Wells Map
- Aquifer Transmissivity Map

Surface Water Weighting Map

- Stream and Waterbody 300’ Buffer Map
- Wetlands and 100’ Buffer Map
- Hydric Soils Map
- 1% Annual Flood Risk Map (100-Year)

Agriculture Weighting Map

- Agricultural Soils Map
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- Forestry Soils Map

Historic and Cultural Resources Weighting Map

- Historic Sites 300’ Buffer Map
- Public Input: Oak Hill Map

Habitat Weighting Map

- Wildlife Action Plan Map

Co-Occurrence Analysis Map

Co-Occurrence Analysis Map with Conservation Land Overlay

2021 STANDARD NATURAL RESOURCE MAPS

- Water Resources Map
- Watersheds Map
- Bedrock Geology Map
- Historic and Cultural Resources Map
- Prime Agricultural Soils Map
- Topography, Hilltops, and Scenic Vistas
- Trails and Water Access Points Map
- Land Use Map
- Zoning and Economic Revitalization Zones Map
- Development Constraints Map
- Conservation and Town Owned Land Map
- Unfragmented Lands Map

For additional information on Loudon’s resources, please refer to the Loudon Master Plan’s Natural Features Chapter 2018 and other chapters.

1. Introduction

Natural resources provide critical habitat and ecological services in the Town of Loudon. In growing suburban and rural areas, the competing land uses, development pressure, high land values, and sprawling settlement constrain and threaten high quality natural resources. At the same time, there are limited financial resources to protect valued land from development. Loudon is a rural but growing suburb community abutting the City of Concord to the east and accessible via NH 106, NH 129, and NH 28. Much of Loudon's historical identity and sense of community are located in Loudon Village along South Village Road. This road connects the Town Office to the historic village area, Loudon Elementary School, and ready access to NH 106 and NH 129. Village Road follows the Soucook River for a bit. Businesses sprout along these intersections and along these main roads. More recently, commercial development has focused along the NH 106 corridor. The recent completion of the **Loudon Master Plan 2018** enables close consideration of the current state of natural resources and how they relate to other community goals and overall vision of Loudon. The **Natural Features Chapter** broadly influences this NRI, which is a more intensive look at the Towns' natural resources.

About 11% of the Town's area is conservation land.

1.1. Purpose

Natural resources are essential to providing habitat for wildlife, preserving rare or sensitive species and ecosystems, ensuring the sustainability of agriculture, and providing a wide range of ecological services that support the Town of Loudon over the long term. This NRI identifies, prioritizes, and maps these resources. This will help inform land conservation priorities and other practices that can help sustain these natural resources and the benefits they bring.

NRI Maps

Twenty-three (23) primary natural resource maps were developed to display and analyze agricultural lands, hydric soils and wetlands, drinking and surface water resources, conservation and public lands, historic and cultural sites,

LOUDON MASTER PLAN 2018

NATURAL FEATURES OBJECTIVES:

- ✦ To preserve the scenic character of the Town of Loudon by protecting its natural, historic, scenic, and agricultural resources.
- ✦ To promote the conservation, protection, and sound management of the Town's natural resources including water, forests, habitats and open space.
- ✦ To provide recreational opportunities for all ages and user groups.
- ✦ To educate the citizens and Town officials in Loudon on the importance of protecting the Town's natural resources and open space.
- ✦ To respond to new techniques or initiatives, as appropriate, that will enhance the protection of natural resources important to Loudon.
- ✦ To ensure local compliance with federal and state regulations, including gravel excavation.
- ✦ To involve Town boards, and public, private, and state organizations in the protection of Loudon's resources.

Figure 1.1 NRI Resource Categories



forestry soils, agricultural soils, aquifers, wetlands, habitats identified in the NH Wildlife Action Plan (WAP), and more. Some of these were used in the co-occurrence analysis, and other maps provided context for supporting resources in the community.

The outcome of the GIS analysis includes five **Weighted Co-Occurrence Maps**, one for each natural resource category, that display areas of Town with the highest natural resource value. These areas should reflect the presumably highest land conservation values for the Town. Two final **Co-Occurrence Maps** encompass all five resource categories; one of these maps includes an overlay of the conservation and public lands for reference. A brief analysis of each of these maps and their inputs is included in this document. A large map set was developed as part of this NRI, in both paper and digital format, and was provided to the Conservation Commission.

Plan Data

The GIS layers have data that can be displayed on the map series. Data from the layer can also be extracted to look at the finer points of certain resources. For instance, the GIS data layers can also

answer questions such as, “how many acres of forest land do we have?” or “how many miles long is Bee Hole Brook?”. By examining the NRI data from a more specific way, delving into the GIS layers to answer certain questions and correlate those answers with where a feature is located (by looking at the map), we have a much greater understanding of the dozens of data layers that comprise the five categories of the NRI: Agricultural Resources, Wildlife Habitat, Historic and Cultural Resources, Drinking Water Resources, and Surface Water Resources as shown in **Figure 1.1**.

Process

This Natural Resources Inventory (NRI) includes an inventory of natural resources and a weighted co-occurrence analysis for each of the resource category types. The inventory maps and the NRI describe a multitude of natural resources in Loudon, including water resources, agricultural resources, cultural and recreational resources, and habitat resources. The final product is a **Co-Occurrence Map** that combines the weights of all layers. The NRI provides supporting narrative and tabular information using the data layers and other sources that support the conclusions of this project.

The weighted co-occurrence analysis is an attempt to assign relative value to the Town’s resources and the lands that support them.

The inventory component involved developing a list of the primary natural resources in Loudon, identifying the appropriate GIS data layers to display that resource, and mapping them. Then, each natural resource “layer” was assigned a score that defined its relative importance to the Town of Loudon as a natural resource. This valuation was based on information from results of a public survey, knowledge and experience from the Conservation Commission, best planning practices, and advice from experts in the field. Finally, these scored or “weighted” layers were overlaid on top of each other in a co-occurrence mapping exercise. Natural resources with a relative higher value to the Town were given a greater weight, and resources with a relative lower value were given a lower weight. These weights are often referred to as “points” or “scores”. The resulting **Co-Occurrence Map** highlights which areas of Town support the highest value of natural resources. The NRI document and its recommendations are largely based on the inventory and the co-occurrence results.

The process **Table 1.2** displays these key steps in this process. The Conservation Commission was highly involved in this process and reviewed and refined the maps, analysis, and recommendations. The NRI Survey was distributed online via Survey Monkey and was also available in print to obtain the public’s opinions on the importance of various resources. A table of the data inputs and value scores for the co-occurrence mapping is displayed in the next section. The NRI should continually be re-evaluated as newer and better data becomes available. As recommendations are completed, new ones should take their place. The process should become cyclical over a period of years.

Intended Use

The information in this NRI is intended to inform and guide land and water conservation efforts in the Town of Loudon.

It provides information about specific habitats and resources—at both the site and Town-scale—that can support land use decisions and conservation priorities. This NRI provides a benchmark for observing short- and long-term changes, and it should be updated as conditions change and when new information is available. This baseline

Table 1.2

Process		
Conservation Commission Meetings, Public Input Process, and CNHRPC NRI Development	Determine Natural Resource and GIS Data Layers for NRI Mapping	↓
	Survey Monkey Public Feedback on Priorities, Assign “Weights” to Layers	
	Co-Occurrence Mapping	
	Review Draft Co-Occurrence Maps and Results, Adjust Weighting and Data Layers	
	Finalize Maps and Prepare Draft NRI	
	Confirm NRI Results	
	Develop Recommendations	
	Release NRI, Conduct Public Outreach	
	Work on Recommendations	
	Revise NRI Maps and Document as Better Data is Available	

assessment may be refined through field investigations and gathering of ground truth data, further developing this document into a more comprehensive inventory and assessment. The NRI may be incorporated into the Town's Master Plan and other planning documents. The NRI and its accompanying maps are intended to serve as an informational tool that may inform future changes in zoning, land use regulations, and policies. Finally, the NRI is an educational and outreach resource for Town staff, boards, residents, and other interested individuals.

NRI Objectives

- Increase identification and understanding of the Town's natural resources.
- Develop accessible information that can inform decisions about balancing development and conservation.
- Identify resources that are potentially at risk in Loudon.
- Identify natural resources that interact as systems.
- Provide a visual resource that can be used as a reference for collaboration among Town Boards and Commissions.
- Capture a snapshot of the Town's natural resources for use as a baseline in tracking land use trends.
- Compile information that may be used for a more comprehensive NRI or Open Space Plan using data sets specifically developed for the Town of Loudon.
- Work towards improving and protecting water quality in the Upper Merrimack Region and Soucook River watersheds.
- Develop and promote educational conservation resource for the Town and the public.
- Increase public awareness about the need to conserve at-risk resources for future use and knowledge of the criteria used to determine the most valuable areas.

Recommendations

Using observations identified by the NRI data, public input, and Conservation Commission priorities, a number of NRI recommendations are proposed at the end of this document. Highest scoring co-occurrence areas can be obtained from the **NRI Map** set to identify future conservation protection. In addition, general strategies for outreach, management, and regulatory action are included.

Using GIS analysis, Loudon is calculated to contain about 29,897 total land acres.

This acreage is used for many of the NRI data tables.

For instance, 11% of the Town is under conservation.

1.2. NRI Community Survey Results

An online survey of open space resources was taken by Loudon residents to provide input for conservation priorities. A total of 145 responses were received. Respondents answered 13 questions, some of which were in the format of multiple choice, check all that apply, and/or write-in responses. The results of this survey were incorporated into the value scores and the results of the co-occurrence analysis. The full results from the Survey Monkey online survey are available in the Appendix.

Survey responses indicated a high value for natural resources. There was strong support for the necessity of clean drinking water, as well as strong support for trails, wildlife habitat, and agriculture. Locations within Loudon that were most commonly cited as important for their natural resource value are Loudon Ridge and Oak Hill, as well as a range of recreational and agricultural sites across town. These locations were accurately portrayed as high value in the co-occurrence analysis.

1.3. Co-Occurrence Weighting

Each natural resource data layer has been assigned a value score, shown in **Table 1.3**. The data layers and value scores in this table are the inputs for the GIS based co-occurrence analysis maps. A higher score indicates a higher natural resource relative value to the Town, and a lower score a lower relative value. These scores were assigned based on public input from the community survey and from the experience and knowledge of the

Table 1.3

Co-Occurrence Weighting	
Data Layer	Value Score (adds to 100)
Agriculture Category Total	24
Agricultural Lands	9
Farm Soils – Prime	8
Farm Soils – Statewide Importance	5
Forestry Soils – Group IA and IB	2
Wildlife Habitat Category Total	25
Wildlife Action Plan Highest Ranked Habitat in NH	13
Wildlife Action Plan Highest Biological Habitat in Region	7
Wildlife Action Plan Supporting Landscapes	5
Scenic, Cultural and Recreational Category Total	13
Historic and Cultural Sites with Buffer 300'	6
Public Input Additions (Oak Hill)	7
Drinking Water Category Total	18
Public Water Supply with Buffer 500'	8
Stratified Drift Aquifers (all)	3
Stratified Drift Aquifers Transmissivity >2,000 sq ft/day	4
Stratified Drift Aquifers Transmissivity >3,000 sq ft/day	3
Surface Waters Category Total	20
Wetlands (NWI)	3
Hydric Soils	3
Wetland Buffer 100'	4
Floodplains 1% Annual Flood Risk (100-year)	3
Waterbodies (3+ acres), Rivers, Stream Buffers 300'	7
Total	100

Conservation Commission. Decisions about which layers to include in the co-occurrence analysis were determined by the Conservation Commission after several months of discussion. Minor adjustments to the values were made based on research, best planning practices, local input, and quality of the available data.

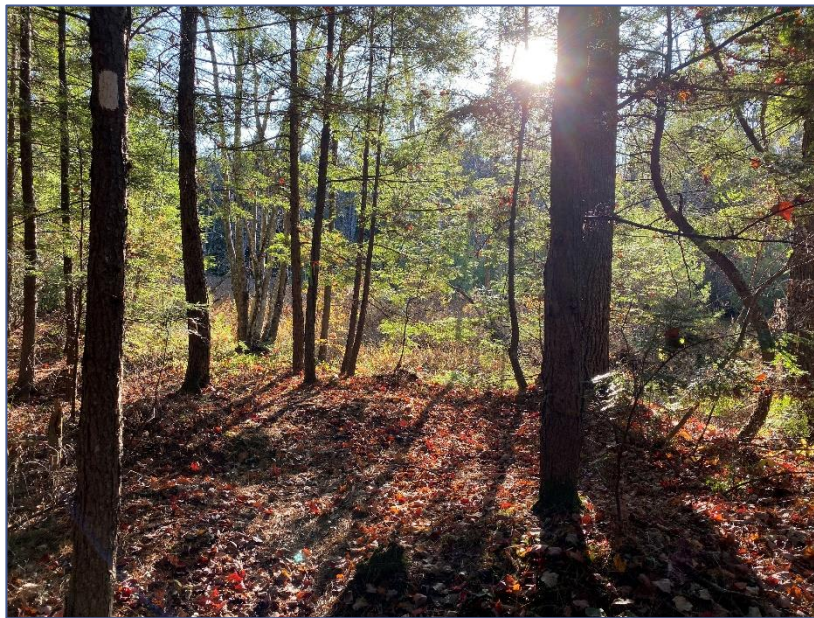
The natural resource data layers were divided into five categories:

- ✦ Surface Waters.
- ✦ Drinking Water.
- ✦ Agriculture.
- ✦ Scenic, Cultural and Recreational.
- ✦ Wildlife Habitat.

Table 1.3 lists each data layer representing a natural resource, and the relative value score assigned to it. These layers and values were the inputs for the GIS based co-occurrence analysis maps and add up to total 100.

Individual data layer maps and the five category weighting maps are described in the next sections. The final, composite **Weighted Co-Occurrence Map** displays the areas of most natural resource value to the community of Loudon.

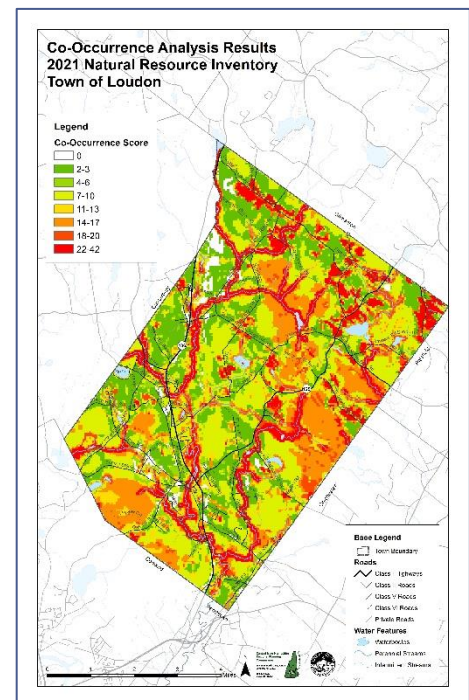
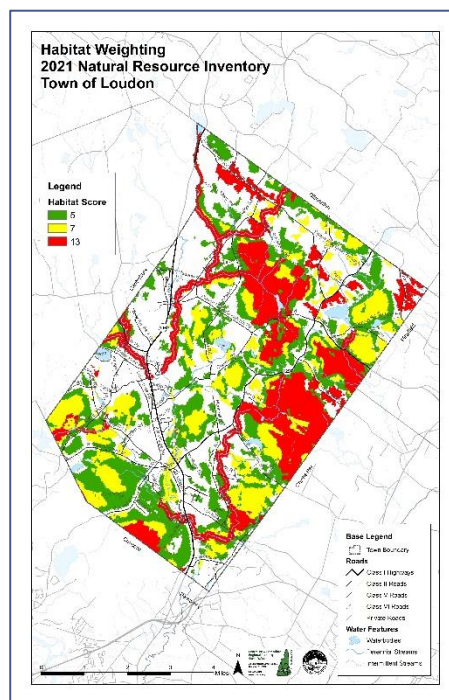
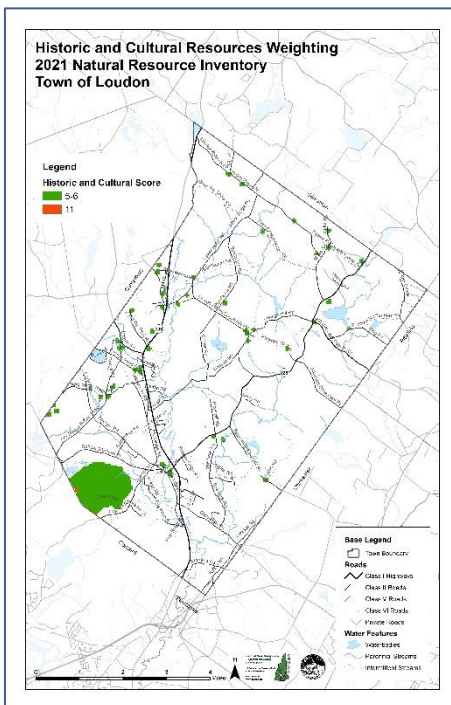
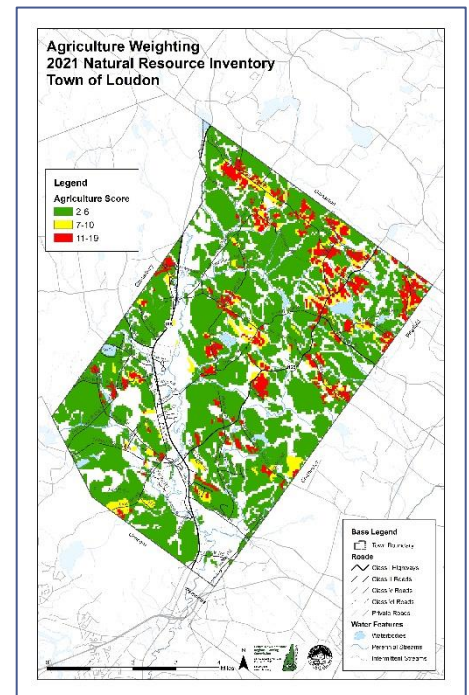
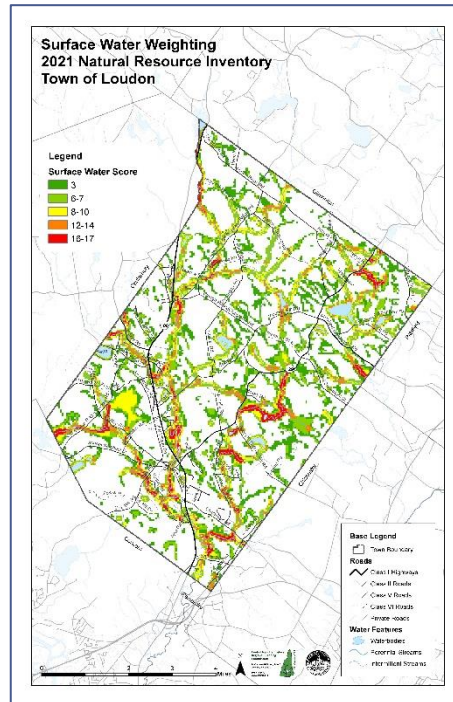
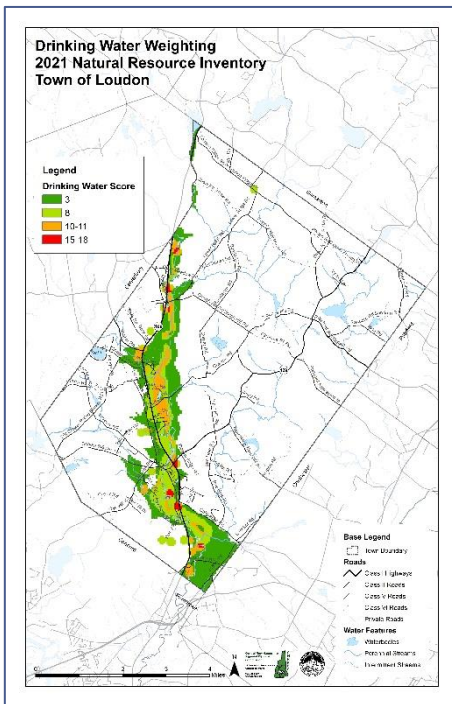
Additional information on natural resources in Loudon is available throughout the document and within the 2018 Master Plan.



Edge of Pine Brook Wetland. Photo by CNHRPC, 2019

1.4. Co-Occurrence Results

A **Weighting Map** was produced for each of the five categories. The data inputs and value scores for each of these maps are described in the corresponding chapter later in the document. The final **Weighted Co-Occurrence Map** combines the results of the individual category **Weighting Maps** using the values ascribed in **Table 1.3**.



2. Water Resources Co-Occurrence

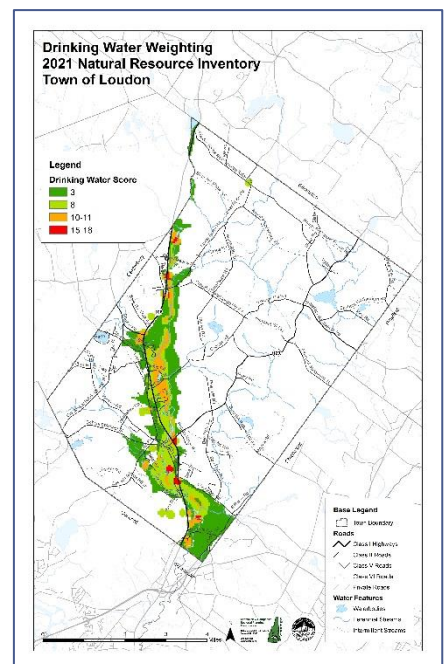
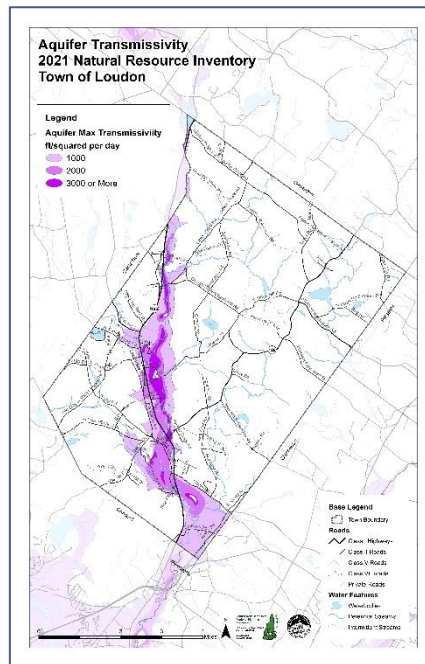
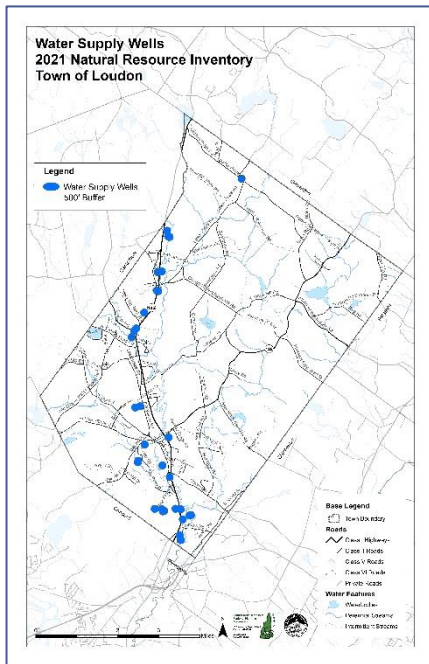
Water resources are a critical asset in Loudon, providing habitat for wildlife, drinking water, recreational opportunities, and flood storage. Comprising both surface water and groundwater resources, they represent some of the most fragile ecosystems and are particularly sensitive to certain types of land use. This section provides an overview of the watersheds, surface waters, floodplains, wetlands, water infrastructure, and aquifers in the Town as depicted on the NRI's water resources map series.

2.1. Drinking Water Input Value Scores and Co-Occurrence Results

Public Water Supply with Buffer 500': A 500' buffer around the Town's public water supply wells was assigned a

Value Score: 8

high value score, 8 points out of the 100 point total. These wells provide drinking water for local restaurants, neighborhoods, and others in Towns.



Stratified Drift Aquifers: Groundwater aquifers provide water that feeds into rivers, streams, ponds, lakes and wetlands, but also are the source of water for drinking water wells. The Town has many residential wells as well as larger wells that supply water to public water systems. These wells require healthy and clean groundwater. Groundwater aquifers are needed to

Value Score: 3

Value Score: 4

Value Score: 3

maintain existing water quality, quantity, and safety for present and future drinking water needs. Loudon hosts some of the highest quality aquifers in the region, encompassing an area of deep sand and gravel in the Suncook River Valley an excellent drinking water source. All aquifers in Loudon were assigned a value of at least 3 points, with additional points for higher productivity aquifers. Four (4) additional points were assigned to aquifer areas with a high transmissivity (above 2,000 square feet per day), and 3 more points for the highest

needs. Loudon hosts some of the highest quality aquifers in the region, encompassing an area of deep sand and gravel in the Suncook River Valley an excellent drinking water source. All aquifers in Loudon were assigned a value of at least 3 points, with additional points for higher productivity aquifers. Four (4) additional points were assigned to aquifer areas with a high transmissivity (above 2,000 square feet per day), and 3 more points for the highest

transmissivity (above 3,000 square feet per day). Transmissivity is a measure of how much water can move through an aquifer.

Drinking Water Co-Occurrence Results: The highest value lands for drinking water in Loudon are found along the

Drinking Water Category Total: 18

Soucook River, which coincides with the highest value aquifers and the location of many existing public water supply wells. This analysis of

drinking water resources suggests areas where land conservation efforts are likely to preserve drinking water resources, but a more detailed and specialized analysis of drinking water resources may be prudent for analyzing the current and future drinking water needs.

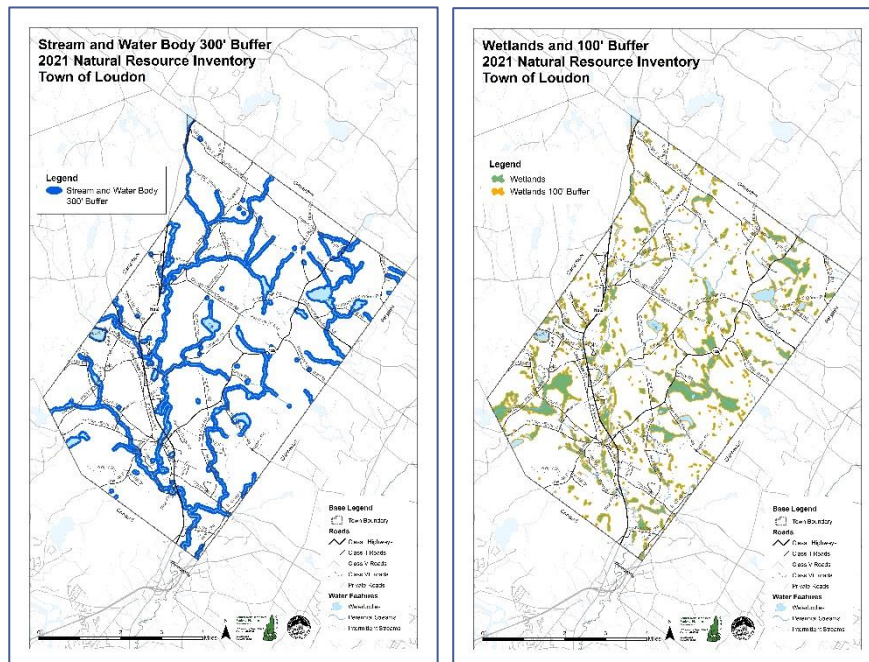
Survey results and common sense both show safe and secure drinking water resources are critically important to the Town of Loudon. The category is worth a total of 18% of the total scores for the Town. The individual input data layers are scored very highly.

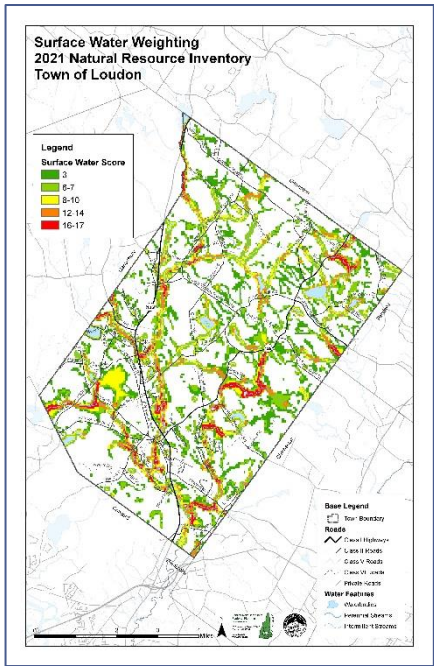
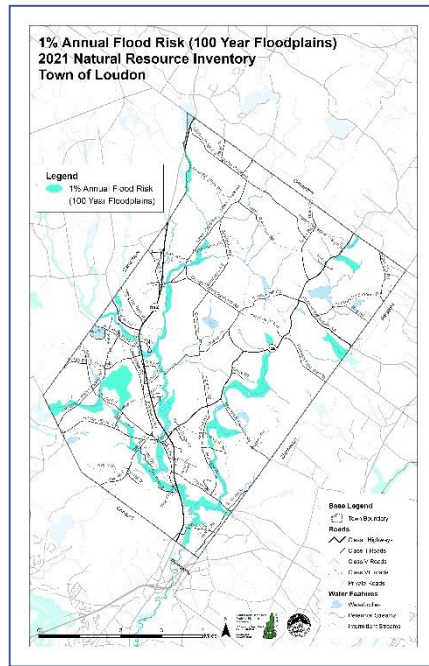
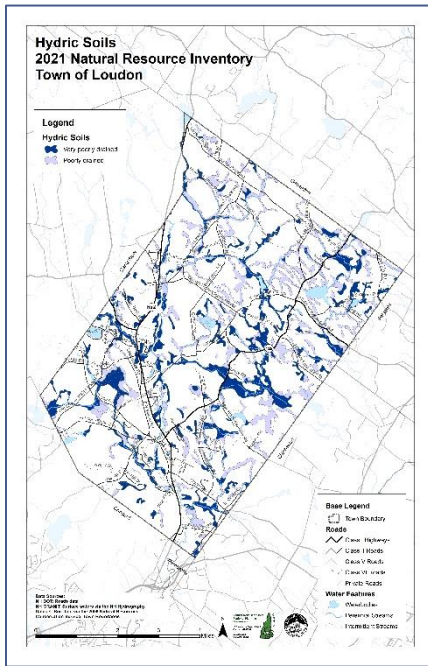
2.2. Surface Waters Input Value Scores and Co-Occurrence Results

Water Bodies (3+ acres), Rivers, Streams with 300' Buffer: This layer includes water bodies (lakes and ponds)

Value Score: 7

greater than 3 acres, plus all rivers and streams and a 300' buffer around them. This layer scores a 7 which is among the highest scores. Water bodies have a number of habitat, ecological, hydrological, and cultural values to the Town of Loudon.





Wetlands and Wetlands 100' Buffer: The National Wetlands Inventory of wetlands were assigned a value score of **Value Score: 3** 3, with areas within a 300' buffer of wetlands scoring 4 additional points. Wetlands are important for clean surface waters, mitigating floods, and providing critical habitat for wildlife.

Hydric Soils: Hydric soils are generally not suitable for development but can support a range of ecological functions similar to that of wetlands. Hydric soils usually coincide with wetlands and can also include areas that are not defined as wetlands in the National wetlands Inventory. Hydric soils were assigned a value score of 3.

Floodplains 1% Annual Risk: Areas with a 1% annual flood risk, also known as the 100-year floodplain, are assigned a value score of 3. Protecting floodplains can help reduce flood damage during floods by keeping development out of flood prone areas. Floodplains also absorb and distribute floodwaters, helping reduce the severity of flooding downstream. This data layer is from FEMA Digital Flood Insurance Rates (DFIRM) data.

Surface Water Co-Occurrence Results: The co-occurrence results of the Surface Water related layers highlights **Surface Waters Category Total: 20** much of the Soucook River, Bee Hole Brook, Pine Island Brook, and much of Sanborn Brook. Many of these waterways are also accompanied by wetland complexes. Numerous other wetland areas also stand out, including the conserved land of Hunting Swamp.

Survey results and Conservation Commission discussions indicated that clean, healthy bodies of water were important to the Town, especially its lakes, ponds, streams, and rivers. The Surface Waters category comprises 20% of the total co-occurrence score for Loudon.

2.3. Public Water Supplies

According to the NH Department of Environmental Services (NHDES), Loudon has 34 public water supplies serving residential, commercial, industrial, and exempt properties. The **Water Resources Map** displays these locations as roughly following the Soucook River corridor and aquifer.

Despite the aquifer proximity, the only public gravel wells in Town are two of the NH Motor Speedway wells along NH 106, serving 9,000 people non-continuously. Most of the wells in Town are drilled into bedrock and are drilled deeply. Yet the bedrock two wells serving The Villages community on Iris Lane are 1,006’ deep and 1,210’ deep to serve 79 people continuously and are situated within the lower transmissivity areas of the aquifer. **Table 2.1** displays the public water supply wells in Loudon.

Table 2.1

Public Water Wells		
Well Type	Number	Total Population Served
Bedrock Well	26	5,443
Dug Well	4	633
Gravel Well	2	9,000
Spring	2	708
Totals	34	15,784

Source: NHDES Register Public Water Supplies (PWS)

Although the Town currently does not have a municipal water supply, this situation may change toward the middle of the century. The responsibility of maintaining a healthy water supply falls onto the community.

Much of the Town relies on agriculture, excavation, and industry for its economic sustenance. Sometimes these enterprises conflict with aquifers and the public water supplies. Unfiltered runoff and water supply contamination are common from agricultural areas that utilize pesticides, herbicides, and which may have livestock in the vicinity of a waterbody or near the top of a watershed. Excavation and industry have similar runoff potential from their equipment and materials items or fluids. Other public water supply contamination comes from aging and underperforming septic systems, land use intensity and location, and through the presence of highways (salt, oil, gas, etc). Public water supplies are routinely tested and reported to NHDES.

Wellhead Protection Areas (WHPA) are the locations under which groundwater flows to a producing well.

Private and residential wells can also have similar pollutants, plus minerals, radon, arsenic, uranium, and more from the bedrock. Over 600 private wells since 1984 were permitted by NHDES throughout the community. Well

owners are encouraged by the Town to test their well water at least every few years. For more detailed information, visit the NH DES OneStop program at <https://www.des.nh.gov/onestop-navigation>. The NH Department of Environmental Services hosts the numerous administrative rules for water quality and quantity at <https://www.des.nh.gov/rules-and-regulatory/administrative-rules>.

2.4. Aquifers/Groundwater

There are two types of groundwater sources from which Loudon obtains its water, bedrock aquifers and stratified drift aquifers. The ability of the varying bedrock types to yield drinking water supplies are irregular. This yield is referred to as “transmissivity.”

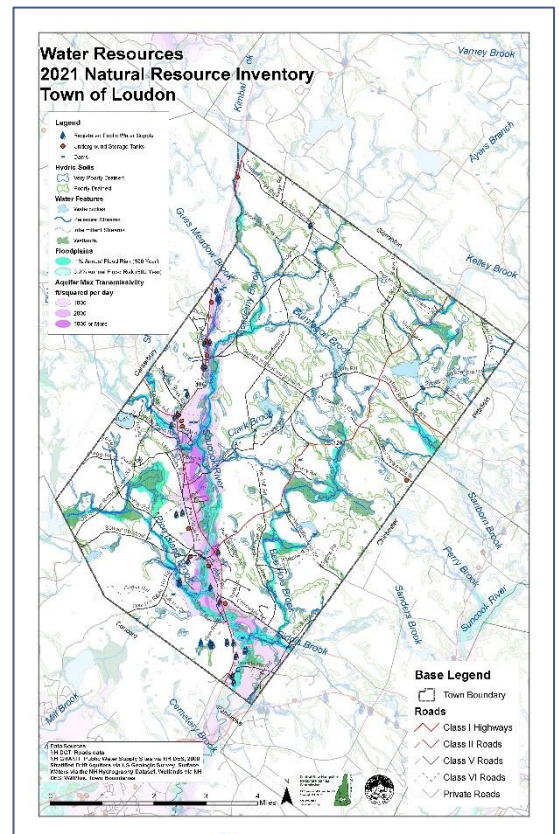
Bedrock aquifer well yields are positively correlated with proximity to water and lineaments, and negatively to slope/elevation and the Plutonic bedrock group.¹ Much of Loudon is either situated at high elevations on steep slopes or is underlain by Plutonic and Volcanic bedrock (26% of the Town). In these areas, less water is readily available near the surface unless the bedrock is tapped. The Plutonic group include areas to the south of the stratified drift aquifer from around School Street to Staniels Road, an area east of the stratified drift aquifer around Currier Road/Piper Hill Road/Bee Hole Road, a small area between East Ricker Road and Wiggins Road, and an area along the Canterbury border from Concord to Shaker Brook.

Geological factors may contribute to some problems related to water quantity and pumping within rural or high elevation areas.

Bedrock Aquifers

Over the course of several hundred years, the melting Wisconsin ice sheet deposited layer after layer of sands and gravels along the major waterways of New Hampshire. During periods of meltwater, finer silts and clays were also deposited. Glacial Lake Merrimack was once located in the present Merrimack River valley where dozens of feet of deposition now lie. After half a millennium of melting and siltation patterning these layers of soils, the soils were eroded over the last nearly 12,000 years. Steep sandy banks of the Merrimack River were exposed for the first time as material was exposed by this erosion. These water-bearing layers range from 40

Aquifer transmissivity is the rate at which groundwater travels horizontally through an aquifer, usually expressed as square feet per day.



¹ USGS Moore 2002

feet- to 80 feet- deep in some locations and are now known as stratified drift aquifers.² The highest transmissivity area in Loudon follows along the highly developed Soucook River corridor. Bedrock aquifers may be more productive in the easternmost section of town.

About 3,776 acres (or 13%) of stratified drift aquifers underlie the Town’s total area. About 26% of the Town is underlain by Plutonic bedrock geology which is not conducive to easy water withdrawals.

For the purposes of the co-occurrence mapping, bedrock geology with its bedrock aquifers is not a data layer which is typically mapped. The stratified drift aquifer data layer performs this purpose. Yet Loudon should be aware of potential bedrock limitations in Town that restrict easier access to water.

Stratified Drift Aquifers

The stratified drift aquifers in Loudon underlie the Soucook River from Concord/Pembroke to Canterbury and Gilmanton, with a short west-east section from Pine Island Brook across the Soucook to Bee Hole Brook. Collectively, the aquifer is referred to as the Soucook River aquifer. Transmissivity rates are high throughout the section of aquifer in Loudon, ranging from less than 1,000 sf²/day to greater than 4,000 sf²/day.

Table 2.2

Stratified Drift Aquifer Transmissivity	
Yield Range in sqft ² per day	Acres in Loudon
< 1,000	2,300.0
1,000 – 2,000	999.5
2,000 – 4,000	370.8
> 4,000	16.6
Total	3,775.8

Source: USGS Aquifer Transmissivity Data Layer

Overall, there are 3,776 acres of stratified drift aquifer in Town, covering about 13% of the Town’s area. The highest yield (>4,000 sf²/day) totals a very small but important area, only 17 acres, while the second highest yield area (2,000- 4,000 sf²/day) is about 371 acres in size. Most of the aquifer (2,300 acres) in Loudon has a transmissivity of less than 1,000 sf²/day.

Because stratified drift aquifers are comprised of easily accessible layers of fine sand and gravel, many excavation operations in Town have commercial success operating on the aquifer. These are detailed in the **2018 Master Plan**.

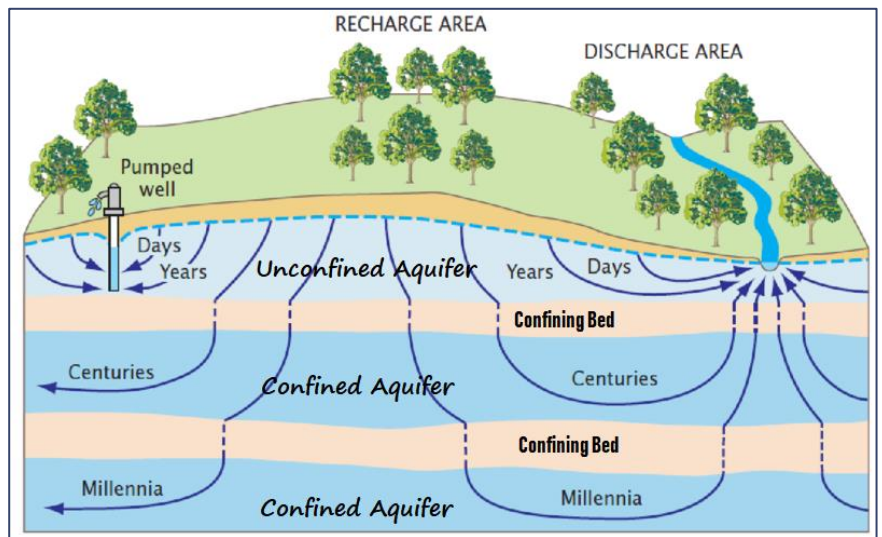
About 10 sections of Loudon’s stratified drift aquifers transfer at least 2,000 sq ft² of water per day. These 387 acres are the Town’s most important aquifer areas.

² USGS Ayotte and Toppin 1995

The stratified drift aquifers are portrayed in **Figure 2.3** as the unconfined aquifer most easily accessed and recharged close to the earth's surface. The bedrock aquifers are portrayed as the confined aquifers which are more difficult to access and require centuries to millennia to recharge with water.

The data from **Table 2.2** shows the greatest total populations served by public drinking water wells in Loudon lie mostly within the stratified drift aquifer (gravel) areas. These sand and gravel areas are dependent on the surface water flows that descend from watershed divides for replenishment and filtration. Future potential municipal water supplies would likely tap into this resource. Today's impact on the land on top of the aquifers and within the watersheds in general will influence the future water quality available to Loudon residents.

Figure 2.3 Groundwater Recharge Flow



Source: USGS Conceptual Groundwater Flow Diagram as modified by CNHRPC



Beaver Pond. Photo courtesy of Stephanie Aubert

2.5. Watersheds

Loudon is situated in an important location, hosting sections of major watersheds for the Merrimack River (southwest), Soucook River (central), and Suncook River (northeast Loudon). Five smaller local subwatersheds flow into the rivers, ponds, streams, wetlands, and brooks of Loudon and its surrounding communities. The Soucook River is the Town’s most prominent waterbody.

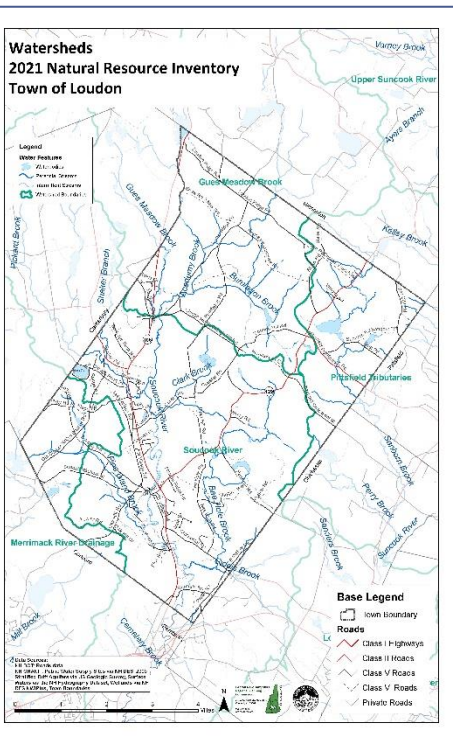
The Gues Brook subwatershed spans beyond the northwestern corner of Loudon into Northfield and Gilmanton, dipping into Loudon to roughly follow Clough Hill Road and Loudon Ridge Road. The Perry Brook-Suncook River subwatershed is located over the northeastern corner, encompassing Sanborn Pond. Most of

Table 2.4

Subwatersheds HUC 12			
HUC #	Subwatershed Name	Loudon Location	Total Acres
10700060202	Gues Meadow Brook	NW Clough Hill to Pittsfield Rd	7,840.5
10700060302	Soucook River	Canterbury to Chichester	14,804.6
10700060503	Pittsfield Tributaries (Suncook)	Blake Rd to Pleasant St	4,613.0
10700060802	Merrimack River Drainage	SW corner Berry Pond to Oak Hill	2,638.5
Total Acres			29,896.7

Source: NH GRANIT Hydrologic Unit Codes (HUC) 12 data

this subwatershed is located in Gilmanton, Barnstead, Pittsfield and Chichester. From Clough Pond’s Berry Road to Mudgett Hill Road, the Soucook River watershed spans the majority of the community from the Canterbury border roughly along Clough Hill Road to Pleasant Street at Loudon’s Concord-Pembroke-Chichester border to the southeast. This is the largest watershed in Loudon. The Bow-Bog Brook Merrimack River subwatershed is located south of Clough Pond and encompasses Hoit Road Marsh and Hothole Pond and encircles Concord’s Turtle Pond. The Bow Bog Brook-Merrimack subwatershed also encompasses sections of Canterbury, Concord, and Pembroke. **Table 2.4** displays the details.



A watershed is an area of land that captures precipitation, surface water runoff, groundwater, etc. and drains into specific waterbodies.

Four subwatersheds of the Merrimack River, Suncook River, and Soucook River cover Loudon.

2.6. Surface Waters

Nearly 11 miles of the Soucook River flow through Loudon, originating in Gilmanton and flowing through Loudon south to from the Pembroke/Concord border. Bee Hole Brook is also a substantial watercourse at about 8.5 miles in Loudon. With the multiple shorter named brooks, Town hosts many miles of watercourses, not including intermittent streams and unnamed brooks.

Over 45 miles of named flowing brooks and rivers travel within and through Loudon.

The Town hosts significant named pond acreage, the largest of which is the nearly 87-acre Sanborn Pond. Clough Pond at nearly 44 acres hosts the Town beach. There are also numerous unnamed ponds, swamps, and wetlands like the Hoyt Road Marsh Wildlife Management Area (WMA) located throughout Loudon which contribute to the overall surface water availability. **Table 2.5** lists the named surface waters in Town.

About 200 acres of large named ponds are located in Loudon.

Waters Subject to RSA 483-B, the Shoreland Water Quality Protection Act

Several watercourses are subject to the [NH RSA 483-B, the Shoreland Water Quality Protection \(SWQPA\) Act](#) which provides regulations for protected shoreland and streams. For rivers and streams, Academy Brook (at juncture of unnamed 3rd order stream) Bumfagon Brook (at juncture of Academy Brook), and Soucook River (juncture of Gues Meadow and Bumfagon Brooks) are subject to the SWQPA. For lakes and ponds,

Clough Pond, Crooked Pond, Hole Brook Pond, Rocky Pond, Sanborn Pond, Holt Pond and O’Brien Recreation Dam are subject to the SWQPA. There may be additional waters not listed which must comply with these regulations.

The accompanying NH Code of Administrative Rules Env-Wq 1400 (SWQPA) can be found at:

<https://www.des.nh.gov/sites/g/files/ehbemt341/files/documents/env-wq-1400.pdf>.

Despite the attraction and attention given to the Soucook River over the decades by various volunteer groups, little progress has been made toward getting the Soucook River nominated and designated into the [NHDES Rivers](#)

Table 2.5

Named Surface Waters	
Rivers & Brooks	Size
Academy Brook	3.95 miles
Bee Hole Brook	8.52 miles
Bumfagon Brook	4.63 miles
Clark Brook	2.80 miles
Giddis Brook	0.40 miles
Gues Meadow Brook	2.08 miles
Perry Brook	0.35 miles
Pickard Brook	0.82 miles
Pine Island Brook	2.89 miles
Sanborn Brook	5.34 miles
Shaker Branch	2.63 miles
Soucook River	10.72 miles
Total Miles	45.15
Large Ponds	Size
Clough Pond	43.90 acres
Crooked Pond	28.80 acres
Hothole Pond	21.70 acres
Rocky Pond	17.33 acres
Sanborn Pond	86.90 acres
Total Acres	198.7

Management and Protection Program (RMPP). The Rivers Management and Protection Program affords riverfront communities provides some protective measures and additional local control of activities within the river corridor. This may be a future goal to work toward. These protections include state recognition of the river's value, Establishment of a Local Advisory Committee (LAC), development of a River Corridor Management Plan, stream flow protections, coordinated regulatory review and comment, and specific river protections related to new dams, landfills, hazardous waste activity, sludge application, and more. River designation into the RMPP does not mean loss of local land use authority, does not mean diminished riparian rights, does not mean loss of property value, and does not mean additional government intrusion. Visit <https://www.des.nh.gov/water/rivers-and-lakes/rivers-management-and-protection> for more information.

Riparian and Wetland Buffers

A wetland buffer is a naturally vegetated upland area adjacent to a wetland or surface water. Riparian buffers are those vegetated areas along rivers and streams. Riparian buffers act as living filters that protect surface water quality, in turn helping to preserve our state's high-quality lakes and rivers. The Soucook River is the predominant moving water source in Loudon, although the Town has many miles of significant brooks and a large acreage of ponds and wetlands. Sanborn Pond is nearly 87 acres, the largest standing waterbody.

Loudon's Zoning Ordinance contains a Wetlands Conservation District Overlay with the purpose of protecting groundwater, protecting habitats and preventing development on or near wetlands. Permitted uses include forestry and tree farming, agriculture, wildlife management, conservation and nature trails. No fertilizers or pesticides are permitted within the buffer. Wetlands over 2,000 square feet require a 75' buffer which may also be applied for smaller areas if the wetland has exceptional functional value. A 75' wetlands buffer is also applied to vernal pools, brooks, streams, and brooks not protected by the Shoreland Water Quality Protection Act. As worded, the Zoning Ordinance implies that all wetlands must be mapped and delineated by a certified wetlands scientist to be covered by the Overlay District.

As exemplary as this Wetlands Conservation District Overlay is, there may be room for improvement. Specifically, clarification of whether all wetlands and water areas are covered within the District or just those mapped by a wetlands scientist, and perhaps revising the buffer from 75' to 100' or 125', depending on the current Town priorities.

Setback or Buffer?

Setback is a distance requirement from wetlands or surface waters for specific activities such as construction or septic systems (required by zoning or permit).

Buffer is a land management practice of encircling a vegetated or wetland area at a certain distance.

A 2019 fact sheet from the Connecticut River Joint Commission entitled *The Importance of Riparian Buffers for Your Land and Your Environment* is available for public outreach at:

<https://www4.des.state.nh.us/blogs/rivers/wp-content/uploads/living-with-the-river-buffer-flyer-R.pdf>.

The NH Department of Environmental Services in conjunction with planning agencies developed the *Innovative Land Use Planning Techniques Handbook*, with a section on *Shoreland Protection: Importance of Riparian Buffers* located at <https://www.nh.gov/osi/planning/resources/documents/ilupt-chpt-2.6.pdf>.



Beaver Dam. Photo courtesy of Stephanie Aubert

WHAT ARE NH'S WETLAND SETBACKS? NHDES FAQ

<https://www.des.nh.gov/organization/divisions/water/wetlands/categories/faq.htm#faq3>

Under NH Wetlands Law 482-A:1, there are no setbacks for wetlands unless they are acted upon. Several specific resource types in NH have buffers, which are added levels of protection.

Prime Wetlands: Under RSA 482-A:15.

Several municipalities in NH have "Designated Prime Wetlands."

- Some municipally designated prime wetlands have a 100 foot prime wetland buffer zone.

Waterbodies protected under the Shoreland Water Quality Protection Act (SWQPA) RSA 483-B.

All lakes and ponds greater than 10 acres, all 4th order and greater streams and rivers and all waterbodies subject to the tide are protected under the SWQPA:

- 50 foot primary structure setback.
- 20 foot accessory structure setback.
- Limitations on removing vegetation adjacent to these waterbodies.

Tidal Buffer Zone in SWQPA.

The area extending landward 100 feet from the highest observable tide line.

- 100 foot TBZ This area can contain wetlands, transitional areas, and natural and developed uplands.
- 250 Protected Tidal Zone

Septic Systems under RSA 485-A.

NHDES Subsurface Systems Bureau requires that new septic systems are installed:

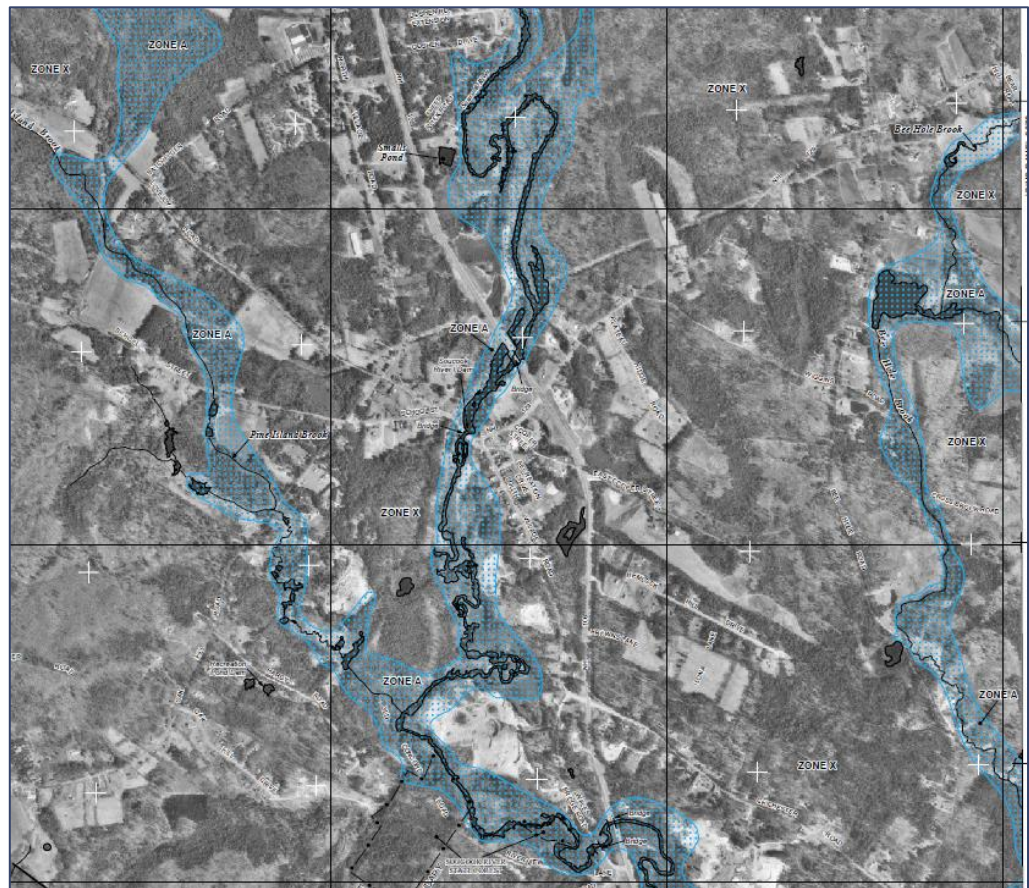
- 75 feet from wetlands having very poorly drained soils.
- 50 feet from wetlands having poorly drained soils. In the protected shoreland, if the soil is a porous the setback is at least 125 feet from the reference line of the waterbody.

2.7. Floodplains

A floodplain is the low lying ground adjacent to rivers that is prone to flooding. Flood hazard areas that have a 1% chance of being inundated by a flood event in any given year are commonly referred to as the 100-year floodplain. The flood hazard areas with a 0.2% chance of annual flooding are often referred to as the 500-year floodplain. The **Loudon Hazard Mitigation Plan 2017** described the floodplains in detail, provided a series of recommendations, and developed a series of maps. The Town does have a Floodplain Development Ordinance which regulates development in these areas. The approximate assessment of existing structures in the floodplain, single family and non-residential buildings, totaled over \$64.7 million³ as of May 2016 from the **Hazard Mitigation Plan 2017**.

Figure 2.6 NFIP Floodplains: Pine Island Brook, Soucook River, Bee Hole Brook

Shown in **Figure 2.6**, locations of 1% annual chance of flooding (Zone A) include the entirety of the Soucook River, Pine Island Brook, Bee Hole Brook and Bog Pond through which Bee Hole flows, the entirety of Shaker Brook, Bumfagon Brook, the entirety of Pickard Brook, and Sanborn Brook into Pittsfield. Loudon's floodplains are displayed on the **Water Resources Map**.



Source: FEMA Digital Flood Rate Insurance Map #33013C-0365, 2010

According to current mapping (**FEMA Merrimack**

County Digital Flood Rate Insurance Maps 2010), there are no 500-year floodplains mapped in Loudon (0.2% annual chance). Some of those areas may flood. The Town should consider obtaining by tax deeded properties or by purchasing conservation land to provide additional flood capacity in the areas around waterbodies and the mapped floodplain. Multiple benefits are available when land in the floodplain is permanently protected from development. Conservation land in the floodplain provides additional water capacity during flood events, protects

³ Loudon Hazard Mitigation Plan 2017

unique habitat communities along waterbodies, enables channel movement without harm to structures, and as a safety measure to ensure people do not build in the floodplains in the future and are subject to flood loss.

2.8. Wetlands

In New Hampshire, wetlands are defined as “an area that is inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and under normal conditions do support, a prevalence of vegetation typically adapted for life in saturated soils conditions.” Wetlands are not always wet, but they generally include familiar places such as marshes, wet meadows, beaver impoundments, swamps, fens, bogs, vernal pools and the surroundings of other surface water bodies. Wetlands are determined by characteristics of vegetation, soils, and hydrology. They perform a variety of ecological functions, such as providing significant habitats for wildlife and plants, maintaining good water quality, providing storage during a flood event, and as sources for recreation. Loudon’s wetlands are depicted on the **Water Resources Map**.

Table 2.7

National Wetlands Inventory		
Wetland Class	Acreage	Total % of Town
Palustrine	2,332.2	7.8%
Lacustrine	249.5	0.8%
Riverine	0.0	0.0%
Total	2,581.7	8.6%

Source: NWI Data Layer

The US Fish and Wildlife Service’s National Wetland Inventory contains several classifications of wetlands, palustrine (marshes or swamps and trees), lacustrine (around lakes and of a shallow depth), and riverine (connected by rivers). Estuary and marine wetlands are found along coastal areas. Loudon hosts palustrine and lacustrine wetlands as displayed in **Table 2.7**.

About 9% (2,582 acres) of the Town are wetlands.

Loudon’s Zoning Ordinance contains a Wetlands Overlay Zoning District that requires 75’ setback from wetlands mapped by a certified wetlands scientist. Open space developments require buildable parcels to be no more than 25% wetlands or steep slopes (Loudon Zoning Ordinance, Section 401.3.B Contiguous Buildable Area). There are no other building setbacks from wetlands. State protection is minimal, so with only 9% of the Town covered in wetlands, local regulation need to be strong enough to enable wetlands and their unique habitat to remain untouched by development.

2.9. Hydric Soils

Hydric soils by definition are formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions (lacking oxygen) in the upper part of the soil. Most hydric soils exhibit characteristic features that result from repeated periods of saturation or inundation that last more than a few days. Distinctive characteristics persist in the soil during both wet and dry periods, making them particularly useful for identifying hydric soils in the field. Hydric soils are identified by the Natural Resource Conservation Service and New Hampshire requires that wetland determinations and delineations are conducted by certified wetland scientists. Hydric soils are considered a development constraint because they are difficult to develop without significant permitting and engineering.

About 21% (6,346) acres in Loudon are hydric soils (poorly drained and very poorly drained).

Around Loudon’s rivers, brooks, and wetlands, hydric soils are located in all sections of the Town. Development of these areas may provide to be challenging, and when subdivision plans and site plans are reviewed, any hydric soils on the plats should be evaluated by the Conservation Commission. The family names and map units are noted in

Table 2.8.

Table 2.8

Hydric Soils			
Map Unit Key	Full Soils Category Name and Slope	Acreage	Total % of Town
Poorly Drained (Group B & C)		3,325.7	11.1%
315A	Mashpee sand 0 to 5 percent slopes	15.1	0.1%
415A	Moosilauke fine sandy loam, 0 to 3 percent slopes, very stony	85.2	0.1%
415B	Moosilauke fine sandy loam, 3 to 8 percent slopes, very stony	1,225.0	4.1%
214A	Naumburg loamy sand, 0 to 5 percent slopes	315.0	1.1%
647A	Pillsbury sandy loam, 0 to 3 percent slopes, very stony	158.0	0.5%
647B	Pillsbury sandy loam, 3 to 8 percent slopes, very stony	1,274.2	4.3%
5A	Rippowam very fine sandy loam, 0 to 3 percent slopes, frequently flooded	68.5	0.2%
105A	Rumney very fine sandy loam, 0 to 3 percent slopes, frequently flooded	157.0	0.5%
547B	Walpole sandy loam, 3 to 8 percent slopes, very stony	27.7	0.1%
Very Poorly Drained (Group A/D & D)		3,020.3	10.1%
296A	Catden mucky peat, 0 to 1 percent slopes	33.6	0.1%
194A	Catden mucky peat, 0 to 1 percent slopes, ponded	359.2	1.2%

Table 2.8

Hydric Soils			
Map Unit Key	Full Soils Category Name and Slope	Acreage	Total % of Town
894A	Meadowsedge peat, 0 to 1 percent slopes	825.5	2.8%
196A	Meadowsedge peat, 0 to 1 percent slopes, ponded	7.2	0.0%
394A	Chocorua mucky peat, 0 to 1 percent slopes	1,001.9	3.4%
406A	Medomak mucky silt loam, 0 to 2 percent slopes, frequently flooded	49.1	0.2%
649A	Peacham cobbly mucky fine sandy loam, 0 to 1 percent slopes, extremely stony	144.4	0.5%
17A	Searsport-Chocorua-Naumburg complex, 0 to 1 percent slopes	548.6	1.8%
393A	Timakwa mucky peat, 0 to 1 percent slopes	23.2	0.1%
49A	Whitman very fine sandy loam, 0 to 3 percent slopes, very stony	27.5	0.1%
Total Poorly Drained & Very Poorly Drained Hydric Soils		6,346.0	21.2%

Source: Merrimack-Belknap County Soils Survey, 2011. Figures are rounded

As displayed on the **Hydric Soils Map**, the poorly drained and very poorly drained soils follow Gues Meadow Brook, Bee Hole Brook, Pine Island Brook, Clark Brook, Academy Brook, Pine Island Brook, Giddis Brook and the Soucook River. In the northern half of Town, hydric soils are especially prolific. The hydric soils also encompass the wildlife management areas under conservation.

3. Agriculture and Forestry Resources Co-Occurrence

Loudon is home to many productive agricultural farms, orchards, tree farms, hay fields, and nurseries that sell their products locally or to out-of-Town distribution centers. The Town has an active Agricultural Commission which researches, supports, and promotes local farms and farm products. A list of the active agricultural operations and with the respective tax map and lot numbers were mapped for this NRI.

In the **Agriculture Weighting Map**, the highest value agriculture lands are located in the northeastern section of Loudon north of Loudon Ridge Road. These farmlands host most of the Town’s existing locations of agricultural operations.

Survey results and Conservation Commission discussions revealed that agriculture, active farmland, and farms were very important to the Town of Loudon. The agriculture category makes up 24% of the total co-occurrence score for Loudon.



Moore Farm. Photo courtesy of Brad Moore

3.1. Agriculture Input Value Scores and Co-Occurrence Results

Farm Soils: The Merrimack County Soils Survey identifies various soil types that are considered the best soils for agricultural purposes. Soils categorized as “Prime Farmland Soils” were assigned a value score of 8 points, and “Soils of Statewide Importance” were assigned a value score of 5 points. Farm soils are scattered throughout the Town but are especially prominent in the north and along Loudon Ridge. Farm soils often, but do not always, align with existing farmlands.

Value Score: 8
Value Score: 5

Forestry Soils:

Value Score: 2

The Merrimack County Soils Survey

also identifies soils that are most productive for forestry purposes. The best forestry soils, groups IA and IB soils, were assigned a value score of 2 points.

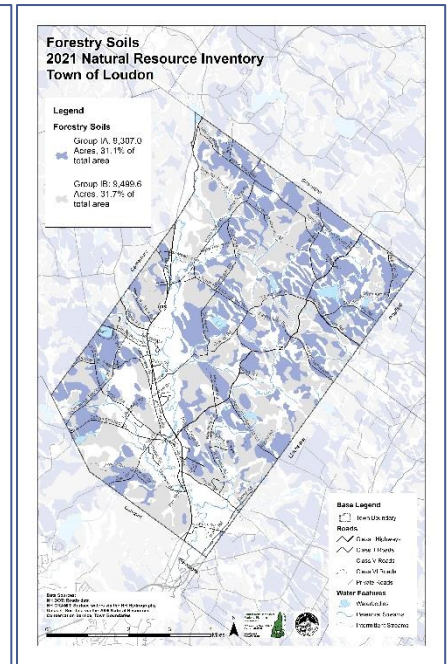
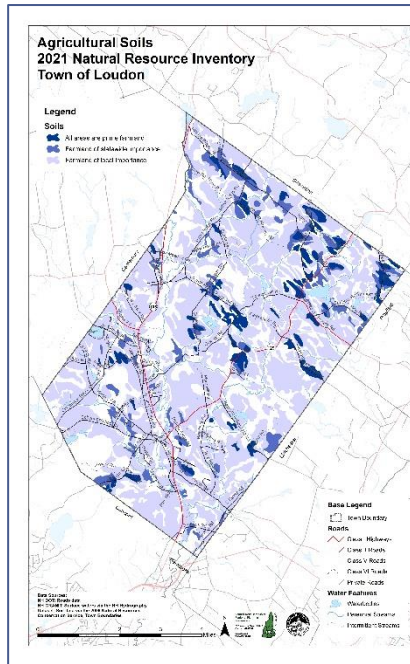
Agricultural Lands: This includes any

Value Score: 9

agricultural land, maintained fields,

and orchards in the Town of Loudon. This data is sourced from a land use data layer

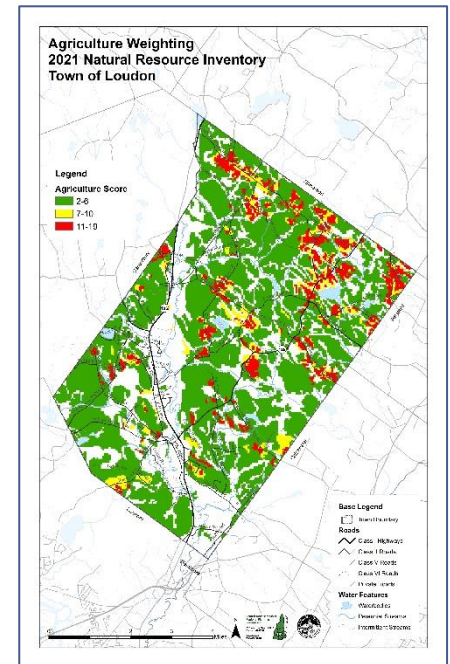
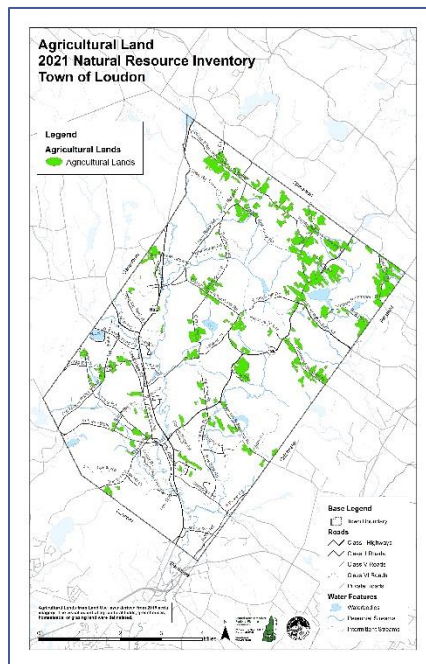
maintained by the Central NH Regional Planning Commission, which categorizes all parts of Town into various land uses, including residential, commercial, and agricultural. Agricultural lands were assigned 9 points, among the highest value scores of all layers.



Agriculture Co-Occurrence Results:

Agriculture Category Total: 24

The results shown in the **Agriculture Weighting Map** display locations of the highest quality agricultural land in the northeastern two-thirds of Town. It highlights Loudon Ridge and Ridge Road, Upper City Road, and various other sites. These areas have a strong agricultural value and should be targeted for conservation if preserving agriculture and agricultural lands is a goal of the community.



Survey results and Conservation Commission discussions revealed that agriculture, active farmland, and farms were very important to the Town of Loudon. The Agriculture category comprises 24% of the total co-occurrence score.

3.2. Agricultural Operations

Over 200 individual agricultural operations such as active farms, , nurseries and orchards and greenhouses in Loudon cover about 2,372 acres, or 8% of the Town. The types of farming include dairy, livestock, beef, corn, produce, eggs, flowers, horses, maple syrup, trees and shrubs, row crops, hay fields, large home gardens, and built operations such as barns, silos, paddocks, and greenhouses. The majority of the 2,263 acres of agricultural activity in Loudon supports open-air (not built) agricultural operations. The **Agricultural Land Map** displays these areas of agricultural activity.

Almost 8% (2,263 acres) of the Town is used for active agricultural purposes, while another 0.4% (109 acres) is built agricultural land, like farm buildings and greenhouses.

The Town’s Agricultural Commission used to host a website. A revitalized website of the Commission has the potential to become a vital resource to the community’s landowners and farmers, providing information and educational resources. Maintaining this site would encourage additional community outreach and connection with residents.

3.3. Important Farmland Soils

The **Agricultural Soils Map** displays the locations of the highest quality soils in Town. The agricultural operations located along Loudon Ridge Road and Clough Hill Road are situated within these most productive areas. There are three categories of farmland soils: Prime Farmlands, Farmland of Local Importance and Farmland of Statewide Importance. All three types are found in Loudon to total a staggering 19,573.8 acres, which is 65.6% of the Town’s total area. Prime Farmlands cover 5% of the Town, while Locally Important Farmlands cover 55% of Loudon. Statewide Important Farmland soils cover nearly 6% of Loudon. **Table 3.1** details Loudon’s best farm soils.

Table 3.1

Farmland Soils					
Map Unit Key	Full Soils Category Name and Slope	Hydrologic Rating*	Drain Class**	Acreege	Total % of Town
Prime Farmlands					
46B	Henniker fine sandy loam, 3 to 8 % slopes	PH	WD	54.4	0.2%
166B	Canterbury fine sandy loam, 3 to 8 % slopes	PH	WD	407.7	1.4%
458B	Metacomet fine sandy loam, 3 to 8 % slopes	PH	MWD	6.1	0.0%
478B	Gilmanton fine sandy loam, 3 to 8 % slopes	PH	MWD	1,034.1	3.5%
Total				1,502.3	5.0%

Table 3.1

Farmland Soils					
Map Unit Key	Full Soils Category Name and Slope	Hydrologic Rating*	Drain Class**	Acreeage	Total % of Town
Locally Important Farmlands					
12B	Hinckley gravelly fine sandy loam, 3 to 8 % slopes	NH	ED	34.9	0.1%
12C	Hinckley gravelly fine sandy loam, 8 to 15 % slopes	NH	ED	112.2	0.4%
26A	Windsor loamy fine sand, 0 to 3 % slopes	NH	ED	76.0	0.3%
26B	Windsor loamy fine sand, 3 to 8 % slopes	NH	ED	182.2	0.6%
26C	Windsor loamy fine sand, 8 to 15 % slopes	NH	ED	32.4	0.1%
35A	Champlain loamy fine sand, 0 to 3 % slopes	PH	SED	262.7	0.9%
35B	Champlain loamy fine sand, 3 to 8 % slopes	PH	SED	1,164.6	3.9%
35C	Champlain loamy fine sand, 8 to 15 % slopes	NH	SED	113.4	0.4%
43C	Canton very fine sandy loam, 8 to 15 % slopes, very stony	NH	WD	21.2	0.1%
45B	Montauk fine sandy loam, 3 to 8 % slopes, very stony	PH	WD	7.2	0.0%
47B	Henniker fine sandy loam, 3 to 8 % slopes, very stony	PH	WD	142.5	0.5%
47C	Henniker fine sandy loam, 8 to 15 % slopes, very stony	PH	WD	245.6	0.8%
47D	Henniker fine sandy loam, 15 to 25 % slopes, very stony	PH	WD	89.0	0.3%
166D	Canterbury fine sandy loam, 15 to 25 % slopes	NH	WD	210.8	0.7%
167B	Canterbury fine sandy loam, 3 to 8 % slopes, very stony	PH	WD	131.3	0.4%
167C	Canterbury fine sandy loam, 8 to 15 % slopes, very stony	NH	WD	681.1	2.3%
167D	Canterbury fine sandy loam, 15 to 25 % slopes, very stony	NH	WD	708.9	2.4%
220B	Boscawen fine sandy loam, 3 to 8 % slopes	NH	ED	127.4	0.4%
220C	Boscawen fine sandy loam, 8 to 15 % slopes	NH	ED	298.1	1.0%
250B	Chatfield-Hollis-Montauk complex, 3 to 8 % slopes, very stony	PH	WD	39.3	0.1%
250C	Chatfield-Hollis-Montauk complex, 8 to 15% slopes, very stony	PH	WD	439.0	1.5%
290B	Champlain-Woodstock complex, 3 to 8 % slopes	PH	SED	208.9	0.7%
290C	Champlain-Woodstock complex, 8 to 15 % slopes	PH	SED	139.0	0.5%
443B	Chichester sandy loam, 3 to 8 % slopes, very stony	PH	WD	66.4	0.2%
443C	Chichester sandy loam, 8 to 15 % slopes, very stony	PH	WD	414.5	1.5%
443D	Chichester sandy loam, 15 to 25 % slopes, very stony	NH	WD	18.0	0.1%
449B	Scituate fine sandy loam, 3 to 8 % slopes, very stony	PH	MWD	14.7	0.0%
449C	Scituate fine sandy loam, 8 to 15 % slopes, very stony	PH	MWD	41.7	0.1%
459B	Metacomet fine sandy loam, 3 to 8 % slopes, very stony	PH	MWD	1,649.7	5.5%
459C	Metacomet fine sandy loam, 8 to 15 % slopes, very stony	PH	MWD	1,267.9	4.2%
459D	Metacomet fine sandy loam, 15 to 25 % slopes, very stony	PH	MWD	12.6	0.0%

Table 3.1

Farmland Soils					
Map Unit Key	Full Soils Category Name and Slope	Hydrologic Rating*	Drain Class**	Acreeage	Total % of Town
479B	Gilmanton fine sandy loam, 3 to 8 % slopes, very stony	PH	MWD	867.1	2.9%
479C	Gilmanton fine sandy loam, 8 to 15 % slopes, very stony	PH	MWD	544.8	1.8%
480B	Millsite-Woodstock-Henniker complex 3-8% slopes very	PH	WD	2,278.7	7.6%
480C	Millsite-Woodstock-Henn complex 8-15% slopes very stony	PH	WD	3,761.8	12.6%
Total				16,405.3	54.9%
Statewide Important Farmlands					
46C	Henniker fine sandy loam, 8 to 15 % slopes	PH	WD	129.1	0.4%
166C	Canterbury fine sandy loam, 8 to 15 % slopes	NH	WD	591.0	2.0%
313A	Deerfield fine sandy loam, 0 to 5 % slopes	PH	MWD	48.2	0.2%
478C	Gilmanton fine sandy loam, 8 to 15 % slopes	PH	MWD	439.8	1.5%
613A	Croghan fine sandy loam, 0 to 5 % slopes	PH	MWD	458.1	1.5%
Total				1,666.2	5.6%

* PH = Partially Hydric
NH = Not Hydric

** MWD = Moderately Well Drained
WD = Well Drained
SED = Somewhat Excessively Drained
ED = Excessively Drained

Source: Merrimack-Belknap County Soils Survey, 2011. Figures are rounded

Approximately 5% (1,502 acres) of the soils in Loudon are prime farmlands, and another 55% (16,405 acre) of soils are locally important farmland.

As noted above, Prime Farmland soils are the highest category of important farmlands and comprise 5% of the Town. These areas are indicated on the **Agricultural Soils Map**. Understanding the soil attributes (slope, ability to retain water, consistency) can help the Conservation Commission and Agricultural Commission focus on opportunities to protect these lands forever by way of conservation easement.

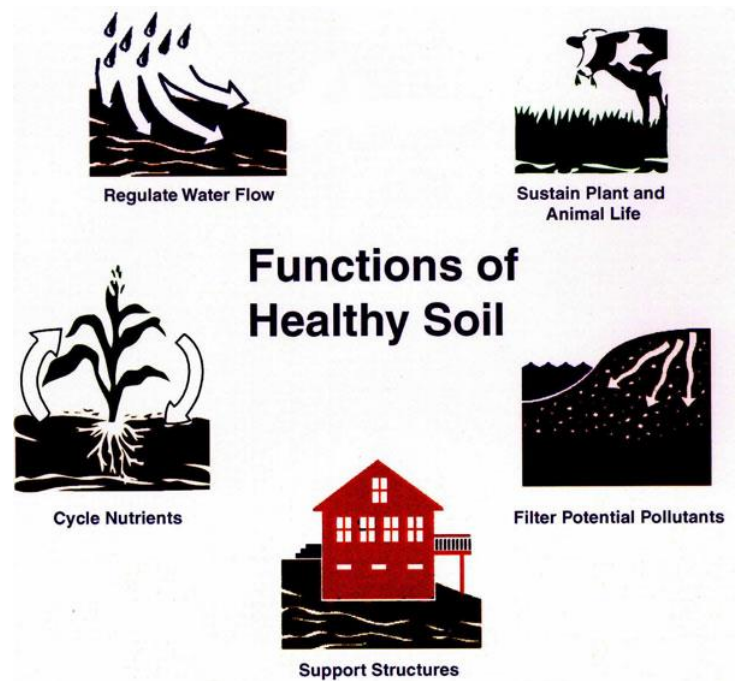
The soil names and the numeric-alpha key will appear on Planning Board development subdivision plans and site plans. The slope of site locations on the plan can be approximated by the letter of the key (A-E) shown, where further into the alphabet indicates a higher slope range – for instance, D is 15-25% for most soil categories. Conservation Commission members can apply soil family knowledge as described in **Table 3.1** to assist with their review of potential developments, review of wetlands applications, and other duties. When a potential development is shown to be located on Prime Farmland soils, or Locally or Statewide Important soils, there is an

opportunity working with the landowner to site the proposed development in the least intrusive way to these farmland soils as well as to obtain conservation easements.

The [USDA Natural Resources Conservation Service \(NRCS\)](https://www.nrcs.usda.gov/wps/portal/nrcs/main/nh/soils/surveys/) updates soil survey maps every 30-40 years. In New Hampshire, soils are updated on a county basis. Merrimack County was updated in 2011 together with Belknap County. Locally, the Merrimack County Conservation District

(<http://merrimackccd.org/>) staff works directly with landowners and communities to provide education and technical assistance by answering questions, supporting local food growing and markets, selling low-cost nursery bulbs and trees available for planting, and providing resources for successful agricultural operations, whether a home garden or a commercial venture. The Loudon Conservation Commission and Agricultural Commission could approach the M CCD with specific questions or concerns related to soils in Town, particularly when new or expanded development encroaches on high-importance soils.

Figure 3.2 Soil Functions



Source: <https://www.nrcs.usda.gov/wps/portal/nrcs/main/nh/soils/surveys/>

3.4. Forestry Soils

Of Loudon’s 29,897 total acres, about 2,910 acres are found within the NH 106 and the Soucook River corridor as well as Loudon Village, encompassing much of the Town’s developed area. These soils are mainly sand and gravel and support white pine growth, but are now mostly developed with infrastructure, roads, homes, and businesses.

The white pine soils of Group IC (10%) are located along the Soucook River and NH 106 corridor and represent the most developed areas of Town.

Soils types can support more than one kind of use, so many soils can be categorized in combinations of agricultural, forestry and/or hydric soils. Over 85% of the Town’s soils are suitable for tree growth. The **Forestry Soils Map** displays the locations of Loudon’s forest soils by forest groups. The dominant forest soils types are Group IB (32%)

and Group IA (31%), which along with Group IIA (2%) better support hardwood tree varieties. The Group IIB poorly drained soils (11%) support northern spruce and fir and appear along the Town’s streams and waterbodies. The forest soils of Loudon are documented in **Table 3.3**.

The [UNH Cooperative Extension Merrimack County Office](#) located in Boscawen is a local resource about forestry. Forest health, pest management, storm damage help, and regular educational sessions and fun activities such as bird or tree identification walks make Co-op Extension a wonderful, no-cost solution for forestry issues.

The Conservation Commission should investigate opportunities to protect the Group IC white pine forest soils and their habitats along the Soucook River.

Ways include limiting future development along the River through buffers and setbacks, keeping any tax-deeded Town property along the Soucook River for permanent conservation, talking with UNH Cooperative Extension about techniques to encourage forests and forest soil health, hosting white pine trees planting events, and holding guided walks in Town Forests and along the Soucook River for the public.

Table 3.3

Forestry Soils				
Forest Group	Definition	Types of Wood	Acreeage	Total % of Town
Group IA	Deeper loamy soils, moderately-to well- drained	Prime northern hardwood	9,307.0	31.1%
Group IB	Sandy or loamy soils, moderately-to well-drained	Oak & beech	9,499.6	31.8%
Group IC	Outwash sands & gravel	White pine	2,910.1	9.7%
Group IIA	1A &1B with limitations (very steep, shallow, or rocky)	Northern hardwood	612.4	2.0%
Group IIB	Poorly drained soils	Northern spruce & fir	3,325.7	11.1%
Total			25,654.9	

Source: Merrimack-Belknap County Soils Survey 2011. Figures are rounded

4. Historic and Cultural Resources Co-Occurrence

Inventories of the conservation lands, historic resources, and recreational resources are available in the **Loudon Master Plan 2018**. Areas of scenic value, underlying bedrock upon which all landforms were created, trails, historic and cultural sites, and places important to the community are considered under this category. This NRI seeks to use the most pertinent information from all sources to make better informed decisions about future preservation of the most important historic and cultural areas in Town.

The **Historic and Cultural Resources Weighting Map** helps highlight areas that contribute to the Town's pastoral and cultural qualities. Survey results and Conservation Commission discussions indicated that while scenic, recreational, historic, and cultural significance was important to the Town, it was more of a contributing factor rather than a primary driver in determining priorities for land conservation. The category comprises 13% of the total co-occurrence score for Loudon. Future versions of this NRI could consider recreational resources including trails and water access points.

4.1. Historic and Cultural Resource Input Value Scores and Co-Occurrence Results

Historic and Cultural Sites 300' Buffer: The presence of historic or cultural sites often contributes to appeals to

Value Score: 6

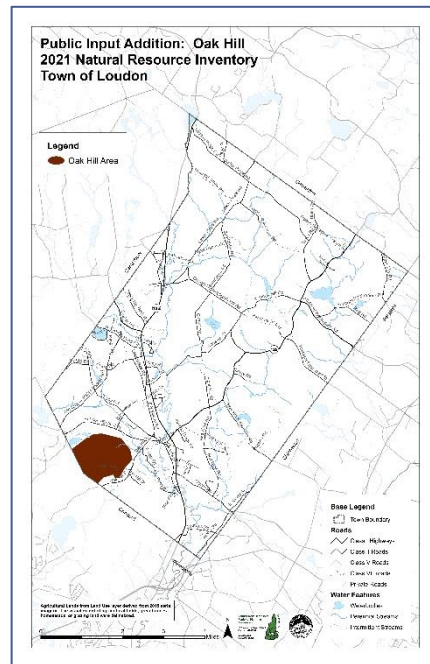
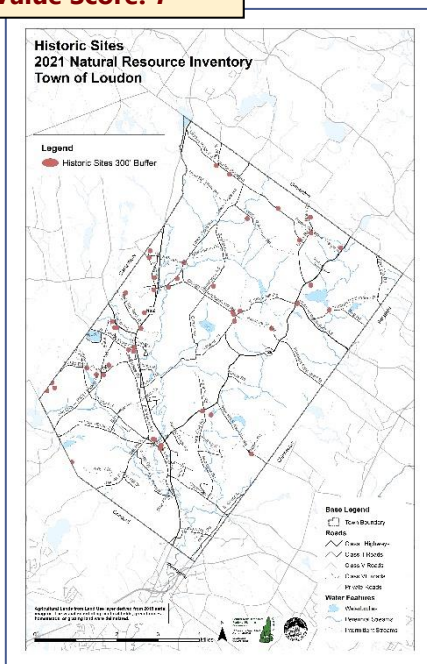
conserve properties. A database of historical and cultural sites was developed and reviewed, based on lists developed by the Town in past planning documents and exercises.

A 300' buffer from these sites was included in the analysis and assigned a value score of 6 points.

Public Input Additions: After reviewing the survey, a few areas of Town were identified as being particularly

Value Score: 7

important cultural or historic locations. The most prominently cited locations included Loudon Ridge, Clough Pond, Oak Hill, a kettle hole near the Village, and various agricultural sites. Each of these locations was already scored highly on the co-occurrence analysis, except for the area of Oak Hill. To accommodate this important addition, a data layer was developed to delineate the area of Oak Hill, which was assigned value score of 7 points.

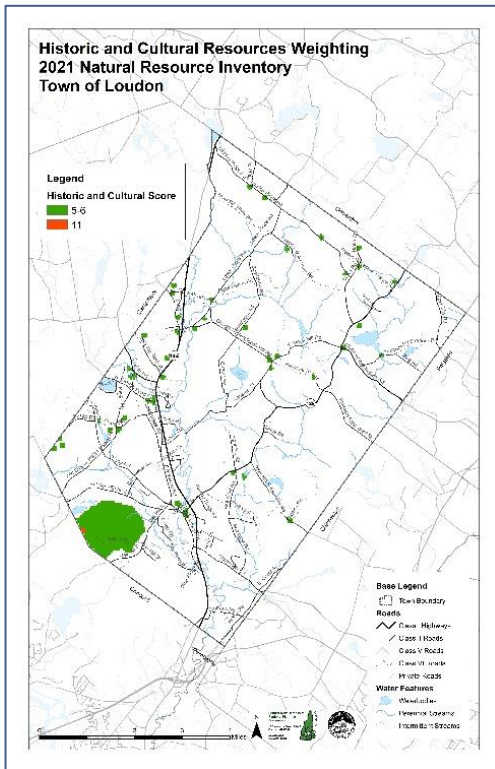


Scenic Views and Vistas: For multiple reasons, this analysis did not directly include scenic views and vistas. First, it was difficult to determine coverage of a viewshed with accuracy. Attempts to draw one appeared arbitrary, and sophisticated viewshed analysis were beyond the scope of this project. It was difficult to identify and score which particular views and which aspects of a view was prized to individuals. Second, it appeared that scenic values were accounted for within other categories. For example, agriculture was highly prized by Loudon residents in part because of the scenic views the fields offer. Third, the areas that appeared to have the highest scenic values were already scored very highly on the **Co-Occurrence Map** of other categories. Scenic views were valued by residents based on the survey but appeared less prominent than other categories. For these reasons, basic scenic views were not included in the co-occurrence analysis.

Cultural and Recreational Co-Occurrence Results: The co-occurrence results of the Cultural and Recreational layers

Historic and Cultural Category Total: 13

highlight the locations with significant cultural or historic significance and adjustments the scoring to ensure the Town’s value for Oak Hill was properly reflected in the analysis.



The **Historic and Cultural Resources Weighting Map** helps highlight areas that contribute to the Town’s recreational and cultural qualities. Survey results and Conservation Commission discussions indicated that while scenic, recreational, historic, and cultural significance was important to the Town, it was more of a contributing factor rather than a primary driver in determining priorities for land conservation. The category comprises 13% of the total co-occurrence score for Loudon.

4.2. Bedrock Geology

Supporting data for the NRI is included to enable a more complete understanding of the natural and historical resources of community. Upon which all history and present settlement are located is the bedrock geology of the Town.

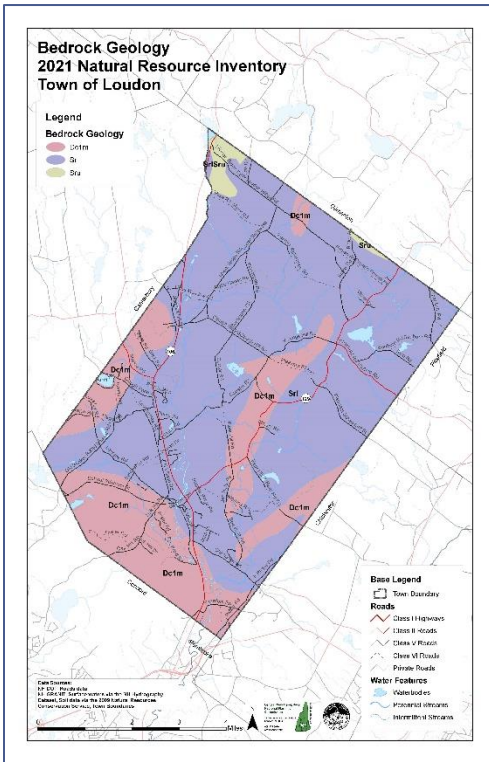
Underlying Loudon are formations of bedrock upon which today's forests, development, roads, and hydrology rest. The familiar pattern of bedrock deposits spanning a general southwest to northeast direction follows the receding glaciers of over 12,000 years ago, a shared pattern with most of New England. Glacial recession formed the Northeast's rivers and lakes and provided the parent material (bedrock) for the soil variations found throughout a given area. The bedrock material influences surficial geology, the stratified layers of sand, gravel, and fine material, which in turn influences soil type formation. The landscapes created by glacial erosion left layers of land formations like hills (Oak Hill) and boulders, ponds (Sanborn Pond) and hydrology (Soucook River), and the vegetation (forests and grasses) occurring atop the bedrock and soils. The Town resides on mostly Metasedimentary & Metavolcanic rock (74%) and some Plutonic & Volcanic rock (26%) as shown in **Table 4.1**.

Table 4.1

Bedrock Geology				
Map Code	Formation Unit	Type	Acreage	Total % of Town
Dc1m	Concord Granite (Late Devonian)	P	7,729	26%
Srl	Lower Rangeley Formation	M	21,719	73%
Sru	Upper Rangeley Formation	M	448	1%
Total			29,897	100%
P = Plutonic & Volcanic				
M = Metasedimentary and Metavolcanic				
<i>Source: US Geological Survey Surficial Geologic Map Plate 1627 (figures are rounded)</i>				

The Upper Rangeley Formation (1% of the Town) bedrock unit is located under NH 106 at the border with Belmont, and under a sliver of Loudon's northern boundary with Belmont west of NH 129. The Lower Rangeley Formation (73%) is present under the Suncook River subwatershed and in northeastern Loudon west of NH 129 down to Piper Hill Road. The bedrock unit Concord Granite (26%), a Plutonic & Volcanic rock, underlies strips of land west of NH 106 bordering with Canterbury, a strip roughly following west and under NH 129, the entire southern section of Loudon from School Street west to the Chichester border, and a strip running under from Bee Hole Road to Pleasant Street Road into Chichester.

About 73% (21,719 acres) of the Town is underlain by the Lower Rangely Formation bedrock, a type of Metasedimentary and Metavolcanic rock.

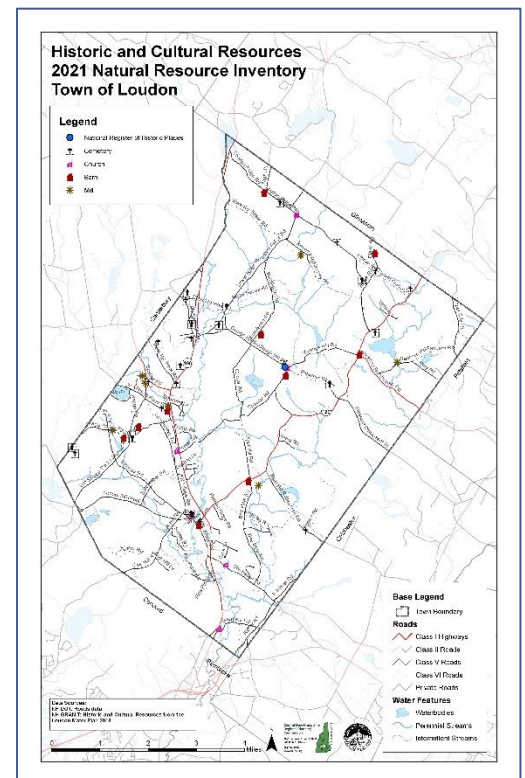


A **Bedrock Geology Map** was produced for this NRI. Knowledge of local bedrock units is important for development, drinking water, excavation of mineral deposits, soil chemistry for agriculture, and potential for faults and fractures which may lead to earthquakes. Water from wells drilled into bedrock may contain dissolved iron, manganese, calcium, radon, arsenic, or other undesirable constituents that occur naturally in higher concentrations in some rocks than in others. For example, the two bedrock units with the highest concentrations of arsenic in well water, the Concord Granite and the Lower Rangeley Formation, are located primarily in central New Hampshire according to the [USGS 1999 Study of Arsenic, Iron and Manganese in Groundwater and Bedrock](#). There may be newer sources of information available on this topic but understanding bedrock characteristics enables awareness and action. For instance, the Town could encourage residents to test their wells every 2-3 years to understand and mitigate elements found in drinking water.

To view the bedrock geology map of the greater Loudon area and compare it with New Hampshire, visit the [US Geological Survey Mineral Resources Online Spatial Data Map](#) website.

4.3. Historic and Cultural Sites

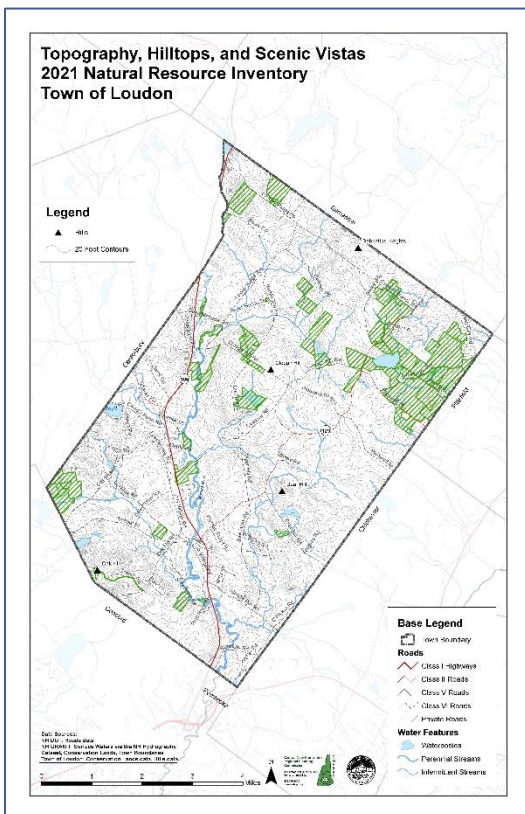
The Town has a rich history with important sites, buildings, monuments, or features throughout the community. As displayed on the **Historic and Cultural Sites Map**, concentrations of locations are located along NH 106, in the Village, along Loudon Ridge Road, on Class VI roads with little access. These locations were just as important for the Town’s history as they are in today’s life. They include old mill sites, cemeteries, historic barns, farms, original stone houses, district schoolhouses, public sites, and existing historic buildings. More information can be found in the **Loudon Master Plan 2018** or from the Historical Society. Oak Hill was featured prominently. Historic locations buffered by 300’ were included in the co-occurrence analysis.



4.4. Steep Slopes or Ridgelines

The Town is defined by its steep slopes and ridgelines. These areas supported early settlement patterns and are important to the community to preserve. Steep slopes are a constraint to development, but development is possible. Watershed runoff becomes a significant problem without the proper management of fertilizers, pesticides, erosion, sedimentation, and reclamation. The Town adopted a Steep Slope District (overlay) in the Zoning Ordinance to help protect these locations at the 2007 Town Meeting. Steep slopes are defined in the zoning as an area having an elevation change of 25 feet or more and the average slope is 25% or greater. The ordinance applies where the proposed site disturbance is greater than 25,000 square feet (about 0.57 acres). Special

exceptions can be sought for areas totaling 10,000 square feet or less.



Many of the farms in town are situated along steep slopes or at the top of steep slopes. Agricultural runoff is a known cause of water quality degradation. The **Topography, Hilltops, and Scenic Vistas Map** displays the main hills, 20' topographic contours, and conservation lands. Hills and high elevation points above sea level are displayed in the next section in **Table 4.2**. Visual representation can provide greater support for more protective regulations. Further conversations could be held with agricultural property owners and the Agricultural Commission on watershed protection measures that would benefit the entire community. Regulation of solar and wind energy could also be explored.

4.5. Scenic Views and Viewsheds

Within its borders, Loudon hosts a wide range of elevations, from under 370' at the low-lying Soucook River in the Village to the Town's highest point of Sabattus Heights on Loudon Ridge Road at 1,040' above sea level. The Town is host to many hills, most of which are located on private property. At any of

these locations, scenic viewsheds are identified in several directions. In addition, the roadside views of lowland areas also offer a rural, scenic beauty which could similarly be preserved for their scenic value. The Oak Hill Fire Tower can be climbed according to the Town and the City of Concord guidelines. The facility is owned by the State of New Hampshire and was identified by the public as an important natural resource to protect.

A scenic view is the pleasing scenery as seen from lowland areas, and a scenic viewshed is the view as seen from a promontory or high location in Town which may extend over many miles.

Table 4.2

Hills and Elevation		
Name	Elevation Above Sea Level	Location
Bear Hill	740'	North of Bear Hill Road
Clough Hill	800'	Clough Hill Road
Loudon Ridge	990'	Loudon Ridge Road
Oak Hill	920'	Shared with City of Concord
Piper Hill	620'	Piper Hill Road
Apex of Pleasant Street (Unnamed)	710'	Pleasant Street
Presby Lane Hills (Unnamed)	840'	Presby Lane
Sabattus Heights	1,040'	Loudon Ridge Road, west of Blake Road
Whitney Hill	720'	Top Lovejoy Farm Road and Whitney Road, with Concord

Several hills in Loudon span from 620' elevation above sea level to 1,040'.

Future editions of this NRI could include a Viewsheds Map displaying the topography of Loudon, and the location of hillside views. Scenic vistas of Loudon's waterbodies are seen from such as Oak Hill, Clough Hill and Currier Road promontories. These vistas help define Loudon's identity.

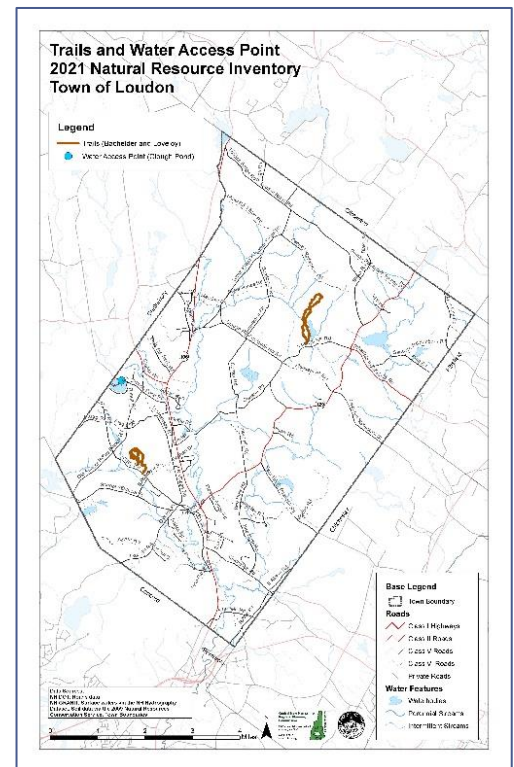
Source: Loudon Master Plan 2001, CNHRPC compiled research from online topographic maps

4.6. Recreational Trails and Water Access

Loudon hosts both a local trails system within the Loudon (Batchelder) Town Forest and shared regional trails with Concord to the Oak Hill Fire Tower. The Batchelder Town Forest trails are entered at the parking lot along Youngs Hill Road. The trails consist of two loops, one 1.2 miles and the other 1.6 miles in length, connected by a bridge over Bumfagon Brook. The Lovejoy Trails are an extensive trail network entered from the parking area on Lovejoy Road. Both sets of trails are maintained by the Town of Loudon and the Conservation Commission. The Oak Hill Trails are the most well-known public trails in Loudon and span the far of Oak Hill into Concord. Oak Hill Trails are maintained by local trail volunteers although the tower and Oak Hill Road are owned by the State. Trails maps are available on the Town website at <https://www.loudonnh.org/conservation-commission/pages/loudon-trails>.

There are few recreational water access points in Loudon, and most are privately owned and not widely publicized. However, the Town Beach on Clough Pond is one of the few sites residents and visitors can enjoy. The beach is unsupervised and sometimes the NHDES has closed the beach after testing for e. coli or cyanobacteria, both common occurrences in local waters.

Future versions of the NRI could include a full inventory of Loudon's public recreational assets as a co-occurrence dataset. Trails are popular recreation destinations for residents and visitors, but can also cause the need for constant maintenance, and perhaps the enforcement of trail regulations.

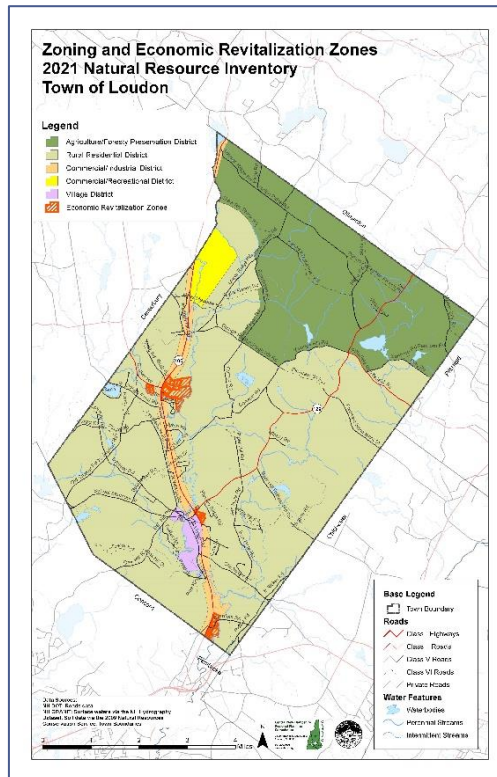
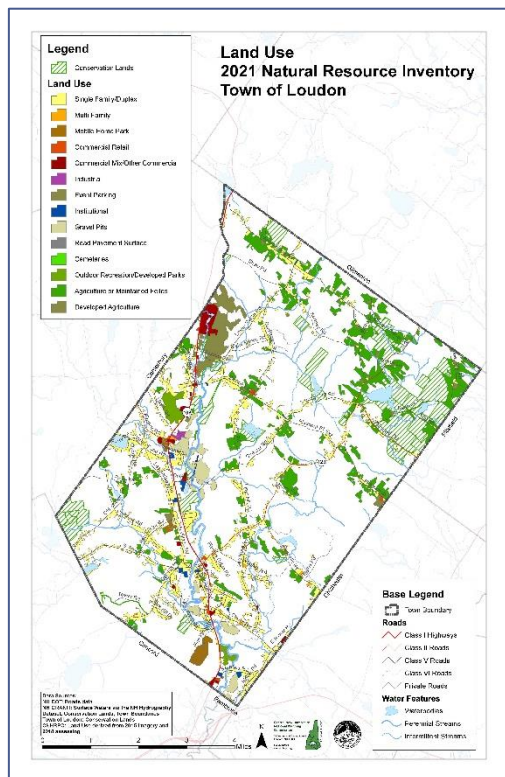


4.7. Land Use and Zoning

Land use planning refers to the process by which land is allocated between competing and sometimes conflicting uses in order to secure the rational and orderly development of land in an environmentally sound manner. This helps ensure the creation of sustainable human settlements. For Loudon and much of Central New Hampshire, this began with land grants in the 1700s. Early attempts to settle were often in conflict with the indigenous Native Americans. Incorporated in 1773, settlements were started on Loudon Ridge and in Loudon Village along the Soucook River. With human occupation came public municipal buildings, roads, stores, and homes and farms.

As described in the **2018 Master Plan**, Loudon has grown significantly, with the latest population boom in the 1980-1990 decade. For this NRI, the **Land Use Map** identifies areas of the Town where development has already taken place as categorized by specific land use, delineated by aerial photography and Loudon’s tax map assessing records.

The Town’s Land Development Regulations and the Zoning Ordinance guide the location and type of future development. The **Zoning Map** illustrates where in the community different zoning districts are located. Zoning



should reflect economic and housing needs, as well as the environment and natural resource needs. This can be done by directing development to areas that can sustain it with existing or planned infrastructure, and minimal negative impacts to natural resources. It can also restrict certain uses that are incompatible with to location or community goals. Of note in Loudon is that the primary commercial zones in Loudon are along the Route 106 corridor and overlap with

areas that were identified as having a high natural resource value to the Town.

Loudon has adopted a Wetland Protection Overlay District Ordinance, a Steep Slope Overlay District Ordinance, an Open Space Development Ordinance, a Floodplain Ordinance, and other tools that assist with protecting the Town’s rural character and natural resources. The Town could consider an Aquifer Protection Overlay District

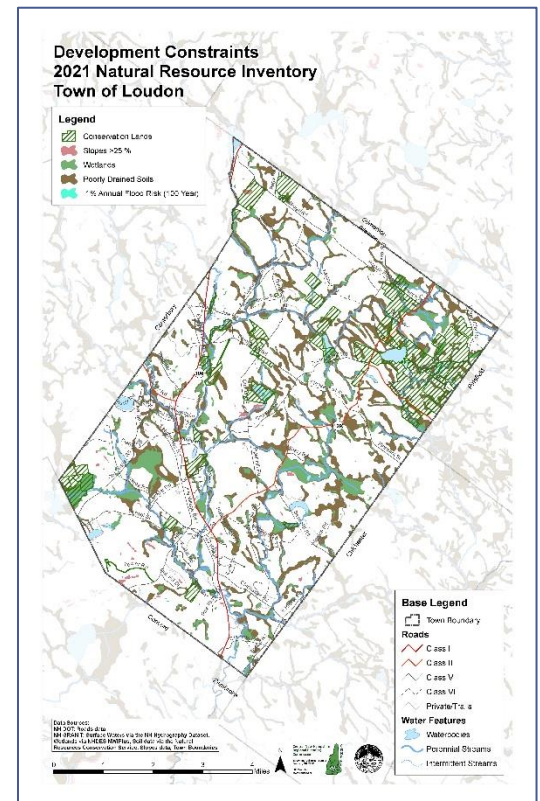
Development is altering the landscape in any number of ways such as: Changing landforms from a natural or semi-natural state for a purpose such as agriculture, housing, business or infrastructure.

Ordinance as well to ensure future water supplies contain the fewest contaminants and the transmissivity remains high to accommodate a growing community.

Other resource-related zoning could include small and large wind energy systems ordinance, solar energy ordinance to ensure visual scenic views are maintained while supporting the wide-spread use of alternative energy.

Not only existing land use and zoning drive the potential for future development. Conservation lands, steep slopes, wetlands, hydric soils, and floodplains are constraints that may make development impossible or too costly. The **Development Constraints Map** shows these constraints and can help identify areas which may be ripe for development. Conversely, it can be used as a starting point for identifying areas that are better suitable for development.

Other resource-related zoning could include small



5. Wildlife Habitat Resources Co-Occurrence

As a rural community with a low population density and large blocks of undeveloped land, Loudon contains natural communities and habitats which are host to a wide variety of wildlife. The [NH Fish and Game](#) maintains a listing of species, the [Wildlife Action Plan](#), occurring in New Hampshire that are state- and federally- threatened and endangered, of special concern in the State, introduced species, and species of greatest conservation need. The species listing includes diadromous fish, freshwater fish, marine fish & marine invertebrates, mammals, reptiles, amphibians, mussels, insects, and birds. The [NH Rare Plants, Animals, and Exemplary Natural Communities](#) document was updated in May 2021 and contains town by town lists of species, including those for Loudon. The Hoit Wildlife Management Area (WMA) in Loudon is owned by NH Fish and Game for the purpose of protecting and improving the wildlife habitat. Threatened and endangered species as well as more common wildlife require a range of habitat types and scales.

5.1. Wildlife Habitat Input Value Scores and Co-Occurrence Results

Wildlife Action Plan: The Wildlife Action Plan is a dataset developed by New Hampshire Fish and Game to display areas with the highest quality wildlife habitat. This layer is the most heavily weighted data layer in this category as it represents areas of important habitat better than any other layer. Three different categories in this data layer are used, the highest being “Highest Ranked Habitat in NH” with a value score of 13 points, followed by the “Highest Ranked Habitat in Ecological Region” with a value score of 7 points, and “Supporting Landscapes” was assigned a value score of 5 points. This dataset itself is a co-occurrence result of various habitat layers. More information on the Wildlife Action Plan dataset can be found on the [NH Fish and Game website](#).

Value Score: 13

Value Score: 7

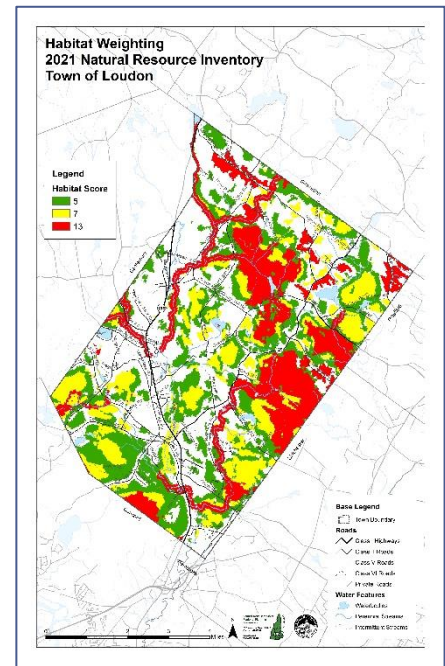
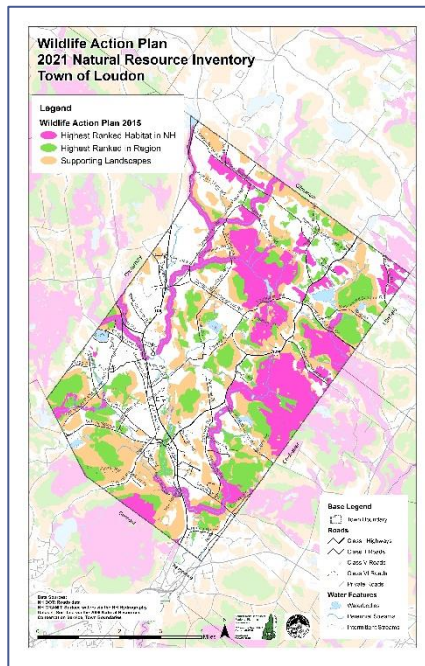
Value Score: 5

Unfragmented Lands: Although the

Value Score: 0

co-occurrence analysis did not

include an unfragmented lands dataset, the Wildlife Action Plan dataset indirectly incorporates land fragmentation in its tiered ranking. In future versions of this NRI, it may become more useful to develop a distinct dataset to separate the Town of Loudon into blocks of land unfragmented by roads, development, or human activities. Large areas of land not fragmented by roads or other human disturbances are important for a range of species and thus have a higher value than smaller blocks of undeveloped land. The Wildlife Action Plan takes these blocks into consideration well enough that a separate data set was not required at this time.



Wildlife Habitat Co-Occurrence Results: The co-occurrence results of the wildlife habitat-related layers directly

Wildlife Habitat Category Total: 25

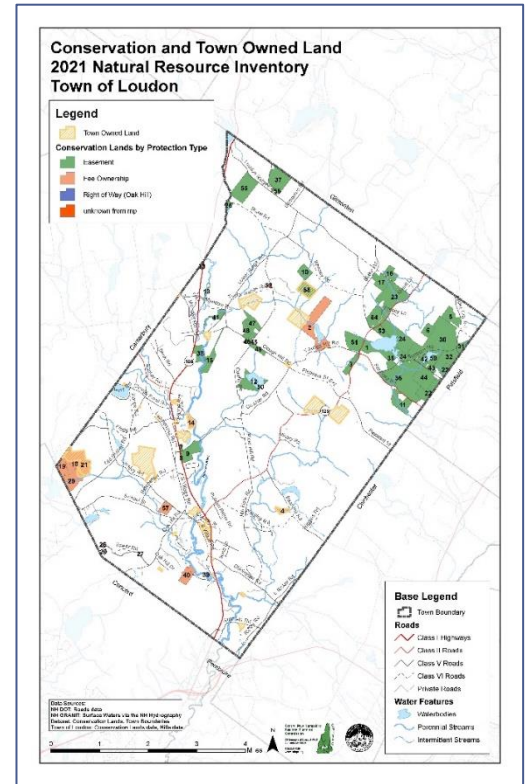
reflects the Wildlife Action Plan tiers. The highest value conservation land is located in a large forest block along the

Chichester town line bounded by Pleasant Street, NH Route 129, and Bear Hill Road, as well as the smaller block to its north. A large area of Bumfagon Brook in north-central Loudon, as well as stream corridors including the northern areas of the Soucook River and Bee Hole Brook, stand out as having high conservation value. Areas in reds, oranges, and yellows on the map show the areas of the higher habitat value, where the higher scored data inputs coincide.

Wildlife Habitat was deemed very important to the Town of Loudon in the Survey and by Conservation Commission discussions. The Wildlife Habitat category comprised 25% of the total co-occurrence score for Loudon.

5.2. Conservation and Town Owned Lands

About 30 conservation or public lands in Loudon as displayed on the **Conservation and Public Lands Map**, some of which are comprised of multiple parcels. These properties, which may or may not be permanently preserved, include conservation easements, deed restrictions, scenic easements, wildlife management areas (WMA), open space, and fee owned lands. These conservation and public areas are located throughout the community but are concentrated along the northeast corner next to Pittsfield, along the Soucook River, along Clough Hill Road, in the Village, and in the western corner with Concord. Vast swathes of unprotected land are located in the southern and central areas of Loudon. **Table 5.1** documents the conservation lands.



About 11% (3,125 acres) of the Town's land is considered under conservation. These include easements, Wildlife Management Areas, Town Forests, and fee owned parcels.

Table 5.1

Conservation Lands				
Name	Acres	Conservation Type	Program or Source	Map-Lot #
Bachelor Town Forest	222.0	CE & Town FO	LCIP #1, #2, #3	25-6, 34-4, 34-5
Bearhill Commons Lot	17.6	Town FO	TOLP #4	13-24
Bergeron WMA	80.5	CE	NHFG #1, #2	17-3, 9-5
Bronnenberg Easement	77.0	CE	FRTE #4	39-34, 39-35
Bumfagon Brook	50.0	CE	FRTE #1	44-13
Cabot/Holt Pond	91.0	CE	FRTE #3	41-16, old 41-6
Gues Meadow Brook Conservation Restriction	7.3	CE	NHMS	61-9
Soucook River Recreation Area	21.0	Town FO		40-15
Grady Conservation Restriction	56.3	CE	NHMS	51-26
Green	98.0	CE	LCIP #4	27-2, 36-1
Hoit Road Marsh WMA	115.0	FO	NHFG	56-3, 56-4, 56-8, 55-11
Maxfield	146.0	Town FO		56-5, 56-7
J Merrill	189.4	CE	LCIP #5	8-1, 8-2, more
R Merrill	279.0	CE	LCIP #6, #7	26-7, 26-9

Table 5.1

Conservation Lands				
Name	Acres	Conservation Type	Program or Source	Map-Lot #
Canterbury River Conservation Restriction	8.6	CE	NHMS	64-2
Osborne WMA	444.0	CE	NHFG	8-6, 8-6, 9-1, 9-2
Sanborn Family Trust	339.0	CE	LCIP #7	17-1, 17-2
Sleeper	92.7	CE	FRTE #2	63-12, 62-13
Smith Lot 2 Conservation Restriction	40.3	CE	NHMS	50-19
Soucook River State Forest	47.0	FO	State	19-14, 11-6
Soucook River WMA	25.9	CE	NHFG #3	51-19
Yeaton	137.0	CE	LCIP #8	8-3, 8-4, 8-9
Smith	116.0	CE		42-8, 42-9-1, 42-37, 42-42, 42-10, 42-2
Davies	68.0	CE	FRPP	25-7
NHMS	53.4	CE		52-17
Ladd	65.0	CE	TOLE #2	26-10, 26-12
Moore	40.0	CE	TOLE #1	65-1
Chesley Field	25.0	Town FO	Town Cons Fund	29-85
Lovejoy Open Space	135.0	Town FO	TOLP #17	39-11
Cabot/Sanborn Pond	38.0	Town CE	FRTE #5	8-5
Total	3,215.0	10.5%		
FO = Fee Owned		NHMS = NH Motor Speedway		
CE = Conservation Easement		NHFG = NH Fish & Game		
LCIP = Land Conservation Investment Program		TOLE = Town of Loudon Easement		
FRTE = Five Rivers Conservation Trust Easement		TOLP = Town of Loudon Purchase		

Source: NH GRANIT, Loudon Cons Comm, AxisGIS, Tax Maps, CNHRPC compiled data

Opportunities for obtaining land along the larger watercourses like Bee Hole Brook and the rest of the Soucook River remain. View the **Conservation and Town Owned Land Map** for further detail. Conservation lands with 1,000' buffers are included in the co-occurrence analysis as part of the Wildlife Habitat category.

5.3. Unfragmented Blocks

The main factor influencing the use of forest lands for timber products and wildlife habitat range is the level of fragmentation on the landscape. Fragmenting features such as roads, residential development, commercial and

A conservation easement is a permanent legal restriction against future development and other activities on a parcel as specified in the conservation easement deed.

industrial activity have been prevalent on the New Hampshire

landscape since early settlement years. The location of unfragmented lands, the land blocks not separated by roads, houses or other human development, was mapped for Loudon and the surrounding communities.

About 13% (3,796 acres) of the Town is contained within the three largest blocks of local unfragmented lands.

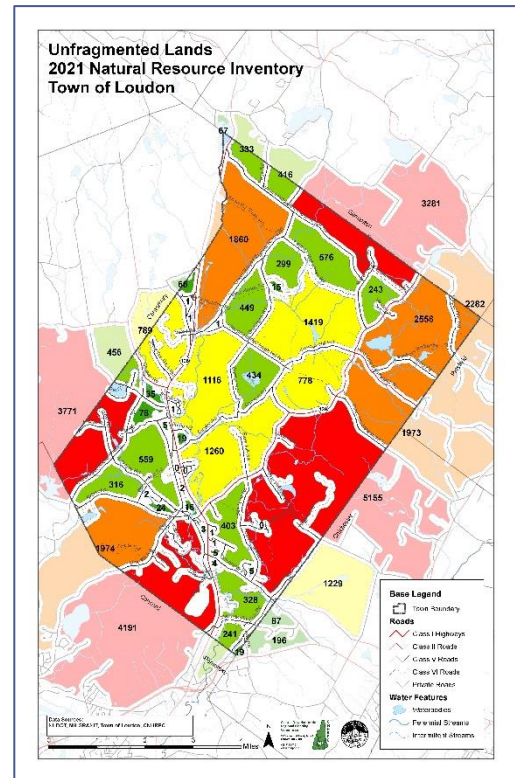


Table 5.2

Unfragmented Blocks		
Largest Loudon Block Locations	Locally Significant Acreage	Regionally Significant Acreage
NH 129 – Pleasant St – Bear Hill Rd	3,309	5,155
Loudon Ridge Rd - Lower Ridge Rd - NH 106	1,759	1,860
Upper City Rd – NH 129 – Pittsfield Rd	1,722	2,558
Kenney Rd – NH 129 – Youngs Hill – Clough Hill Rd - Bumfagon Rd	1,419	---
NH 106 – NH 129 – Currier Rd	1,260	---
NH 106 – Clough Rd - Currier Rd – NH 106	1,116	---
School St – Oak Hill Rd – Concord	979	1,974
South Village Rd – Oak Hill Rd – Concord	868	4,191
Concord- Old Shaker Rd – Berry Pond - Canterbury	843	3,771
Totals	13,275	19,509

Source: CNHRPC GIS Calculations Using Road Buffers, 2021

Loudon is a growing rural community with most of its development concentrated along the main routes NH 106 and NH 129 and the Class V Town roads. By conducting a GIS operation of buffering publicly maintained roadways by 400', an unfragmented lands inventory was conducted. In Loudon, this operation excludes Class VI unmaintained roads. These large blocks connect regionally to the surrounding communities' unfragmented lands, thereby increasing the overall natural resource value of the regional block. The **Unfragmented Lands Map** provides visual detail.

As shown in **Table 5.2**, the largest unfragmented block completely within Loudon is 1,419 acres spanning from Kenney Road east to NH 149, south to Youngs Hill Road and Clough Hill Road, west to Bumfagon Road. Two additional large unfragmented blocks are situated to the southwest, from NH 106 heading east to Piper Hill Road and Currier Hill Road. These three blocks situated within Loudon's geographic center along with a fourth large 778

acre block between Youngs Hill Road and NH 129 may represent some of the best opportunities for constraining future development through regulation or protection.

Loudon also hosts extraordinary, large unfragmented areas at its northern, eastern, and southern perimeters. Regionally significant blocks are identified from the Town Center area west toward school street to Oak Hill Road (1,974 acres), and from Oak Hill Road to South Village Road to Concord (4,191 acres). Yet much of Loudon's unfragmented forested area is found on the eastern edge of Town with Pittsfield and Chichester, where blocks of 5,155 acres, 1,973 acres and 2,558 acres are noted.

5.4. Current Use

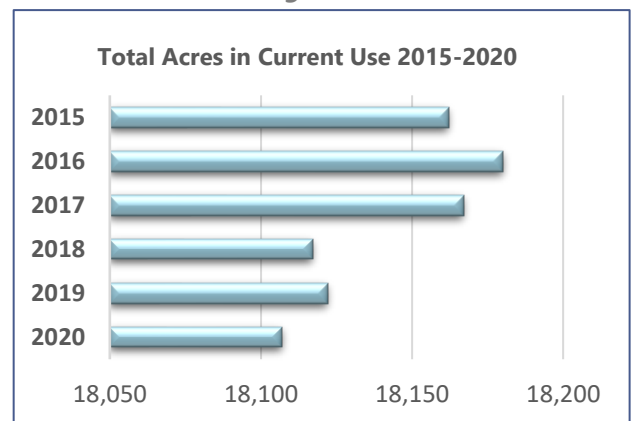
Current use provides a lower tax rate for land over 10 acres utilized for a non-residential purpose. Rules produced by the [NH Department of Revenue Administration](#) and assessment ranges change annually. Between 2015 to 2020, current use in Loudon has remained consistent, trending slightly lower each year with a net loss of about 73 acres over these 6 years. In 2015, 18,162 acres (about 62% of the Town) were under current use. By 2020, 18,107 acres (about 62% of the Town) were under current use. This indicates consistent development trends during this period as the total number of parcels placed under current use (between 469 to 474 parcels) remained very regular. This data is portrayed in **Table 5.3** and **Figure 5.4**.

Table 5.3

Current Use (CU) Trends				
Year	Total Acres in CU	# of Parcels in CU	Total % of Town in CU	Acres with 20% Recreational Discount
2020	18,107	473	61.5%	9,444
2019	18,122	468	61.5%	9,446
2018	18,117	470	61.5%	9,438
2017	18,167	473	61.7%	9,544
2016	18,180	474	61.7%	9,561
2015	18,162	469	61.7%	9,594

Source: Numbers are rounded. Total land acres of 29,453 used for calculations. NHDRA Current Use Reports, CNHRPC compiled research

Figure 5.4



At the same time, between 2015-2020 the number of acres receiving the extra 20% current use discount for permitting recreational use on their property resulted in an overall net increase of 150 acres. While not alarming, this trend is indicative of landowners reducing the amount of land open recreationally to others. This trend should be monitored to determine the cause of this effect, such as why are property owners feeling it is more beneficial to maintain landowner privacy than to leave their property open to hunting or hiking on their land.

About 62% (18,107 acres) of the Town is under current use in 473 parcels while 9,444 acres of the Town receives the additional 20% recreational discount.

The slowly declining number of acres in current use should be monitored, but Loudon remains in steady current use condition. With a consistent 62% of Town land under current use, these lands may not be prioritized for future development by owners.

The Land Use Change Tax program enables 50% of the tax for taking the land out of current use to be allocated into the Town’s Conservation Fund for use by the Conservation Commission to purchase conservation lands. The other 50% is deposited into the General Fund. When small acreages are removed from current use annually, the amount of funding deposited into the Conservation Fund is very low. It may be difficult for the Conservation Commission to purchase conservation easements or properties when there is little development in Loudon. One action the Town could take is to allocate 100% of the Land Use Change Tax to the Conservation fund to enable more conservation purchases.

The Wildlife Action Plan places its priority habitat areas into three categories:

- Tier 1 is the highest ranked habitat in NH by ecological condition.
- Tier 2 is the Highest ranked habitat in biological regions (ecoregions or watershed groups).
- Tier 3 is the supporting landscapes (other significant habitat, regional-scale).

5.5. Wildlife Action Plan (WAP) Habitats

The NH Wildlife Action Plan 2015 (WAP) with updated 2020 data is an important component of the Loudon NRI. Wildlife habitats were identified across the state. In Loudon, the dominant [Appalachian oak pine forest](#) represents 42% of the Town’s area, hosting essential habitat to large-roaming mammals such as bobcat, moose, bear, black bear, lynx, deer, and predator birds like owls. The second largest habitat at 27% of Loudon’s area is the [hemlock hardwood pine forest](#) which hosts species such as bats, eagles, songbirds, snakes, moose, turtles, and salamanders. State-endangered Blanding’s Turtle, Timber Rattlesnake, Common Nighthawk, and New England Cottontail need Loudon’s forest habitat for survival. The WAP habitat datasets were used for the **Habitat Weighting Maps**. The locations of the highest priority habitat (Tier 1) are found along the northern Soucook River corridor, within the block between Lower Ridge Road and Youngs Hill Road and within the block between Pleasant Street and Bear Hill Road. Tier 1 habitats follow along Academy Brook, Shaker Brook, Bee Hole

Table 5.5

Wildlife Action Plan Habitats		
Habitat	Acres	Percentage of Town Acres
Appalachian Oak Pine Forest	12,423.9	41.6%
Developed Impervious	1,642.8	5.5%
Developed or Barren	1,617.4	5.4%
Floodplain Forest	120.1	0.4%
Grassland	2,298.9	7.7%
Hemlock Hardwood Pine Forest	8,174.9	27.3%
Open Water	468.5	1.6%
Peatland	495.8	1.7%
Rocky Ridge	3.2	0.0%
Sand/Gravel	466.5	1.6%
Temperate Swamp	369.0	1.2%
Marsh and Shrub Wetland	1,815.5	6.1%
Total Town Acres	29,897	100.0%

Source: NH Wildlife Action Plan 2020 data

Brook, Bumfagon Brook, Pickard Brook and flow into ponds and wetlands. The Tier 2 locations are generally along the periphery of the Tier 1 habitats. **Table 5.5** displays the WAP habitat types and their percentage in Loudon/

About 10% (756 acres) of Tier 1 highest priority habitat in Loudon is protected by conservation, while the remaining 6,774 acres of Tier 1 habitat is vulnerable to development.

Table 5.6

Wildlife Action Plan Habitat Priorities			
Tier Priority	Acres	Percent of Tier Protected Acres	Percent of Town Acres
Tier 1 Acres	7,629.8	----	25.5%
Tier 1 Acres Protected (Conservation)	755.8	9.9%	---
Tier 2 Acres	4,479.7	----	15.0%
Tier 2 Acres Protected (Conservation)	835.3	18.6%	---
Tier 3 Acres	11,226.8	----	37.6%
Tier 3 Acres Protected (Conservation)	846.7	7.5%	---
Total Tier Habitat Priority Acreage	23,336.6	----	78.1%
Total Protected Tier Habitat	2,437.9	8.2%	---

Source: NH Wildlife Action Plan 2020 data

The WAP utilized the newest available satellite imagery resources and techniques to determine the locations and acreages of priority habitat areas. The most recent data indicates only 2,438 acres of the total 23,337 Tier 1, Tier 2, and Tier 3 habitat in Loudon is protected from development. The Conservation Commission could concentrate future easement and conservation property purchasing around the Tier 1 and Tier 2 areas to best protect the habitat needed for wildlife species. This information is shown in **Table 5.6**.



Animal Tracks. Photo courtesy of Stephanie Aubert

6. Conclusion and NRI Recommendations

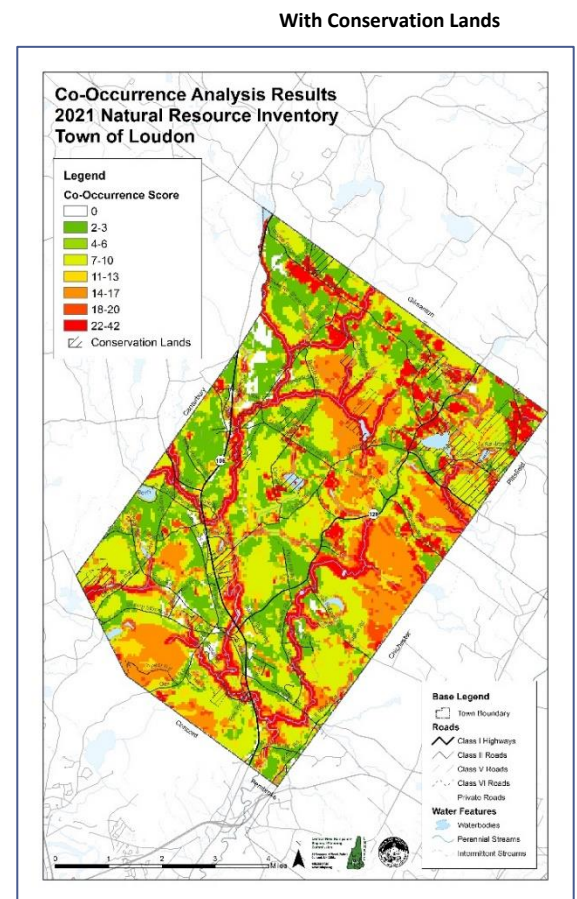
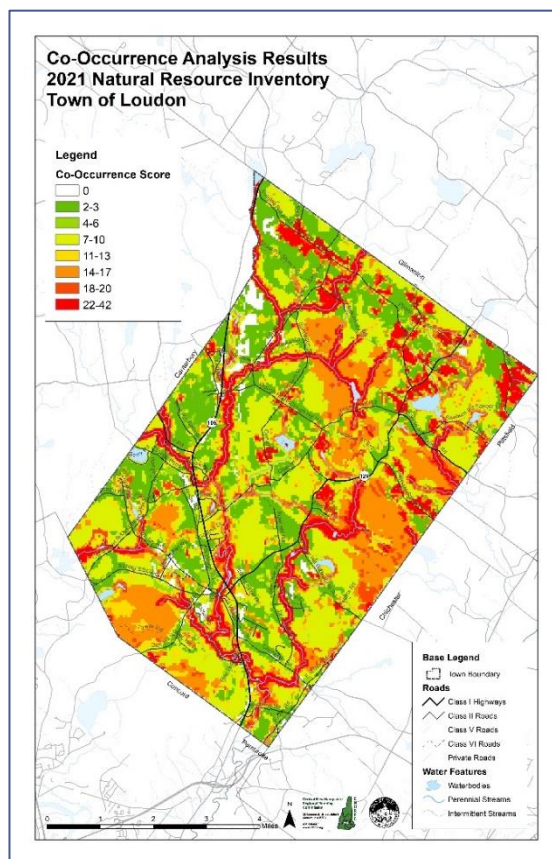
The **NRI Maps** and data have helped highlight lands that are likely to best meet the Town's conservation priorities. An examination over time of the natural resources in these locations and their contributions to the Town of Loudon should also lead to a series of more detailed recommendations.

6.1. Weighted Co-Occurrence Analysis

The **Weighted Co-Occurrence Map** should be considered the composite map of data layers, including inputs for each of the above categories. The **Weighted Co-Occurrence Map** displays the highest priority natural resource locations in the community based on the value the community placed on the various natural resources. The analysis identified the most essential locations in Loudon to conserve.

Additional investigations into any given property may find new insights not represented by the statewide GIS data layers used in this analysis. Despite this limitation of the statewide data, the maps still can accurately portray high-level priority areas across town.

These priority areas follow the Town's waterways, including the Soucook River, Bee Hole Brook, and others. It also includes farms and fields along Ridge Road. Broader areas of relatively high value exist in east of NH Route 129 and south of Pleasant Street to the Chichester border, as well as northwest of Young's Hill Road.



6.2. NRI Recommendations

Reviewing the NRI maps, document, and best planning practices generate potential recommendations for Loudon to undertake to better protect its natural resources. The recommendations are based on the Town's values, the location of each resource, and a brief overview of local policies and regulations. Many of the recommendations overlap and apply to more than one natural resource group. Overlapping recommendations may indicate a higher priority task. The recommendations below are not listed in order of priority.

1. Use this Natural Resources Inventory and the Co-Occurrence Analysis to inform decision making on natural resource protections, including future easement and conservation property purchases.

This NRI and Co-Occurrence Analysis is intended to be a tool to help the Conservation Commission and others make more informed decisions regarding the multiple natural resources in Loudon. The **Co-Occurrence Analysis Map** and the individual category **Weighting Maps** roughly indicate which lands in Loudon provide the highest resource value to the Town. This will help to prioritize the limited time and funding resources for securing additional conservation lands. For instance, conservation projects could include:

- ❁ Protect the **aquifer by obtaining conservation lands** or easements on parcels along the Soucook River and the aquifer area. Include tax deeded parcels when available.
- ❁ Concentrate future easement and conservation property purchasing around **the Tier 1 and Tier 2 Wildlife Action Plan areas** to best protect the habitat needed for wildlife species.
- ❁ Add **digital photographs of Loudon locations** to future versions of this NRI to illustrate each of these natural resources to tie the NRI's data and maps into the imagery to better connect people to the resources they love.
- ❁ Work with the **Agricultural Commission to accomplish joint preservation projects** in high priority areas. Many Conservation Commission priorities are shared with Agricultural Commission.
- ❁ Purchase conservation land or procure **conservation easements in the floodplain** to obtain additional floodwater capacity and habitat.

Conversely, the NRI maps can be used to help identify the best lands to support future housing and economic development needs with minimal impact to the environment.

2. Consider adopting an Aquifer Protection Ordinance to strategically protect the Town's most valuable drinking water sources and other resource protection regulations.

The aquifers are critical regional resources, and the Soucook River/NH 106 aquifer is one of the best in the Central NH region. Although Loudon does not yet have its own municipal water supply today, the Town may have its own water district by mid-century to accommodate growth. Concord and Pembroke depend on the Soucook River area

aquifers and developed Aquifer Protection Ordinances to protect their wellheads that draw from these highest transmissivity aquifers. Incidentally, the Soucook River/NH 106 aquifer is located under Loudon's NH 106 commercial area, recently zoned under RSA 79E as an Economic Revitalization Zone (ERZ) district. Economic development should be balanced with the necessity of preserving drinking water quality.

The Town could consider identifying areas of this corridor to be preserved for future drinking water wells and adopting an Aquifer Protection Ordinance which would include restrictions and require special exceptions for certain uses. The Concord and Pembroke APOs, which use the Soucook aquifer, should be examined so Loudon can evaluate feasibility and can utilize some of their language in Loudon's own APO zoning overlay proposal.

Other resource related zoning could include small and large wind energy systems ordinance, solar energy ordinance to ensure visual scenic views are maintained while supporting the wide-spread use of alternative energy. Speak with the Central NH Regional Planning Commission or investigate what other NH communities are doing for more details.

3. Hold conversations with agricultural property owners and the Agricultural Commission related to watershed protection measures that would benefit the entire community.

The Agricultural Commission, which advocates for agricultural operations, should be approached for their support with keeping aquifers, surface waters, and drinking water supplies safe to use. Through cooperation with the Agricultural Commission, agricultural property owners should be encouraged to use best management practices for agriculture during land management, crop rotation, dairy operations, animal husbandry, and orchard/vegetable growing operations to ensure a cleaner watershed. Education and incentives could be used to help keep the herbicides, pesticides, and livestock waste from infiltrating the water supplies. Ensure the active agriculture operations do not negatively impact the aquifers and surface waters by encouraging the use of best management practices.

4. Allocate 100% of the Land Use Change Tax to the Conservation Fund to enable more conservation purchases.

Funding for conservation properties is limited to donations, the Conservation Fund which receives at present 50% of the Land Use Change Tax, and sometimes state grant programs. If the Conservation Commission can obtain the support needed for Town Meeting to allocate the full 100% to the Conservation Fund, more easements and town forests can be purchased. A targeted educational and information program for Town residents should occur well before Town Meeting to ensure support would be available for the measure.

5. Encourage residents to test their water wells every 2-3 years to understand and mitigate elements found in drinking water.

An extensive public outreach campaign may be necessary. The goal is not to shock or overly concern residents, but to give them the information they need to test their wells. An example “case study” could be one volunteer from each of the Town Boards agrees to participate and share their data with the Conservation Commission for compilation. A personal level approach may be necessary, so compiling these case studies from Town Boards into a pamphlet residents and businesses can use with example measures on how to filter their water could be made available.

6. Consider the benefits of the Soucook River’s designation into the NHDES Rivers Management and Protection Program (RMPP).

Over the decades, there has been attention given to the Soucook River and its various values to the community. The NH DES Rivers Management and Protection Program affords riverfront communities some protective measures and additional local control of activities within the river corridor. This may be a future goal to work toward for the Soucook River. In the Central NH Region, several rivers are designated into the RMPP: Upper Merrimack River, Contocook and North Branch Rivers, and more recently, the Warner River. These protections include state recognition of the river’s value, establishment of a Local Advisory Committee (LAC), development of a River Corridor Management Plan, stream flow protections, coordinated regulatory review and comment, and specific river protections related to new dams, landfills, hazardous waste activity, sludge application, and more. River designation into the RMPP does not mean loss of local land use authority, does not mean diminished riparian rights, does not mean loss of property value, and does not mean additional government intrusion. Visit <https://www.des.nh.gov/water/rivers-and-lakes/rivers-management-and-protection> for more information.

7. Construct a separate Loudon Conservation Commission website, either in accordance with the Town’s CivicPlus agreement or on a separately maintained website, and work with the Loudon Agricultural Commission to re-develop their own website in the same fashion.

The Conservation Commission and Agricultural Commission share some common goals related to land protection over generations and have many opportunities to partner with the other on specific topics. A joint website update (or development) that includes the Trails Committee will enthruse new prospective members and will enable the posting of special topics, meetings, documents, projects, trails, conservation lands, town forests, etc. The Agricultural Commission once had the foundation for an informative website, and a new website should be developed to support the community’s landowners and farmers. Developing and maintaining both websites would encourage additional community outreach and connection with residents.

8. Utilize opportunities to permanently protect Loudon's cultural and historical heritage sites.

Grant programs are available for purchase and renovation of structures. The [NH Historical Markers](#) program enables recognition of locations important to the Town's past while ensure private property remains in private hands, and the [National Register of Historic Places](#) is a national recognition requiring adherence to certain guidelines. Partnering with local the Loudon Historical Society can offer additional opportunities for projects. The [NH Division of Historical Resources](#) contains program information that Loudon may find useful for these and other preservation options. Also consider cultural and historical resources that may be associated with potential new conservation properties. Leveraging the cultural and historic aspect of properties can broaden their appeal and support for conservation efforts.

9. Investigate opportunities protect the Group IC white pine forest soils and their habitats along the Soucook River.

Protecting the white pine forest soils group may prove more difficult than anticipated, since most of the existing Group IC soils are developed. Although not the highest quality soils, white pine forests harbor unique habitats, and there are not many of these acres left in Loudon. The Conservation Commission could address this issue in several ways, including limiting future development along the River through buffers and setbacks in the Zoning Ordinance, keeping any tax-deeded Town property along the Soucook River for permanent conservation, talking with UNH Cooperative Extension about techniques to maintain forests and forest soil health, holding events to plant white pines, and holding guided walks in Town Forests and along the Soucook River for the public.

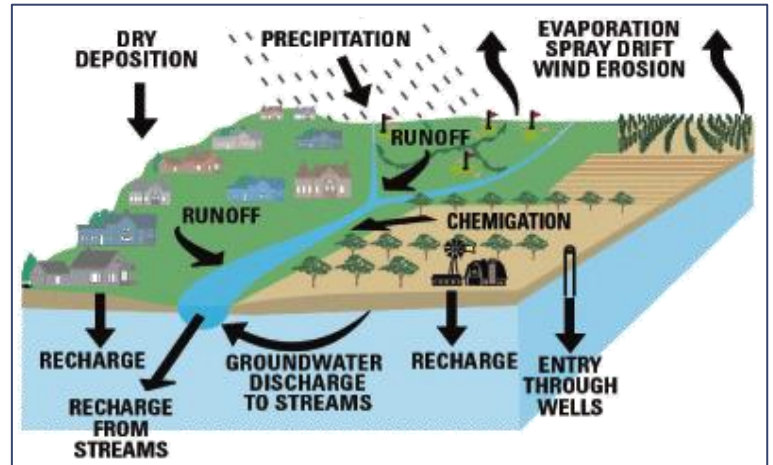
10. Update the Wetlands Conservation Overlay District language to encompass clarifications, new references, and an increased buffer.

Clarify whether all wetlands and water areas are covered within the District or just those mapped by a wetlands scientist. Consider revising the buffer from 75' to 100' or 125', depending on the current Town priorities. The ordinance references older laws and should be updated to the Shoreland Water Quality Protection Act.

Buffers work by filtering sediment from runoff, filtering pollution and chemicals, regulating stream flow to recharge groundwater, stabilizing streambanks to reduce erosion, providing wildlife habitat, supporting aquatic habitat, providing recreation opportunities, and improving aesthetics around surface waters. References to appropriate wetland buffers stream buffers, and surface water buffers are available on the internet. Sources include [Shoreland Water Quality Protection Act](#), [NH Department of Environmental Services](#), and more.

Runoff into Surface and Groundwater

A good local informative resource, Buffer Options for the (NH Great) Bay at <https://www.bufferoptionsnh.org/> provides explanations, references, and guidance for establishing municipal buffers in New Hampshire.



Source: USGS Factsheet, *Monitoring for Pesticides in Groundwater and Surface Water 2008*

11. Ensure those who manage their land as woodlots for timber harvesting utilize best management practices to reduce erosion and maintain water quality. Encourage the development of forest management plans, perhaps on an incentive basis.

Town staff and/or volunteers could pursue the opportunity for education when a property owner files an “Intent to Cut”. The use of best management practices and developing forest management plans will help ensure the rich forest soils are not degraded or do not runoff in the watershed and can provide habitat for wildlife. The development of a comprehensive Conservation Commission website can help with some of the explanations and posting of resources. Many resources are available at [UNH Cooperative Extension \(Merrimack County\)](#), [Merrimack County Conservation District](#) and the [NH Division of Forests and Lands](#), and New Hampshire’s North County communities and organizations.

12. Work with the Planning Board to evaluate the potential impacts and opportunities that may arise from the overlap between the Route 106 commercially zoned land with underlying high-value natural recourse.

Of note in Loudon is that the primary commercial corridor and commercially zoned land in Loudon parallels the Soucook River and largely overlaps with an area identified in the co-occurrence analysis as among the highest value in town. This area contains high value aquifers, floodplains, wildlife habitat, and several community drinking water wells. Also of note is the district’s shape, which is a buffered distance from Route 106 and is not necessarily sensitive to the intricacies of the land and access to infrastructure. The Conservation Commission should engage a conversation with the Planning Board on the boundaries and details of this zoning district to ensure that it appropriately maximizes and balances a range of community goals.