

CHAPTER 1

NATURAL RESOURCES AND OPEN SPACE

This chapter, Natural Resources and Open Space, addresses some of the most important assets of the Town of Athol: its rolling hills, steep ridges, forests, remnant farmlands and meadows, streams, ponds, wetlands and aquifers, and the Millers River. It describes past and potential future land use trends, and presents an overview of Athol's landscape character and a selective inventory of the Town's natural resources. The Town's extensive natural and open space areas are essential elements in the economic, social, and ecological fabric of Athol.

The quantity, quality, and spatial relationships between Athol's open space and natural resources are identified. Due to the similar subject matter, aspects of the 2000 Athol Open Space and Recreation Plan Update have been incorporated into the contents of this chapter. This work includes mapping and inventories of land use, wetlands, and ridgelines. Information on water resources and open space inventories has been updated from the Open Space Plan. Available information related to water quality and fisheries is presented within a watershed context, since sources of pollution upstream have a direct impact on the quality of water, wildlife, and fisheries that move downstream in the Millers River and its tributaries.

In 2000, the Town of Athol completed its Open Space and Recreation Plan Update. As part of this effort a community survey was distributed to 5,256 households and nearly sixteen percent (16%) of the surveys were returned. The survey findings were instrumental in shaping the goals and objectives for both the Open Space and Recreation Plan and the Natural Resources and Open Space chapter of the Master Plan. Although the community survey does not represent the opinions of every Athol resident nor every age and income bracket, it provides the best current assessment of the issues and resources residents believe are most important and worthy of attention.

Goals:

In the survey and in separate comments, Athol residents revealed their overarching natural resource and open space goals, as follows:

- To improve, maintain, and protect natural resources including lakes, streams, and drinking water supplies, large forested areas, open fields, wildlife and their habitat areas, wetlands including vernal pools, and farmland.
- To preserve, protect, and provide public access to significant natural areas, open spaces and unique attributes.

Objectives:

The Town developed a Five-year Action Strategy as part of the 2000 Open Space and Recreation Plan Update. The following objectives are summarized from the Action Plan:

- Promote community actions that preserve open spaces.
- Broaden public awareness of Athol's natural and recreational resources.
- Use innovative growth management strategies such as adopting a cluster-zoning ordinance, a scenic roadways bylaw, and a wetlands protection by-law.
- Promote the redevelopment of brownfield properties through the adoption of a Municipal Tax Abatement Bylaw.
- Identify, acquire, and protect aquifers and aquifer recharge areas.
- Pursue grants to purchase and protect open space parcels of ecological, scenic, or cultural significance, such as the Sanders Street Swamp and the Whitney-Hamlet land, as well as lands within aquifer recharge areas.
- Link scattered conservation and recreation areas through the establishment of a continuous greenway network.
- Apply conservation easements to Town-owned properties of ecological, scenic, or cultural significance.
- Protect unique vegetative communities and lands along the banks of the Millers and Tully Rivers.
- Encourage active community involvement with the Miller's River Watershed Non-Point Source Assessment 604(b) Project.
- Adopt the Millers River Non-Point Source Pollution Project 604(b) recommendations.
- Maintain or plant woody vegetation around ponds and along rivers to reduce erosion, filter polluted runoff, absorb floodwaters, and slow water velocity.
- Submit a proposal to declare portions of the Millers River in Athol scenic, pursuant of the Massachusetts Scenic Rivers Act, (M.G.L., Chapter 21, § 17B), to ensure protection of the river from certain types of development and alterations.
- Continue remediation efforts to reverse the eutrophication¹ of Lake Ellis and maintain its water quality.
- Study means of alleviating chronic flooding on Lake Ellis (Department of Public Works, 2000).

¹Eutrophication: excessive nutrient enrichment that leads to excessive algal and dense weed growth.

- Distribute a packet of “Best Management Practices” and educational materials to homeowners, schools, and businesses to protect public and private surface and ground water resources.

This chapter includes an overview of Athol’s land uses and landscape, and sections of natural resources and open space. The section on natural resources provides inventories and analyses of the Town's topography, geology, and soils including a discussion of prime farmland and forestland soils; water resources including rivers, wetlands, aquifers, and drinking water supplies; vegetation; and, wildlife, fisheries and their habitat. The section on Athol’s open space resources provides an inventory of lands by level of protection (permanent, limited, temporary, and unprotected) and by ownership (public and private) (*see the Open Space Map*). These properties are assessed taking into consideration their natural resource and recreational values (*see the Special Landscape Features Map*).

Landscape Character, Land Use, and Land Use Change

The Town of Athol, a historic manufacturing town, is located within the picturesque Millers River Valley, in the North Quabbin Region of Central Massachusetts, approximately twenty-five miles west of Fitchburg, thirty-eight miles northwest of Worcester and seventy-two miles west of Boston. Encompassing a geographic area of over thirty-three miles, the community is bordered by New Salem and Orange to the west, Royalston to the north, Phillipston to the east and Petersham to the southeast.

Athol has several distinct landscapes both in its variety of built environments and natural resources. The overall landscape is dominated by mountainous ridges, which rim riparian corridors along the East Branch of the Tully River and the Millers River. Athol has a densely populated urban center packed with historic mills, shops, restaurants, municipal buildings, and parks. This traditional downtown district developed along the banks and flood plain of the Millers River as manufacturers sought to take advantage of the river’s flow for power. North and south of this downtown area and along major roadways extending outward, are residential neighborhoods of varying densities. In addition, the Town has many natural resources including surface waters, such as the Millers River, ponds, scattered wetlands, tributary streams and brooks, and rolling hills, steep ridges, forests, farmlands, and meadows.

The banks of the Millers River just east of the Starrett Manufacturing Plant are steep and comprised of till and bedrock. The river cascades over steep terrain in this section. Dams at the Starrett Plant control the flow of water for hydroelectric power and other manufacturing uses. Southwest of the dams, the banks open up and the terrain flattens out at the confluence of the Tully River. Here the river is used for canoeing and other recreational purposes. Flowing south to the Millers, Tully River is flanked on its west bank by a hilly ridge and on its east bank by an alluvial floodplain comprised of sand and gravel soils.

The predominant peaks in Athol are Round Top, Little Round Top, Pratt Hill, Cobb Hill, Sheep Rock, and Chestnut Hill to the east and north of Athol Center. The rolling hills to the south are Rice Hill, Conant Hill, and Kelton Hill. Together these hills form a forested plateau.

Another distinctive characteristic of Athol’s landscapes is the presence of large undeveloped open spaces that are due to conservationists’ efforts at protecting a significant amount of land at relatively low cost. The success of this movement indicates a willingness to preserve the characteristics that make Athol special (*see the Open Space Map*). Northeast of the downtown district, a region along the river is largely undeveloped and contains two large protected forests: the Millers River Wildlife Management Area and Bearsden Forest Conservation Area.

Table 1-1 lists the acreage of selected natural resources and agricultural land uses in Athol. In 1999, seventeen thousand, eight hundred and seventy-seven (17,877) acres of land were classified as natural resources or agricultural land. Forestland accounted for nearly seventy-six percent (76%) of the total land area of Athol, all of which is zoned for single-family residential use on lots of one-acre or more. The Town also has three hundred and forty-four (344) acres of wetlands and nine hundred and fifty-two (952) acres of forested wetlands, based on information from the United States Fish and Wildlife Service’s National Wetlands Inventory (NWI).² “Forested wetlands” is a subset of the total forest acreage. Surface water in the form of lakes, ponds, rivers, and streams account for six hundred and seventy-one (671) acres. Agricultural land accounts for six hundred and sixty-three (663) acres.

Table 1-1: Natural Resources and Agricultural Land Acreage

Land Use	Acres	Percentage of Total Land Area in Athol
Surface Water	671	3.1%
Non-Forested Wetlands*	344	1.6%
Forested Wetlands*	952	4.5%
Forest	16,220	76.0%
Cropland	325	1.5%
Pasture	309	1.5%
Orchard, Nursery, etc.	29	0.1%
Total	17,898	83.8%
Total Land Area in Athol	21,354	100%

* These figures were determined from calculations using National Wetlands Inventory data.

Forested wetlands is a subset of Forest.

Source: MacConnell, 1999 MassGIS, Land Use Coverage. (except for wetlands data).

The total land area of Athol is twenty-one thousand, three hundred and fifty-four (21,354) acres. The three thousand, four hundred and seventy-seven (3,477) acres not in natural resources or agriculture are in land uses that constitute the built environment along the banks of the Millers and Tully Rivers, several lakes and the road network. These include single and multi-family residential, commercial, and a small amount of industrial uses.

² The Emergency Wetland Resources Act of 1986 directs the National Wetlands Inventory (NWI) to provide a digital wetlands database for the United States describing the characteristics, extent, and status of the Nation’s wetlands and deepwater habitats. The database is used for the production of customized maps and other applications including planning for watershed and drinking water supply protection; fisheries restoration; floodplain protection; and endangered species recovery; siting of transportation corridors, schools, and other municipal buildings; and construction of solid waste facilities. Users can access the database online at the National Wetlands Inventory Home Page: <http://www.nwi.fws.gov>.

In Table 1-2, a comparison of the types of land uses and their acreages between 1971 and 1999 highlights the natural resources that have been reduced due to housing pressures and changing development patterns. Pasture and forestland were the primary resources converted to other uses. During the last twenty-eight years, Athol lost five hundred and twenty-seven (527) acres of forestland and one hundred and eighty (180) acres of pasture to residential uses of a quarter acre or more. In 1971, lots a quarter to a half-acre in size were the dominant type of housing development. By the late 1990s, houses were being built on larger lots. Between 1971 and 1999, the number of house lots larger than a half-acre in size increased by sixty-seven percent (67%). Prior to 1971, most homes were built in the neighborhoods surrounding Athol Center. However, during the last quarter Century, most residential development occurred as frontage lots on the north-south running roads far from the center.

Table 1-2: Changes in the Land Area of Different Natural Resource, Agricultural, and Developed Land Uses Between 1971 and 1999

	Land Use Acreages in 1971	Land Use Acreages in 1985	Land Use Acreages in 1999	Change in Acreage from 1971 to 1999
Cropland	364	331	325	-39
Pasture	489	455	309	-180
Forest	16,747	16,514	16,220	-527
(Forested Wetlands*)	N/A	N/A	952	-
Non-Forested Wetland	358	361	344	-14
Mining (Gravel, etc.)	49	55	35	-15
Open Land (including power lines)	223	231	276	53
Participation Recreation and Golf	163	158	158	-6
Water Recreation	13	13	13	0
Residential Multi	6	20	21	15
Residential <1/4 acre	63	63	63	0
Residential 1/4 - 1/2 acre	991	1,030	1,106	115
Residential > 1/2 acre	780	958	1,302	522
Commercial	137	140	143	6
Industrial	76	82	82	7
Urban Open**	132	173	207	75
Transportation	40	37	37	-3
Waste Disposal	33	35	16	-18
Water	671	671	671	0
Orchard/Nursery	19	28	29	10
Total Acreage, net change	21,354	21,354	21,354	

**These figures were determined from calculations using National Wetlands Inventory data. Forested wetland is a subset of Forest. **Urban Open includes cemeteries, parks, public and institutional green space, and vacant undeveloped land. Sources: MacConnell 1971, 1985, and 1999 MassGIS Land Use Coverages.*

It is important to note that some losses in pastureland are a result of field to forest succession. Some of the pastureland is growing back into forestland at the main Cass Farm on Chestnut Hill Road, from Old Keen Road to Silver Lake Street.

According to the 1999 Land Use and Land Use Change (1971-1999) Map, the prevailing development pattern between 1971 and 1999 was individual residential lots, of one acre or more, located along the roads on the edge of large expanses of forested land. These frontage lots are a type of residential development, which does not require Town Planning Board approval, as does the subdivision of land. Under The Subdivision Control Act, M.G.L. Chapter 41, Section 81K, land may legally be divided through an Approval-Not-Required (ANR) Plan.

An ANR plan may create a lot if the new lot complies with the minimum frontage requirements of the zoning. ANR endorsements can be applied for if every lot within the divided tract, at the time it is divided, has existing roadway frontage as required by the zoning bylaw. Not only must new lots meet the minimum frontage requirements, they must front on one of the three types of public ways, and must receive the Planning Board's determination that the vital access to such lots is practical access, that the way is adequate, and that the access from the way to the buildable portion of the lot is adequate. If these conditions are met, ANR endorsement is given.

A subdivision is required for the construction of a new road, which would create legal frontage for new building lots. According to the 1999 Land Use and Land Use Change (1971-1999) Map, there appears to be at least two areas that were subdivided since 1971: in western Athol, north of Route 202 and off Pleasant Street, east of the High Knob water tank. Even so, the current development pattern of ANR lots is likely to continue, based on the relative ease of developing frontage lots and the amount of available land along Athol's public ways.

Other changes in the land use acreage figures between 1971 and 1991 have been accounted for, and are described below:

- A loss of fourteen (14) acres of non-forested wetland has been attributed to the actions of beavers building dams and causing increases in surface waters.
- A loss of thirty-nine (39) acres of cropland is accounted for by the acquisition of Cass Meadow (a flood plain cornfield near the Tully and Millers Rivers, which is being used as a wellhead protection area), Pickard Farm off North Orange Road and Moore Hill Road, and Sentinel Elm Farm off Moore Hill Road by the Department of Fisheries and Wildlife. These lands were converted to wildlife habitat and account for some of the increase in Urban Open land (*see the 1999 Land Use and Land Use Change (1971-1999) Map*).
- A loss of eighteen (18) acres of waste disposal land occurred when the Town dump located between Route 32 and the Tully River was closed and converted to a capped landfill.
- A loss of fifteen (15) acres of mining land can be attributed to the closing of several sand-and-gravel operations such as the E. W. Sykes sand pit on South Athol Road, near South Athol Pond, the Joseph Mallet & Sons operation, which became a new warehouse for Bunzel Extrusion, and another site off Route 32, near the Town dump.

- In 1971, the Resource Mapping Project at the University of Massachusetts, Amherst aggregated land use classes into twenty-one use codes.³ Since then, several changes in the classification system expanded the use codes to thirty-seven. Orchard and nursery were once classified as Woody Perennial. However, it appears that this code was not present in Athol in 1971, so the orchard and nursery acreage seen in subsequent years must be recent changes. Land that was once classified as open land was reclassified as power lines in 1991 following a change in the land use code system funded by both the Massachusetts Water Resources Authority (MWRA) and the Executive Office of Transportation and Construction (EOTC).

Natural Resources

Geology, Topography and Soils

Athol's surficial geology is largely a result of glacial activity. Though influenced by modern rivers and streams, great ice sheets, estimated to have a thickness of up to two miles, scraped and wore deep grooves into the land during the Pleistocene Era, 11,000 to 1.8 million years ago. As the glaciers advanced, materials scraped from the underlying bedrock were carried south. As temperatures warmed, the melting ice sheets left sediments and melt-waters in their wake. Glacial tills, consisting of unconsolidated sand, gravel, silt and clay, are remnants of that era.

Geologic activity and glacial sculpting also left a deep imprint on Athol's surface topography, which is highly variable with a large amount of relief. Steep-sided valleys, granite mountains, rock outcrops, and rushing streams typify the area. Little Round Top, Sheep Rock, Round Top, Pratt Hill, and Bemis Hill reflect the tremendous scouring power of ice, rain and wind. Pratt Hill is Athol's highest peak at one thousand, two hundred and eighty-two (1,282) feet above sea level.

Observation and data from the United States Geological survey show Athol's soils to be rough and stony, comprised of till and bedrock on the eastern part of Town, and moist sand and gravel on the southern and western portions of Town (*see the Prime Agricultural and Forestry Soils Map*). Athol's soils were influenced by the deposition of a large glacial lake that once straddled Athol and Orange. Over thousands of years, sediments ran off surrounding hills and collected as thick layers of sand, silt and gravel on the lake bottom. When the lake drained, the rich sediments were left behind. Today, these deposits measure approximately two hundred (200) feet thick and extend over thirteen (13) square miles. Over the years, several privately owned and operated sand and gravel operations have taken advantage of the Town's abundant deposits. Gneiss, a material that comprised the foundations and retaining walls of area enterprises, was also mined. A gaping hole is all that remains of a feldspar and mica mine that once operated at the base of Round Top Mountain, in the Bearsden Conservation Area (*see the Special Landscape Features Map*).

³ MassGIS, Datalayer Descriptions and Guide to User Services, September 2000, Boston, MA, <http://www.state.ma.us/mgis>, pp. 73-75.

Athol is included in an interim soils report for Northwestern Worcester County, Massachusetts,⁴ which updates an earlier soil survey published by the United States Department of Agriculture (USDA) in 1927. The report describes the soils in the area and their suitability and limitations for agricultural, forestry, recreation, building, and sanitation. At present, only the hand drawn field maps for the soils report are available from the Natural Resources Conservation Service to determine specific soil characteristics. Montachusett Regional Planning Commission (MRPC) obtained these maps and generalized the soils information to the prime classifications for agricultural and forestry uses. This information was then digitized and overlain onto the Geographic Information System (GIS) land use maps. Soils that underlay the built environment are not included in the total.

Prime Farmland Soils and Farmland

It is a priority of the USDA to identify prime agricultural farmland, which is best suited to grow food, feed, forage, fiber, and oilseed crops. Prime farmland soils produce the highest yields with minimal energy and economic resources, and farming it results in the least damage to the environment. The soils are first grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. Eight capability classes rank soils from minimal to severe in limitations. Soils with severe limitations are precluded from commercial crop production. The soils are further grouped into subclasses that reflect the main limitation of the soil for farming. Subclasses are designated by letters: 'E' is for risk of erosion if not properly managed, 'S' is for shallow, droughty, or stony soil, and, 'W' is for soil that is watery or that requires artificial drainage. Table 1-3 lists the prime farmland soils found in Athol, and describes the crops they yield in tons per acre. In Athol, these soils are class II soils, indicating moderate limitations, which may reduce the choices of plants or require special conservation practices, or both.

The Prime Agricultural and Forestry Soils Map shows the locations of the prime agricultural soils. Athol has roughly sixteen hundred and sixty-eight (1,668) acres of prime agricultural soils. Table 1-4 lists the acreage of the prime agricultural soils by level of protection. Only a small percentage of the agricultural soils are on lands under either temporary (Ch 61, 61A, 61B), or permanent protection (Federal, State, Municipally owned, or under conservation restriction) from development. Less than one third of the acreage containing prime agricultural soils is under some form of protection.

⁴ Northwestern Worcester County Conservation District and USDA Natural Resources Conservation Service, Interim Soil Report for Northwestern Worcester County, Massachusetts.

Table 1-3: Prime Farmland Soils in Athol

Field Symbol	Soil Unit	Capability Class	Corn Silage Yield/Acre (Tons)	Alfalfa Hay Yield/Acre (Tons)	Grass-Clover Yield/Acre (Tons)	Corn, Sweet Yield/Acre (Tons)	Slope
36A	Merrimac fine loamy sand	2S	18	4	5.7	6.1	0-3%
38A	Sudbury fine sandy loam	2W	18	3.5	7.6	5.9	0-3%
36B	Merrimac fine loamy sand	2S	18	4	5.7	6.1	3-8%
124B	Paxton fine sandy loam	2E	24	4.5	7.5	5.9	3-8%
38B	Sudbury fine sandy loam	2E	18	3.5	7.6	5.9	3-8%
57B	Scituate fine sandy loam	2W	24	4	6.5		3-8%
81B	Woodbridge fine sandy loam	2E	24	4	7.5	5.6	3-8%
81C	Woodbridge fine sandy loam	2E	24	4	7.5	5.6	3-8%
83B	Skerry fine sandy loam	2E	18	3.5	7		3-8%
83C	Skerry fine sandy loam	2E	18	3.5	7		3-8%

Source: Northwestern Worcester County Conservation District and USDA Natural Resources Conservation Service, "Interim Soil Report for Northwestern Worcester County, Massachusetts."

Table 1-4: Acreage of Prime Agricultural Soils in Athol

	Prime Agricultural Soils	
	Acres*	% of Prime Agricultural Soil Total Acreage
Ch 61	81.1	4.9%
Ch 61A	67.7	4.1%
Ch61B	59.4	3.6%
Municipally Owned	127.1	7.6%
Permanently Protected	159.9	9.6%
Acres of Prime Agricultural Soils under Permanent or Temporary Protection	495.2	29.7%
Acres of Privately Owned, Unprotected, Prime Agricultural Soils	1,173.3	70.3%
Total Prime Soils Acreage	1,668.5	100

Sources: Northwestern Worcester County Conservation District and USDA Natural Resources Conservation Service, "Interim Soil Report for Northwestern Worcester County, Massachusetts" and Montachusett Regional Planning Commission Department of Geographic Information Systems.

For the most part, the agricultural soils in Athol require measures to control erosion. Erosion of the surface layer reduces productivity and mixes the subsoil into the plow layer. It lowers water quality by polluting streams, ponds, and culverts with sediment. Erosion is a hazard where slope exceeds three percent (3%).

The Merrimac and Sudbury series of soils are very deep, moderately well to excessively drained soils that formed in water sorted gravelly and sandy material derived mainly from granitic, gneissic and some schistose rocks. They are nearly level to very steep soils found on outwash terraces and plains and associated kames, eskers, stream terraces and water deposited parts of moraines.⁵ Merrimac soils have slope ranges from 0 to 35 percent.

⁵ Outwash: glacial deposits washed over, transported, and redeposited by meltwater streams.

Sudbury soils have slope ranges from 0 to 15 percent. The steeper slopes are on the margin escarpments of terraces and plains, and on eskers and kames.⁶ Runoff is slow or medium. Permeability is moderately rapid or rapid in the solum and rapid or very rapid in the substratum. Mean annual precipitation is about forty-two (42) inches, the mean annual temperature is about forty-eight (48) degrees, and mean growing season ranges from one hundred and twenty (120) to two hundred (200) days.

The Paxton, Scituate, Skerry, and Woodbridge series of soils are very deep, moderately well drained soils formed in Wisconsin age loamy glacial till⁷ derived from granitic, schistose, and gneissic rocks. They are nearly level to moderately steep soils on till plains, hills, and drumlins. Slope ranges from 0 to 25 percent (Paxton soils range from 0 to 35 percent). Surface runoff is slow to rapid. Permeability is moderate in the surface layer and subsoil and slow or very slow in the dense substratum. Mean annual temperature ranges from 45 to 50 degrees Fahrenheit, mean annual precipitation ranges from 40 to 47 inches, and the growing season ranges from 100 to 160 days.

Where the agricultural soils are moderately well drained, they cannot be tilled or worked until late spring or early summer and are not well suited to early season crops.

Athol currently contains a modest number of active farms of different sizes. According to the 1999 Land Use and Land Use Change (1971-1999) Map, there are six hundred and sixty-three (663) acres of cropland, pastureland, orchards, and nurseries, which is about three percent (3%) of the total land area in Town. The 1997 United States Census of Agriculture reports that there were forty farms in Athol. Seventeen were smaller than fifty acres; the remaining twenty-three were between fifty and one hundred (50-100) acres. Twenty-five farms sold crops and twenty-three farms sold livestock and poultry and their products. Total market value of the agricultural products sold is estimated to be less than two million dollars.

One of the reasons conservationists appreciate both working farms and forests is because productive land provides the landowner income, which may be an incentive in keeping the land in its undeveloped state. Athol has a number of acres in farmland, half of this is in pasture (49%), which may point to lower soil fertility, poor markets, or low farming profitability. Table 1-5 describes the number of acres voluntarily enrolled in the Chapter 61A Program. The Chapter 61A Program provides landowners a reduction in their property taxes in exchange for keeping their land in farming uses. In addition, a lien is placed on their property. The Town also has the right-of-first-refusal with any land in the Chapter 61 Programs. Of the total number of acres enrolled in the Chapter 61A Program (647 acres), only thirty-six (36) acres are considered cropland. This means that there are potentially many acres of cropland without even this temporary level of protection from development. Because remaining farmland in Athol contributes to the Town's scenic and rural character, as well as its local economy, it would behoove residents interested in conserving these

⁶ Esker: Long, low, typically sinuous ridge of sand and gravel deposited along the course of a stream that tunneled through a wasting sheet.

Kame: conical hill of sand and gravel deposited by meltwater streams in contact with glacial ice.

Kame Terrace: valley side deposits of sediment laid down in a lake around the edges of a dwindling glacier.

⁷Till: unsorted and unstratified glacial drift deposited directly from the ice without subsequent reworking by streams, usually containing material of a wide range of sizes.

remaining lands to consider all farmland to be a valuable resource that is vulnerable to development pressures.

Table 1-5: Number of Acres Enrolled in the Chapter 61A Program by Agricultural Category

Category	Acreage
Truck Crop Vegetables	31
Field Crops	5
Wood Products	184
Pasture	382
Nurseries	11
Non-Productive Necessary Land	34
Total	647

Source: Town of Athol Board of Assessors, 2001.

Prime Forestland Soils and Working Forests

While agricultural land is in short supply in Athol, the Town has abundant forestland. The Town has sixteen thousand, two hundred and twenty (16,220) acres of forest, about seventy-six percent (76%) of the total land area. Many of the soils underlying the forested lands in Town are Class 7 soils with very severe limitations, making them unsuitable for agricultural cultivation but well suited for forestry uses. The productive capacity of these forests can be determined by following the model of the Massachusetts Prime Forest Classification System. The USDA has a policy to locate prime forestlands and protect them from conversion to non-agricultural uses. USDA funded a project by the Department of Forestry and Wildlife Management of the University of Massachusetts to define, classify, and map the prime forestlands in the State.

The system has nine categories of forestland soils based on productivity and wetness.⁸ Prime 1, 2, and 3, Prime 3 wet, Statewide Importance and Statewide Importance wet, Local Importance and Local Importance wet, and Unique. Prime forestland soils support a production of white pine wood fiber at a rate greater than eighty-five cubic feet per acre per year, and northern red oak wood fiber at a rate greater than forty cubic feet per acre per year. The forestland with Prime 1, 2, and 3 soils would be the most important to conserve for commercial forest management. Soils of statewide and local importance still have the potential for producing wood products but the financial return may not be as high.

Many of the soils in Athol belong to soil associations that are steep and extremely stony. Though they are ill suited for farming, the soils are classified as Prime 1, 2 and 3 forestlands. By comparing these categories to the soil survey field maps for the Town of Athol, one can identify the areas in Town that contain prime forestland soils. Research Bulletin Number 735/June 1991, "Forest Productivity Mapping of Massachusetts", by the Department of Forestry and Wildlife Management, provides similar information for 1991. It is unclear what

⁸ University of Massachusetts, Department of Forestry and Wildlife Management in cooperation with Massachusetts Department of Environmental Management and the USDA Forest Service, Prime Forestland Classification for Forest Productivity in Massachusetts, October 1985.

the source of their acreage data is, and it varies from the MacConnell land use data, but it is a close approximation. Total forest acreage by productivity class is described in Table 1-6.

The majority of the prime forestland soils occur on the hilly, glacial till ridges upland from the rivers and lakes in Athol to the northeast and to the southeast of the Millers River. Prime 1 forestlands are comprised mainly of the Montauk-Scituate-Canton, the Ridgebury-Whitman, and the Peru and Berkshire-Marlow associations, which are characterized as rolling, steep and extremely stony. Prime 2 forestlands are comprised mainly of the Charlton-Chatfield and Tunbridge-Lyman-Berkshire Associations, also characterized as rolling and extremely stony, though not as steep. Soils that are best suited to agriculture in Athol are also classified as Prime 2 forestlands. These are located on the glacial outwashes and floodplains of the Millers and Tully Rivers, as well as the banks of Riceville Brook, Lake Ellis, Whites Pond, South Athol Pond, and Lake Rohunta. However many of these areas are found in the built environment and are unavailable to either forestry or agriculture.

Table 1-6: Acreage of Forest Soil Productivity Classes and Soil Associations

Soil Productivity Class	Acreage	Soil Associations
Prime 1	1,020	Montauk-Scituate-Canton, Ridgebury-Whitman, Peru and Berkshire-Marlow associations
Prime 2	6,875	Charlton-Chatfield, Tunbridge-Lyman-Berkshire Associations
Prime 3	6,826	Scituate, Walpole, Hinkley, Canton, Tunbridge, Charlton, Chatfield, Paxton, Lyman, Berkshire,
Prime 3W	25	Walpole
Statewide Importance	133	Ridgebury-Whitman
Statewide Importance Wet	469	Scarboro
Local Importance	142	Ridgebury-Whitman
Local Importance Wet	465	Scarboro
Total Forest Acres	15,955	92.4% of the Forest Acreage have Prime Soils.
Total Town Acres	21,361	

Source: Research Bulletin Number 735/June 1991, "Forest Productivity Mapping of Massachusetts," Department of Forestry and Wildlife Management, p. 43.

MacConnell Land use data for 1999 shows Athol has sixteen thousand, two hundred and twenty (16,220) acres of land in forested uses. Of this acreage, one thousand, seven hundred and ninety-six (1,796) acres are in temporary protection under Chapter 61, one thousand, five hundred and sixty-nine (1,569) acres are under State control, and another one thousand and thirty-four (1,034) acres are held by the Town at Bearsden Conservation Area.

The Prime Agricultural and Forestry Soils Map shows the locations of the prime forestland soils. Athol has thirteen thousand, seven hundred and thirty-seven (13,737) acres of prime forestland soils. Table 1-7 gives the acreage of the prime forestland soils by level of protection. Fifteen percent of the prime forestland soils are on lands under temporary protection (Chapter 61, 61A, or 61B), while twenty-seven percent are under permanent protection (Federal, State, Municipally-owned, or under conservation restriction). Nearly forty-three percent of the acreage of prime forestland soils is under some form of protection.

Table 1-7: Acreage of Prime Forestland Soils in Athol

Protection Status	Prime Forestland Soils	
	Acres	%
Chapter 61, Temporary Protection	1,267.4	9.2%
Chapter 61A, Temporary Protection	520.9	3.8%
Chapter 61B, Temporary Protection	335.1	2.4%
Municipally-Owned, Permanent Protection	1,774.4	12.9%
Other Permanently Protected	1,980.7	14.4%
Prime Forestland Soils under Permanent or Temporary Protection	5,878.5	42.8%
Privately-Owned, Unprotected, Prime Forestland Soils	7,859.1	57.2%
Total Prime Forestland Soils Acreage	13,737.6	100.0%

Sources: Northwestern Worcester County Conservation District and USDA Natural Resources Conservation Service, Interim Soil Report for Northwestern Worcester County, Massachusetts, and Montachusett Regional Planning Commission Department of Geographic Information Systems.

Water Resources

Watersheds and Surface Waters

Athol is rich in water resources that include a variety of rivers, streams, ponds, wetlands, and aquifers (*see the Water Resources and Wildlife Habitat Map*). The community’s dominant water feature is the Millers River, which meanders for nearly seven miles through Athol’s northern highlands. Originating in New Hampshire, the Millers River flows westward, ultimately merging with the Connecticut River. Within Massachusetts, the Millers River drains an area of approximately three hundred and thirteen (313) square miles, and includes all or a portion of seventeen municipalities.

Athol owes its early industrial development to the Millers River and its tributaries. The W.H. Amsden Door and Sash Factory was the first local industry to utilize the main stem of the river for hydroelectric power. A variety of other factories followed suit, constructing dams and channels to control the flow of water.

Although many of these factories disappeared long ago, their legacy remains. Several Athol ponds owe their existence to the Town’s industrial past. Athol contains eight warm water ponds or lakes, ranging in size from the eight-acre Ward Pond to the seventy-acre Sportsman Pond. Six of these ponds are man-made. A series of dams erected along Mill Brook, which once powered nine of Athol’s industrial enterprises, formed Morse’s Pond, Match Pond, Lord Pond and an unnamed pool used by J. Wesley Goodman & Sons Billiard and Pool Table Factory. Eventually drained, Lord Pond is now the site of the Lord Pond Plaza strip mall. The dam near the intersection of Hapgood and Chestnut Streets reminds residents about the important role rivers played in the Town’s historic development.

Millers River Watershed

In addition to a myriad of economic and social impacts, industrialism left a deep imprint on the quality of Athol's rivers and streams. A century of industrial activity and widespread dumping took its toll on the Millers River, degrading the river's quality and character. During the 1930s and 1940s, the Millers River was among the best-stocked river corridors in Massachusetts, but, by the 1950s, pollution from industrial and domestic sources destroyed fish stocks and the recreation potential of the river. The Millers River Watershed Council orchestrated cleanup efforts beginning in the 1970s. Its perseverance paid off, and by 1983 the river was clean enough to resume stocking.

The Millers River watershed is located in north central Massachusetts and southwestern New Hampshire. It is bordered on the east by the Nashua River watershed, west by the Connecticut River watershed, and on the south by the Chicopee River watershed. From its tributaries of origin in New Hampshire, the Millers River flows south, then gradually west into the Connecticut River. The topography of the watershed is hilly with uplands ranging from two hundred to fifteen hundred feet in elevation above sea level. Glacial deposits of till, sand, and gravel are the most common soil parent material throughout the watershed.

The Millers River basin drains a total of three hundred and ninety-two (392) square miles, three hundred and twenty (320) of which are in Massachusetts (DEP, 1995). The sub-basins of two tributaries of the Millers River represent large portions of the basin: Tully River (74.0 square miles) and the Otter River (60.4 square miles). The Millers River's total length is fifty-one (51) miles, forty-four (44) of which are in Massachusetts. There are three thousand, five hundred and forty (3,540) acres of lakes, ponds, and reservoirs in the watershed. Flood control and hydroelectric power are controlled by eight dams on the main river, as well as three on the north branch, and two on the south branch in Winchendon. In addition, there are numerous other dams along the Otter and Tully Rivers and the small tributaries throughout the basin. From Winchendon to its confluence with the Connecticut River, the Millers River fluctuates between sluggish and rapid flows with an average drop of twenty-two feet per mile.

Eighteen mostly rural Massachusetts communities are located in the basin, with a population of nearly ninety-two thousand (92,000) people. In the last decade, the watershed population grew by four thousand seven hundred (4,700), from eighty-seven thousand (87,000) in 1990. The most densely populated area is Gardner. The major industries within the basin are paper companies. Tool manufacturing and furniture making were dominant industries in the past, but most of these plants have since closed and now play a much smaller role in the regional economy.

State and Federal legislation, passed in the 1960s and 1970s, greatly affected the treatment waste received before it was discharged into rivers and streams. The Massachusetts Clean Water Act enacted in 1966 specified laws, standards, and procedures for the implementation of Federal legislation at the State level. It contained provisions for the regulation of discharge to surface waters, ground waters, and sewer systems, and provisions for State technical assistance to communities for construction of public treatment plants. The Federal Water Pollution Control Act of 1972 (Public Law 92-500) as amended by the Clean Water Act of 1977 sought to eliminate discharge of pollutants into navigable waters by 1985.

Public Law 92-500 also provided for Federal grants for construction of public sewage treatment facilities.

The National Pollution Discharge Elimination System (NPDES) is a program established under the Clean Water Act that provides for issuing, managing, terminating, monitoring, and enforcing permits for the legal discharge of pollutants into navigable waters. The permits impose pretreatment requirements that must be met by the discharger. Three facilities in Athol have individual (NPDES) permits, as shown in Table 1-8.

Table 1-8: National Pollution Discharge Elimination Permits in Athol

Facility	Type	Permit #	Receiving Stream	Expiration Date	Maximum Flow
Athol Waste Water Treatment Facility	Major	MA0100005	Millers River	10/28/02	1.75 MGD
L.S. Starrett Company	Major	MA0001350	Millers River	01/01/03	0.07 MGD
Athol Water Treatment Facility	Minor	MA0002381	Unnamed Tributary	09/15/92*	<1.0 MGD

*MGD = Millions of Gallons per Day. *Athol Water Treatment Facility will be switched to a General Permit rather than re-issued an individual permit.*

Source: Division of Wastewater Management, MA Department of Environmental Protection.

Between 1973 and 1977, eight wastewater treatment plants were constructed on sites along the Millers River. Even still, testing of fish caught in the Millers River has identified problems of polychlorinated biphenyls⁹ or PCB contamination resulting in fish advisories by the Massachusetts Department of Public Health. Although the river is rated as Class B, appropriate for fishing and swimming, consumption of fish caught there is not advisable.

Table 1-9 presents water quality testing results from the Commonwealth of Massachusetts Millers River Watershed 1995 Resource Assessment Report. The table also provides ratings for aquatic life and fish consumption, notes the lack of assessments for primary and secondary contact, and identifies the overall ranking of each river segment. Despite a Class B status for these waters, the Department of Public Health has issued an advisory against fish consumption, due to high content of mercury¹⁰ and PCBs in many fish species. In a five-mile section of the river, PCBs negatively affect populations of aquatic life. The classification of rivers and streams in Massachusetts does not necessarily mean that the river meets that classification. The stated class for a particular river is in fact only the State's goal for that river.

Mercury is toxic to the human nervous system. Chronic breathing of mercury vapors can cause a range of physical symptoms, including the inability to coordinate body movement

⁹ Polychlorinated Biphenyl: any of several compounds that are produced by replacing hydrogen atoms in biphenyl (a white, crystalline hydrocarbon used as a heat-transfer medium) with chlorine, have various industrial applications, and are poisonous environmental pollutants that tend to accumulate in animal tissues. They are often found in waste oils.

¹⁰ Mercury is a naturally occurring element, a volatile liquid metal (at normal temperatures), that easily becomes a gas. Mercury conducts electricity, and can be used to directly measure temperature and pressure. Its applications can be found everywhere in human society: as a catalyst in industrial processes, in solvents, and pesticides; in light switches, lamps, and batteries, in paints and preservatives, and in cosmetics and pharmaceuticals.

and hearing, speech and vision impairment. Exposure to mercury in other forms can lead to skin rashes and kidney damage. Cadmium is a chemical associated with mercury and used in batteries. Exposure to cadmium has been linked with kidney disease.

Mercury is released to environmental media (air, water, soil) by a wide variety of natural processes and human interventions. The most likely source of mercury in water systems is natural deposition from acid rain. There is a constant biogeochemical cycle of mercury. This cycle includes release of elemental mercury as a gas from the rocks and waters (degassing); long-range transport of the gases in the atmosphere; wet and dry deposition upon land and surface water; absorption onto sediment particles; and bioaccumulation in terrestrial and aquatic food chains. Worldwide, natural emissions of mercury from physical and biological processes may equal or exceed manmade emissions.

However, urban runoff, illegal dumping, poor storage practices, mining, and natural deposits contribute mercury and other heavy metals to water bodies. Many types of common household products contain heavy metals. For example, most types of household batteries contain mercury and cadmium. Manmade discharges may result from industrial processes, such as: chlorine-alkali production, mining operations, paper mills, leather tanning, pharmaceutical production, and textile manufacture.

Mercury is less toxic in its volatile form, mercury-zero, than in organic compounds like methylmercury or inorganic salts (mercury-two). Mercury zero, however, is volatile, and thus can spread throughout the environment through secondary biological mechanisms. Once it reaches inland aquatic environments, mercury zero can again accumulate and be transformed into methylmercury,¹¹ through the photochemical (abiotic) action of sunlight, through the methylcobalamin (a hydrocarbon compound) excreted by bacteria, and through the plants of aquatic ecosystems.

Human agricultural activities may release mercury to the soil through direct applications of organic and inorganic fertilizers (especially sewage sludge and compost), lime, and fungicides. Once in the soil, mercury compounds may undergo the same chemical and biological transformations found in aquatic systems. Elemental mercury (mercury zero) will form various compounds with the chloride and hydroxide ions of soils. The exact result will depend upon the pH, salt content, and other characteristics of the soil.

Bottom feeding organisms consume heavy metals with other food, and the heavy metals proceed through the food chain to affect other animals. Metals in the water tend to bioaccumulate in the tissue of fish (build up in concentration over time). Metals impact the reproductive rates and life spans of aquatic organisms, and hinder photosynthesis in aquatic plants. Effects on the water supply include increased treatment costs, reduction in the carrying capacity of pipes, water discoloration, and possible health hazards.

¹¹ Methylmercury is the form of mercury most available and most toxic to biota (including zooplankton, insects, fish, and humans). This form of mercury is easily taken up by biota and bioaccumulates in their tissues. Unlike many other fish contaminants, such as PCBs, dioxin, and DDT, mercury does not concentrate in the fat, but in the muscle tissue. Thus, there is no simple way to remove mercury-contaminated portions from fish that is to be eaten.

Table 1-9: Summary Table of Testing Results for the Millers River Watershed

Location	Aquatic Life	Fish Consumption	Primary Contact (e.g. Swimming)	Secondary Contact (e.g. Boating)	Overall Ranking of Segment
Millers River from Whitney Pond in Winchendon to the Winchendon Wastewater Treatment Plant (2.0 miles)	Full Support <i>Although levels of aluminum, copper, and lead exceeded criteria frequently, the chronic toxicity test showed no significant toxic effects and so the segment is listed as "full support" for the aquatic life use.</i>	Non-Support <i>High levels of mercury and polychlorinated biphenyls (PCBs)</i>	Not Assessed	Not Assessed	Class B <i>This segment should remain on the 303(d) list of impaired water bodies based on Dept. of Health Fish Advisory</i>
Millers River from Winchendon Wastewater Treatment Plant to confluence with Otter Brook (5.3 miles)	Non-Support <i>EPA tests showed no survival in fathead minnows, which is interpreted as "not supporting" for the aquatic life use. It is suspected that water quality problems are related to atmospheric deposition.</i>	Non-Support <i>High levels of mercury and polychlorinated biphenyls (PCBs)</i>	Not Assessed	Not Assessed	Class B <i>This segment should remain on the 303(d) list of impaired water bodies based on Dept. of Health Fish Advisory</i>
Millers River from the confluence with Otter Brook to a USGS gage station in South Royalston (4.8 miles)	Not Assessed	Non-Support <i>High levels of mercury and polychlorinated biphenyls (PCBs)</i>	Not Assessed	Not Assessed	Class B <i>This segment should remain on the 303(d) list of impaired water bodies based on Dept. of Health Fish Advisory</i>
Millers River From the USGS gage station in South Royalston to the Erving Paper Company (17.5 miles)	Full Support (16.5 miles) Threatened (1.0 mile) <i>Discharge from L.S. Starrett Co. in Athol exceeded permit limits for acute toxicity two out of six times. These results are interpreted as "threatening" the segment for one mile downstream from the discharge.</i>	Non-Support <i>High levels of mercury and polychlorinated biphenyls (PCBs)</i>	Not Assessed	Not Assessed	Class B <i>This segment should remain on the 303(d) list of impaired water bodies based on Dept. of Health Fish Advisory</i>
Otter River from wetlands in Hubbardston and Templeton to the outfall at the Gardner Wastewater Treatment Plant (2.6 miles)	Threatened (2.6 miles) <i>Low ratings for dissolved oxygen and percent saturation are attributed to natural wetlands conditions. Yet EPA toxicity tests indicated significantly lower growth rates in Fathead minnows.</i>	Threatened <i>The source and cause of the threat is unknown.</i>	Not Assessed	Not Assessed	Class B <i>This segment should remain on the 303(d) list of impaired water bodies based on Dept. of Health Fish Advisory</i>
Otter River from the Gardner Wastewater Treatment Plant outfall to the Seaman Paper Company Dam (4.3 miles)	Non-support (4.3 miles) <i>Super-saturation of dissolved oxygen due to increased primary productivity, coupled with high nutrient values indicates enrichment. Gardner WWTP is not meeting the copper limit and seems to have lead problems.</i>	Full Support	Not Assessed	Not Assessed	Class B <i>This segment should remain on the 303(d) list of impaired water bodies based on Dept. of Health Fish Advisory</i>

Table 1-9: Summary Table of Testing Results for the Millers River Watershed (con't)

Location	Aquatic Life	Fish Consumption	Primary Contact (e.g. Swimming)	Secondary Contact (e.g. Boating)	Overall Ranking of Segment
Otter River from the Seaman Paper Company to the confluence with Millers River and Trout Brook (5.5 miles)	Non-Support (5.5 miles) <i>Low dissolved oxygen rates in early morning and super-saturation during daylight coupled with high nutrient values indicate enrichment. Tests indicate significant toxicity below the Templeton WWTP and the Seaman Paper Co. (0.5 miles)</i>	Non-Support Chronically high levels of aluminum, copper, zinc and lead resulting from the treatment plant and Seamon Paper Co.	Not Assessed	Not Assessed	Class B <i>This segment should remain on the 303(d) list of impaired water bodies based on Dept. of Health Fish Advisory</i>
East Branch Tully River from Tully Brook and Falls Brook to its confluence with the West Branch in Athol Center (10.5 miles)	Non-Support (10.5 miles) <i>Rapid Bioassessment Protocol II indicated moderate impairment, which is interpreted as non-support for aquatic life. The source of impairment is unknown.</i>	Non-Support <i>High levels of mercury and polychlorinated biphenyls (PCBs)</i>	Not Assessed	Not Assessed	Class B <i>This segment should remain on the 303(d) list of impaired water bodies based on Dept. of Health Fish Advisory</i>
West Branch Tully River from Sheomet Lake, Warwick, to its confluence with the East Branch (6.2 miles)	Full-Support (6.2 miles) <i>This was the reference station for the bioassessments and so it was assumed to be fully supported</i>	Non-Support <i>High levels of mercury and polychlorinated biphenyls (PCBs)</i>	Not Assessed	Not Assessed	Class B <i>This segment should remain on the 303(d) list of impaired water bodies based on Dept. of Health Fish Advisory</i>
Tully River from the confluence of its east and west branches to its confluence with Millers River (1.5 miles)	Not Assessed	Non-Support <i>High levels of mercury and polychlorinated biphenyls (PCBs)</i>	Not Assessed	Not Assessed	Class B <i>This segment should remain on the 303(d) list of impaired water bodies based on Dept. of Health Fish Advisory</i>

Source: MA Department of Environmental Protection, "Millers River Watershed Assessment Report," 1995.

Currently, the Massachusetts DEP is funding an ongoing study to determine the extent of the PCB problem in the Millers River. The project found that much of the PCB problem originates in the Baldwinville stretch of the Otter River in an area where historically both an electric light and a paper recycling facility used PCBs in their manufacturing processes.

According to the Housatonic Valley Association, an organization working for the cleanup of the Housatonic River in Berkshire County, PCBs can last in sediments for centuries. Cleanup treatments depend on the extent of the contamination. In some cases, PCBs, which are heavy metals, collect together into contaminant plumes where they slowly move through sediments like oil. Dredging may be the best solution in that case. However, where the contamination is not nearly as severe, allowing river sediments to bury the PCBs naturally may be more reasonable. Dredging is very expensive and can end up mixing contaminated sediments throughout the river ecosystem. Until the PCBs are cleaned-up or dealt with in a

manner that reduces their impact to people, wildlife, and fisheries, the wildlife and recreational benefits of the Millers River will not be fully realized.

The Massachusetts Department of Public Health's 1998 Freshwater Fish Consumption Advisory List included more specific Advice Codes and footnotes for the Millers River. The P1 code states that, "children younger than twelve (12) years, pregnant women, and nursing mothers should not eat any affected fish species from this water body." This includes brown trout and American eel. The Millers River also has a P2 code, "the general public should not eat any of the affected fish species from this water body." It also has a P4 code; "the general public should limit consumption of non-affected fish species from this water body to two meals per month." In the footnotes section of the Advisory List, it states "the public should refrain from eating all brown trout and eels from the Millers River below the confluence with the Otter River. Consumption of all other fish species from the Millers River should be limited to two meals per month per person. Pregnant women and nursing mothers should not eat any fish from the Millers River and its tributaries in order to prevent exposure to infants and developing fetuses."

The information presented in the table on aquatic life and fish consumption (*see Table 1-9*) may appear to be in conflict. It is possible for a river segment to be interpreted as having a "non-support" rating for fish consumption and a "full support" status for aquatic life use. Although this appears as conflicting, the two interpretations are the results of different testing methods and assumptions made by EPA. For example, when fish flesh is measured for contamination, many species of fish are tested, and not all are found to contain mercury or PCBs. It is assumed that because PCBs are not found in other fish species, the presence of PCBs in any fish does not immediately infer that all aquatic life is threatened. In fact the Massachusetts Department of Public Health's fish advisories are very specific. The fish advisory identifies only the species that are likely contaminated and suggests consumption limits for discreet segments of the citizenry (i.e. pregnant women and children).

Other testing methods are used to determine the level of support for the "aquatic life" use. Both acute toxicity and chronic toxicity tests are applied with different methods. The acute toxicity tests measure levels of certain metals like aluminum, copper, and lead downstream of point sources of pollution like wastewater treatment plant discharges. The acute toxicity test compares these levels found to permit criteria. The chronic toxicity testing methods measure changes to normal growth levels for indicator species like the fathead minnow. Therefore, acute toxicity test results in a segment downstream of a discharge pipe might show levels of copper, which exceed the criteria of the company's permit but, if the minnows are growing normally with no signs of toxicity, then the segment would receive a full support for aquatic use.

According to the information summarized in Table 1-9, a significant portion of the Millers and Otter Rivers upstream from Athol received a rating of Non-support for Aquatic Life. This means that contaminants in the water were found to have a negative impact on the growth of indicator fish species. Where the segments of the Millers and Otter rivers had a Non-Support or a Full Support/Threatened rating for Aquatic Life, the cause of the rating was often inferred. These sources of contaminants are referred to as "point sources" of pollution because the pollutants can be traced to a discreet outflow pipe, or point. These

potential point sources of pollution include Winchendon Wastewater Treatment Plant, L.S. Starrett Company, Gardner Wastewater Treatment Plant, and Seaman Paper Company.

The Town of Athol should look carefully at its own use of the river as a disposal site for its wastewater and take advantage of any opportunity to participate in watershed-wide, water quality improvement work. The only potential point source of pollution identified in Table 1-9, located in Athol, is the L.S. Starrett Company. Although Athol's own wastewater treatment system was not mentioned as a potential source, it is not uncommon for wastewater treatment plants to have sporadic problems due to a damaged collection system and the resulting infiltration and inflow of ground- and storm-water.

Athol's sewage treatment plant, completed in 1971, is located off South Athol Road and discharges treated effluent into the Millers River downstream of the Town's central business district. According to the 1990 Census, seventy-eight percent (78%) of Athol's housing units are linked to the system. The plant's capacity is 1.75 million gallons per day (MGD) for primary and secondary treatment. Since the plant's normal daily flows average between 0.8 to 1.2 MGD, that capacity appears adequate to meet the Town's current needs. However, because of problems with inflow/infiltration during major storm events, flows through the system can exceed 3.0 MGD. When this occurs, the plant becomes overwhelmed and untreated effluent is deposited directly into the river. One early corrective effort involved relining the Cass Meadow Sewer. This eliminates more than two hundred and fifty thousand (250,000) gallons per day of infiltration when the river is high. Several other deteriorated sections are scheduled for repair or replacement. When the treatment plant begins to process on average 1.4 MGD of wastewater (80% of its capacity), it will be required by the DEP to begin plans for expansion. Expansion of the wastewater treatment plant's capacity may be one way of dealing with major hydraulic flows since it is unlikely that Athol will be able to repair all of its infiltration and inflow problems in a cost effective manner.

Although wastewater treatment facilities constructed throughout the watershed have been treating major pollution discharges for over twenty years, the Millers River is still plagued by pollution from PCBs, chlorination, heavy metals, erosion, landfill leachate, storm water runoff and acid rain. These pollutants and stressors to the watershed's ecosystems come from both point sources like wastewater treatment plants and manufacturing plants and non-point sources including failed residential septic systems, improperly managed manure pits, and rainwater runoff carrying roadside applied herbicides. The Montachusett Regional Planning Commission and the Franklin Regional Council of Governments recently received a \$57,500 grant from the Department of Environmental Protection (DEP) to conduct the Millers River Watershed Non-point Source Assessment 604b Project. The aim of the project is to "work together to create a solid information base, to guide future governmental and private actions to reduce non-point source pollution, and improve and ensure a high level of water quality in the Millers River Watershed."

Wetlands and Floodplains

Many wetland types, from vernal pools and forested wetlands to floodplains, exist along Athol's rivers, streams and ponds. These hot spots of biological diversity are nature's way of ensuring good water quality. Both inland wetlands and floodplains perform crucial functions including flood storage and control and pollution filtration. Supporting approximately forty-three percent (43%) of the nation's rare and endangered species, wetlands are home to an abundance of wildlife. Since they are also common recharge zones for groundwater sources, it is important that Athol identify and protect its wetlands and floodplains.

Athol's major wetland resources include:

- The banks and vegetated wetlands associated with Newton Reservoir, Lake Ellis, Lake Rohunda, Davenport Pond, Ward Pond, and White Pond;
- The bordering vegetated wetlands, forested wetlands, and flood plains associated with the Millers River, Tully River and various brooks (Rich Brook, East Branch – Tully River, Gulf Brook, Thousand Acre Brook, Mill Brook, Thrower Brook, Riceville Brook);
- Paine Swamp;
- Six certified vernal pools;
- The area at the base of Round Top Mountain, opposite Paige Cabin; and
- The area in the vicinity of Brickyard Road and Mount Pleasant, Kelton Hill and White Pond Road, Doe Valley Road and New Sherborn Road, Chase Road, Batchelder Road, Pleasant Street, and High Knob Mountain.

Though large, relatively undisturbed wetlands remain in Athol, future urban development and harmful land use practices threaten them. Presently, Athol's wetlands may not be protected sufficiently, as evidenced by a loss of fourteen (14) acres of wetlands since 1971, nearly four percent of the acreage then. Local zoning does provide for a Floodplain District that regulates land uses within the areas defined on the Flood Insurance Rate Maps and the Flood Boundary and Floodway maps of 1982, on file with the Selectmen. The zoning also establishes a Groundwater Protection District that consists of Zone II-delineated Recharge Areas. Permitted uses are subject to special permit approval to ensure conformity with the bylaw. Noxious uses are prohibited. Yet, according to the Planning Board, the development potential is only constrained by ten percent within the overlay district, as determined from the recent buildout analysis by the Montachusett Regional Planning Commission.¹²

Beyond zoning, the provisions of the Federal Clean Water Act, the Massachusetts Wetlands Protection Act (M.G.L. Chapter 131, Section 40, February 14, 1997), and the Massachusetts Rivers Protection Act, as amended in 1996, provides some protection to wetlands.

The Clean Water Act prohibits virtually any ground-disturbing activities within one hundred (100) feet of all wetlands unless approved through special permit. However, historic enforcement of the law does not meet the stated policy of "no net loss" of wetlands acreage, nor are there adequate systems for tracking the losses annually, according to a report by the

¹² Conducted by the Montachusett Regional Planning Commission, the effort was funded by the Executive Office of Environmental Affairs.

National Academy of Sciences.¹³ The United States Fish and Wildlife Service estimated that the nation was losing fifty eight thousand, five hundred (58,500) acres of wetlands to development or agriculture annually, as of 1997. According to the National Audubon Society, wetlands losses are closer to one hundred thousand (100,000) acres a year.

The Massachusetts Wetlands Protection Act (the Act) prohibits removal, dredging, or alterations of any river or stream bank, freshwater or coastal wetlands, beach, dunes, flat, marsh, meadow or swamp bordering on any resource area as defined in the Act without a permit from the Commission to perform the work. Its intent is to ensure the protection of public and private drinking water and groundwater supplies, land containing shellfish, wildlife habitat, and fisheries, to control flooding, and to prevent storm damage and pollution.

The Rivers Protection Act, Chapter 258 of the Acts of 1996, creates a 200-foot riverfront corridor on each side of a perennial river or stream, measured from the mean annual high-water line of the river, to protect the natural integrity of rivers and to encourage and establish open space along river.¹⁴ The riverfront areas protect water quality, stabilize stream banks, reduce flood peaks and downstream flooding, support fish and wildlife habitat, and protect groundwater. Riverfront areas may contain wetlands and floodplains, but intermittent streams are not subject to the Rivers Protection Act.

The law builds on the strength of the existing permitting procedures under the Wetlands Protection Act. The local conservation commission or the State Department of Environmental Protection (DEP) reviews projects located within the riverfront area. Work in the riverfront area is not prohibited, but applicants must demonstrate that their projects have no practicable alternatives and will have no significant adverse impacts. Existing structures such as single-family homes and accessory uses are exempt from the Rivers Protection Act.

Aquifers and Drinking Water Supplies

Aquifers are important water resources that exist underground. When it rains, a large percentage of water infiltrates the soil, slowly migrating down to the saturated zone. The area between the saturated zone and the unsaturated zone is known as the water table of the aquifer. When more rain enters the aquifer than is taken out, the water table rises. Four aquifers are known to underlie the Town of Athol. One potential high yield aquifer underlies Lake Ellis. The Department of Public Works (DPW) identified Third Island as a primary drilling location, though after investigation, it was determined that it was insufficient to support the Town's needs. Although no plans exist to utilize this aquifer in the near future, it could play an important role later.

A second aquifer underlies the Millers River and supports the South Street Municipal Well. The South Street Well has a safe yield of 1.4 million gallons per day (MGD) and a permitted withdrawal of 1.08 MGD. It currently serves as Athol's reserve water supply.

¹³ The Associated Press, "Wetlands Laws Not Enforced", Telegram and Gazette, Wednesday, June 27, 2001.

¹⁴ <http://www.state.ma.us/dep/consumer/rpa.htm>.

A third aquifer, underlying the Tully River, has a potential yield of 3.0 MGD. The site was first identified as a potential source in 1959. This aquifer now supports three wells at Athol's new Tully Wellfield. On May 1, 2000, the Tully Well Field Treatment and Distribution System went on-line. This new facility replaces the South Street Municipal Well as Athol's primary public water source, significantly increasing the Town's capacity and abolishing the need to invest four million dollars (\$4,000,000) in updating Athol's antiquated filter plant. The Tully Wells have the potential to expand available water by more than 2.0 MGD, though any higher water withdrawals will be regulated by DEP to coincide with historic use figures and actual population increases. Because of its highly permeable soils, a fourth aquifer, which lies beneath the White Pond-South Athol Pond complex, may be considered as a future public groundwater resource.

The Tully Wells may have eliminated the need for the Newton and Phillipston Reservoirs, which previously served as reserve supplies. The Department of Public Works has ceded management of the approximately 700-acre Newton Reservoir property to the Conservation Commission, which hopes to use the site for recreational purposes. The Town has not yet determined what to do with the Phillipston Reservoir. Athol officials are currently negotiating with the Town of Orange, who is interested in tapping into Athol's supply.

It may be prudent for the Town of Athol to consider the status of the quality and quantity of its drinking water supplies within a watershed context. For example, the term 'safe yield' is used as a measure of the total capacity of a well or surface reservoir. The safe yield is the amount of water that could be withdrawn every day without decreasing its capacity to supply the same amount tomorrow. The safe yield does not take into account the impact of draw down on local wetlands or the risk of contamination within the recharge area. Perhaps in the future DEP will incorporate sub-watershed environmental impacts in their methods for determining a well's safe yield. In addition, because the Millers River watershed, including the East Branch of the Tully River, is currently experiencing water quality problems, Athol would be wise to explore methods for decreasing its exposure to contamination in all of its drinking water supplies.

Athol may also want to develop a means for regulating the amount of water used by incoming industries. It is not uncommon for manufacturers to represent in the aggregate a significant portion of a community's daily drinking water withdrawal. Town's can develop programs that encourage conservation among incoming businesses. In summary, Athol is in an enviable position with its seemingly steady supply of clean drinking water. However, effort will be required to ensure that both the quality and quantity of the Town's drinking water supplies are maintained in the future.

Vegetation

Athol boasts a variety of plant life including coniferous and deciduous forests, grasslands, wetlands, and riparian vegetation. Soil type, elevation, and climate largely determine the type of vegetation that exists. The 1999 MacConnell land use statistics indicate that nearly seventy-six percent (76%) of Athol's land area was forested at the time the survey was taken. The forested slopes of the Bearsden Conservation Area, lands managed by the Division of

Fisheries and Wildlife, and stretches of the Millers and Tully Rivers and riparian areas are natural places where hikers, campers, bird watchers, cross-country skiers, canoeists, and anglers recreate. These vegetated areas also contribute to species diversity by providing nesting areas, food and protection to area wildlife.

Athol is located within the North Central Hardwoods-Hemlock-White Pine zone. Eighteen commercial species, representing a mixture of northern hardwood, upland central hardwood and white pine forests, have been observed in the Bearsden Conservation Area, Athol's largest protected forest. The most common species, comprising eighty-five percent (85%) of the forest cover, are white pine, red oak, red maple, and black birch. Other observed species include white birch, white ash, sugar maple, yellow birch, beech, hickory, black cherry, white oak, aspen, gray birch, cedar, hop hornbeam, and pitch pine.

The Department of Public Works and the Conservation Commission have launched timber management programs on lands under their jurisdiction. The work was contracted out to two foresters, Glen Freedom and Michael Mauri. Timber harvests at Newton Reservoir and Thousand Acre Reservoir in 1993/1994 generated more than twenty thousand dollars (\$20,000) for Town Water revenues. Revenues from logging on Town property in the Thrower Road area went into the general fund. Currently the Town is logging at the end of Hillside Terrace and around the Phillipston Reservoir on a property formerly known as the Poor Farm property (exit 18 off Route 2). If managed thoughtfully, timber harvests produce forest stands that provide a long-term source of periodic income and at the same time provide opportunities to produce conditions beneficial to specific wildlife species.

Millers River Greenway Natural Resource Inventory

In 1997, Matthew Hickler and the Nature Conservancy completed a natural resource inventory along the stretch of the Millers River that extends from Orange Center to Athol Center. The purpose of the study was to provide information that would aid planners in making appropriate decisions about a proposed bikeway along the south side of the river, and to provide baseline data about natural resources along the river corridor. The inventory uncovered a number of interesting and unusual plant communities. Although the area contains no examples of classic floodplain forest, one small patch of silver maple dominated floodplain forest occurs north of the Town well, by South Athol Road. According to a report by the Natural Heritage and Endangered Species Program, floodplain forests are the most threatened, globally significant wetland community types in New England.¹⁵ Unfortunately, many of Massachusetts' floodplain forests were historically converted to residential, agricultural, industrial, and commercial uses prior to the Rivers Protection Act due to their scenic qualities, high soil fertility, and level terrain accessible to the rivers' hydroelectric potential.

The Cook's Cove area, which lies northwest of Daniel Shay's Highway, is a nearly ten-acre backwater along the drainage between Lake Rohunta and the Millers River. The cove supports aquatic vegetation throughout, including native milfoil, and a wide array of other

¹⁵ Kearsley, Jennifer, Inventory and Vegetation Classification of Floodplain Forest Communities in Massachusetts, Westborough, MA: Natural Heritage and Endangered Species Program.

species. Shallow areas support emergent marsh communities. Yet, exotic invasive plants threaten to choke the diversity in the Cove. Adjacent to Cook's Cove, a stand of black ash occurs within a red maple swamp. The stand grows on two to five acres, which is uncommonly large in Massachusetts. Other interesting plant communities include a black cherry stand just north of the sewage treatment plant and a wet meadow community in an old oxbow meandering, which runs between the Town's well and the sewage treatment plant.

The Millers River Greenway survey listed a host of vegetation species they sighted. None of the species listed appears on the Massachusetts List of Endangered, Threatened, and Special Concern Species published by the Natural Heritage and Endangered Species Program. This may indicate that the species have been eliminated, or that they are present in areas not surveyed. A more exhaustive effort or other sources of Athol vegetation data are needed to determine the status of endangered plant species in Athol.

Wildlife and Fisheries

A host of wildlife abounds within Athol's borders, largely owing to the diversity of its major habitat types. Rivers, wetlands, forests, meadows, and mountain ridges provide sustenance, mating grounds, and vegetated cover to the wildlife that dwell within. Since many species rely on a variety of habitat types during different periods of their life cycle, species diversity is greatest in areas where several habitat types occur in close proximity to one another. When habitats are of high quality and ample quantity, wildlife populations thrive.

The Bearsden Conservation Area and its environs support a stable population of deer, otter, mink, muskrat, porcupine, fisher, and fox. The Athol Conservation Commission actively manages the Bearsden Forest for wildlife, planting vegetation to attract wildlife species. The return of beaver to Athol, though contentious, has led to the creation of wetlands that provide excellent habitat for trout, horned pout, and many species of transient and migratory bird life. The eastern coyote and the black bear are two recent additions to the Bearsden Forest. Past bear sightings in the area gave rise to the Bearsden name, but deforestation led to a disappearance of bears from the area several decades ago. Evidence indicates that the namesake is back in the area, whether as a resident or a transient guest is uncertain at this point.

The Millers River is an important flyway, providing a safe foraging and resting area for large numbers of migrating waterfowl, shore birds, passerines, and raptors. Each September, area naturalists congregate on the summit of Round Top hoping to observe groups of migrating broad-winged hawks, often numbering in the hundreds, ospreys and an occasional bald eagle. Members of the Athol Bird and Nature Club have recorded this spectacular event for scientific journals since the late 1960s. Other migrants include Canadian geese and several species of ducks, including Mergansers and Cormorants. Great Blue Heron have been observed along stretches of the Millers River and in the beaver pond complex near Thousand Acre Swamp. Bald eagles, Red-shouldered and Broad-winged hawks, and Great-horned and Barred owls, once rare, have established resident populations in Athol. Other bird species observed soaring overhead include Upland sandpiper, Virginia rail, Northern shrike,

Goshawk, Northern raven, Carolina wren, Marsh wren, hooded mergansers, Common mergansers, and Common redpoll.

Unfortunately, the contamination of the Millers and Otter Rivers, and the East Branch of the Tully River with PCBs, mercury, metals, and pathogens lessens the overall quality of the Millers River watershed for the wildlife that depend on these corridors and habitats for migration routes and home ranges. According to the 1995 Millers River Watershed Resource Assessment Report, toxins found in the water of certain segments of the rivers affect growth in fathead minnows and, certain native fish populations are off-limits to human consumption throughout the entire watershed. Studies involving PCB contamination in the Housatonic River have concluded that wildlife populations are negatively impacted by the presence of PCBs in the river sediments. As cleanup efforts continue to address both point and non-point sources of pollution, the wildlife habitat value of the Millers River Watershed will increase.

Periodic logging of forested areas has created meadows and the early successional habitats favored by some wildlife species. Logged years ago, the area known as the Thousand Acre Cut-Off is a prime example of an early successional habitat. The poplar saplings are a favorite food of ruffed grouse and new seedlings and shoots provide ample cover for cottontail rabbit, snowshoe hare and white-tailed deer. These wildlife populations, as well as squirrel and waterfowl, draw hunters and nature enthusiasts to Town, generating tourism that contributes to the local economy.

The Massachusetts Division of Fisheries and Wildlife (DFW) has sponsored programs aimed at subsidizing local wildlife populations. The ringed-neck pheasant, which is not native to North America, is stocked annually as game for Athol hunters. Another successful program involves the reintroduction of the wild turkey, which was eradicated from Massachusetts more than one hundred and fifty (150) years ago. Wild turkeys have been captured in other states and released in Massachusetts during a campaign that began forty (40) years ago. Now Massachusetts' wild turkey population is soaring, with the help of strict hunting regulations and reforestation.

Local surface waters support a diversity of fish species that are popular among anglers. Several ponds and lakes offer warm water anglers the opportunity to catch large-mouth bass, pickerel, bullhead (horned pout), and panfish. While native populations of trout can be found in Thousand Acre Brook, Buckman Brook and Thrower Brook, the DFW stocks Ellinwood, Riceville, Tully and West Brooks with various types of native and non-native trout. Through an Atlantic salmon reintroduction program initiated by the Division in 1983, smolt have been liberated throughout the length of the Millers River below the Birch Hill Dam. Unfortunately, PCB and thermal pollution in the Millers River and dams along the Connecticut River have limited the success of this program, but the recent construction of fishways at key points has negated some of the harmful effects of the dams. During the past few years, populations of Atlantic salmon have increased.

Rare Fish and Wildlife Species

Athol provides habitat for wildlife species that are of special concern, according to the Massachusetts Natural Heritage and Endangered Species Program of the Division of Fisheries and Wildlife and the Department of Environmental Management Forest Stewardship Program (see Table 1-10). The species that most often catch the public’s eye are those that are considered “desirable” such as the Atlantic Salmon. While the importance of this species is undeniable, lesser-known species should not be overlooked since all play a crucial role in ecosystem health. Given this reality, permanently protecting the habitat areas of these species should be considered a top priority. Equally important, Athol should seek ways of permanently reducing the amount of contaminants in its rivers and water bodies. The rivers, ponds and streams of Athol are home to all of these species.

Table 1-10: Rare Fish and Wildlife Species Rated of Special Concern to the State, and found in the Town of Athol

Scientific Name	Common Name	Taxonomic Group
Clemmys Guttata	Spotted Turtle	Reptile
Clemmys Insculpta	Wood Turtle	Reptile
Notropis Bifrenatus	Bridle Shiner	Fish
Ophiogomphus Aspersus	Brook Snaketail	Odonate
Enallagma Laterale	New England Bluet	Odonate
Aeshna Mutata	Spring Blue Darner	Odonate
Desmocerus palliatus	Elderberry Long Horn Beetle	Beetle
Alasmidonta undulata	Triangle Floater	Mussel
Strophitus Undulata	Squawfoot	Mussel
Hemidactylum scutatum	Four-Toed Salamander	Amphibian
Ambystoma Jeffersonianum	Jefferson Salamander	Amphibian
Scaphiopus holbrookii	Spadefoot Toad	Amphibian
Accipiter striatus	Sharp-Shinned Hawk	Bird
Cistothorus platensis	Sedge Wren	Bird

Sources: Division of Fisheries and Wildlife, “Millers River Greenway Natural Resource Inventory,” 2001; Matthew Hinkler and David Small, Biology Department, University of Massachusetts, Amherst 1997.

Turtles

Two rare species of turtle are found in the wetlands of Athol: the Spotted Turtle and the Wood Turtle. Spotted turtles inhabit a variety of wetland habitats in Massachusetts, including marshy meadows, wet woodlands, boggy areas, beaver ponds, and shallow muddy-bottomed streams. They can be found in Red Maple and Atlantic White Cedar swamps and woodland vernal pools. They require a soft substrate and prefer areas with aquatic vegetation. The Wood Turtle inhabits slow-moving streams with sandy bottoms and heavily vegetated stream banks. They nest in sandy, gravelly banks and hibernate in the bottoms and muddy banks in winter. They spend summers in the tangled vegetation of meadows and upland forests, returning to the streams in late summer to mate.

The greatest threats to the survival of the Spotted Turtle and the Wood Turtle include:

- Commercial exploitation by the pet trade;
- Pollution of streams;
- Increased development of wooded stream banks;
- Road construction and wetland alteration;
- Habitat fragmentation;
- Nest predation by nocturnal animals;
- Highway casualties of egg-laying females; and,
- Hay-mowing operations that destroy the tangled vegetation.

The Massachusetts Natural Heritage and Endangered Species Program recommends a number of strategies to protect these turtles. Enforcement of the Massachusetts Endangered Species Act should provide protection from the pet and biological supply trades. Timber harvesting should be restricted to frozen winter conditions. Forest cutting regulations under the Forest Cutting Practices Act (304 CMR 11.04 8G) should be strictly observed. Harvesting practices should include a fifty-foot no-cut buffer zone along the streams and rivers, erosion control measures, and use of portable or temporary bridges to avoid fording streams. Within a buffer of fifty (50) to three hundred (300) feet of streams inhabited by wood turtles, foresters should employ selective cutting instead of regeneration cutting. Timber harvesting equipment should be kept at least fifty (50) feet from vernal pools during mud season. Vernal pools should be strictly protected from encroachment.

Mussels

Two species of threatened freshwater mussels are found in Athol: the Squawfoot Creeper, and the Triangle Floater. They inhabit small to medium streams and rivers, burying themselves within mud, sand, silt, or gravel. They feed by filtering water for zooplankton, detritus, and small plants and animals. They improve water quality by straining particles and pollutants from rivers. Mussels are food sources for raccoons, muskrats, ducks, herons and fisheries.

Historically, fresh water mussels have been harvested for food and the nacre of their shells, which was used to produce pearl buttons. Today, in many states, they are still harvested to produce the tiny seed beads used in the Japanese cultured pearl industry to encourage pearl production in oysters.

Freshwater mussels serve as environmental indicators of the water quality of rivers, streams, ponds, and lakes. Freshwater mussels are towards the bottom of the food chain. Toxic contaminants from chemical spills, runoff from the application of herbicides, pesticides, and insecticides to fields, and other sources can be detected in their tissue. Predation of the polluted freshwater mussels could eventually lead to bio-magnification of the pollutant within the predator thus leading to the death of the predator.

Mussels are negatively impacted by pollution, siltation, recreational boat facilities, and some forms of timber harvesting. Pollution that adversely affects the host fish, which the mussels use in their reproductive cycle, would result in diminished numbers of mussels. Excessive

siltation can decrease both mussel respiration and the amount of dissolved oxygen present within the water, which affects both the mussel community and other aquatic life that need the oxygen to survive. Creating impoundments and increasing water depths for boats results in decreasing water temperatures within the benthic region. Temperature decreases inhibit the reproduction cycle of freshwater mussels, delaying or preventing the cycle until the water temperature increases. This delay reduces maturation time of the juvenile mussels, threatening their survival through the winter. Timber harvesting crushes or buries any mussels present when harvester machines ford streams without proper bridges.

Dragonflies

Three rare dragonflies have been sighted in Athol: the Brook Snaketail, the New England Bluet, and The Spring Blue Darner.

The Brook Snaketail is a Gomphinid dragonfly, commonly referred to as a Clubtail. It is greenish, with a large, bulbous, superior abdominal appendage. The immature nymphs make their homes in warmer, slow-moving streams and the shallow waters of sheltered bays on larger lakes. The larvae burrow into silt, sand, or gravel along the edges of lakes or rivers. Dragonflies and damselflies are important in the food webs of freshwater streams and lakes. Dragonfly nymphs are an important source of food for trout. Dragonflies are also predators that consume large quantities of mosquitoes and other small flying insects. The immature nymphs feed under water on other invertebrates, but some large species may occasionally eat fish or tadpoles. The larvae are sensitive to changes in water flow and siltation.

The New England Bluet is a small, semi-aquatic damselfly, with a long slender blue abdomen and a blue head. Its wings are transparent and netted. Its preferred habitat includes ponds, lakes, bogs, and ponded sections of rivers with mucky edges and emergent vegetation. They are threatened by recreational and residential use of waters, pesticides, runoff, and projects to remove aquatic vegetation.

The Spring Blue Darner (Spatterdock Darner) is a large (2.8 inches long), blue-eye and brilliant blue-striped dragonfly that emerges in early summer. The species is threatened in Massachusetts. It requires spatterdock (yellow pond lily), a large plant with floating leaves. Spatterdock Darner occurs in ponds, lakes and sluggish streams and seems to require relatively fish free ponds. Sometimes it can be seen at bog ponds. Females perch on the pond lily and lay their eggs on the underwater part of the stem. Continued survival of the Spatterdock Darner may be dependent on the activities of beavers.

Beetles

One rare beetle has been sighted in Phillipston and Winchendon. The Elderberry Long-Horned Beetle is a one-inch long dark metallic blue beetle with a bright orange and black wing. It is most often sighted in June and July. Larva feed on the roots of the elderberry, which grows on low ground in wet areas and the borders of fields and copses. The adults feed on the pollen and the leaves. They lay their eggs on the elderberry stems and the larva burrow into the stems, progress to the roots and pupate in the soil. The species was once wide spread but only a few towns have reported observations of it in the last two decades.

The causes of its disappearance are unknown. It was placed on the endangered species list in 1980. Recovery options include planting elderberry in appropriate habitats, to attract the beetle.

Fish

One rare fish species, the bridle shiner, lives in the warm, still, or slow-moving waters of streams, ponds, and rivers of Athol. It is found over mud, silt, or debris in vegetated areas. The fish spawn in water about two (2) feet deep in openings surrounded by dense emergent vegetation, where there is no perceptible current. The eggs sink to the bottom and adhere to the vegetation. Water-hardened eggs are approximately 1.5 mm in diameter and hatch in fifty-seven (57) hours at seventy-five (75) degrees F. The newly hatched young, about 5 mm long, remain in the vegetation at first then begin to swim in small groups. By late July, they are in schools of one hundred (100) or more and by August when they are about their 22 mm standard length, they join schools of adult fish.

Feeding is by sight and occurs only during daylight hours. Most of the feeding is observed where the water is still or when there is a slight current. Food is taken from plant surfaces and the bottom; plankton organisms are taken on or near vegetation. The species primarily feeds on small insects, crustaceans, amphipods, water mites, mollusks, and plant materials.

Amphibians

One rare salamander has been sighted in Athol: the four-toed salamander. The smallest salamander found in the State, it has only four toes on the hind feet, a constriction at the base of its tail, and a bright white belly speckled with black. It breeds in the hummocks of grasses, sedges, or wet mosses found in wetlands near slow-moving streams or pools of standing water. Bogs, Red Maple and American White Cedar swamps, and vernal pools are its preferred habitats. They eat ticks, spiders, springtails, midges, ground beetles, rove beetles, fly larvae, parasitic wasps, ants, earthworms, and snails.

Threats to their habitat include urbanization and development, road construction, and timber harvesting. Effort should be made to identify and protect the preferred breeding habitat in bog areas and the adjacent wooded uplands. Protection measures aimed at the turtle populations should afford some protection for the salamander as well.

The Eastern Spadefoot Toad is a two-inch, plump, toad that has smooth skin with scattered warts, bright golden eyes with vertical pupils, and two wavy, yellow lines that run down the back. These toads spend most of their time in underground burrows, usually in well-drained, sandy soil along the coast, in river valleys, or in meadows. The toad is nocturnal, and generally appears only during the breeding season. They can be seen as early as May and as late as late August after heavy rains. They eat ground-dwelling insects, especially ants and termites; spiders, and other small arthropods, and some moths.

Breeding occurs during the spring and summer in temporary rain pools. After heavy rains the toads emerge from their underground burrows and commence breeding. The females lay their eggs in irregular strings along grass stems in the water. Each female lays up to 2,500

eggs. The eggs hatch in 2-4 days. The tadpoles are small and bronze-colored with short rounded tails that have tiny spots on them. Their undersides are translucent. They transform 14-60 days after hatching.

The Spadefoot Toad is listed as a Threatened Species by the NHESP due to the destruction of its habitat and application of pesticides.

Birds

Two rare birds have been sighted in Athol: The Sharp-Shinned Hawk and the Sedge Wren.

The Sharp-Shinned Hawk is slate-gray with a slim body, short broad wings, and a long, narrow, notched or square-tipped tail. The hawk has been particularly susceptible to the actions of humans over the last century. Pesticides used in the 1950s accumulated in the prey of the hawk, resulting in reproductive failure when the eggshells became too thin to withstand incubation, due to magnification of DDT levels along the food-chain. At present, the eastern population is again declining, potentially as a result of acid rain and the use of Fenitrothion, a pesticide used to control spruce budworm. Further research is needed to determine the impacts of forest maturation, large-scale land use changes, and forest management and agricultural practices on the population and its breeding habits.

The Sedge Wren, formerly known as "Short-billed Marsh Wren," is a small bird with a brown back and buffy underparts. The crown is brown streaked with white. It has an indistinct white eyebrow, a short, cocked tail, and a short, slender bill. It is distinguished from the Marsh Wren by its lack of a prominent eye stripe. Sedge Wrens generally prefer upland habitats with tall, dense vegetation and moderate cover. They are shy, elusive birds that are difficult to locate.

They nest in wet or dry grasslands, sedge meadows, planted cover, hayfields, lightly grazed pastures, and grassed waterways. They breed from late May through early June. The nest is built in sedges or rush-like grasses within 1 to 2 feet of muddy ground or shallow water. It is a well-hidden ball of woven grasses with an opening on one side. The interior is lined with cattail down, fur or feathers. Male sedge wrens often build additional "dummy" nests. These nests are unlined and not as well constructed as the actual nest. Dummy nests can accumulate in great numbers where several pairs of sedge wrens are nesting as a colony. Usually 6 or 7 smooth, white, short, oval eggs are laid per clutch. Sedge wrens often lay 2 clutches per year. Incubation is done by the female and lasts for 12 to 14 days. The young are tended by both adults but primarily by the female. They leave the nest 12 to 14 days after hatching.

The bird has been considered a very rare migrant and sporadic nester in the State since the 1960s. The species is threatened by the loss of wetland habitats due to human development. The best way to maintain populations of the sedge wren is through the conservation and protection of sedge-marsh habitat. Programs involving wetland restoration may also help provide additional breeding and nesting locations for this species.

Open Space

Residents express concern over the quality of the natural environment and the quantity of ecological resources in a variety of ways. One way is through community-based land protection measures. During the past several decades, the Athol Conservation Commission has actively worked to protect hundreds of acres in Athol, the majority of it lying within the Bearsden Forest Conservation Area. Below, Table 1-11 lists the type and amount of open space in Athol.

Table 1-11: Number of Acres of Open Space by Level of Protection from Development

Land Permanently Protected from Development	Area in Acres
US Army Corps of Engineers	84.0
Department of Environmental Management and Division of Fisheries and Wildlife Law Enforcement	1,318.4
Town of Athol Conservation Commission	1,842.3
Mount Grace Land Conservation Trust	41.0
USDA Forest Legacy Conservation Restriction	414.0
Total	3,699.7
Land with Limited Protection from Development	
B&M Railroad	106.0
Town of Athol Park and Recreation Department	60.8
Town of Athol School Department	170.9
Town of Athol Department of Public Works	27.0
Total	364.7
Land Temporarily Protected from Development	
Chapter 61 – Forestry	1,796.0
Chapter 61A –Agriculture	647.0
Chapter 61B – Recreation	648.7
Total	3,091.7
Land Not Protected from Development	
Pine Beach Complex	60.9
Lake Rohunta-Eagleville Complex	5.0
Morgan Memorial Complex	232.5
Ellinwood Country Club	240.2
Little League Ball Field	3.5
Woodsman Rifle & Pistol Club	21.1
Athol Archery Club	111.7
Total	674.9
Total Open Space Land	7,831.0

Source: Athol Open Space & Recreation Plan, 2000.

This section includes an inventory of all of the parcels of land that are of conservation or recreation interest to the residents of Athol. These parcels are listed by protection status: permanent, limited, temporary, or unprotected. Within each of these protection categories,

the parcels are listed by public and private ownership. These resources are identified on the Open Space Map.

According to the Massachusetts Executive Office of Environmental Affairs, Division of Conservation Services, land is permanently protected if it is owned by the Town's Conservation Commission, one of the State's conservation agencies (i.e. the Massachusetts Department of Environmental Management), a nonprofit land trust (i.e. the Nature Conservancy), or if the Town received State or Federal funds for the purchase or improvement of the property. Private land is considered protected if it has a deed restriction in perpetuity, if an Agricultural Preservation Restriction (APR) has been placed on the property, or if DEP has placed a conservation restriction on it as part of the Wetlands Conservancy Program. Removing land from permanent open space protection status so that it may be developed requires an affirmative vote by two thirds of the State Legislature.

The publicly owned, permanently protected parcels in the Town of Athol are those held by U.S. Army Corps of Engineers, the Massachusetts Department of Environmental Management, the Massachusetts Division of Fisheries and Wildlife, and the Athol Conservation Commission. The privately held, permanently protected parcels have conservation easements attached to their deeds that are held by the U.S. Department of Agriculture-Forestry Service or by Mt. Grace Land Conservation Trust.

A parcel of land in Massachusetts is considered to have limited protection from development when a town or water district owns it. If a town-owned parcel of land is not under the legal authority of the Conservation Commission, but instead, is under the authority of the Select Board, then it is considered to have limited protection. The parcel in question could be called a wildlife sanctuary or a town forest, but not have the long-term protection afforded by Conservation Commission lands. Without permanent protection status, and a legal restriction on uses attached to the deed, it is possible that town-owned parcels could be converted to school playgrounds, parking lots or other town uses, upon Town meeting approval to do so. The level of protection afforded publicly-owned parcels with limited protection depends on the policies of each community. In most cases, the watershed district would be required to show the Massachusetts Department of Environmental Protection just cause for converting the use of the land.

Temporarily protected parcels are those that are enrolled in the Chapter 61 tax abatement programs. The Chapter 61 programs offer landowners a reduction of their property taxes in return for signing a contract promising that the predominant use of the land will not change during an agreed upon time (ten years for Chapter 61 and 61B, one year for Chapter 61A). The Chapter 61A program helps farmers by reducing their taxes while they farm their land. The Chapter 61 program helps lower the expenses of maintaining actively managed forestland while landowners with parcels in the Chapter 61B program receive lower property taxes in exchange for keeping their land in open space for ten years. One of the benefits of the tax abatement programs to the community is that it can provide an opportunity to permanently protect land. When one of these parcels, which is enrolled in one of the Chapter 61 programs is put up for sale, the Town has a one hundred and twenty (120) day waiting period during which it can exercise its right of first refusal to purchase the property.

Permanently Protected Parcels

Athol has many permanently protected conservation and recreation sites, totaling approximately three thousand, seven hundred (3,699.7) acres. These properties are listed in Table 1-12 and identified by ownership status, owner, assessed acreage and, where available, by the Assessor’s map, block, and lot numbers. Descriptions of the sites follow the table.

Table 1-12: Open Space Parcels that are Permanently Protected from Development

Ownership Status	Owner and Site	Assessors' Map #	Assessors' Lot #	Acreage
Public	United States of America			
	<i>Army Corps of Engineers</i>			
	Tully Lake Reservation	1	1	19
	Tully Lake Reservation	1	2	4
	Tully Lake Reservation	1	3	4
	Tully Lake Reservation	1	4	5
	Tully Lake Reservation	1	10	10
	Tully Lake Reservation	1	11	15
	Tully Lake Reservation	1	12	22
	Tully Lake Reservation	1	46	5
	Tully Lake Reservation		Total	84
	Commonwealth of Massachusetts			
	<i>Department of Environmental Management</i>			
	Petersham State Forest	56	77	85.3
	Petersham State Forest	55	56	35.5
	Petersham State Forest	55	60	29.6
	Petersham State Forest	56	76	7.7
	Petersham State Forest		Total	158.1
	Lawton State Forest	6	11	90.4
	Lawton State Forest	6	14	48.4
	Lawton State Forest	6	17	127.1
	Lawton State Forest	7	13	31.9
	Lawton State Forest	7	4	31.2
	Lawton State Forest	8	25	1.3
	Lawton State Forest	8	26	40.2
	Lawton State Forest	8	25	6.7
	Lawton State Forest	8	24	8.6
	Lawton State Forest	8	27	6.7
	Lawton State Forest		Total	392.5
	<i>Division of Fisheries and Wildlife</i>			
	Millers River Wildlife Management Area	2	12	187.7
	Millers River Wildlife Management Area	2	9	50.6
	Millers River Wildlife Management Area	2	48	126.3
	Millers River Wildlife Management Area	2	11	18.7
	Millers River Wildlife Management Area	2	10	52.6
	Millers River Wildlife Management Area	2	14	11.5
	Millers River Wildlife Management Area	2	7	136.8
	Millers River Wildlife Management Area	2	7	80.8

Table 1-12: Open Space Parcels Permanently Protected from Development (con't)

Ownership Status	Owner and Site	Assessors' Map #	Assessors' Lot #	Acreege
<i>Division of Fisheries and Wildlife (con't)</i>				
	Millers River Wildlife Management Area	3	34	8.4
	Millers River Wildlife Management Area	3	11	60.4
	Millers River Wildlife Management Area	3	19	12.5
	Millers River Wildlife Management Area	5	4	16.0
	Millers River Wildlife Management Area	5	3	4.0
	Millers River Wildlife Management Area	5	1	1.5
	Millers River Wildlife Management Area		Total	767.8
	Commonwealth of Massachusetts		TOTAL	1,318.4
Town of Athol Conservation Commission				
	Bearsden Forest Conservation Area	3	12	195.5
	Bearsden Forest Conservation Area	3	16	34.1
	Bearsden Forest Conservation Area	3	13	70.2
	Bearsden Forest Conservation Area	3	15	58.7
	Bearsden Forest Conservation Area	3	14	61.7
	Bearsden Forest Conservation Area	3	32	86.3
	Bearsden Forest Conservation Area	3	27	98.1
	Bearsden Forest Conservation Area	3	25	127.1
	Bearsden Forest Conservation Area	3	26	45.3
	Bearsden Forest Conservation Area	3	20	49.7
	Bearsden Forest Conservation Area	3	24	14.1
	Bearsden Forest Conservation Area	3	21	95.1
	Bearsden Forest Conservation Area	3	28	23.6
	Bearsden Forest Conservation Area	3	29	29.5
	Bearsden Forest Conservation Area	3	30	51.7
	Bearsden Forest Conservation Area	3	23	13.1
	Bearsden Forest Conservation Area		Total	1,053.8
	Rowe Half Acre	14	21	0.5
	Cass Meadow Conservation Area	14	14	2.4
	Cass Meadow Conservation Area	14	15	2.4
	Cass Meadow Conservation Area	14	17	7.0
	Cass Meadow Conservation Area	14	19	3.1
	Cass Meadow Conservation Area	14	20	6.6
	Cass Meadow Conservation Area		Total	22.0
	Dr. A. Drury Conservation Area	?	?	3
	Minnie French Conservation Area	8	8	20
	Tully River Conservation Area	15	16	45
	Gulf Conservation Area	2	29	30
	Newton Reservoir	43	1	304.4
	Newton Reservoir	43	1	114.9
	Newton Reservoir	43	13	4.9
	Newton Reservoir	43	14	38.4
	Newton Reservoir	43	4	45.4
	Newton Reservoir	43	5	145.1
	Newton Reservoir	43	55	5.2
	Newton Reservoir	43	57	6.7
	Newton Reservoir	43	9	3.5
	Newton Reservoir		Total	766.5
	Town of Athol Conservation Commission		TOTAL	1,842.3
	PUBLIC LAND WITH PERMANENT PROTECTION		TOTAL	3,244.7

Table 1-12: Open Space Parcels Permanently Protected from Development (con't)

Ownership Status	Owner and Site	Assessors' Map #	Assessors' Lot #	Acreage
Private/CR	Mount Grace Land Conservation Trust owns the CR			
	Power-Biggs Parcel	1	71	27
	Power-Biggs Parcel	1	72	14
	Power-Biggs Parcel		Total	41
	United States Department of Agriculture-Forestry Service owns the CR			
	APR/Hutchinson Parcel	54	11	157
	APR/Hutchinson Parcel	54	2	19
	APR/Hutchinson Parcel	54	33	79
	APR/Hutchinson Parcel	54	3	30
	APR/Hutchinson Parcel	54	7 & 8	39
	APR/Hutchinson Parcel	54	10	20
	APR/Hutchinson Parcel	54	5	14
	APR/Hutchinson Parcel	54	6	56
	APR/Hutchinson Parcel		Total	414
	PRIVATE LAND WITH PERMANENT PROTECTION		TOTAL	455
	TOTAL LAND WITH PERMANENT PROTECTION		TOTAL	3,699.7

Source: Town of Athol Assessors Records, 2000.

Publicly-Owned Permanently Protected Parcels

The following descriptions are for groups of parcels under the same ownership.

Land Owner: United States of America Army Corps of Engineers

Identifier: Tully Lake Reservation

Tully Lake is a 200-acre man-made lake located on the East Branch of the Tully River in Royalston, Massachusetts. The dam was built between 1947 and 1949 at a cost of \$1.6 million, as a part of a network of flood control dams on tributaries of the Connecticut River. Its function is to reduce flood stages in Athol, Orange and other communities along the Millers River, and, in conjunction with other Corps dams, reduce flood stages along the Connecticut River. The recreation area near the dam offers hiking trails, picnic tables, grills, and a boat ramp. A small playground was built in April 2001 to entertain children ages 2 - 12. Recreation opportunities include camping, picnicking, hiking, boating, fishing, and wildlife watching. In the winter, Tully Lake is used for ice fishing and cross-country skiing. The lake can be enjoyed from canoes, kayaks, and motorboats up to 10 horsepower.

Land Owner: Commonwealth of Massachusetts Department of Environmental Management

Identifier: Petersham State Forest

These four parcels of land totaling one hundred and fifty-eight (158) acres are located on the Petersham border off New Sherborne Road. They are satellite sites to the Otter River State Forest. The property is used primarily for timber harvesting, wildlife habitat management, and extensive recreation including hunting, hiking, and bird watching. There are no formal recreation facilities on site.

Land Owner: Commonwealth of Massachusetts Department of Environmental Management,
Division of Forests and Parks

Identifier: Lawton State Forest

This three hundred and ninety-two (392.5) acre property was once owned by the Lawton family, and was operated as a Christmas tree plantation. It fell into disuse over the years and the trees are now overgrown and misshapen. They are of little value as Christmas trees. When the Division of Forest and Parks bought the land, they inherited a lease that they had to carry. The lessees did not maintain the acreage and the land evolved into an early-successional stage forest (a class of land in short supply in Athol). DEM would like to see the land restored to its open condition predating the tree farm to support wildlife habitat.

Land Owner: Commonwealth of Massachusetts Division of Fisheries and Wildlife

Identifier: Millers River Wildlife Management Area

Millers River Wildlife Management Area in Athol is part of a larger, eight-parcel area of river valley, forested hills, and marshland in the region. Athol has several properties totaling seven hundred and sixty-eight (767.8) acres. The largest property is located on the northern border with Royalston. Several smaller properties have frontage on Millers River, from the Phillipston border, westward through the center of Town at the confluence with the Tully River. They provide access to trout-stocked waters. The lands are open to hunting, fishing, trapping, and other passive recreation, but certain restrictions apply. Hunters are required to wear a hunter orange cap when hunting. Snowmobiles and all-terrain-vehicles are prohibited, as is camping.

Land Owner: Town of Athol Conservation Commission

Identifier: Bearsden Forest Conservation Area

The Bearsden Forest encompasses one thousand and fifty-four (1,053.8) acres on the southern bank of the Millers River in the northeastern part of Athol. It is covered with second and third growth forests. Several peaks offer spectacular panoramas and challenging climbing. Many fire roads and trails make most areas easily accessible. Picnickers will find benches and tables provided for their enjoyment, but fires are not allowed without a permit. Snowmobilers will find many well cut trails for their use, but caution is advised, for hikers use the same trails year round, and cross-country skiers in season. Paige Cabin, a twenty by thirty foot log shelter, located at the Bearsden Road entrance to the forest, is available by pre-arrangement, for overnight use by any group supervised by a responsible individual.

Land Owner: Town of Athol Conservation Commission

Identifier: Cass Meadow Conservation Area

This property, owned by the Conservation Commission, is located at the confluence of the Tully and Millers Rivers, and is accessible from Pequoig Avenue. The Historical Commission placed a historical marker at Cass Meadow to identify a Native American crossing point. The Athol Bird and Nature Club and the Conservation Commission hope to create a nature trail through the meadow.

Privately-Owned Permanently Protected Parcels

Land Owner: Mount Grace Land Conservation Trust

Identifier: Power-Biggs Parcel

This two-parcel estate, once owned by Mrs. E. Power Biggs, totals forty-one (41) acres. She died on Friday March 19, 1999, willing her Athol estate to the Mount Grace Land Conservation Trust, with plans to establish an arboretum.

Land Owner: Hutchinson; United States of America Department of Agriculture-Forestry Service owns the Conservation Restriction.

Identifier: Hutchinson Parcel

On July 12, 1996, the USDA Forest Service purchased a conservation easement on four hundred and fourteen (414) acres of woodland in Athol and Petersham from Ted and Beverly Hutchinson through the Forest Legacy Program. The Massachusetts Stewardship Committee had identified the Hutchinson property as important for protecting public water supplies.

Sale of the development rights allows the Hutchinsons to continue managing their land for forest products as they have for the past sixty (60) years. The Hutchinsons will manage their land under the guidance of a Forest Stewardship Plan approved by the State Forester. The Forest Legacy Program allows the Hutchinsons to keep land rights not purchased by the government while protecting key wildlife habitat and water quality.

Parcels with Limited Protection from Development

Parcels with limited protection from development are classified into two categories. There are parcels that are protected due to their current use. Two examples are parcels used to protect water supplies and lands used for railroad purposes. The second type includes those parcels that are owned by a Town department, other than the Conservation Commission. Any change in use of these lands would require either a vote at Town Meeting or, a decision by the Select Board. B&M Railroad parcels totaling one hundred six (106) acres are privately held. The remaining parcels total over two hundred and fifty-eight (258.7) acres and are all Town School and Park and Recreation Department lands.

Table 1-13: Open Space Parcels with Limited Protection from Development

Ownership Status	Owner and Site	Assessors' Map #	Assessors' Lot #	Acreage
Private	B&M Railroad	3	17	72
	B&M Railroad	3	18	34
	PRIVATE LAND WITH LIMITED PROTECTION		TOTAL	106
Public				
	Town of Athol Park and Recreation Department			
	Sanders Street School Playground	29	70	10
	Silver Lake Park	13	78	41
	Fish Park	30	8	6
	Lake Ellis Park	35	47	3
	Phillips Park	32	273	0.3
	Uptown Common	32	272	0.5
	Town of Athol Park and Recreation Department		Total	61
	Town of Athol School Department			
	Pleasant Street School Playground	47	29	11.3
	Pleasant Street School Playground	47	34	11
	Pleasant Street School Playground	47	35	4.8
	Pleasant Street School Playground	47	36	2.3
	Pleasant Street School Playground	47	37	1.3
	Pleasant Street School Playground	47	38	36.5
	Grade School Playground	9	121	2.6
	Grade School Playground	29	224	0.4
	Grade School Playground	31	219	3
	Grade School Playground	31	229	0.2
	TJ O'Brien Athletic Field	36	169	22
	Athol Middle School	0		2
	Lyman Ward School	31	161	5
	Pleasant Street School	47		62
	Riverbend School	31	219	3.5
	Silver Lake School	9	121	3
	Town of Athol School Department		Total	171
	Town of Athol Department of Public Works		Total	27
	PUBLIC LAND WITH LIMITED PROTECTION		TOTAL	259
	TOTAL LAND WITH LIMITED PROTECTION		TOTAL	365

Source: Town of Athol Board of Assessors, 2001.

Parcels with Temporary Protection from Development

The parcels with temporary protection from development are all private owned and are participating in one of the Chapter 61 tax abatement programs: Chapter 61, Chapter 61A, or Chapter 61B. Under these programs, if a landowner intends to sell the classified land or convert it to another use, Town officials must be notified by certified mail. The Town is granted the right of first refusal and a penalty in the form of either a conveyance tax or a roll back tax is assessed. Athol contains thirty-eight (38) lots totaling one thousand, seven hundred and ninety-six (1,796) acres in Chapter 61, twenty-seven (27) lots totaling six

hundred and forty-seven (647) acres in Chapter 61A and twenty-two (22) lots totaling six hundred and forty-eight (648.7) acres in 61B. Currently undeveloped, these lands are of interest for both conservation and recreation purposes. Land under the Chapter 61 programs can be taken out at the landowner’s will. Chapter 61 parcels constitute a large amount of Athol’s open space and, if these parcels are shifted to permanent protection, they can help link existing conservation and recreation lands to form a greenway network.

Table 1-14 lists parcels of temporarily protected land by type and includes their location, ownership, Assessors’ map and lot, the parcel’s area in acres, and in the case of 61A and 61B parcels, the respective category. The temporarily protected parcels are shown on the Open Space Map.

Table 1-14: Open Space Parcels in Athol in the Chapter 61, 61A, and 61B Programs

Chapter 61 Forestry

Location	Owner	Assessors’ Map	Assessors Lot	Acreage
GULF RD	MAGEE ROSEMARY	2	16	18
ADAMS RD	CARFAGNA RICHARD D	56	85	44
ADAMS RD	LAPINSKAS RALPH	56	83	61
BATCHELDER RD	MILDREN FREDRICK B	47	53	23
BIGELOW RD	AITKEN MOLLY BENNETT	56	47	66
CARPENTER RD	SYKES E W INC	50	54	69
CHASE RD	BROOKS ROBIN E	25	132	12
CHASE RD	BROOKS ROBIN E	26	4	6
CHESTNUT HILL AVE	GATAUTIS RONALD J	7	8	21
CHESTNUT HILL AVE	LAWLOR JOHANNA M	2	6	10
CONANT RD	STRUNJO EUGENE M	55	31	38
CONANT RD	STRUNJO EUGENE M	55	100	0
DIKE RD	WILDWOOD FARMS REALTY TRUST	4	1	159
DIKE RD	WILDWOOD FARMS REALTY TRUST	4	2	24
FLAT ROCK RD	KENERSON LAUREY	54	31	35
FLAT ROCK RD	KENERSON LAUREY	55	55	63
FLAT ROCK RD	LEIGHTON RICHARD R	55	48	25
FLAT ROCK RD	LEIGHTON RICHARD R	55	49	4
FLAT ROCK RD	LEIGHTON RICHARD R	55	51	36
FLAT ROCK RD	TITUS JOHN	55	50	19
FLAT ROCK RD	VOELKER JANE E ESTATE	57	1	15
FLAT ROCK RD	VOELKER JANE E ESTATE		4	47
GULF RD	KENERSON LAUREY	2	37	9
GULF RD	KENERSON LAUREY		39	161
KING RD	AKEY KENNETH C	52	64	100
OLD KEENE RD	POWER-BIGGS MARGARET	1	71	25
OLD KEENE RD	POWER-BIGGS MARGARET	1	72	6
OLD KEENE RD	OHARA JOHN PATRICK	1	7	26
PETERSHAM RD	FELDMAN BEN J	56	32	43
PETERSHAM RD	SMITH DAVID A	56	112	17

Table 1-14: Open Space Parcels in Athol in the Chapter 61, 61A, and 61B Programs (con't)

Chapter 61 Forestry

Location	Owner	Assessors' Map	Assessors Lot	Acreage
SOUTH ATHOL RD	BIDWELL DEWEY W	49	23	107
SOUTH ATHOL RD	BLAKLEY LAWRENCE G	57	25	10
SOUTH ATHOL RD	VOELKER JANE E ESTATE	54	32	64
SOUTH ATHOL RD	KIELY THOMAS J	55	43	37
TEMPLETON RD	COLON FRAZIER P ET-AL TRUSTEES	42	9	66
TEMPLETON RD	COLON FRAZIER P ET-AL TRUSTEES	43	18	227
WHITE POND RD	STODDARD RALPH S	53	17	97
WHITE POND RD	STODDARD RALPH S	53	19	6
CHAPTER 61 FORESTRY			TOTAL	1,796

Chapter 61A Agriculture

Location	Owner	Category	Map	Lot	Acreage
WHITE POND RD	KING DANIEL F	TR CRP VEG	52	120	3
1743 WHITE POND RD	KING DANIEL F	TR CRP VEG	53	8	2
15 WAITE RD	LEGRAND LESTER	TR CRP VEG	57	15	9
3327 CHESTNUT HILL AVE	ROBINSON ROBERT J	TR CRP VEG	1	26	17
511 BROOKS RD	WASLASKE MICHAEL J	FIELD CRPS	16	5	5
WAITE RD	LEGRAND LESTER	PROD WOOD	57	14	16
15 WAITE RD	LEGRAND LESTER	PROD WOOD	57	15	78
1386 PLEASANT ST	NYE HAROLD L	PROD WOOD	47	39	27
1513 S MAIN ST	STONE RICHARD D	PROD WOOD	17	7	27
4287 SOUTH ATHOL RD	NORTH OREN F	PROD WOOD	55	4	36
BEARSDEN RD	MUNDELL BEVERLY A	PASTURE	37	55	47
MOORE HILL RD	WALTERS ROBERT W	PASTURE	16	33	59
SOUTH ATHOL RD	BIDWELL DEWEY W	PASTURE	19	3	20
SOUTH ATHOL RD	BIDWELL DEWEY W	PASTURE	19	4	101
1595 SOUTH ATHOL RD	BIDWELL DEWEY W	PASTURE	19	1	22
15 WAITE RD	LEGRAND LESTER	PASTURE	57	15	5
1743 WHITE POND RD	KING DANIEL F	PASTURE	53	8	2
280 MOORE HILL RD	WALTERS ROBERT W	PASTURE	16	32	31
4287 SOUTH ATHOL RD	NORTH OREN F	PASTURE	55	4	10
4466 SOUTH ATHOL RD	KIELY THOMAS J	PASTURE	55	43	15
511 BROOKS RD	WASLASKE MICHAEL J	PASTURE	16	5	1
555 WHITE POND RD	STANGE CARL G	PASTURE	51	26	28
775 BEARSDEN RD	MUNDELL BEVERLY A	PASTURE	39	10	41
1386 PLEASANT ST	NYE HAROLD L	NURSERIES	47	39	11
MOORE HILL RD	WALTERS ROBERT W	NONPRODUCTIVE NECESSARY LAND*	16	33	10
280 MOORE HILL RD	WALTERS ROBERT W	NONPRODUCTIVE NECESSARY LAND*	16	32	20
1743 WHITE POND RD	KING DANIEL F	NONPRODUCTIVE NECESSARY LAND*	53	8	4
CH. 61 AGRICULTURE				TOTAL	647

*NONPRODUCTIVE NECESSARY LAND: The land that farm buildings and other features sit on that are necessary to farm operation but that do not yield farm product.

Table 1-14: Open Space Parcels in Athol in the Chapter 61, 61A, and 61B Programs (con't)

Chapter 61B Recreation

Location	Owner	Category	Map	Lot	Acreage
790 CARPENTER RD	CAMP CHENEO ASSOCIATION	CAMP	52	29	20
SOUTH MAIN ST	GATAUTIS RICHARD P	NATURE	24	16	15
3385 SOUTH ATHOL RD	BISHOP PAULINE G	NATURE	49	26	18
BATCHELDER RD	ELLINWOOD COUNTRY CLUB INC	GOLF	47	68	1
PLEASANT ST	ELLINWOOD COUNTRY CLUB INC	GOLF	47	73	22
PLEASANT ST	ELLINWOOD COUNTRY CLUB INC	GOLF	48	1	180
PLEASANT ST	ELLINWOOD COUNTRY CLUB INC	GOLF	48	3	2
PLEASANT ST	ELLINWOOD COUNTRY CLUB INC	GOLF	48	4	20
PLEASANT ST	ELLINWOOD COUNTRY CLUB INC	GOLF	48	13	13
JORDAN DR	ATHOL SPORTSMANS CLUB	HUNT	12	47	0.5
SILVER LAKE ST	ATHOL SPORTSMANS CLUB	HUNT	11	70	3
459 PINEDALE RD	ATHOL SPORTSMANS CLUB	HUNT	11	71	28.7
SPORTSMANS POND ISLANDS	ATHOL SPORTSMANS CLUB	HUNT	11	115	143.5
THROWER RD	25 SPORTSMENS CLUB OF ATHOL	HUNT	51	16	3
WHITE POND RD	25 SPORTSMENS CLUB OF ATHOL	HUNT	51	17	25
WHITE POND RD	25 SPORTSMENS CLUB OF ATHOL	HUNT		18	4
WHITE POND RD	25 SPORTSMENS CLUB OF ATHOL	HUNT		20	7
553 BATCHELDER RD	MT GRACE SNOWSNOOPERS INC	NR-SKI	50	43	9
PARTRIDGEVILLE RD	LAKE ROHUNTA BEACH ASSOC INC	PICNIC	51	6	4
CHASE RD	PEQUOIG BOWMEN	TARGET	50	36	104
CHASE RD	PEQUOIG BOWMEN	TARGET	50	39	6
390 DOE VALLEY RD	WOODSMAN RIFLE & PISTOL CLUB	TARGET	48	9	20
	CHAPTER 61B RECREATION			TOTAL	648.7

Source: Town of Athol Board of Assessors, 2001.

Unprotected Parcels of Special Interest

Unfortunately, most of Athol’s existing recreation facilities lie within the unprotected category and could easily be converted to developed uses. Table 1-15 lists all unprotected open space and recreation areas that are open to the public. A number of these unprotected properties are of particular interest to local citizens.

Banks of the Millers River

A permanent greenway is proposed along the southern bank of the Millers River, extending from Athol Center to Orange Center. The benefits of this greenway are two-fold: (1) the greenway would help protect water quality and wildlife habitat, and (2) provide an important opportunity for recreational activities along the river, such as hiking and biking. Ideally, the trail would merge with the recently established Tully Mountain trail in Orange. Athol’s Greenway Committee is actively working towards making the greenway a reality by encouraging area landowners to place conservation restrictions on their property. Protection of land within the recharge area of the Town’s new primary water supply, which comes from

an aquifer below the Millers River, should be viewed as a priority and will complement the Greenway Committee's efforts.

Table 1-15: Open Space and Recreational Parcels that are Unprotected from Development

Owner	Management	Assessors' Map	Assessors' Lot	Acreage
Pine Beach Complex	Peter Garrett (Ownership Uncertain)	51	6	5
		51	7	15
		51	10	12.4
		51	9	25.6
		51	28	2.9
Morgan Memorial Complex	Morgan Memorial	54	3	29
		53	23	93
		54	6	6
		53	25	77
		53	24	4.7
		54	1	0.8
		54	2	0.3
		54	10	0.06
		54	12	3.4
		54	16	0.6
		54	24	0.6
		54	25	4.7
		54	37	3.5
		54	47	8.8
Ellinwood Country Club	Ellinwood Country Club	47	68	0.7
		47	73	21.5
		48	1	180.8
		48	3	3.4
		48	4	19.9
		48	13	13.9
Little League Ball Field	American Legion	13	190	3.5
Woodsman Rifle & Pistol Club	Woodsman Rifle and Pistol Club	48	9	21.1
Athol Archery Club	Pequoig Bowmen	50	36	104.7
		50	39	7.0
Lake Rohunta /Eagleville Complex				5.0
	UNPROTECTED PARCELS		TOTAL	675

Source: Town of Athol Board of Assessors, 2001.

The Whitney/Hamlet Properties

This one hundred and fifty five-acre site in South Athol is of tremendous recreation interest. The Board of Selectmen recently authorized a nonprofit equestrian group to pursue a State grant for \$300,000 to buy the land, which when added to existing Town-owned property and, possibly, abutting Petersham land, would be developed into the largest Municipal Equine Center in New England. A network of trails would serve equine and a variety of human

activities, including cross-country skiing and hiking. The money would also help fund development of a conservation and recreation center.

Scenic Resources & Unique Environments

Athol boasts a number of scenic vistas and unique features that set it apart from surrounding communities (*see the Special Landscape Features Map*). Several old mills and charming residential neighborhoods attest to Athol's history as a thriving manufacturing village and give contrast to the surrounding rural landscape. Because of the Town's undulating topography, interesting glimpses of church spires, roof-scapes, mountains, and rivers can be seen from various locations. The observation towers atop Round Top and Sheep Rock Mountains afford panoramic views in any direction. The view atop Round Top, the focal point of the Bearsden Forest, has long been recognized as the best in the area. Visitors can observe peaks in three states including Mount Monadnock in Jaffrey, New Hampshire and Mount Equinox in Manchester, Vermont. Sheep Rock is a favorite haunt of YMCA youth groups, offering a rare view of the Millers River far below, and ledges across the valley.

Athol is rich in other unique features, as identified in the Conservation Commission's "Land and Waters" booklet and the Athol Bicentennial Commission's "Athol History Trail" booklet, both of which are available at the Athol Public Library.

Unique Natural Features

- Athol's "Fault". Extending ten miles into the southern part of Royalston, this fault can be viewed in several locations where ledges are exposed and road cuts in bedrock are visible. Identification markers would be a great help to those wishing to locate this geologic feature.
- Folding. Several fine examples of geologic folding appear along Batchelder Road, attesting to the immense pressure that helped shape Athol's topography.
- The Deep Cut. In 1907, three years after Newton Reservoir was completed, an air pocket developed in a high point of the lengthy water line, near the far end of Bearsden Road. This impeded water flow, creating constant headaches for the Water Commissioners. To eliminate the problem, the Town blasted the ledge, which created a narrow, man-made canyon. Quite a feat at the time, the canyon continues to draw visitors today.

Unique Cultural Features

- Stone Walls. Hundreds of miles of stone walls remind Athol residents about the role agriculture played in the Town's early historic development. Farmers built these walls to prepare their land for planting (by removing stones and boulders left by the last Ice Age), contain livestock, and mark boundary lines.

- Native American Sites and Crossings. At least twenty (20) documented sites are located in Town. The Historical Commission investigated these sites and placed historical markers to identify many of them. Prominent sites include:
 - A. Huncus Island, the area's last known Native American campsite.
 - B. Haley's Meadow, a campground where arrowheads and other artifacts were discovered.
 - C. Millers River Crossing Point I, located at Cass Meadows, off South Athol Road, by the railroad trestle.
 - D. Millers River Crossing Point II, located in the Bearsden Conservation Area, near where the old Lewis Bridge crossed the Millers River.
 - E. Indian Cornfield, located east of Round Top Mountain, in the Bearsden Conservation Area.
- Mud Hut Colony. Remains of a mud hut colony for one hundred and twenty-five (125) immigrant workers who came here from Italy in 1902 to dig the 18-acre reservoir lie half hidden on the west bank of the Newton Reservoir. At least eighteen (18) of these sod mounds are still visible two hundred to three hundred (200-300) feet west of the dam.
- Sunday Walls. These legendary walls are situated one thousand, five hundred (1,500) feet southeast of the Bearsden Road extension. As the story goes, two brothers built the walls around 1770 as part of a contest to see who could lay the most wall in a single day. They gathered fieldstones by the dozens and commenced to build their own walls, starting about five feet apart and going in opposite directions. These walls, useless at the time but legendary now, were the subjects of curiosity for years. They were suitably marked on October 2, 1968.
- Home of W.A. "Candy" Cummings. Originator of the curve ball, Mr. Cummings was elected to the Baseball Hall of Fame. In 1906, he retired to 375 Pequoig Avenue.
- Oldest house in Athol. Located at 35 Moore Hill Road, the house was originally built as a two-room log cabin. It was later enlarged and a major restoration in 1969 gave the house its modern look, yet much of the original interior remains intact.
- Power-Biggs Estate (The Arboretum). This property was deeded to the Mount Grace Land Trust and will become the future headquarters for the Land Trust. The house was typical of its period and recent restoration efforts are viewed favorably.

Recommendations

- **Riparian corridors, lakes, and ponds should be given priority for funding for open space protection.**
 - Emphasis should be placed on protecting riparian habitats and public drinking water supplies.
 - Work with the Department of Environmental Management and the Mt. Grace Land Conservation Trust to develop an active open space conservation program for the Town of Athol that combines passive recreation and land protection with priority given to parcels of land that provide access to the Millers and Tully Rivers.
 - Support watershed planning efforts to improve water quality and habitat areas for wildlife and for recreational fishing.
 - Support efforts to increase and improve opportunities for water-based recreation such as fly-fishing (on the upper reaches of Millers River), and a boat ramp at Fish Park.
 - Request that the Department of Environmental Protection's Wetlands Conservancy Program and MassGIS provide new wetlands mapping in digital formats such as ortho-photography.
 - Adopt a Wetlands Protection Bylaw aimed at preserving wetland areas and establishing criteria for no net loss of wetlands.
- **Develop a public education program regarding Best Management Practices for the protection of public drinking water supplies.**
 - Program elements would include a set of Best Management Practices for businesses that store, use, and/or dispose of hazardous materials to ensure the protection of the aquifer from contamination by these uses.
- **Develop a public education program for the protection of surface water resources and associated rare, endangered, threatened and valued wildlife and plant species habitats including riparian areas.**
 - Program elements would include a set of Best Management Practices to encourage private landowners to protect properties around ponds, lakes, streams, rivers and wetlands; and an
 - educational program conducted through the schools to teach students about rare and endangered species, their habitats and threats to their survival.
- **Consider supporting efforts to preserve remaining farmland by providing Town match funding for Agricultural Preservation Restriction (APR) applications.**

- **Implement methods for protecting Open Space.**
 - Work with regional conservation land trusts to sponsor a forum on the long-term protection of open space and farmland that discusses estate planning options and the tax benefits available for interested landowners through open space protection programs.
 - Request that the Select Board notify regional conservation land trusts about land parcels to be removed from the Chapter 61 land classification and taxation programs for conversion to residential uses.

- **Consider supporting efforts to protect working forests and prime forestland soils including promoting sustainable forestry techniques.**
 - Continue to explore ways of contributing to the clean up of the Millers River and its watershed through water quality monitoring, wastewater treatment facility improvements, and/or the adoption of Wetlands Protection Bylaws.
 - Develop an incentive program for brownfields redevelopment, to encourage reuse of vacant or underutilized parcels.
 - Encourage business development that is sensitive to the environment.
 - Consider a Warrant Article for Town Meeting to form a formal committee appointed by the Town Manager to implement recommendations of the Open Space and Recreation Plan and the Master Plan.

- **Consider the following Zoning changes recommended in the Open Space and Recreation Plan:**
 - Develop a Ridge Protection Overlay District Zoning Bylaw that would protect the scenic and wildlife values of Athol's mountaintops and ridgelines through limiting the density and visual impact of residential development.
 - Evaluate the applicability of Cluster Development Bylaws and other methods and techniques that promote the protection of open space.
 - Review existing subdivision control regulations to strengthen the protection of natural resources.
 - Consider adopting a Transfer of Development Rights (TDR) Bylaw that would allow development rights to be transferred away from significant natural resource areas identified by the Town. Development rights would be transferred to designated areas such as village centers where sewer and water infrastructure is available and development is desirable.
 - Identify financial resources to conduct studies to locate future water supplies.
 - Delineate Zone II Water Recharge Areas for all future public water supplies and expand the Groundwater Protection District to encompass these areas and prevent contamination from hazardous materials.

Mapping Products

The creation of maps of Athol's natural resources is important to provide an understanding of the spatial relationship of natural resource areas to each other and to developed areas in the Town. This is an essential step for prioritizing natural resource areas that are important to protect from potentially detrimental land uses. Maps of Water Resources and Wildlife Habitat, and of Open Space, have been created to identify and show the locations of these resources. A Slopes Map has been created to show potential ridge protection areas. In addition, a Prime Agricultural and Forestry Soils Map has been developed to indicate the best areas for farming and forestry. The Special Landscape Features Map developed for the Athol Open Space and Recreation Plan (2000) is also included with this chapter; this map shows the locations of Athol's most unique natural and cultural features and sites. The final natural resource mapping product is the Composite Environmental Assessment Map that combines elements from the earlier maps.

Water Resources and Wildlife Habitat Map - This map synthesizes information about the locations of significant water and wetland resources with information about significant wildlife habitats. MassGIS data is used to show the surface water (rivers and streams), public water supplies, Massachusetts Department of Environmental Protection (DEP) Zone II interim and approved wellhead protection areas, aquifers, and outstanding resource waters in Erving. Wetland information for the Town was obtained from the National Wetlands Inventory generated by the United States Fish and Wildlife Service. Aquifer potential was determined using the MassGIS surficial geology data and maps produced by the United States Geological Survey (USGS). The Water Resources and Wildlife Habitat Map shows aquifers with potential yields of 50-200 Gallons Per Minute (GPM), and aquifers with potential yields less than 50 GPM. The map also shows important habitats for rare and endangered species as identified by the Natural Heritage and Endangered Species Program (NHESP). The NHESP maps the priority habitats for State-protected rare species and the estimated habitats of State-protected rare wildlife populations in resource areas, such as wetlands and forestlands. Both of these habitat types are included on the Water Resources and Wildlife Habitat Map and incorporated into the Composite Environmental Assessment Map.

Open Space Map - This map shows the protected open space as contained in the MassGIS data, with 1999 updates produced by Cartographics Associates, Incorporated, for the Montachusett Regional Planning Commission work on the Athol Open Space and Recreation Plan. The map includes permanently-protected open space, Town-owned lands with limited protection from development, and private lands that have temporary protection from development through their enrollment in the Chapter 61, 61A, or 61B programs in which property owners guarantee that the land will remain without development for a certain period of time, in exchange for property tax reductions.

Slopes Map – This map identifies the slope characteristics of the Town, breaking the information into five categories:

- 0 to 3%, which are best suited for agricultural uses, as well as development.
- 3 to 8%
- 8 to 15%.
- 15% to 25%, which pose a constraint for industrial and commercial development.
- greater than 25%, which are virtually unbuildable.

Areas with slopes greater than twenty-five percent (25%) are indicated on the Composite Environmental Assessment Map.

Prime Agricultural and Forestry Soils – This map identifies the location and extent of prime soils suitable for agriculture and forestry in Athol. Any soils located in areas that have been developed have been subtracted from the prime soils.

Special Landscape Features Map – This map, originally developed for the Athol Open Space and Recreation Plan (2000), identifies the location of Athol's most unique natural and cultural features and sites.

Composite Environmental Assessment Map – This is an analysis map. It shows the areas in Town that are unbuildable due to various environmental constraints such as their proximity to a river or wetland or endangered or rare species habitat, their steep slopes, or their permanent protection from development. This map also identifies areas where development should be limited. These areas include forestland with Prime 1, 2, or 3 soils and potential aquifer protection areas.