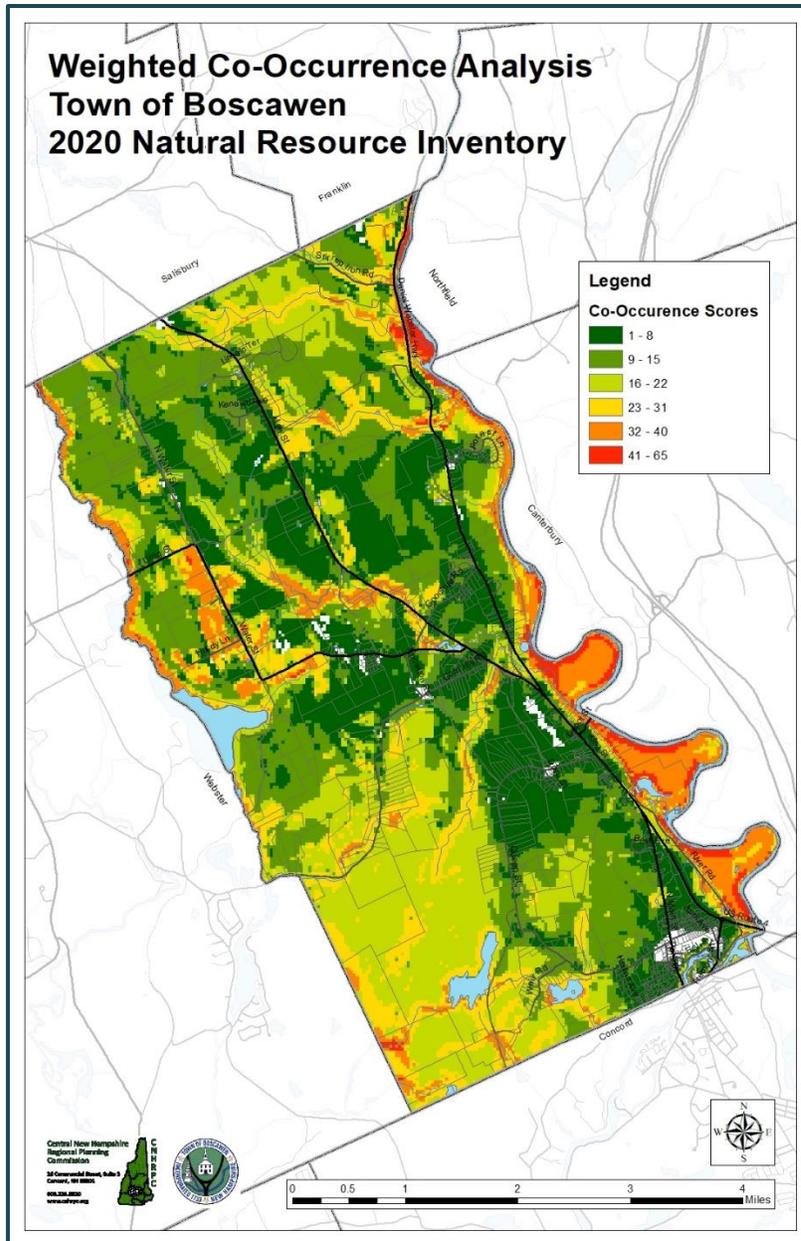




2020

# Natural Resources Inventory and Assessment with Co-Occurrence Mapping

## Town of Boscawen, New Hampshire



Prepared for the Boscawen Conservation Commission  
May 29, 2020

Adopted by the Boscawen Planning Board into the Master Plan 01-05-21



# 2020

## Natural Resources Inventory and Assessment with Co-Occurrence Mapping

### Town of Boscawen, New Hampshire

Prepared by:

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**APPENDIX**

A. NRI Survey Results (Survey Monkey and Tabulated) .....	<i>see attached</i>
B. NRI Data Input Layers and Scoring .....	<i>see attached</i>

**CO-OCCURRENCE MAPS 11X17**

- Surface Water Weighting Map
- Drinking Water Weighting Map
- Agriculture Weighting Map
- Scenic, Historic, and Recreation Weighting Map
- Habitat Weighting Map
- Weighted Co-Occurrence Analysis Map

**NATURAL RESOURCE INVENTORY MAPS 11X17**

- Agricultural Land Map
- Conservation Lands and Public Lands Map
- Land Use Map
- Recreation and Cultural Resources Map
- Prime Farmland Soils Map
- Forestry Soils Map
- Trails Map
- Topography and Scenic Vistas Map
- Scenic Viewsheds Map
- Unfragmented Lands Map

*For additional information on Natural Resources in the Town of Boscawen, please refer to the Boscawen Master Plan’s Natural Resources Chapter 2018.*

# 1. Introduction

Natural resources provide critical habitat and ecological services in the Town of Boscawen. In growing urban and rural areas, competing land uses, development pressure, high land values, and sprawling settlement constrain and threaten high quality natural resources. Boscawen is a rural but growing community directly north of the City of Concord and accessible via Interstate 93 at Exit 17. US Routes 3 & 4 travel in the north-south direction in the Town. US 3 follows King Street where much of Boscawen's historical identity and commercial enterprises are jointly located. The recent completion of the **Boscawen Master Plan 2018** enables close consideration of the natural resources and how they relate to other community goals and overall vision, and contributes to this NRI.

## 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 Boscawen over the long term. This NRI identifies, prioritizes, and maps these resources. This will help inform land conservation priorities and other practices that help sustain these natural resources and the benefits they bring.

### NRI Maps

Ten primary natural resource maps were developed to display and analyze topography, agricultural resources, water resources, conservation and public lands, scenic views and viewsheds, recreational trails, historic and cultural sites, unfragmented lands, forestry soils, agricultural soils, and habitats identified in the NH Wildlife Action Plan (WAP).

The **Land Use Map** identifies areas of the Town where development has already taken place as categorized by specific land use, delineated by hand using GIS aerial photography from 2015, with supporting information from the Town of Boscawen's tax map assessing records. This map also displays where potential future development may occur. The culmination of the plan includes six co-occurrence maps that display areas of Town with the highest natural resource value, and presumably the highest land conservation value for the Town. Five weighted co-occurrence maps show

## BOSCAWEN MASTER PLAN 2018 NATURAL RESOURCES OBJECTIVES:

- ✦ To preserve the traditional, rural, and visual character of Boscawen by protecting its natural, historic, scenic, agricultural, forestry, and water resources.
- ✦ To promote the conservation, protection, and sound management of the Town's natural resources.
- ✦ To develop tools to be used with sound planning principles to conserve Boscawen's natural, historic, scenic, agricultural, forestry, and water resources.
- ✦ To raise the awareness of the citizens and officials in Boscawen of the importance of protecting the Town's natural resources.
- ✦ To provide opportunities for recreational enjoyment of the Town's natural resources by Boscawen citizens.

natural resource score results for five different topic areas; Agriculture, Cultural and Recreational, Drinking Water, Surface Water, and Wildlife Habitat. A final co-occurrence map encompasses all five resource categories. 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.

## Process

This Natural Resources Inventory includes an inventory of natural resources and a weighted co-occurrence analysis. The inventory maps and describes a multitude of natural resources in Boscawen, including water resources, agricultural resources, cultural and recreational resources, and habitat resources. The weighted co-occurrence analysis is an attempt to assign relative value to the resources and the lands that support them.

The first step, the inventory component, involved developing a list of natural resources in Boscawen, identifying the appropriate GIS data layers to display that resource, and mapping them. Second, each natural resource “layer” was assigned a score that identified its relative importance to the Town of Boscawen as a natural resource. This valuation was based on information gleaned from results of a public survey, knowledge and experience from the Conservation Commission, best 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 higher value to the Town were given a greater weight, and resources with a relative lower value were given a lower weight. The resulting map highlights which areas of Town support the highest value of natural resources. The NRI document, and its recommendations are based on the inventory and the co-occurrence results.

The table to the right 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.

Process	
Conservation Commission Meetings, Public 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
	Analysis and NRI Preparation
	Develop Recommendations
NRI Release and Public Outreach	

## Recommendations

The priority conservation areas included in this document are developed based on the co-occurrence analysis and data obtained in the map set. In addition, general strategies for outreach, management, and regulatory action are included.

## Intended Use

The information in this NRI is intended to inform and guide land conservation efforts in the Town of Boscawen. 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 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. It is intended to serve as an informational tool that may inform future changes in zoning, land use regulations, and policies. Finally, it is an educational resource for Town staff, boards, residents, and other interested individuals.

## NRI Objectives

- Increase identification and understanding of the Town’s natural resources.
- Develop information that can inform decisions about balancing development and conservation.
- Identify resources that are potentially at risk.
- Identify natural resources that interact as systems.
- Provide a visual resource that can be used as a reference for collaboration among Town Commissions and Boards.
- Capture a snapshot of the Town’s natural resources for use as a baseline in tracking land use trends.
- Compile preliminary information that may be used for a more comprehensive NRI or Open Space Plan.
- Work towards improving and protecting water quality in the Upper Merrimack Region and Contoocook 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 sites.

## 1.2. NRI Community Survey Results

An online survey of open space resources was taken by Boscawen residents to provide input for conservation priorities. A total of 58 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 full survey results from the Survey Monkey survey are available in the Appendix.

### 1.3. Co-Occurrence Weighting

Each natural resource data layer has been assigned a value score. A higher score indicates a higher natural resource value to the Town, and a lower score indicates a lower relative value. These scores were assigned based primarily on public input from the community survey, and experience and knowledge from the Conservation Commission. Minor adjustments to the values were made based on research and best practices.

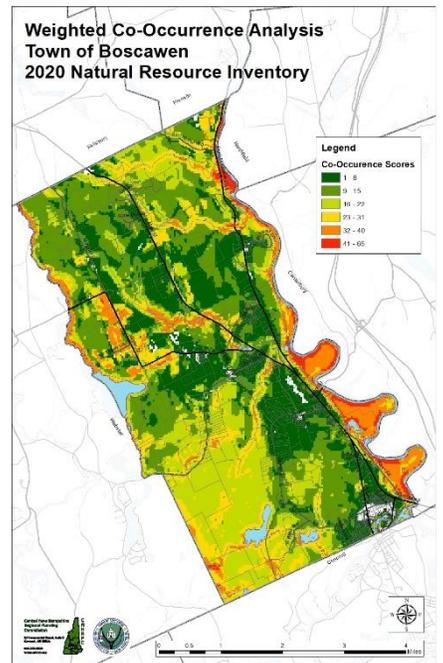
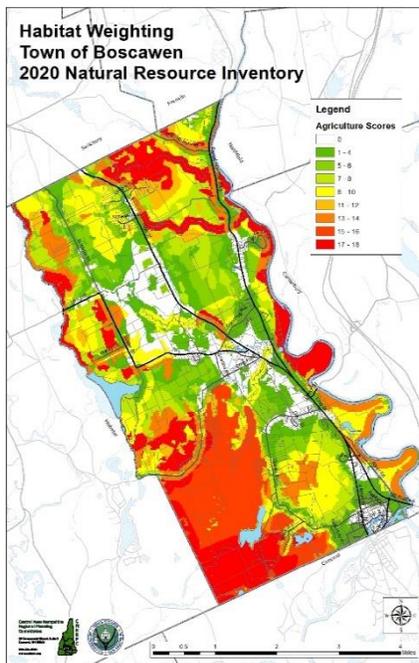
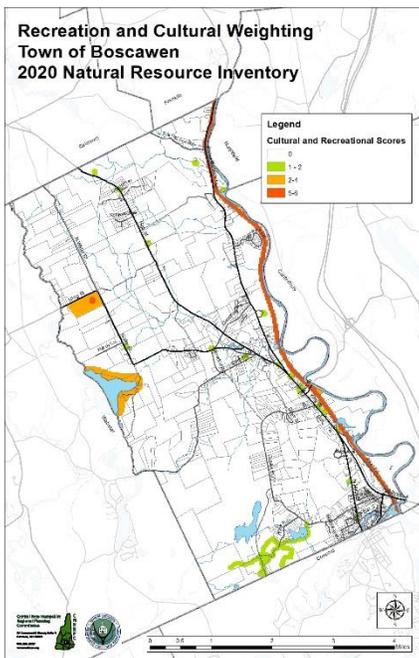
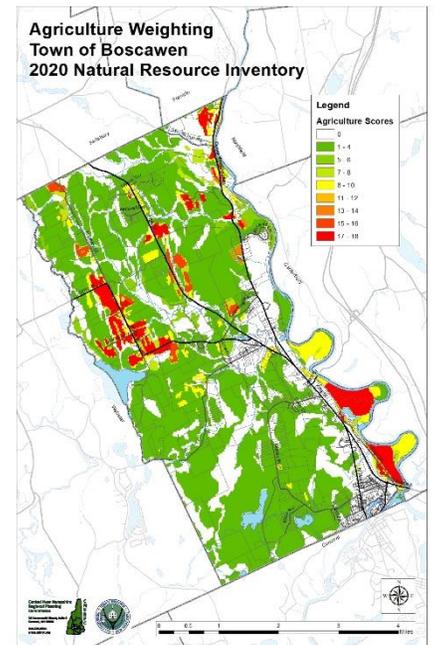
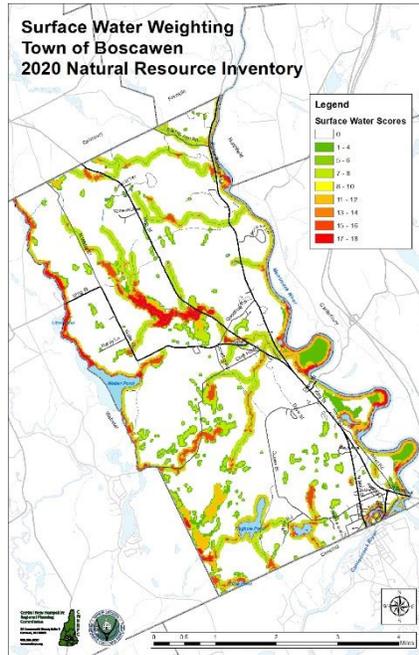
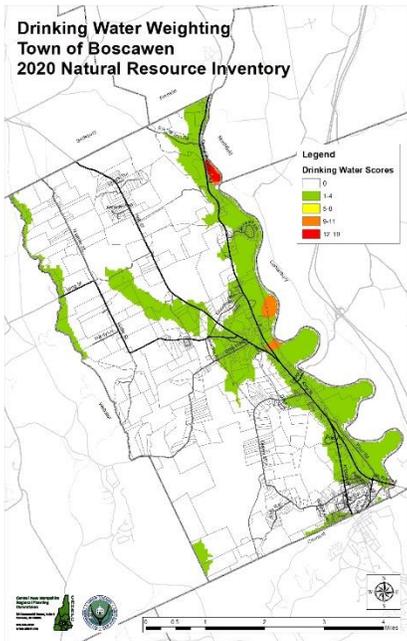
Table 1.1

<b>Co-Occurrence Weighting</b>	
<b>Data Layer</b>	<b>Value Score (adds to 100)</b>
Agricultural Lands	8
Farm Soils – Prime	8
Farm Soils – Statewide Importance	5
Forestry Soils – Group IA and IB	2
<b>Agriculture Category Total</b>	<b>23</b>
Conservation Land Buffer 1000'	4
Wildlife Action plan Highest Ranked Habitat in NH	10
Wildlife Action plan Highest Biological Habitat in Region	5
Wildlife Action plan Supporting Landscapes	3
Unfragmented Blocks 2,000-5,000 acres	3
Unfragmented Blocks >5,000 acres	6
<b>Wildlife Habitat Category Total</b>	<b>31</b>
Recreational Trails 200' Buffer	2
Public Input Additions	4
Historic and Cultural Sites Buffer 300'	2
Viewshed/Scenic Lands High Promontory	0
Viewshed/Scenic Lands Lowlands	0
<b>Cultural and Recreational Category Total</b>	<b>8</b>
Public Water Supply Buffer 500'	10
Stratified Drift Aquifers (all)	4
Stratified Drift Aquifers Transmissivity >1000 sq ft/day	5
<b>Drinking Water Category Total</b>	<b>19</b>
Wetlands	3
Wetlands and Wetland Buffer 100'	4
Floodplains 1% Annual Flood Risk (100-year)	4
Waterbodies (3+ acres), Rivers, Streams, Buffers 300'	8
<b>Surface Waters Category Total</b>	<b>19</b>
<b>Total</b>	<b>100</b>

The natural resource data layers were divided into five categories: Surface Water; Drinking Water; Agriculture; Scenic, Historic, and Recreation; and Wildlife Habitat. A co-occurrence weighting map was created for each of these five categories, as well as for a final co-occurrence map that includes all data inputs. The table at left lists each data layer representing a natural resource, and the 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. The six weighting maps, one for each category plus a combined total map, along with a description of the input data layers, is included in the next section. Additional information on each natural resource is available later in the document.

## 1.4. Co-Occurrence Results

A co-occurrence 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** displayed here is described with the conclusions and recommendations.

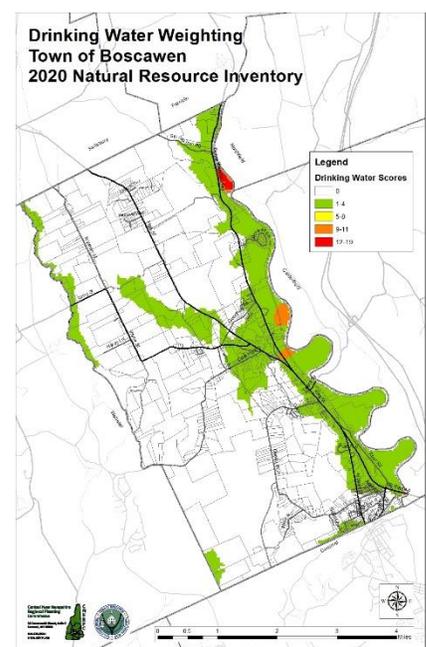
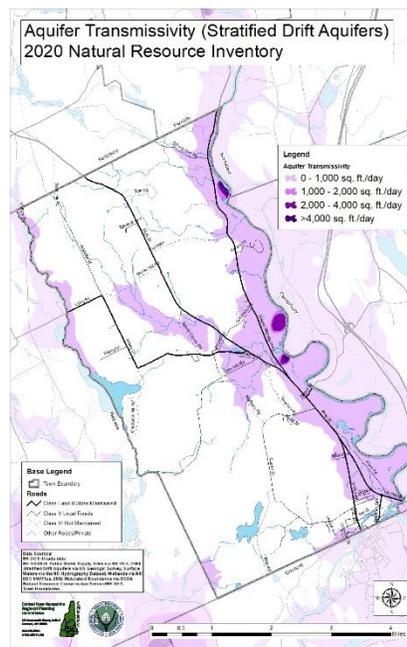
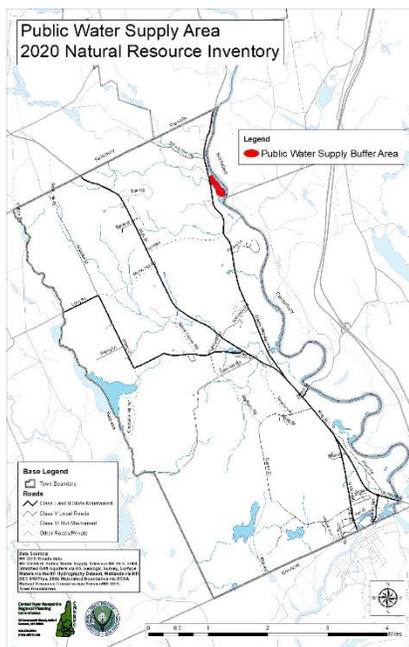


## 2. Water Resources Co-Occurrence

Water resources are a critical asset in Boscawen, 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**. Many of these features were used to develop the Surface Water and Groundwater resource maps.

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

**Public Water Supply Buffer 500'**: A 500' buffer around the Town's public water supply wells is assigned the highest value score of any data layer (10 out of the 100 point total). These wells provide municipal drinking water for a significant portion of the Town's residents and businesses.



**Aquifers:** Groundwater aquifers provide water that feeds into rivers, streams, and lakes, but also are the source of water for residential and commercial wells. The Town has many residential wells used for drinking water and other potable uses, as well as larger wells that supply water to public water systems. All of these wells require healthy groundwater. Groundwater aquifers are needed for existing water quality and safety for present and future drinking water needs. All stratified drift aquifers are assigned a value of 4 points, plus an additional 5 points for aquifer areas with the highest transmissivity (can move more water).

**Drinking Water Co-Occurrence Results:** The highest value lands for drinking water coincides with the highest value aquifers, specifically in the vicinity of the public water supply wells. A more detailed analysis of drinking water resources

may be prudent for analyzing the current and future drinking water needs of the Town, however this analysis shows areas where land conservation efforts are likely to preserve drinking water resources.

Survey results and common sense both show safe and secure drinking water resources are critically important to the Town of Boscawen. The category is worth a total of 19% of the total scores for the Town. The individual input data layers are scored very highly.

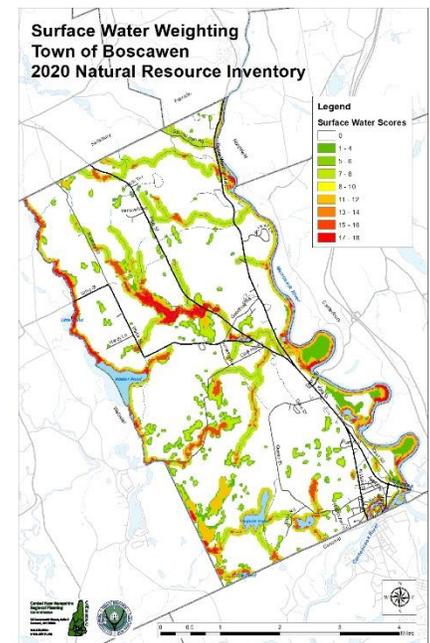
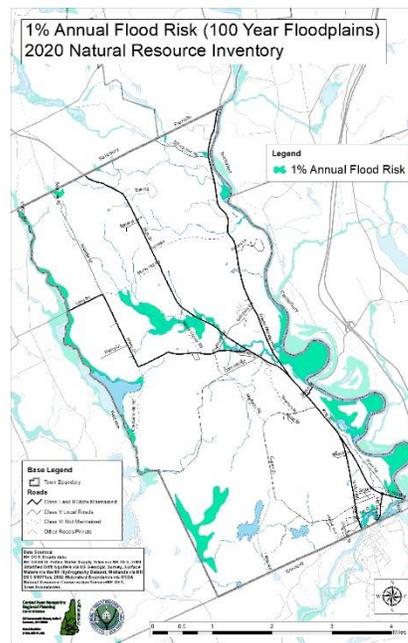
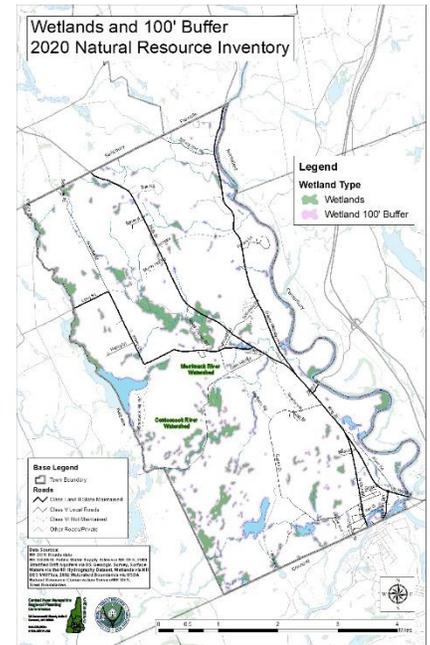
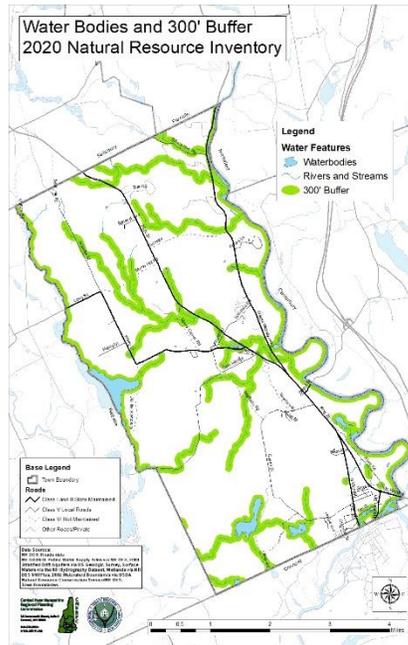
## 2.2. Surface Waters Input Value Scores and Co-Occurrence Results

**Water Bodies 300' Buffer:** This layer includes all rivers, streams, and water bodies (lakes and ponds) greater than 3 acres, plus a 300' buffer around them. This layer scores an 8. Water bodies have a number of habitat, ecological, hydrological, and cultural values to the Town of Boscawen.

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

**Floodplains:** Areas with a 1% annual flood risk, also known as the 100 year floodplain, are assigned a value score of 4. 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 Tannery Brook and its associated wetland complex, Beaverdam Brook and its wetlands, along the Webster Town line north of Walker Pond, and the Merrimack River.



Survey results and Conservation Commission discussions indicated that clean healthy bodies of water were important to the Town of Boscawen, particularly the Merrimack River. The Surface Waters category makes up 19% of the total co-occurrence score for Boscawen.

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

### 2.3. Watersheds

Boscawen is located within two main watersheds, the Contoocook River and the Merrimack River watersheds, as well as four smaller local subwatersheds. The Punch Brook subwatershed in Franklin covers the northern eastern corner of Boscawen. The Tannery Brook subwatershed is located over the entire eastern side of the Town on over past Water Street. This is the largest watershed in Boscawen. The Contoocook River subwatershed is located south of Knowlton Hill in the southeast section of Town and includes the Hirst Wildlife Management Area. The western side of Town including Walker Pond is the Deer Meadow Brook subwatershed.

Table 2.1

Subwatersheds HUC 12			
HUC #	Subwatershed Name	Location	Total Acres
1070006 MERRIMACK RIVER WATERSHED			
10700060101	Punch Brook Subwatershed	From Canterbury I-93 to south of Stirrup Iron Road to High Street to Salisbury	20,261
10700060102	Tannery Brook-Merrimack River Subwatershed	Boscawen-Canterbury surrounding Merrimack River & US 3, most of High Street	22,505
1070003 CONTOOCCOOK RIVER WATERSHED			
10700030602	Contoocook River Subwatershed	Flaghole Pond to Knowlton Hill to North Main to King Street to Penacook Village	13,262
10700030603	Deer Meadow Brook Subwatershed	North Water Street to Queen Street, east of Flaghole Pond to Horsehill	12,278

Source: NH Department of Environmental Services Hydrologic Unit Codes 12 data, 2012

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Four subwatersheds of the Merrimack and Contoocook Rivers are located in Boscawen.

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Although it appears that the critical drinking water supplies in Boscawen lie mostly within the stratified drift aquifer areas, these sand and gravel areas are dependent on the surface water flows that descend from these watershed divides.

## 2.4. Surface Waters

The primary watercourses in Boscawen are the Merrimack River which the Town shares with Canterbury as its joint boundary, and a short section of the Contoocook River where it converges with the Merrimack. These rivers total over 11 miles in length in Boscawen. Yet the Town hosts over 20 miles of smaller watercourses, the most prominent including Tannery Brook as well as Beaverdam Brook which forms the Town line with Webster.

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About 32 miles of named flowing brooks and rivers travel within and through Boscawen.

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There are also numerous unnamed and perennial streams, brooks, and ponds located throughout Boscawen. The largest pond is Walker Pond, about half of which resides in Webster, as well as Patenaude’s Pond which is privately owned on an approximate 1,000 acre parcel.

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About 197 acres of named ponds are located in Boscawen.

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[NH RSA 483-B, the Shoreland Water Quality Protection \(SWQPA\) Act](#), provides regulations for protected shoreland and streams which includes the Merrimack River and Contoocook River. The accompanying NH Code of Administrative Rules Env-Wq 1400 (SWQPA) can be found at: <https://www.des.nh.gov/organization/commissioner/legal/rules/documents/env-wq1400.pdf>.

In 1990, Town Meeting voted to support the designation of the Upper Merrimack River into the National Wild and Scenic Rivers program which would have placed protections upon the river. The article failed to pass. A few years later, the Upper Merrimack River was accepted into the [NHDES Rivers Management and Protection Program](#), which affords the riverfront communities, including Boscawen, provides some [protective measures](#) and additional local control of activities within the river corridor. Both the Merrimack River and Contoocook Rivers and “designated rivers.”

Table 2.2

Surface Waters in Boscawen		
Rivers & Brooks	Size	Notes
Tannery Brook	5.81 miles	Largest drainage area in Boscawen
Cold Brook	3.2 miles	Tannery Brook tributary
Moore’s Brook	0.97 miles	Joins Tannery
Glines’ Brook	2.38 miles	Joins Merrimack
Beaverdam Brook	6.98 miles	Forms boundary with Webster
Stirrup Iron Brook	1.18 miles	Historical features
Cabot Brook	3.98 miles	Historical features
Merrimack River	10.4 miles	Forms boundary with Canterbury. Drains in Newburyport, MA
Contoocook River	0.9 miles	Flows northeast to drains into Merrimack River in Penacook
<b>Total Miles</b>		<b>31.82</b>
Ponds	Size	Notes
Flaghole (Patenaude’s) Pond	70 acres	Privately owned
Walker Pond	95 acres	Shared with Webster (190 ac)
Flanders’ Pond	15 acres	Of Tannery Brook
County Farm Pond	N/A	Of Glines Brook
Moore’s Pond	1 acre	Of Choate’s Brook
Couch Pond (Little Pond)	1.4 acres	Along Beaverdam Brook
Morse Hill Pond	15 acres	Of Tannery Brook
<b>Total Acres</b>		<b>197.4</b>

Source: Boscawen Master Plan, CNHRPC compiled data

## 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 Merrimack River is the predominant surface water in Boscawen, although the Town has many miles of brooks and large acreage of ponds.

The Town does not have hydrologic buffers within their zoning ordinance for wetlands or streams, which would provide additional protections to the waterbodies and the watersheds. In 2016, the Town's Subdivision Regulations contained a 100' wetlands buffer. The Planning Board held a hearing to place the buffer instead within the Zoning Ordinance. However, the wetlands buffer was downsized to 25' and the Zoning article passed within the cluster development ordinance.

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A **setback** is a distance requirement from wetlands or surface waters for specific activities such as construction or septic systems.

A **buffer** is a land management practice leaving a naturally vegetated or wetland area protected.

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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://www.des.nh.gov/organization/divisions/water/dwgb/dwspp/riparian-buffer-gap-anlys.htm>.

The NH Department of Environmental Services Riparian Buffer Analysis of 2008 provides a study for the protection of buffers not covered under the Shoreland Water Quality Protection Act to protect water quality which are. See:

<https://www.des.nh.gov/organization/divisions/water/dwgb/dwspp/riparian-buffer-gap-anlys.htm>.

## 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.

## 2.5. Aquifers/Groundwater

There are two types of groundwater sources from which Boscawen 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.<sup>1</sup> Because much of Boscawen is at high elevation on steep slopes and is underlain by Plutonic Spaulding Tonalite bedrock (49% of the Town), less water is available at these heights, including Water Street and High Street. These geological factors contribute to some of the historical problems related to water quantity and pumping within rural areas.

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

### 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 feet- to 80 feet- deep in some locations and are now known as stratified drift aquifers.<sup>2</sup> The two highest transmissivity areas in Boscawen are situated along the fourth meanders of the Merrimack River in a northerly direction, under the Northern Rail Trail and appear untouched from present-day development. These areas have been placed under conservation (Sanborn Agricultural Preservation Restriction and the Merrimack River State Forest), although their restrictions may not be permanent or specifically protect groundwater.

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About 3,400 acres of stratified drift aquifer underlie 21% of the Town’s total area. The majority of Boscawen’s aquifers, 3,272 acres, transfer less than 1,000 square feet of water per day.

---

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 Boscawen should be aware of the bedrock limitations in Town that restrict easy access to water.

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<sup>1</sup> USGS Moore 2002

<sup>2</sup> USGS Ayotte and Toppin 1995

## Stratified Drift Aquifers

The stratified drift aquifers in Boscawen have transmissivity rates that range from greater than 4,000 square feet squared per day (sf<sup>2</sup>/day), decreasing down to less than 1,000 sf<sup>2</sup>/day. Overall, there is almost 3,400 acres of stratified drift aquifer in Town, covering about 21% of the Town's area. The highest yield (>4,000 sf<sup>2</sup>/day) totals a very small acreage, only 13 acres, while the second highest yield area (2,000- 4,000 sf<sup>2</sup>/day) is only 50 acres in size.

Table 2.3

Stratified Drift Aquifer Transmissivity	
Yield Range in sqft <sup>2</sup> per day	Acres in Boscawen
< 1,000	3,272
1,000 – 2,000	39
2,000 – 4,000	50
> 4,000	13

Source: USGS Aquifer Transmissivity Data Layer

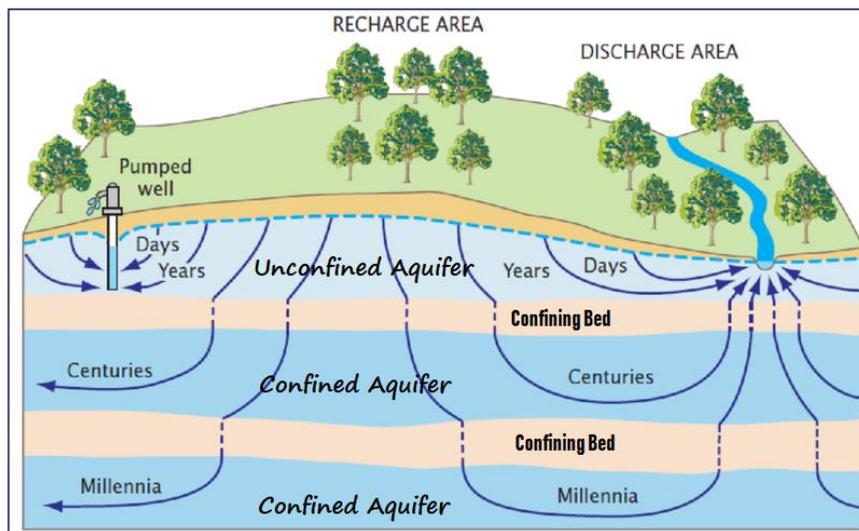
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Less than 1% of Boscawen's aquifers transfer more than 1,000 sq ft<sup>2</sup> of water per day. These 102 acres are the Town's most important aquifers.

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The stratified drift aquifers are portrayed in Figure 2.1 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.

Figure 2.1 Groundwater Recharge Flow



Source: USGS Conceptual Groundwater Flow Diagram as modified by CNHRPC

## 2.6. Floodplains

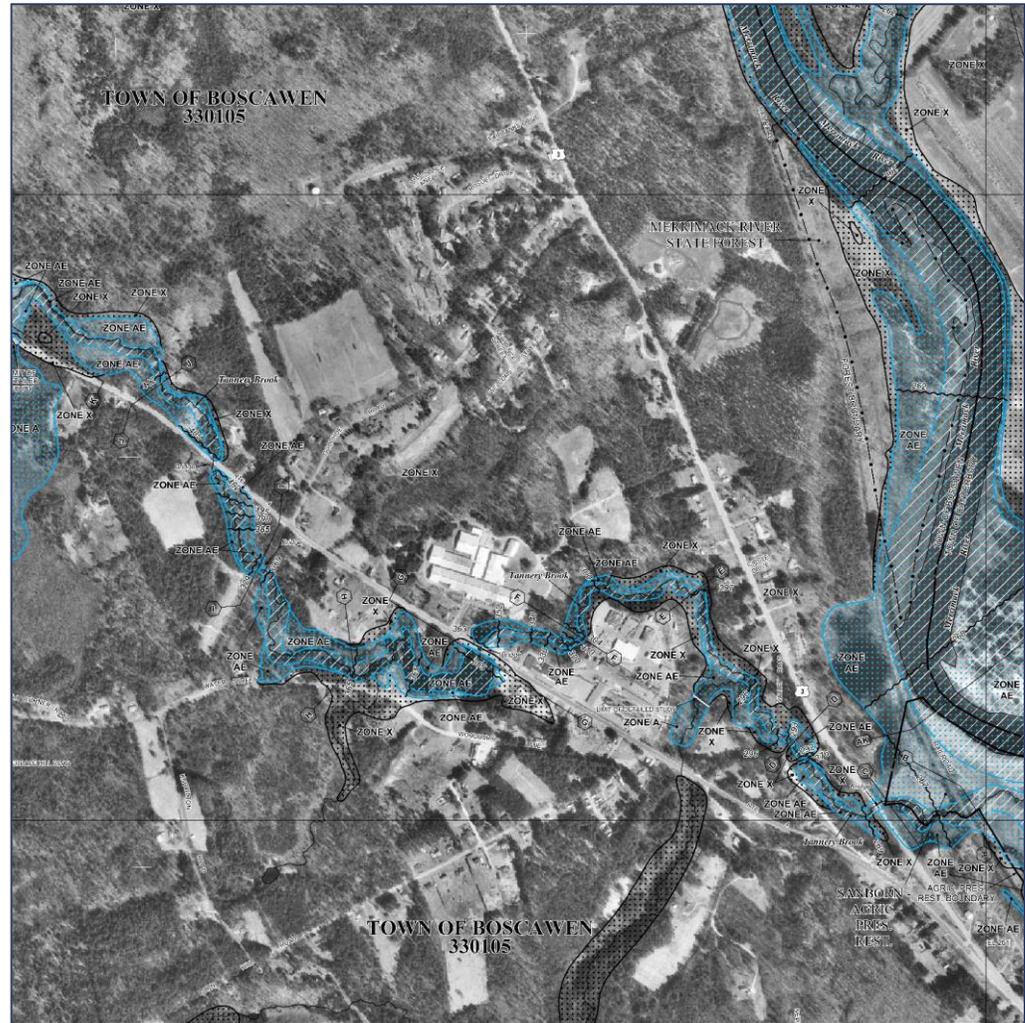
A floodplain is the low lying ground adjacent to rivers that is prone to flooding. Flood hazard areas that have a one percent chance of being inundated by a flood event in any given year are commonly referred to as the 100-year floodplain. The flood hazard areas with a 0.2% chance of annual flooding are often referred to as the 500-year floodplain. The **Boscawen Hazard Mitigation Plan 2018** described the floodplain 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, totals over \$8.8 million<sup>3</sup>.

Locations of 1% annual chance of flooding include the Merrimack River along King Street deep into the ox-bow lands, the Contocook River along Eel and Tremont Streets, along wetlands on the southwestern side of Town, along Tannery Brook and

its wetlands between Water Street and US 4, and around Walker Pond and Pond Brook – in fact following most of the Boscawen-Webster boundary. Locations of the 0.2% annual chance are along most of the brooks in Town and along the more developed river meanders of the Merrimack River.

Figure 2.2 NFIP Floodplains along US 3 & US 4 Intersection



Source: FEMA Digital Flood Rate Insurance Map #D33013C-0309, 2010

<sup>3</sup> Boscawen Hazard Mitigation Plan 2018

## 2.7. 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 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. Boscawen’s wetlands are depicted on the **Water Resources Map**.

Table 2.4

National Wetlands Inventory		
Wetland Class	Acreage	Total % of Town
Palustrine	888.0	5.5%
Lacustrine	136.8	0.8%
Riverine	209.7	1.3%
<b>Total</b>	<b>1,234.5</b>	<b>7.6%</b>

Source: NWI Data Layer

The US Fish and Wildlife Service’s National Wetland Inventory contains three classifications of wetlands, palustrine (marshes or swamps and trees), lacustrine (around lakes and of a shallow depth), and riverine (connected by rivers). Of Boscawen’s 16,252 total acres, 7.6% (1,235 acres) are wetlands.

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About 8% (1,235 acres) of the Town is classified as wetlands.

---

Boscawen’s cluster developments require a 25’ setback from jurisdictional wetlands (Boscawen Zoning Ordinance, Section 14.02 Conditional Use Permit Required) as does the new Land Development Regulations in their definitions. There are no other building setbacks from wetlands. State protection is minimal, so local regulation will enable wetlands and their unique habitat to remain untouched by development.

## 2.8. Public Water Supplies

Boscawen has several critical public water supplies, including the three Merrimack County wells along the Merrimack River interval within the County's complex, and the Penacook-Boscawen Water Precinct

that delivers water to the Main Street, King Street, and Water Street areas. The unusual provision of municipal water in a rural location such as Water Street is imperative because of the lack of water available in western Boscawen. With no stratified drift aquifer in this location, the land is underlain by Spaulding-Tonalite Bedrock which is not conducive to groundwater collection. Refer to the bedrock geology sections in this NRI for further description.

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

Much of the Town relies on agriculture for personal and economic sustenance. Sometimes, agriculture and public water supplies can conflict. 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. Other public water supply contamination comes from ageing and underperforming septic systems, land use intensity, and location, and through the presence of highways (salt, oil, gas, etc) and railroads.

Private and residential wells can also have similar pollutants, plus radon and arsenic from the bedrock. Well owners are encouraged by the Town to test their wells every few years.

The Penacook-Boscawen Water Precinct is under the management of Water System Operator, Inc as of January 2018 to ensure monitoring, system reporting, and handling of violations as required by the NH Department of Environmental Services (NHDES). The Water Precinct's website is <https://boscauwenwater.com>.

The NH Department of Environmental Services hosts the numerous administrative rules for water quality and quantity at <https://www.des.nh.gov/organization/commissioner/legal/rules/index.htm#waterq>.

### 3. Agriculture and Forestry Resources Co-Occurrence

Boscawen 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 Agricultural Commission which researches, supports, and promotes local farms and farm products. A list of the active agricultural operations and their products along with the respective tax map and lot numbers can be found in the **Boscawen Master Plan 2018**.

In the **Agriculture Weighting Map**, the highest value agriculture lands are located within the Merrimack River intervals, along Water Street and North Water Street, at the Merrimack County Farm, and along High Street. These are the primary existing locations agricultural operations.

Survey results and Conservation Commission discussions revealed that agriculture, active farmland, and farms were very important to the Town of Boscawen. The agriculture category makes up 23% of the total co-occurrence score for Boscawen.

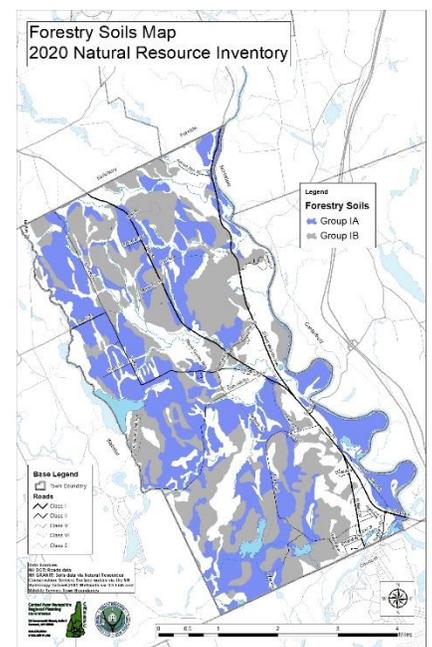
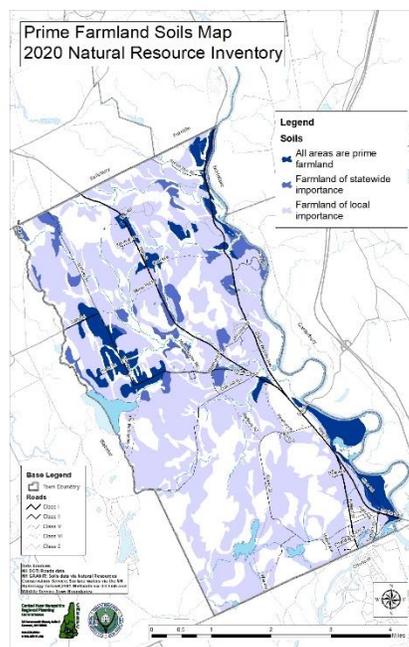
#### 3.1. Agriculture Input Value Scores and Co-Occurrence Results

**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” are scored 8 points, and “Soils of Statewide Importance” 5 points.

##### Forestry Soils:

The Merrimack County Soils Survey also identifies soils that are most productive for forestry purposes. The best forestry soils, groups IA and IB soils, are assigned 2 points.

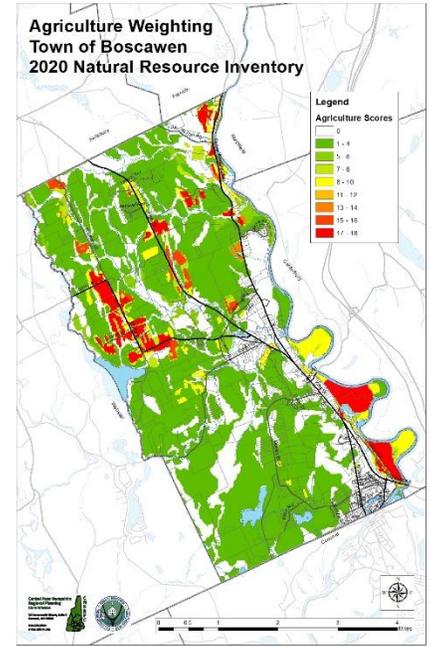
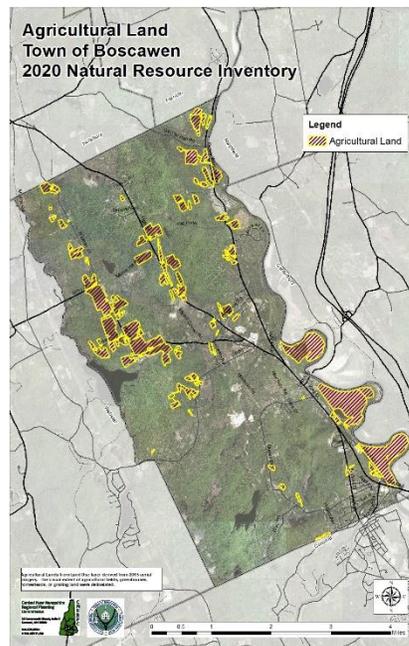
**Agricultural Land:** The Central NH Regional Planning Commission maintains a Land Use layer for the Town of Boscawen, where all land is categorized into various land uses, from residential, to commercial, to agricultural. The Agricultural lands layer



used in this analysis is derived from this land use layer, and includes any agricultural land, maintained fields, and orchards in the Town of Boscawen. Agricultural lands are assigned 8 points.

### Agriculture Co-Occurrence Results:

The co-occurrence results of the Agricultural related layers highlights areas along Water Street, along the Merrimack River near King and River Streets, as well as a number of smaller areas in the northern half of Boscawen. These lands are likely to have a strong agricultural value and should be targeted for conservation if preserving agriculture and agricultural lands is a goal.



## 3.2. Agricultural Operations

There are around 25 agricultural operations such as active farms, nurseries and orchards in Boscawen that cover about 3,589 acres, or 22% of the Town. The types of farming include dairy, livestock, beef, corn, produce, eggs, flowers, horses, maple syrup, trees and shrubs, and hay fields. Over 2,000 acres (12% of the Town) support hay fields, silage, and corn fields. The **Agricultural Land Map** shows active fields and orchards undergoing agricultural activity and includes many of these operations.

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About 22% (3,589 acres) of the Town is used for active agricultural purposes.

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Most of this agricultural land (63%) is used for hay or timber products, nurseries or for equine purposes. The remaining farms (37% of all agricultural lands, or 8% of the Town) produce food for human consumption, such as produce, dairy, poultry, beef, and more.

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About 8% (1,336 acres) of the Town is used to grow fruits, vegetables, and animal products.

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### 3.3. Important Farmland Soils

The **Prime Farmland Soils Map** displays the locations of the highest quality soils in Town. The farms located along the Merrimack River, North Water Street, High Street, and Daniel Webster Highway (US 3) are situated within these most productive areas.

Approximately 9% (1,407 acres) of the soils in Boscawen are prime farmlands.

**Table 3.1 Prime Farmland Soils**

Map Symbol	Full Soils Name	Hydrologic Rating	Drain Class	Acreage	Total % of Town
101A	Ondawa very fine sandy loam, 0 to 3 percent slopes, frequently flooded*	Not Hydric	Well drained	221.6	15.7%
104A	Podunk fine sandy loam, 0 to 3 percent slopes, frequently flooded*	Partially Hydric	Moderately well drained	56.1	4.0%
166B	Canterbury fine sandy loam, 3 to 8 percent slopes	Partially Hydric	Well drained	62.7	4.5%
201A	Ondawa very fine sandy loam, 0 to 3 percent slopes, occasionally flooded	Partially Hydric	Well drained	368.7	26.2%
478B	Gilmanton fine sandy loam, 3 to 8 percent slopes	Partially Hydric	Moderately well drained	498.1	35.4%
48A	Madawaska loamy sand, 0 to 3 percent slopes	Partially Hydric	Moderately well drained	144.6	10.3%
64A	Groveton fine sandy loam, 0 to 3 percent slopes	Not Hydric	Well drained	55.5	3.9%
<b>Total</b>				<b>1,407.3</b>	<b>8.7%</b>
* if protected from flooding or not frequently flooded during the growing season					

Source: Merrimack-Belknap County Soils Survey, 2017

Prime farmland soils are the highest category of important farmlands and comprise 9% of the Town. Farmland soils categorized of statewide importance are also located in Boscawen, adding another 4% (685 acres). The most productive agricultural operations are located within one of these soils groupings, although operations can still occur in locally important soils.

### 3.4. Forestry Soils

Of Boscawen’s 16,252 total acres, 6,772 acres are contained within about 75 lots which are used as vacant wood lots. Of these properties, 3,999 acres are categorized as managed forest property according to assessing records. Most of the managed woodlands produce hard and soft wood timber and cordwood, as indicated by the Master Plan’s Natural Resources Chapter, although some are shared for hay crops. While the Town has about 1,650 total parcels, these 75 wood lots covering 42% of the Town illustrate the importance of forestry in Boscawen and the rural nature of the community.

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About 42% (6,772 acres) of the Town is used for forestry purposes.

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Soils types can support more than one kind of use, so many soils are concurrent with agricultural and/or forestry soils. Over 89% of the Town’s soils are suitable for tree growth. The **Forestry Soils Map** displays the locations of Boscawen’s forest soils by forest groups. The dominant forest soils types are Group IA (34%) and Group IB (31%) which better support hardwood varieties. The Group IIB poorly drained soils (9%) support northern spruce and fir and appear along the Town’s streams and waterbodies.

Table 3.2

Forestry Soils				
Forest Group	Definition	Types of Wood	Acreage	Total % of Town
Group IA	Deeper loamy soils, moderately- to well-drained	Prime northern hardwood	5,504.6	33.9%
Group IB	Sandy or loamy soils, moderately- to well-drained	Oak & beech	5,068.1	31.2%
Group IC	Outwash sands & gravel	White pine	1,699.7	10.5%
Group IIA	1A & 1B with limitations (very steep, shallow, or rocky)	Northern hardwood	836.2	5.1%
Group IIB	Poorly drained soils	Northern spruce & fir	1,425.5	8.8%
<b>Total</b>			<b>14,534.1</b>	<b>89.4%</b>

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The white pine soils of Group IC (11%) are located along the Merrimack River, King Street, and the junctions of US Routes 3 and 4 in the most developed areas of Town.

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*Source: Merrimack-Belknap County Soils Survey, 2017*

## 4. Land, Historic and Recreational Resources Co-Occurrence

Inventories of the conservation lands, historic resources, and recreational resources are available in the **Boscawen Master Plan 2018**. Trails, historic and cultural sites, and places important to the community are considered. This NRI seeks to use that information to make better informed decisions about future preservation of the most important areas in Town.

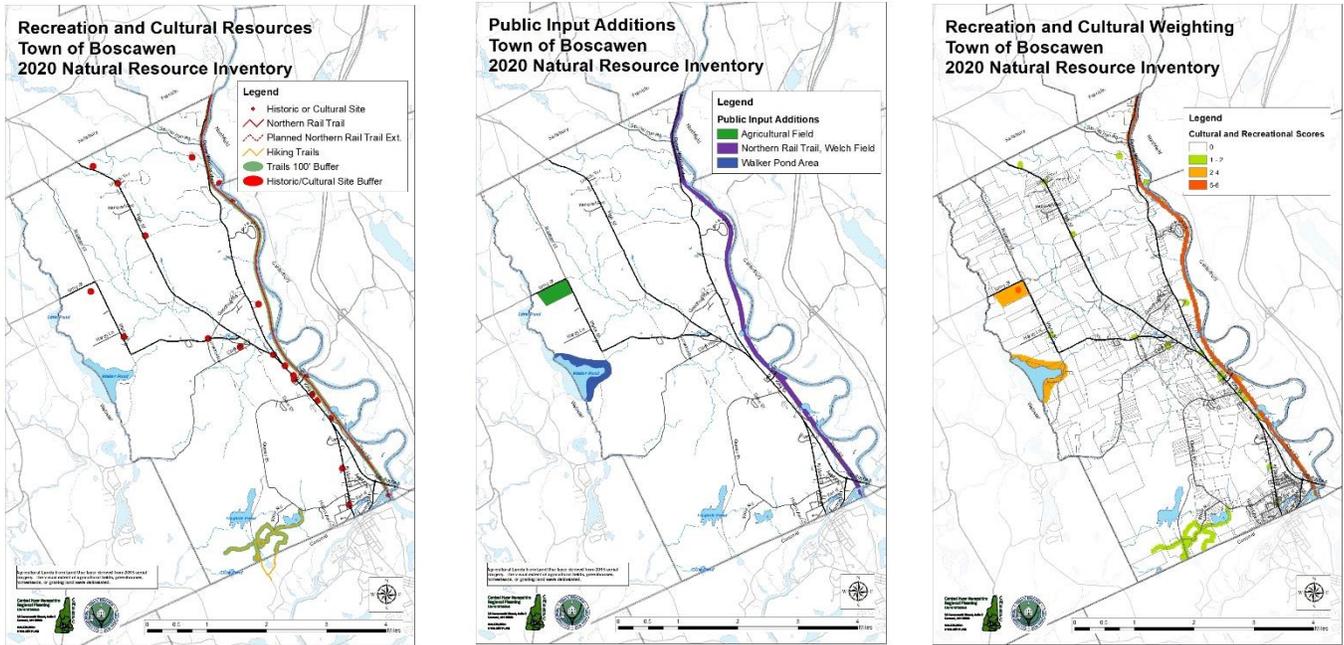
The **Recreation and Cultural Resources Weighting Map** helps highlight areas that contribute to the Town's recreational and cultural qualities. Survey results and Conservation Commission discussions indicated that while scenic, recreational, historic, and cultural significance was important to the Town, it was more of a contributing factor rather than a primary driver in determining priorities for land conservation. The category makes up 8% of the total co-occurrence score for Boscawen.

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

**Recreational Trails 200' Buffer:** The Survey and Conservation commission feedback indicated trails are highly valued by Boscawen Residents. The Northern Rail Trail in particular received many mentions in the Survey. A complete inventory of trails is not available, and only public trails are included in this analysis. A 200' buffer from these trails are assigned a value score of 2.

**Historic and Cultural Sites 300' Buffer:** The presence of historic or cultural sites often contributes to appeals to conserve properties. A database of historical and cultural sites was developed and reviewed, based on lists included in past planning documents. A 300' buffer from these sites is included in the analysis and assigned a value score of 2.

**Public Input Additions:** After reviewing the survey, a few areas of Town were identified as being particularly important. This included an agricultural field off Water Street, the area around Walker Pond, the Northern Rail Trail, and Jamie Welch Memorial Field. A data layer was developed to delineate these areas and was assigned a value score of 4.



**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. Second, it appeared that scenic values came into play through other categories. For example, agriculture was highly prized by Boscawen residents in part because of the scenic views the fields offer. Third, the areas that appeared to have the highest scenic value were already scored very highly on the co-occurrence map for other categories. Scenic views were valued by residents based on the survey, but appeared less prominent than other categories. For these reasons, a basic scenic views and map was created, but were not included in the co-occurrence analysis.

**Cultural and Recreational Co-Occurrence Results:** The co-occurrence results of the Cultural and Recreational layers highlight the areas specifically identified as important in the Survey and the historic and cultural sites in Town. It has a relatively small impact on the final co-occurrence scoring and map as compared to four other natural resource categories (Agriculture, Groundwater, Surface Water, and Wildlife Habitat).

## 4.2. Conservation and Public Lands

There are over 40 conservation or public lands in Boscawen as displayed on the **Conservation and Public Lands Map**. These properties, which may or may not be permanently preserved, include conservation easements, deed restrictions, scenic easements, and open space. These areas are located in the four corners of the community and along the edges, leaving vast swathes of unprotected land in the middle of the community. Many of the Town's significant waterbodies, such as Flaghole Pond, Merrimack River, Contoocook River, Tannery Brook, and others are not surrounded by conservation easement. Conservation lands with 1,000' buffers are included in the co-occurrence analysis as part of the Wildlife Habitat category.

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About 20% (3,238 acres) of the Town's land is considered under conservation. Of this, over 2% (379 acres) of land is owned by the Town of Boscawen in fee ownership that may not have protective deed restrictions.

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

### 4.3. 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. Over the last decade in Boscawen from 2008 through 2018, the total acreage of land in current use has fluctuated little, with a net gain of 259 acres. In 2008, 9,805 acres (60% of the Town) were under current use where by the end of 2018, about 10,064 acres (62% of the Town) were under current use. This indicates consistent development trends during the last decade, as more acres were placed under current use instead of removed from the program.

Conversely, the number of acres receiving the extra 20% current use discount for permitting recreational use on their property has dropped by a net 641 acres. Data for 2017 and 2018 were not available. In 2008, 7,370 acres (45% of the Town) received the 20% recreational discount while in 2016, 6,729 acres (41% of the Town) received the discount. The slowly rising number of acres in current use with the declining recreational discount may be indicative of property owners feeling it is more beneficial to maintain privacy or perceived safety than be open to hunting or hiking on their land. Still, with a fairly consistent 62% of Town land under current use, these lands may not be prioritized for future development.

Table 4.1

Current Use (CU) Trends			
Year	Total Acres in CU	Acres with 20% Recreational Discount	Total % of Town in CU
2008	9,805.1	7,370.4	60.3%
2009	9,881.0	7,424.0	60.8%
2010	9,895.0	7,421.9	60.9%
2011	9,921.2	7,443.6	61.0%
2012	9,909.4	7,281.4	61.0%
2013	9,928.0	7,055.0	61.1%
2014	9,927.4	6,972.9	61.1%
2015	9,937.3	6,735.3	61.1%
2016	9,923.6	6,729.3	61.1%
2017	10,056.7	N/A	61.9%
2018	10,063.9	N/A	61.9%

Source: Boscawen Master Plan 2018, CNHRPC compiled research from Town Reports

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About 62% (10,064 acres) of the Town is under current use while about 41% (6,729 acres) receives the 20% recreational discount).

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## 4.4. Recreational Trails

Boscawen hosts both a local trails system within the Boscawen Town Forest and the most southern section of the [Northern Rail Trail](#), which is maintained by the [NH State Parks](#) and local trail advocates. Some of Boscawen's trails are displayed on the **Trails Map**, however GIS map data is not available for all public trails in Boscawen, and a number of informal trails exist on private property are also not mapped. The Class VI Weir Road Town Forest trails total approximately 5 miles of easy, moderate, and difficult climbs along the Dagody Hill Loop Trail, Colby Trail, Blue Ridge Trail, Hirst Marsh Trail, and other trail loops. They follow Old Weir Road into Concord and connect to the Hirst Wildlife Management Area. The Northern Rail Trail with its trailheads on River Road and Depot Street attracts bicyclists, walkers, snowmobiles, and other users from across the State, heading 56 miles northwest into Lebanon.

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About 13 miles of recreational trails in Boscawen give users a local experience at the Town Forest (5 miles) and connect to a wider network via the paved or packed stone dust Northern Rail Trail (8 miles).

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## 4.5. Historic and Cultural Sites

The Town has a rich history with important sites, buildings, monuments, or features throughout the community. As displayed on the **Recreation and Cultural Resources Map**, concentrations of sites are located along King Street, US 3 and US 4 and Water Street. These locations were just as important for the Town's history as they are in today's life. They include cemeteries, parks, farms, boat ramps, public sites, and old buildings.

## 4.6. Steep Slopes or Ridgelines

The **Topography and Scenic Vistas Map** display the promontories in Boscawen. The highest locations often form ridges and valleys, such as Choate Hill and Colby Hill between US 3 and 4 or the unnamed ridge from Corn Hill Road to Flaghole Pond. There are ridgeline preservation and protection opportunities to be considered.

Steep slopes are a development constraint and are often defined as between 15% to 25% or greater. Watershed runoff is exaggerated by the presence of steep slopes without proper management. The greatest acreage of slopes are found on the sides of the named hills.

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Boscawen does not have steep slope or ridgeline regulation.

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## 4.7. Scenic Views and Viewsheds

Within its borders, Boscawen hosts a wide range of elevations, from under 300’ at the low-lying Merrimack River to the Town’s highest point on Raleigh Hill at 920’ above sea level. The Town is host to many hills, most of which are located on private property. The Boscawen Hill can be climbed according to the Town Forest guidelines. 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.

A **scenic views** 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.

About 12 named hills in Boscawen span from 380’ above sea level to 920’ above sea level.

Table 4.2

Hills and Elevation		
Name	Elevation Above Sea Level	Location
Collins Hill	380'	Between North Main Street and King Street
Ariat Mountain (aka The Mountain)	580'	West of King Street, section known as Windy Ghoul
Clark Hill (aka Crete Hill)	600'	West Side of Lower King Street
Dagody Hill	620'	Southern Boundary Shared with Concord
Clay Hill	640'	North Bank of Corn Hill
Colby Hill (aka Gerrish Hill)	640'	North of Colby residence
Boscawen Hill	680'	In Boscawen Town Forest, Ledge Outcropping
Knowlton Hill	760'	Upper Queen Street
Plummer Hill	780'	Off Corn Hill Road
Choate Hill (aka Poplar Hill)	800'	Between Daniel Webster Highway and High Street
Jackman Hill (aka Chadwick Hill)	800'	Chadwick Hill Road
Raleigh Hill	920'	North Water Street to Salisbury Boundary

The **Viewsheds Map** shows the topography of Boscawen, which can indicate the location of hillside views. Scenic vistas of Walker Pond and Mount Kearsarge are seen from promontories, as are views of the Merrimack County Farm. These vistas help define Boscawen’s identity.

Source: Boscawen Master Plan 2018, CNHRPC compiled research from topographic maps

## 4.8. Bedrock Geology

Underlying the community are formations of bedrock upon which forests, construction, roads, and hydrology rest. The Town resides on about half Plutonic & Volcanic rock (49%) and half Metasedimentary & Metavolcanic rock (51%). A map of bedrock geology could be produced with available data should the data layer not be present on another map in Town. The single largest type of bedrock is the Plutonic & Volcanic Spaulding Tonalite which is located under North Water Street and US 4 in the northwestern section of Town. Spaulding Tonalite extends west across US 3 to form the border of much of the Merrimack River in Boscawen.

The characteristics of Spaulding Tonalite are weakly foliated to nonfoliated, with spotted biotite quartz diorite, tonalite, granodiorite, and granite; garnet and muscovite may or may not be present. This type of bedrock does not conduct groundwater aquifers.

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About 49% (7,819 acres) of the Town is underlain by Spaulding Tonalite bedrock, a type of Plutonic & Volcanic rock.

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Table 4.3

Bedrock Geology				
Map Code	Formation	Type	Acreage	Total % of Town
Dc1m	Concord Granite (Late Devonian)	P	33	0%
Dll	Littleton Formation	M	244	1%
Ds1-6	Spaulding Tonalite (Early Devonian)	P	7,885	49%
Sm	Madrid Formation (Upper Silurian)	M	1,138	7%
Sp	Perry Mountain Formation, undivided (Middle to Lower Silurian)	M	4,224	26%
Srl	Lower Rangeley Formation	M	155	1%
Sru	Upper Rangeley Formation	M	1,024	6%
Ssf	Smalls Falls Formation, undivided (Upper to Middle Silurian; Ludlovian and Wenlockian)	M	1,550	10%
<b>Total</b>			<b>16,252</b>	<b>100%</b>
P = Plutonic & Volcanic				
M = Metasedimentary and Metavolcanic				
<i>Source: US Geological Survey</i>				

## 5. Wildlife Habitat Resources Co-Occurrence

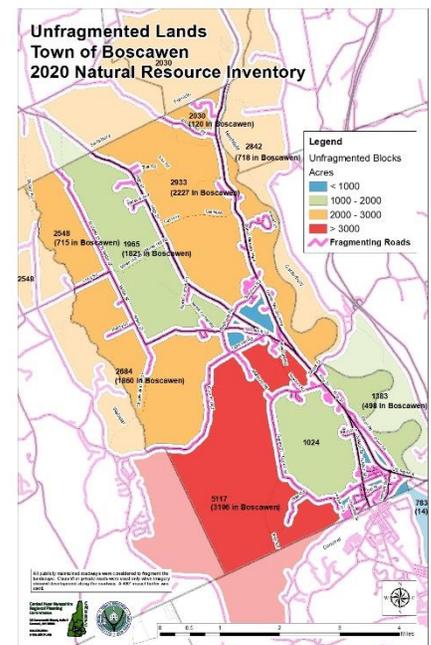
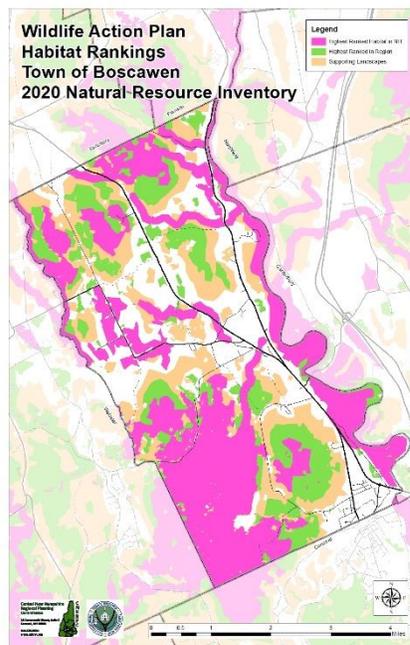
As a rural community with a low population density and large blocks of undeveloped land, Boscawen contains natural communities and habitats which are host to a wide variety of wildlife. The [NH Fish and Game](#) maintains a listing of species occurring in New Hampshire that are state- and federally- 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 2020 and contains town by town lists of species, including those for Boscawen. The Hirst Wildlife Management Area in Boscawen 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 show 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” (10), then “Highest Ranked Habitat in Ecological Region” (5), and “Supporting Landscapes” (3). More information on the Wildlife Action Plan dataset can be found on the [NH Fish and Game website](#).

**Unfragmented Lands:** This dataset developed by CNHRPC breaks the Town of Boscawen into blocks of land unfragmented by roads, development, or human activities. Large areas of land that are not broken up 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 unfragmented lands layers includes a 500’ impact buffer from all roads. Unfragmented blocks with 5,000 acres or more are assigned the highest value score (6), and blocks between 2,000-5,000 were assigned a lower score (3). Boscawen is unique in that it has unusually large areas of unbroken landscapes when compared to neighboring communities.



### Conservation Land Buffer 1,000':

Lands adjacent to existing conservation land were assigned a value score of 4. Having larger continuous areas of conserved space has a higher total habitat value than multiple fragmented open spaces. Some wildlife species require large areas of land undisturbed by human activities.

### Wildlife Habitat Co-Occurrence

**Results:** The co-occurrence results of the wildlife habitat related layers shows

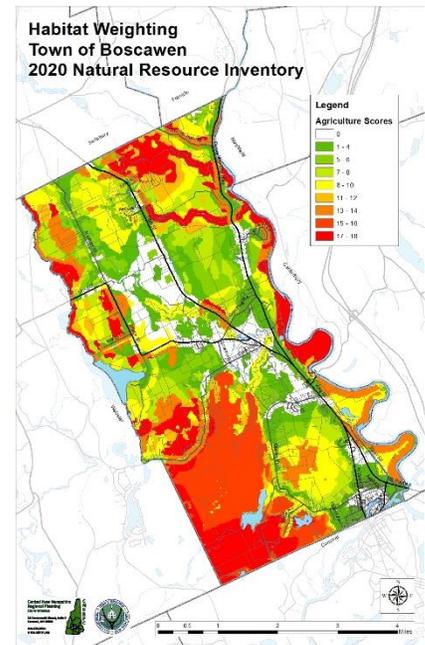
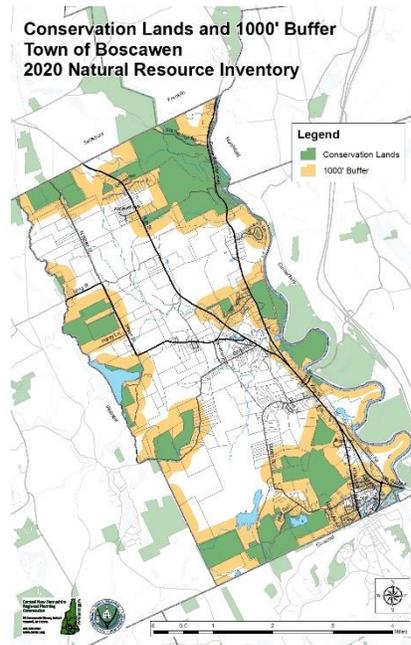
high habitat value lands in the large, unbroken block of land in the southwest corner of Boscawen, an area of north-central Boscawen, along the portions of the Merrimack River, and along streams including Glines Brook and others. Areas in reds, oranges, and yellows on the map show the areas of the higher habitat value, where the higher scored data inputs coincide.

Wildlife Habitat was deemed very important to the Town of Boscawen in the Survey and by Conservation Commission members, and so the Wildlife Habitat category makes up 31% of the total co-occurrence score for Boscawen.

## 5.2. 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 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 determined for Boscawen and the surrounding communities.

Boscawen is a rural community with most of its development concentrated along the main routes and Class V Town roads. By conducting a GIS operation of buffering publicly maintained roadways by 400', an unfragmented lands inventory was conducted. In Boscawen, this operation excludes Class VI unmaintained roads, except for Marlborough Road, which was determined to have nearby human activity. These large blocks connect regionally to the surrounding communities' unfragmented lands, thereby increasing the overall natural resource value of the regional block. See the **Unfragmented Lands Map** for visual detail.



The largest unfragmented block totals 3,197 acres within Boscawen and is situated in the area surrounding the Boscawen Town Forest and the private Patenaude Pond, spanning from the Concord and Webster Town line to Corn Hill Road, and then to King Street and Queen Street. This extraordinary area is also regionally significant, totaling 5,167 acres in Webster, Concord, and Boscawen combined. The second largest unfragmented land block of 2,227 acres is located between High Street and Daniel Webster Highway, from Goodhue Road to the Salisbury Town line. This block is the second largest regionally significant unfragmented land area at a total of 2,933 acres in Salisbury and Boscawen. Several other unfragmented blocks of over 1,000 acres are located in Boscawen between the main public roads.

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About 33% (5,423 acres) of the Town is contained within the two largest blocks of local unfragmented lands.

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Table 5.1

Unfragmented Blocks		
Block Location > = 120 Acres	Locally Significant Acreage	Regionally Significant Acreage
Corn Hill Rd - Weir Rd	3,196.5	5,116.6
High St - DW Hwy	2,226.8	2,933.1
Corn Hill Rd - Long St	1,860.1	2,684.5
N Water St - High St	1,821.0	1,964.5
Queen St - N Main St	1,023.8	0.0
East of DW Hwy	718.2	2,408.3
West of Water St - N Water St	714.9	2,548.2
Two Southern Merrimack River	498.0	1,383.3
Stirrup Iron Rd - DW Hwy	120.2	1,763.4
<b>Totals</b>	<b>12,179.4</b>	<b>20,802.0</b>

Source: CNHRPC GIS Calculations Using Road Buffers, 2019

### 5.3. Wildlife Action Plan (WAP) Habitats

The NH Wildlife Action Plan 2015 (WAP) is an important component of the Boscawen NRI. Using the habitats identified in Town, the dominant [hemlock-hardwood-pine forest](#) hosts species such as bats, eagles, songbirds, snakes, moose, turtles, and salamanders. The [Appalachian oak-pine forest](#) hosts similar species. Covering nearly 75% of Boscawen’s land area, these two forests also represent essential habitat to large-roaming mammals such as bobcat, moose, bear, black bear, owls, lynx, deer, and others. State-endangered Blanding’s Turtle, Timber Rattlesnake, Common Nighthawk, New England Cottontail need Boscawen’s forest habitat for survival.

The WAP utilized the newest available satellite imagery resources and techniques to determine the locations and acreages of priority habitat areas.

Table 5.2

Wildlife Action Plan Habitats		
Habitat	Acres	Percentage of Town Acres
Hemlock-hardwood-pine	7,058.1	43.4%
Appalachian oak-pine	4,808.4	29.6%
Grassland	1,712.9	10.5%
Developed or Barren	1,011.5	6.2%
Temperate swamp	542.0	3.3%
Marsh and shrub wetland	531.5	3.3%
Water	404.1	2.5%
Peatland	84.5	0.5%
Floodplain forest	77.4	0.5%
Rocky ridge	16.9	0.1%
Cliff and talus slope	8.5	0.1%

Source: NH Wildlife Action Plan 2015

Table 5.3

Wildlife Action Plan Habitat Priorities			
Tier Priority	Acres	Percent of Tier Protected Acres	Percent of Town Acres
Tier 1 Acres	6,194.0	----	38.1%
Tier 1 Acres Protected (Conservation)	1,456.0	23.5%	---
Tier 2 Acres	2,522.0	----	15.5%
Tier 2 Acres Protected (Conservation)	586.0	23.2%	---
Tier 3 Acres	3,168.0	----	19.5%
Tier 3 Acres Protected (Conservation)	586.0	18.5%	---
Total Tier Habitat Priority Acreage	11,884.0	----	73.1%
Total Tier Habitat Protected Acreage	2,628.0	22.1%	

Source: NH Wildlife Action Plan 2015

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).

The locations of the highest priority habitat (Tier 1) are found along the Merrimack River corridor and within its oxbows, along Stirrup Iron Brook, Pond Brook, Tannery Brook, along the sides of North Water Street and Water Street, around Clark Hill, and the entire southwestern section of Town from Corn Hill Road to Hirst Marsh. The Tier 2 locations are generally along the periphery of the Tier 1 habitats.

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About 24% (1,456 acres) of the Tier 1 highest priority habitat is **protected** by conservation, while the remaining 76% (4,738 acres) of highest priority habitat is **vulnerable** to development.

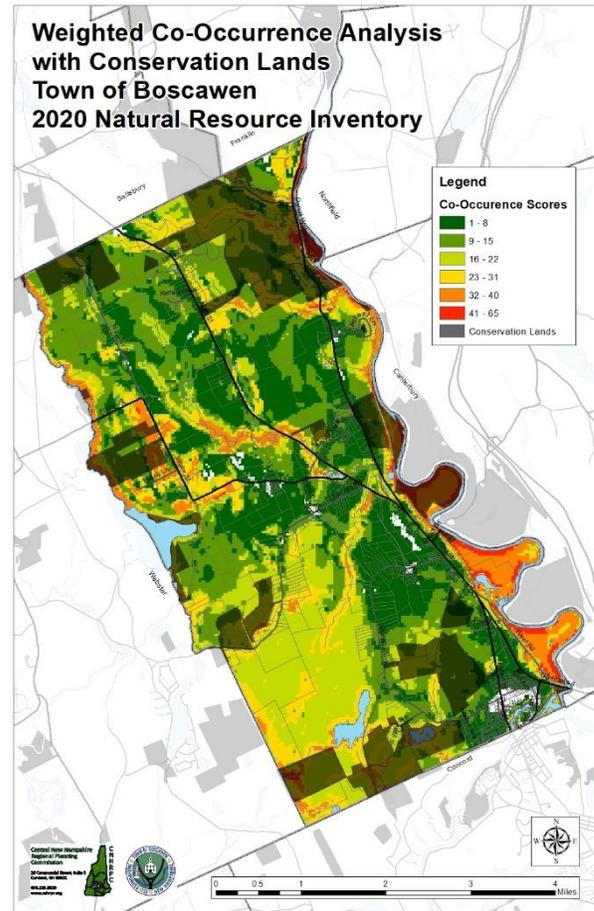
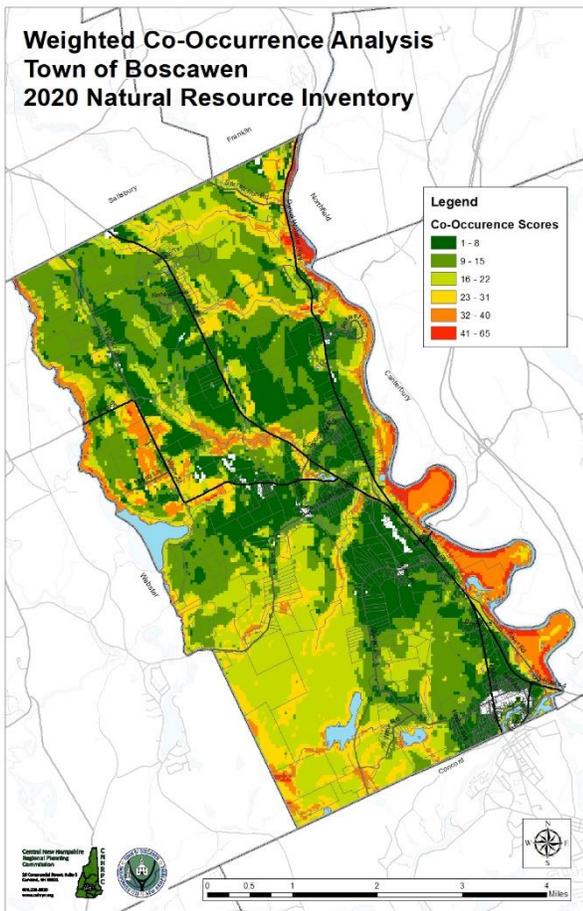
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## 6. Conclusion and NRI Recommendations

The NRI Maps and data have helped highlight lands that are likely to best meet the Town's conservation priorities. The details of the natural resources and their contributions to the Town of Boscawen also lead to a series of more detailed recommendations.

### 6.1. Weighted Co-Occurrence Analysis

The **Weighted Co-Occurrence Map** visually displays the highest priority natural resource locations in the community. The analysis found the most essential locations in Boscawen to protect for future generations include the drinking water wells, Merrimack River corridor and intervalles, Tannery Brook, Beaverdam Brook, Cold Brook, Hirst Wildlife Management Area, locations along Water Street, and a large block of unfragmented land in the Town's southwest corner. When overlaid with existing conservation lands, it is revealed that much of the lands that support the highest natural resource value to the Town are not presently conserved.



## 6.2. NRI Recommendations

As a result of reviewing the NRI data, following are potential recommendations for Boscawen 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 nature resource group.

### 1. Protect the high value aquifers by permanently conserving the lands above and surrounding them.

The highest value drinking water supplies are 1) in the vicinity of the Merrimack County wells, 2) the area of the US 3 and US 4 intersection east to the Merrimack River 3) the interval directly north and along the Northern Rail Trail, 4) generally along the interval of the Merrimack River and 5) along Tannery Brook between Water Street and High Street. These high value drinking water areas of high transmissivity should be targeted for future protection if they are found not to be permanently conserved.

### 2. Research and enact building setbacks from wetlands.

Boscawen Planning Board’s new Land Development Regulations, Definitions and the Zoning Ordinance, Article 14.02, b) (8) both require a 25’ setback from jurisdictional wetlands but there are no other building setbacks from wetlands. Many communities have zoning ordinance wetland setbacks of 75’ or greater. This might be an ordinance to further research and place before Town voters.

### 3. Include riparian and wetland buffers in the Zoning Ordinance.

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. After factoring in the

[Shoreland Water Quality Protection Act](#), conservation land abutment, and typical municipal buffers, the [NH Department of Environmental Services](#) developed suggested local buffer protections of surface waters, called the [Riparian Buffer Gap Analysis](#).

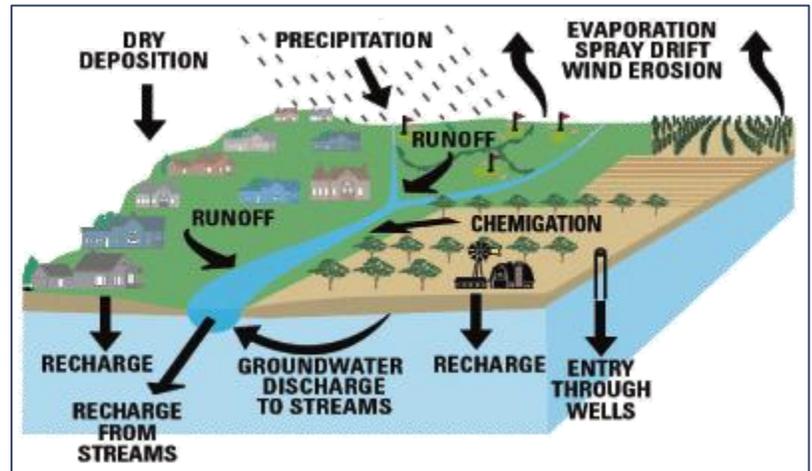
Table 6.1

Riparian Buffer Gap Protection Levels	
Level of Buffer Protection	Description of Buffer Protection
1. High	Land Conservation > 300 ft
2. Medium to High	Land Conservation > 100 ft and <= 300 ft
3. Medium	CSPA Buffer Protection
4. Medium to Low	Local Zoning buffer > 100 ft
5. Low	Local Zoning Buffer > 50 ft and < 100 ft
6. None	No Buffer Protection

Source: NH DES Riparian Buffer Gap Analysis, <https://www.des.nh.gov/organization/divisions/water/dwqb/dwsp/documents/riparian-buffer.pdf>

The recommended levels of riparian buffer gap protection of surface waters are as follows in **Table 6.1**. The conservation land under consideration are those that are adjacent to surface waters. A good local informative resource, Buffer Options for the (NH) Bay at <https://www.bufferoptionsnh.org/> provides explanations, references, and guidance for establishing municipal buffers in New Hampshire.

Runoff into Surface and Groundwater



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

**4. Purchase conservation land or procure conservation easements in the floodplain.**

The benefits are multiple when land in the floodplain is permanently protected from development. Conservation land in the floodplain provide additional water capacity during flood events, protects 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.

**5. Ensure those who manage their land as woodlots for timber harvesting utilize best management practices. Encourage the development of forest management plans, perhaps on an incentive basis.**

Town staff should 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.

**6. Ensure the active agriculture operations do not negatively impact the aquifers, surface waters, and drinking water supplies.**

The Town has an Agricultural Commission which advocates for agricultural operations. Best management practices should be utilized during land management. Education and incentives could be used to help keep the herbicides, pesticides, and livestock from infiltrating the water supplies.

**7. Consider regulation of ridgelines and steep slopes to help protect Boscawen’s viewsheds and reduce rainwater runoff.**

A Steep Slopes Conservation District and/or Ridgeline Conservation District, both zoning overlay districts, could be used to define areas in Town where closer regulation is necessary. Elevation change of 20 feet or greater and the average slope of 20 percent or greater are good measures of steep slopes.

**8. Utilize opportunities to permanently protect Boscawen’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 Boscawen Historical Society can offer additional opportunities for projects. The [NH Division of Historical Resources](#) contains program information that Boscawen 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. Examine why there are declining recreational current use discount acres at the same time that current use acreage is greater than ever. The Conservation Commission may want to determine how to encourage this land to remain open for public recreational use.**

Declining recreational current use may in time limit or reduce outdoor enjoyment opportunities on private lands. With a fairly consistent 62% of Town land under current use, these lands may be more likely to remain undeveloped as compared to properties not under current use.

**10. Research the status of areas under conservation (such as the Sanborn Agricultural Preservation Restriction and the Merrimack River State Forest, and several others), that may not carry permanent protection or specifically protect groundwater.**

The easiest land to permanently conserve may be those already under some type of conservation if the deeds permit changes and the landowners are open to perpetual protection, or a semi-permanent protection such as a 99-year protection clause.