SECTION 4

ENVIRONMENTAL INVENTORY AND ANALYSIS

This section of the Orange Open Space and Recreation Plan provides a comprehensive inventory of the natural resources and the significant cultural resources within the Town of Orange. The purpose behind any inventory is to provide a factual basis upon which assessments can be made. The environmental inventory in this case identifies and qualifies the Town's soils, special landscape features, surface waters, aquifers, vegetation, fisheries and wildlife, and unique environments and scenic landscapes.

Each of these resource areas is analyzed from two perspectives. First, the basic values that the Town's natural resources provide the citizenry of Orange are ecological services and cultural amenities. Ecological services include for example, drinking water filtration, flood storage capacity, maintenance of species diversity, and soil nutrient levels. Cultural amenities include the recreational use of open spaces, the quality of life benefits that are maximized by maintaining the area's rural character and scenic beauty, and the direct and indirect beneficial impacts that well-conserved natural resources, such as good drinking water and open spaces, have on the local economy. Second, it is important to determine whether the resource requires conservation so that the quantity and quality required by the citizenry is sustained.

A. GEOLOGY, SOILS AND TOPOGRAPHY

Decisions about land use should take into consideration the inherent suitability of a site for different kinds of development. Environmental factors such as geology, soils, and topography are essential to understanding the spatial relationships of land based natural resources and determining potential sites for future residential, commercial and industrial development or for new parks, hiking trails and open space.

A.1 Geology

The underlying bedrock of Orange is predominantly Monson gneiss, with large banded areas of schist rock forming the upland ridges like Fall Hill, Beech Hill, and Chestnut Hill. Both are hard bedrock that by themselves have no inherent suitability limitations. There may be limitations, based on their relationship to the soils and vegetation in a particular area, for example, and these are pointed out in the relevant sections below. Because of some volcanic activity in pre-historic periods, there is at least one area of soft soapstone rock on the west side of Tully Mountain that would limit development there.

Development elsewhere may be constrained by significant areas of shallow bedrock and rocky ledges that are common in this region, as well as by aquifer recharge areas and many small wetlands.

The Town of Orange that we recognize today is the result of millions of years of geologic history: the great upheavals of the earth's crust and volcanism, and the sculpting power of moving water, ice, and wind. This distinctive physical base has determined the distribution of the Town's water bodies, its soils and vegetation, and its settlement patterns, both prior to and since colonial settlement.

A.1.1 Mountain Building: 700 Million Years to 190 Million Years Ago

The earth's crust is actually a system of plates whose movements and collisions shape the surface. As the plates collide, the earth's crust is compressed and forced upward to form great mountain ranges. In the area of the northeastern United States, the plates move in an east-west direction, thus the mountains formed by their collisions run north to south. Both the Taconic Mountains and the Appalachians were formed in this way.

The pressure of mountain building folded the earth, created faults, and produced the layers of metamorphosed rock typically found in New England today, including the Monson gneiss and schist rock that are the predominant bedrocks in Orange. Collision stress also melted large areas of rock, which cooled and hardened into the granites that are found in some of the hill towns in Massachusetts today. Preceding the collisions, lines of volcanoes sometimes formed, and Franklin County shows evidence of this in bands of dark schist rock metamorphosed from lava flows and volcanic ash. While most of Tully Mountain in Orange is gneiss, its western portion has deposits of soapstone, a metamorphic rock formed from volcanic lava or ash.

A.1.2 Earthquakes and Dinosaurs: 190 Million to 65 Million Years Ago

A great continent known as Pangaea formed through the plate collisions, but it began to break apart almost 200 million years ago (and continues today). This caused earthquakes and formed large rift valleys, the largest of which became the Atlantic Ocean. The Connecticut Valley was one of many smaller rifts to develop, and streams, flowing into it from higher areas to the east, brought soil deposits including gravels, sand and silt. The Dinosaur era had begun, and their footprints are still visible in the sedimentary rock formed from these materials on the valley floor.

By the close of the Dinosaur age, the entire eastern United States including Orange was part of a large featureless plain, known as the peneplain. It had been leveled through erosion, with the exception of a few higher, resistant areas. Today, these granite mountaintops, named monadnocks, are still the high points in this region. Such mountaintops are Mt. Monadnock in New Hampshire, which is visible from parts of Orange; and Mt. Wachusett and Mt. Greylock in Massachusetts.
As the peneplain eroded, the less resistant rock eroded to form low-lying areas, while bands of schist remained to form upland ridges, like the Fall, Beech, Temple, and

Chestnut Hills in Orange. By this time, the Connecticut Valley had been filled with sediment, while streams that would become the Westfield, Deerfield, and Farmington Rivers continued to meander eastward. The Miller's River and other westward-flowing streams would become more significant later on.

A.1.3 Cenozoic Era and the Ice Age, to the Present: 65 Million Years Ago to Today

A long period of relative quiet followed the Dinosaur era. Then, as the Rocky Mountains were forming in the west eight million years ago, the eastern peneplain shifted upward a thousand feet. As a result of the new steep topography, stream flow accelerated, carving deep valleys into the plain. The plain rose one more time, and the Millers River, once a slowly meandering westward stream, now carved its course through the sediment and bedrock. Today, the visible remnants of the peneplain are actually the area's schist-bearing hilltops, all at about the same one thousand (1000) foot elevation.

Mountain building, flowing water, and wind had roughly shaped the land; now the great glacial advances would shape the remaining peneplain into its current topography. The earth's climate cooled until a point about two million years ago, when accumulated snow and ice in the far north began advancing under its own weight. A series of glaciations followed, eroding mountains and displacing huge amounts of rock and sediment. The final advance, known as the Wisconsin Glacial Period, completely covered New England before it began to recede about thirteen thousand (13,000) years ago. It scoured and polished the land into its final form, leaving a layer of glacial debris and landforms that are still distinguishable.

This profile of softly rounded hills, bounded by upland ridges, reveals the gneiss and schist bedrock lying beneath it. It is covered by a variable layer of till, an unsorted mix of rock, clay, and sand left behind by retreating glaciers. While the underlying gneiss is often smooth from the glacial action, the harder schists of the upland ridges are rocky, craggy, and steep. "Roche moutonnees," or sweepbacks, like Tully Mountain, are knobs of gneiss bedrock shaped by icy erosion: smooth on the north up-glacier side, and "plucked" with cliffs and rocky debris on the south.

While the Miller's River probably first formed prior to the glacial period, most of Orange's hydrological system is a remnant of that time. The major streams follow a north-south course with the topography. Smaller streams flow from uplands feeding the extensive wetlands formed by sedimentation that filled drainage points when the glacier receded.

The glacier left gravel and sand deposits in the lowlands and along stream terraces. These are the present day locations of the Miller's River, North Pond Brook, West Brook, and the Tully River. The broadest deposit in Orange is found on the glacial outwash plain in the area of the Town's Municipal Airport, known by townspeople as "The Plains." Where deposits were left along hillsides, they formed kame terraces and eskers. Kames are short hills, ridges, or mounds and eskers are long narrow ridges or mounds of sand, gravel, and boulders. Both are formed by glacial melt waters. Along the base of Tully

Mountain, the kame terraces are flat and gravely with grassland, pines, and pink lady-slippers, all typical of well drained kame soils.

A.2 Soils

The most important values that soils provide for the residents of Orange come from the fact that they sustain a diverse array of plant and animal life through the banking of nutrients and organic matter, they retain and release groundwater, and they produce food and a way of life for local residents. Wetland and riparian soils help to naturally regulate surface water flow and also provide habitats for some of the area's most unique species. Prime farmland soils in Orange provide farmers an opportunity to grow the types of fresh vegetables, fruits and meat products that are both profitable and in demand by local residents. Thus prime soils should be valued by local residents. Residents should take note that the glacial outwash soils being well drained, even droughty, and mostly level, are also potential sites for development.

According to the United States Department of Agriculture (USDA) Soil Conservation Service Soil Survey for Franklin County (February 1967), the soils of Orange fall into two basic associations: the Hinckley-Merrimac and the Shapleigh-Essex-Gloucester soil associations.

The Hinckley-Merrimac soil association occurs on glacial outwash plains and stream terraces, such as in the southern half of Orange. These soils were formed in deep deposits of sand and gravel through glaciation. Pockets of moderately well drained Sudbury soils also occur within this association. The aquifer recharge areas in South Orange lie under these soils, which in many cases are also suitable for development. This poses a conflict due to the threat of groundwater contamination.

The second soil association found in Orange, the Shapleigh-Essex-Gloucester includes soils that have formed in stony, sandy, and gray glacial till. These soils also tend to be stony and contain many large boulders. Scattered throughout this association are areas of moderately well drained Scituate and poorly drained Ridgebury soils. The Shapleigh soils are located on very steep slopes, from 15% to 60%, and many areas have ledge outcrops of schist bedrock. The well drained Essex and Gloucester soils are similar and are found on the upper parts of hills; however, the Essex soils also have a hardpan layer within two and a half feet of the surface with slow permeability. Development constraints within this association vary considerably.

Several tiny pockets of prime agricultural land are scattered throughout Orange, comprising about 1 percent of the total land area. It is important to note that in many instances prime agricultural land is also extremely well suited for development. Thus, legal protection would be required to insure its preservation. These soils are considered Capability Unit I-5, or Class I (the highest quality) according to the Soil Conservation Service Survey; they are deep, well drained, and nearly level. Even when used intensively, the risk of erosion to these soils is minimal. However, much of the soils in

Franklin County are also low in natural fertility and are quite acidic. Thus, careful management is needed to maintain organic matter in these soils.

A.2.1 Prime Farmland and Development Constraints

The Prime Farmland and Development Constraints Map overlays several factors that are important in identifying the areas most likely to be developed and those areas that should be targeted by the Town for parkland and preserves. This map employs a 1997 land use coverage developed by the University of Massachusetts, Natural Resource Mapping Department, which includes residential, commercial, and industrial development, crop and pastureland. Then, information about Orange's hydrology (wetlands and streams, rivers, and water bodies), slopes greater than twenty-five percent (25%), and Prime farmland soils are overlaid on the maps. In this category soils considered Prime, of Statewide Importance, and Unique are shown.

Agricultural soils, especially Prime and those of Statewide Importance have characteristics that make them suitable for development. (In the remainder of this section, these two types of soils are referred to together as "prime.") This is in conflict with the fact that farmland is a critical resource in providing locally grown food and pastoral character to the landscape of Orange. These areas can be seen on the map by looking at all those hatch areas signifying the best soils; some are underlain by developed lands and some by crop and pasture lands. Although some of these soils are located in western Orange, most are located in the eastern two thirds of the community scattered quite evenly across both southern and northern Orange.

The prime farmland soils in southern Orange are found in six main areas: on the Athol town line, north of East River Street, Walnut Hill Road, Eagleville Road, Hunt Farm, and the base of the western aspect of Magoon Hill. Near the Athol town line there is an area bisected by Route 2A that represents portions of the floodplains of both the East Branch of the Tully River and Millers River. A significant portion of this land is already developed. The same is true for the area across from the airport, between Route 2 and 2A just west of East River Street and Millers River. There is a band of farmland soils that traverses from the site of the water tank on Lake Mattawa Road, just south of the Village Residential District, to the eastern side of Walnut Hill Road. While development has occurred, a portion of these soils are still being used for pasture. In between Eagleville and Horton Roads and Lake Rohunta/Eagleville Pond there is another large patch of prime farmland soils that is predominantly forestland managed under a Chapter 61 forest management plan. The Hunt Farm, which is located between Route 122 and 202 and the Wendell town line, is on primarily Prime farmland soils, though there is an almost equal portion of soils that are considered of Statewide Importance. At the base of Magoon Hill is a level area that is located just east of the Mattawa Circle development. Like the area near Eagleville Road, these prime farmland soils are on land in the Ch. 61 Forestland Classification and Taxation Program.

In northern Orange much of the prime farmland soils are found on either side of the main roads, which connect, Route 2A to North Orange, including North Main Street, Wheeler Avenue, East Road, and Athol Road. They also include areas along roads that head north into Warwick and Royalston like Main Street and Tully Road. This speaks to the historic role that farming played in the establishment of North Orange where Colonial roads may have taken advantage of Native American foot trails that connected settlements to fields used for crops. It also means that these prime farmland soils are at risk from future development in this portion of Orange through the "Approval-Not-Required" (ANR) roadside development of residential homes.

As will be shown later in Section 5, Inventory of Lands with Conservation and Recreation Interest, Orange currently has very few farmlands that are permanently protected. Unless there is significant effort towards farmland protection in Orange, future residential development may likely replace some of Orange's most scenic and historic landscapes and reduce the amount of available prime farmland.

It is not possible for the Town of Orange to protect all of its farmland, yet there are ample arguments for protecting a significant percentage of the prime farmland soils from development. Farming will be most profitable on the best soils. Farms that remain in operation help to maintain the historical land use patterns that people so commonly relate to pastoral landscapes. The presence of fresh, locally grown produce in roadside farm stands is often taken for granted by residents, until they are gone.

Prime farmland soils can be reclaimed from forestland. Houses, on the other hand, are not a land use from which farming can recover. Once farmland is converted through development to residential uses, its agricultural value is negated and it will likely never be farmland again. Orange fortunately has the opportunity to work with willing landowners to preserve as much of the remaining farmland as possible.

With the issues of global warming and the need for energy conservation, farmland protection becomes more vital. Locally grown and harvested products allow communities to be more self-sufficient and to help to contribute to the reduction of pollution and use of fossil fuels.

Although the level of farming activity in Orange may not be as diverse as can be seen in other farming communities in the region such as Deerfield, the lessons gained by these communities may be of some assistance to the planning process. The Town of Deerfield approved their Master Plan in April 2000. One chapter of their plan focused on farmland and included a process for prioritizing farmland for preservation, with the understanding that the Town did not have the funding to protect every last acre. Residents also understood that their soils were some of the more valuable silty loams in the world. The process used to prioritize the farmland areas of agricultural land by use, location related to other protected land and critical natural resources, the size of the contiguous farmland area, and the threat of conversion to development. What became clear was that some farmland areas were actually the best locations for future residential development. For

Deerfield, these areas are near their South Deerfield Village Center, where sewer and water infrastructure is available and where farmers find it more and more difficult to farm given existing suburban residential development. Is it appropriate to direct Orange's future growth to areas abutting the village centers where municipal services like sewer and water are already provided?

A.3 Topography

The topography of Orange offers unusual hill formations and magnificent local views, as well as low-lying farmland and wetlands. The areas with the least change in elevation occur in the area of the Municipal Airport and in a valley just northeast of Orange Center. The steeper slopes occur along the upland ridges in the west, northwest, and northern portions of Town.

Slopes over 25 percent comprise approximately 15 percent of the landscape in Orange. These steep slopes may create a serious erosion problem if vegetation is removed during construction of residential development or forest product harvesting activities. In addition, actual building costs increase on steep slopes due to the difficulty of construction, engineering and the length of access roads. Development on slopes of 25 percent or more can create a distinct hazard.

These steep slopes are found predominantly in the northern, northwestern, western and southwestern portions of Orange. Also, the majority of the extensive wetland areas in Orange occur at the base of these significant slopes, namely along the eastern aspects of Chestnut, Fall, Beech, and Pitt Hills. This is significant in that the outer ring of hills is also the location of the majority of the protected land in Town. Steep slopes and wetlands are important considerations in planning for recreational uses. Usually, steep slopes and wetlands are resource areas avoided in trail system design due to erosion and habitat considerations. These areas may be more appropriate for hunting and other activities where trails are not a factor. If these areas were to be used with public access in mind, significant investment in funds, materials and time would be required to develop safe and environmentally suitable recreational facilities.

Level areas also have development constraints. Low lying areas tend to have limited viewsheds, which means that they have a limited capacity to gracefully absorb development. This is exacerbated when there is little vegetation to disguise development with visual barriers. Steep slopes at least offer a limited visual distance, especially when covered with vegetation. But development on the tops of hills and ridges is very visible from the valleys below. Views to and from these high points in Orange are highly prized by residents.

A.4 Analysis

From the above inventory it is clear that within the Town of Orange the geology, topography, and soils provide both ecological services (such as crop production and water purification) and cultural amenities (such as scenic views and hiking trails). The remote ridgelines and steep slopes common to the highlands to the north, west, and northwest have helped to limit development, thereby enhancing the habitat value of these areas for flora and fauna. Residents throughout the region appreciate the scenic value of the highlands such as Tully Mountain In addition, the highlands are destination points for hikers and wildlife enthusiasts.

In advance of future large-lot residential development, State conservation agencies are taking advantage of the natural delineations that the Town's geology has created by permanently protecting land from development in those areas that are already remote. The ecological services and cultural amenities that Orange's ridgelines, hills, and soils provide cannot be replaced. They will be diminished, however, with neglect and poor planning. Adopting ridge protection bylaws and exploring ways to facilitate the protection of prime farmland soils will be required if the residents of Orange want to sustain the Town's rural character and a local economy that includes agricultural operations.

B. LANDSCAPE CHARACTER

The Town of Orange as viewed from above is situated in an area of lush forested uplands and rolling hills, all interlaced with diverse water bodies. The terrain is that of the western slope of a basin. The hills to the northwest have a predominantly southeastern aspect, those in the southwest face northeast. And in the middle of this basin the Millers River cuts through the landscape over the more level plains in the east and then dividing the steeper banks of the river in West Orange.

The outstanding and distinctive scenic characteristics of this landscape are best observed by traveling through the different parts of Town. Downtown in Orange Center, on the floodplain of the Millers River, is the heart of the Town's cultural activities as well as the center for most of the community's institutional and economic activities. Today, the Millers River still links Orange Center to its industrial beginnings. The river, waterfall, and red brick mill buildings create a sense of place in Orange Center.

Traveling north on North Main Street one can view the upland ridges of Far Hill and Beech Hill that demarcate the Town's western boundary. The road takes you over gentle rises towards the wetlands referred to as "The Rookery" which is one of several areas known for bird sightings. Beyond The Rookery lies scenic North Orange, the original 18th century settlement, which is home to the few remaining active farms that were first settled in the 1700's. These farms, for the most part, provide only supplementary income

to their owners, today, largely from haymaking operations. North Orange also offers views of Tully Mountain, the most pronounced topographical feature in the North Quabbin Region. Views to and from Tully are among the most significant in the area. Nearby, Tully and Packard Ponds (both man-made) are surrounded by vacation homes.

Traveling south from North Orange down Wheeler Avenue one finds an area of gentle hills and streams that are part of the drainage of West Brook. This area has been called "wild" by area residents but parts are also blanketed with crop and pasture land.

A drive south of Orange Center takes one through the glacial outwash plain, known locally as "The Plains," where the Municipal Airport takes advantage of broad, flat terrain. The nearby lakes, Mattawa and Rohunta/Eagleville are both popular fishing and recreation spots. Continuing south, Orange State Forest and Chestnut Hill provide wildlife habitat and hunting grounds.

B.1 Analysis

Overall, Orange is a forested landscape with small, scattered patches of cropland, surface water, and residential development surrounding a modest area of dense cultural uses collected around and along the east/west running Millers River, which bisects the Town. The scenic values come from forested hills, pastoral landscapes, both flat and fast running sections of the Millers River, and wild views of mountains like Tully Mountain. The value of the landscape for scenic views, wildlife habitat, and recreation could be diminished by development. Cell towers on hilltops, large vacation homes with lots of reflective surfaces, and sprawling conventional subdivisions on former pastureland would also reduce the scenic integrity of the landscape for current and future generations.

Preventing the wholesale destruction of scenic landscapes, by scattered unplanned development and poor design standards, can be accomplished through an active open space protection program and land use controls. For example, zoning techniques can help to direct where cell towers can be placed, limit development along important ridgelines, and control the amount of vegetation that can be removed from slopes. Conservation design bylaws can also help by making protected open space a component of residential development.

Orange residents and officials recognize that land can be protected from development in a number of ways and using different funding mechanisms (see Section 5, page 3). A landowner can donate or sell his or her development rights or, donate or sell the title to the property. Each of these ways can impact public access, control of the land and its management, and the property taxes generated. When accomplished via conservation easements on privately-held land, land protection can result in lands open to the public and on the tax rolls. Not all state agencies that acquire easements promote public access, and not all town-owned properties result in more management control, but typically town-owned conservation land would provide the greatest opportunity for the Town to

control the land's use, its access by the public, and its management regime. On the other hand, if the Town of Orange were to encourage the protection of privately-owned land with conservation easements that fully support public access, the town would be getting the best of both worlds: access and taxes.

C. WATER RESOURCES

C.1 Surface Water

There are 593 acres of surface waters covering nearly three percent (2.8%) of the surface area of the Town of Orange, which is situated almost entirely within the Millers River Watershed. Only a small portion of Town south of Lake Mattawa Road and Chestnut Hill Road is in the Swift River Watershed. The Swift River Watershed is part of the Quabbin Reservoir System and is therefore considered in its entirety one of the Commonwealth's Outstanding Resource Waters. It should be noted that this portion of the Swift River Watershed may be a future priority for land protection by the Massachusetts Department of Conservation and Recreation (DCR), the agency responsible for managing this public water supply. Also, the waters of the Swift River in Orange may be needed by the Town in the future. Orange's access to the land and water should perhaps be considered and discussed with the DCR before it becomes an issue.

C.1.1 Millers River

The downtown area of Orange is located on the Millers River, which runs roughly east-west, and is fed by the Tully River, Foothill Brook, Orcutt Brook, Darling Brook, Moss Brook, and other small inlets. The stretch of the river that passes through Orange has been classified as a warm water fishery, and for primary and secondary recreation uses by the Massachusetts Division of Water Pollution Control (MDWPC, Water Quality Survey Data: Millers River Basin, 1987.)

The Millers River has significant value to the residents of Orange. Orange Center's development was historically based on Millers River waterpower, which is evidenced by the waterfall and mill brick buildings. Today, the value of the Millers River is primarily recreational. It is one of the best catch-and-release rivers in the State. Catch-and-release rivers are especially popular among anglers because the fish are available and remain stocked year round. The Millers River also contains the proper habitat for several state-listed freshwater mussel species and three species of Special Concern, the four-toed salamander and the spotted and wood turtles.

Public access to the Millers River in Orange has dramatically improved. The new Orange Riverfront Park on East River Street, which replaced the town highway barn and includes a ramp for non-motorized boats, and another put-in for larger water craft on trailers further along on East River Street, provide easy access to the River. Riverfront Park is great new place for the finish to the Millers River Rat Race, the most important

annual celebration of the Millers River, which takes place each spring, between the two centers of Athol and Orange. And, people who want to practice a bit before the race now have two easy access points to the River.

Area municipal officials and residents have worked hard to improve the water quality of the Millers River since the days when raw sewage was discharged from area homes and industries directly into the river. Water quality information is included in this section because the future recreational potential for the Millers River may in part depend on continued improvements.

The water quality of the Millers River has been the subject of over fifty years of research by state and private agencies. 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.

Between 1973 and 1977 eight wastewater treatment plants were constructed at sites along the Millers River. In spite of this, toxicity tests in 1987 found that four of the eight (Athol, Orange, South Royalston, and Winchendon) demonstrated acute toxicity, which Massachusetts Department of Environmental Protection (DEP) thought to be chlorine. In addition, testing of fish caught in the Millers River basin between 1995 and 1997 has identified problems of polychlorinated biphenyl or PCB contamination resulting in fish advisories by the Massachusetts Department of Public Health. Although the river is considered Class "B", appropriate for fishing and swimming, consumption of fish caught there is not advisable. 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.

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 (*Orange is below the*

confluence of 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."

During the summer and fall of 1999, the U.S. Geological Survey measured polychlorinated biphenyl (PCB) concentrations in passive samplers deployed in the Millers River Basin in Massachusetts. The observed PCB concentrations pattern changes indicated a historical release of PCBs likely occurred on the Otter River at the upstream margin of Baldwinville, Massachusetts. PCB concentrations decreased significantly downstream of the confluence of the Otter River with the Millers River because of dilution of Otter River water with mostly uncontaminated water from the Millers River and volatilization of PCBs in steep reaches of the Millers River. The PCB load in the Millers River was relatively small compared with PCB loads in other PCB-contaminated rivers in the Northeast. The likely source of PCBs in the Millers River Basin is the remobilization of PCBs associated with stream sediments. PCBs deposited on the sediment likely originated from an upstream source. Estimated concentrations of PCBs in water throughout the main stems of the Millers and Otter Rivers exceeded the U.S. Environmental Protection Agency's water-quality criterion, which is based on the cancer risk associated with eating fish taken from the water. PCB concentrations detected in indicator fish (white suckers; Catostomus commersoni) sampled in 2000 were four times less than concentrations detected in the same species sampled in 1985-88.

In January 2003, DEP updated the Non-point Source Action Strategy for the Millers River Basin. In it, the 17.5 miles segment of the Millers River which runs from South Royalston to the Erving Paper Co. is described as being having issues of “unknown toxicity, priority organics, metals, nutrients, pathogens…Department of Public Health fish advisory is in effect for this segment due to Mercury and PCBs in fish flesh.”

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 severe cases, PCBs collect together into contaminant plumes where they slowly move through sediments like oil. Dredging may be the best solution in this situation. However, dredging is very expensive and can end up mixing contaminated sediments throughout the river ecosystem. Where the contamination is not severe, allowing river sediments to bury the PCBs naturally may be more reasonable. Until the PCBs are cleaned up, the wildlife, fisheries, and recreational benefits of the Millers River will never be fully realized.

A summary of the water quality testing results presented in the Millers River Watershed Assessment Report is listed in Table 4-1. The summary information includes the sections of the Millers River that were evaluated (location), the toxicity test results in regards to aquatic life, fish consumption, and primary and secondary human contact, and the overall ranking of the river segment as defined by its presence on the Massachusetts Integrated List of Waters (CWA Sections 303d and 305b).

Table 4-1: Summary Table of Testing Results for the Millers River

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 *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.*	Non-Support *High levels of mercury and polychlorinated biphenyls (PCB's)*	Not Assessed	Not Assessed	Class B *This two - mile segment should remain on the 303(d) list of impaired water bodies based on Dept. of Health Fish Advisory*
Millers River from Winchendon Wastewater Treatment Plant To confluence with Otter Brook (5.3 miles)	Non-Support *EPA chronic toxicity tests showed no survival in fathead minnows, which is interpreted as "not supporting" the aquatic life use. Effluent acute toxicity indicated one out of ten exceedences so the facility is considered to be meeting permit limits. It is suspected that water quality problems (low pH) are related to atmospheric deposition.*	Non-Support *High levels of mercury and polychlorinated biphenyls (PCB's)*	Not Assessed	Not Assessed	Class B *This segment should remain on the 303(d) list of impaired water bodies*
Millers River from the confluence with Otter Brook to a USGS gage station in South Royalston (4.8 miles)	Not Assessed	Non-Support *High levels of mercury and polychlorinated biphenyls (PCB's)*	Not Assessed	Not Assessed	Class B *This segment should remain on the 303(d) list of impaired water bodies*
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) *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.*	Non-Support *High levels of mercury and polychlorinated biphenyls (PCB's)*	Not Assessed	Not Assessed	Class B *This segment should remain on the 303(d) list of impaired water bodies based on Dept. of Health Fish Advisory*
Millers River from Erving Paper Company to confluence with the Connecticut River (8.1 miles)	Full Support *Although levels of aluminum, copper, and lead exceeded criteria several times, the chronic toxicity test showed no significant toxic effects and so the segment is listed as "full support" for the aquatic life use.*	Non-Support *High levels of mercury and polychlorinated biphenyls (PCB's)*	Not Assessed	Not Assessed	Class B *This segment should remain on the 303(d) list of impaired water bodies based on Dept. of Health Fish Advisory*

Source: 1995 DRAFT Millers River Watershed Assessment Report; Massachusetts Department of Environmental Protection.

The information on the Millers River in the 2006 draft Massachusetts Integrated List of Waters[1] prepared by the Department of Environmental Protection is shown in Table 4-2 below. The Millers River is one of the water bodies in the state which requires TMDLs. A TMDL, or a Total Maximum Daily Load, is a calculation of the maximum amount of a pollutant that a water body can receive and still meet water quality standards, and an allocation of that amount to the pollutant's sources.

Table 4-2: The Massachusetts Draft 2006 303d List for the Millers River: All Segments Requiring TMDLs (Pollutant Needing a Total Maximum Daily Load)

Name	Segment ID	Description	Size	Pollutant Needing TMDL [EPA Approval Date Document Control Number]
East Branch Tully River (3523275)	MA35-12_2006	Confluence of Tully Brook and Falls Brook in Royalston State Forest, Royalston through Long Pond and Tully Lake to confluence with the West Branch Tully River forming headwaters Tully River, Orange/Athol.	10.0 miles	-Priority organics -Metals
Lake Rohunta/Eagleville Pond (35070)	MA35-70_2006	(Middle Basin) Athol/Orange/New Salem	209 acres	-Metals {Hg-CN176.0} -Noxious aquatic plants -(Exotic species*)
Tully River (3523150)	MA35-14_2006	Confluence East and West Branches Tully River, Orange/Athol to confluence with Millers River, Athol.	1.6 miles	-Priority organics -Metals
West Branch Tully River (3523175)	MA35-11_2006	Outlet Sheomet Lake, Warwick to confluence with East Branch Tully River forming headwaters Tully River, Orange/Athol.	6.6 miles	-Priority organics -Metals

April, 2006 (3) 114 * - non Pollutant
Proposed Massachusetts Year 2006 Integrated List of Waters [ ] – TMDL (Restorative)
CN 262.0 { } – Other Pollution Controls < > – TMDL (Protective)

Notes:

Unknown Toxicity: Used where the results of toxicity tests performed on ambient water or sediment indicate in-stream toxicity but the cause is unknown, or where the condition of the benthic invertebrate community is indicative of a toxic response.

Priority organics: Usually PCB in fish tissue or sediments, sometimes PAH in sediments or associated with waste sites.

Metals: Often mercury in fish tissue; also includes metal-contaminated sediments.

Nutrients: Often used when response indicators such as algae blooms indicate eutrophication; usually refers to phosphorus in fresh waters and nitrogen in coastal embayments.

Pathogens: Disease-causing agents, which can be in the form of bacteria.

The 2006 draft DEP Integrated List of Waters (303d List) is used as a source document for the Millers River and all listed surface waters within the Town of Orange. Section

[1] In 2004, the EPA required Massachusetts to combine Section 303(d) and 305(b) listings into one report, called the Integrated List of Waters. The listings of water bodies in need of TMDLs is the 303(d) listing.

303(d) is part of the Federal Clean Water Act requirements. The State is required by the United States Environmental Protection Agency to identify those water bodies that are not expected to meet surface water quality standards after the implementation of technology-based controls. The sources of impairment are identified for some of the surface waters identified in this section.

C.1.2 Other Rivers and Brooks

First and second order streams play an important role in Orange. Within a watershed, the first and second order streams and brooks provide a diversity of wildlife and fisheries habitat, scenery, and recreational opportunities. Each watershed contains a network of these small channels, known as headwater streams, which represent a majority of the drainage network and are exceptionally vulnerable to development within the watershed.

A number of these rivers and streams have habitat for rare and endangered species that are affected by pollution and can be protected through good open space management and acquisition of lands where these bellwether species exist. (See Rare and Endangered Species Table for Orange in Section E. Fisheries and Wildlife.)

The following inventory describes Orange's streams and brooks, focusing on the extent of the public access and recreational value (*See Water Resources Map*). The 2006 Massachusetts Integrated List of Waters includes the East and West Branches of the Tully River, the Tully River and Lake Rohunta/Eagleville Pond. In each case, the most severe pollutant is identified. Although the affected water bodies may contain other pollutants, the Integrated List of Waters (303(d) list) only includes the results of evaluations upon which DEP has performed some measure of quality control.

- Tully River:

  West Branch: One can walk to most locations along the brook on old fishing trails, which may be accessed by way of road crossings. The West Branch of the Tully River is stocked with brook trout at all bridge crossings. The Massachusetts Integrated List of Waters includes priority organics and metals as the main pollutants and stressors for this river. However, the West Branch also supports a variety of freshwater mussels, including several state-listed species. Marshes located within its backwaters also contain the four-toed salamander, a species of Special Concern in Massachusetts.

  East Branch: This is an excellent cold-water fishery that is also stocked with trout. Access to the river for fishing is most easily gained along its eastern bank in Athol. The Massachusetts Section 303(d) list includes priority organics and metals as the main pollutants and stressors for this river.

- Fall Hill Brook:

  Fall Hill Brook drains the southwestern slopes of Beech Hill and the wildlife preserve off of North Main Street. This area was once known for its great fishing and hunting; however a beaver dam located just north of Dexter Street has flooded the land all the way to Pine Hill Road. The resulting swamp has diminished the recreation value for fishing and hunting along this brook.

- Orcutt Brook:

  This brook is located in West Orange and is a good trout-fishing brook. Access can be gained by way of Warwick Road into Harris Pond, just east of the road. However Harris Pond is privately owned and public access is not guaranteed. According to the Massachusetts Division of Fisheries and Wildlife, Orcutt Brook supports a variety of freshwater mussels, including several state-listed species. Marshes located within its backwaters also contain the four-toed salamander, a species of Special Concern in Massachusetts.

- Moss Brook:

  Moss Brook flows out of Laurel Lake. The confluence of the Moss and Darling Brooks is located north in Warwick. This brook is another good trout fishery, which has been shown to respond well to liming which decreases the pH of the water.

- Poor Farm Brook and West Brook:

  Poor Farm Brook flows out of Warwick leaving Johnsonian Pond as a mere trickle of water. The brook is stocked with trout south of Williams Pond. Poor Farm Brook joins with West Brook north of Wheeler Avenue. West Brook is also stocked with trout and is considered a good fishery with excellent access by way of old fishing trails.

- North Pond Brook:

  North Pond Brook leaves the outlet at the northern end of Lake Mattawa and flows northward towards the Millers River. Between the Lake and the River are several small ponds, three public water supply sources, a high yield aquifer, and the recharge area for the two community public water supply sources. Access to the brook can be gained by way of Town-owned land that has frontage along Holtshire Road.

C.1.1 Lakes and Ponds

The major water bodies in Orange are Lake Mattawa, Lake Rohunta/Eagleville Pond, Tully Pond, and Packard Pond. These areas offer fishing, boating, swimming, and winter recreation opportunities.

- Lake Mattawa

  Located in southern Orange within the Chicopee River Watershed, Lake Mattawa is one of the premier trout and land locked salmon fisheries in Massachusetts. Anyone can access three sides of the lake by way of Mattawa Road, Holtshire Road, and the boat ramp at the northern end of the Lake. Lake Mattawa is also considered one of three Class A water sources in the Town of Orange.

- Lake Rohunta/Eagleville Pond

  In the southeastern corner of Orange along its shared boundary with the Town of Athol, there is a long lake, which is bisected by Route 2. North of Route 2, the lake is referred to as Lake Rohunta. South of the State highway it is called Eagleville Pond. According to a Division of Fisheries and Wildlife official, a dam located on the northern end of Lake Rohunta was built by the Rodney Hunt Company to provide power for its operation in Orange Center. An abandoned power station can be seen at the corner of Daniel Shays Highway and East River Street. This lake is an excellent resource water for fishing, canoeing and kayaking. A public boat ramp is located off of Eagleville Road at its northern end. The Massachusetts Integrated List of Waters (Section 303(d)) list includes noxious aquatic plants and metals as the main stressors for this lake. Noxious plants impair water quality when native and non-native species are present in such a quantity that it retards other uses for the body of water.

- Tully and Packard Ponds

  In the 1800's many manufactured goods were packed in white pine boxes. People built dams on rivers for the sole purpose of creating ponds to produce waterpower. Tully and Packard Ponds were originally dammed for milling white pine logs. Now however, these ponds are surrounded by private homes. The main difference between the ponds is in their depth. Tully Pond is popular for boating and some fishing. Water lilies were visible covering a quarter of the water's surface in the summer of 2007. Car-top boats are often put in from the causeway on Royalston Road or off the dam near the intersection of Tully Road and Mountain Road because there is no other public access. Packard Pond is a deeper pond that is also surrounded by private homes. This pond is popular for boating and fishing but is privately owned with no public access

C.1.4 Other Ponds and Small Bodies of Water

- Division of Fisheries and Wildlife Management Area

  Located near the intersection of North Main Street and Oxbow Road this wildlife area is mostly wetland with some open water. Its main recreational value is for wildlife viewing, birding, hunting, canoeing and kayaking. Access to the open water can be gained from North Main Street.

- William's Pond

  This pond is part of Poor Farm Brook, which begins at the privately held Johnsonian Pond, on the border between Warwick and Orange. Poor Farm Brook is quite slow and shallow to William's Pond but then gains in volume as it runs into the West Branch of the Tully River. This pond is located between North Main Street, Main Street, and Wheeler's Pond Road. This small pond is stocked with trout yearly. There is no guaranteed public access to the pond.

- White's Pond

  This pond is located in North Orange north of North Main Street and west of Flagg Road. It is completely surrounded on all sides by privately held land which has a conservation restriction attached to its deed; thus, White's Pond is permanently protected from development. Because it is a private pond with no public access, its main public value resides in its wildlife habitat.

- Cook's Cove

  This is a unique body of water that is an overflow water body for the Millers River. It is located on the southern bank of the Millers and along the Town's border with Athol. According to a State conservation official, the Cove has great ecological and recreational value that is mostly unrealized due to its poor access. Currently, the Cove can be most easily reached in back of the trailer park on Pine Grove Road, though one needs permission to cross the park's land. Cook's Cove is part of the same wetland system as Eagleville Lake and Lake Rohunta.

C.2 Class A Water Sources

According to the Orange Water Department there have not been any active surface water supplies since 1980, when the Town was directed to build the covered drinking water storage tanks. Prior to that time there were three impoundments that had in the past been used as surface drinking water supplies. The first is called Crystal Springs and is located north of North Pond Brook pond, in an area that is identified on old USGS topographical maps as "filtration plant." The second is called Vorces Pond and is located across the street from the northwest corner of Lake Mattawa. The third is Lake Mattawa, which has not been used as a surface water supply since 1933. To utilize any of these surface water bodies as a drinking water supply, an investment of five to eight million dollars would be required to construct an adequate surface water filtration facility.

C.3 Flood Hazard Areas

One hundred year flood plains in Orange occur in several places, including along the length of the Millers River, around Lake Rohunta, and along the Tully River, Cheney, Poor Farm, and West Brooks, and Coolidge Swamp. A one hundred year flood plain indicates that every year there is a 1% chance that a catastrophic flood will occur. In 1936, and again in 1939, Orange experienced severe flooding that resulted in large property losses, both public and private. According to current zoning by-laws, building within the one hundred year flood plain in Orange is allowed by special permit only.

C.4 Wetlands

Orange has a large number of wetlands, particularly to the east and west of the Temple Hill ridge in North Orange, and to the west and north of Tully Mountain (see the Water Resources Map). Other significant systems are located north of the downtown area, and to the east of Fall Hill, Beech Hill, and the connecting ridge line; and, between Chestnut Hill and North Pond Ridge, running north to south from Chestnut Hill Road to Neilson Road (just outside the Town limits.)

Most of the wetlands in Orange are forested and many are the result of beaver activity, which is indicated by the presence of dead trees. One such wetland, Coolidge Swamp (north and west of Lake Mattawa), is of particular interest because it provides a large beneficial habitat for many wetland and forest animals, bird, and plant species; a heron rookery; as well as scenic views and opportunities for recreation. Other important wetlands include: the heron rookery off North Main Street, a black ash forest along the Millers River, and the black gum swamp located east of Chestnut Hill Lower Road. The last two areas are covered in more detail in the Scenic and Unique Resources part of this section.

C.5 Aquifers

Water plays a very important role in supporting our communities. We use a lot of water every day for drinking, for disposal of our sewage, for irrigating croplands and lawns and for our local industries. The amount of money we, as individuals, pay for our clean drinking water depends on its supply and the amount of effort that is invested in purifying it. Surface reservoirs often require expensive filtration plants that are monitored regularly by paid professionals. In comparison, aquifers contain water that enters the soils within a sub-watershed as precipitation and which slowly infiltrates the ground water levels. This slow infiltration process helps to purify the water at little cost to the consumer. This is one way in which watersheds in their natural, vegetated state provide a valuable ecological service. Land naturally contributes to the hydrologic cycle by storing and releasing water. However, the manner in which we use land can hinder this ecological process by preventing water from infiltrating topsoil and by allowing

contaminated water to leach into the groundwater. Protected open space can help protect the integrity of aquifers by sustaining the land's natural water retention capacity and by reducing the areas covered by land uses, which may store, use, or distribute hazardous materials.

The quality and the quantity of the water within Orange's aquifers will have the greatest impact on the Town's future growth potential. Because the Town of Orange's drinking water supplies appear to be ample, the community may have the ability to better attract industries that require water for their manufacturing processes (See Water Resources in this section).

The Town of Orange has three community public water supply sources, which are active gravel-packed groundwater wells. Lake Mattawa is considered as a surface water supply for emergency purposes only. Well #1 is located off of Holtshire Road on land owned by the Town of Orange. Well #2 is located just south of the Millers River in West Orange off of West River Road. Well #3 is located due east of the intersection of Route 202 and Route 122 near the Town's border with New Salem. Well #1, the oldest well, which is manually operated, is strictly used as a backup water source to Wells #2 and #3.

Bruce Merriam of the Orange Water Department reported that Well #4, which was proposed in 2002, has not been drilled. The Town is still attempting to acquire the land in West Orange. He also indicated that no other by laws or water measures have been implemented since 2002.

In July of 1994, the Orange Water Department was granted a permit to withdraw water based on a set schedule over a twenty-year period. According to Nancy Caffel of the Massachusetts Department of Environmental Protection, the Orange Water Department's twenty-year permit is for the years 1993 to 2013. For the first five-year period the permit allowed the Water Department to withdraw, on an average annual daily basis, 270,000 gallons beyond their registered withdrawal amount of 630,000 gallons. After each five year period the amount permitted is reviewed by DEP to determine if the withdrawal volume was adequate in light of actual population increases. For the second five-year period, 1998 to 2003, the permit allows the Water Department to withdraw, on an average annual daily basis, 300,000 gallons beyond their registered volume, or a total of 930,000 gallons per day.

As of 2004, the average annual daily use for the entire Orange public drinking water distribution system was approximately 535,000 gallons per day. Well #3 was responsible for providing 81 percent of this amount or 433,000 gallons per day, which was approximately half of its safe yield (837,000 gallons per day).

The safe yield of a well is equal to the amount of water that could be pumped on a daily basis, during an extended drought (180 days) without reducing the capacity of the well. Well #2 provided around 19 percent of the daily demand (102,000 gallons per day), which was approximately 20 percent of its safe yield (520,000 gallons per day).

Well #1 is rarely used due to an historic high iron content problem, though its safe yield is 360,000 gallons per day. Therefore, if you add up all of the water supplies and compare this number with its permitted withdrawal, the Town of Orange's current demand for publicly supplied drinking water is far below its capacity.

Wells tap into the underground water supplies called aquifers that are recharged from precipitation. There are two Department of Environmental Protection (DEP) Approved Zone II Aquifer Protection Recharge Areas: one for Wells #1 and #2 and one for Well #3 (blue solid on the Water Resources Map). The recharge area for Wells #1 and #2 stretches from the north bank of the Millers River south along North Pond Brook. There are two types of aquifers that are linked to this recharge area. One is a high yield aquifer that could potentially provide water at a rate of fifty to two hundred gallons per minute.

The high yield aquifer (in dark blue on the Water Resources Map), which provides water to Wells #1 and #2, is situated in a narrow band between the Millers River and Butterfield Park and west of North Pond Brook and east of Holtshire Road. The low yield aquifer (in light blue on the Water Resources Map) could potentially provide drinking water at a rate below fifty gallons per minute. This is part of a much larger low yield aquifer, which runs north to the Millers River and south, surrounding Lake Mattwa, to New Salem.

Well #3 also accesses a low yield aquifer (in light blue on the Water Resources Map) that stretches north to South Orange and east past Lake Rohunta into Athol. The recharge area for Well #3 is defined in the Water Resources Map as an area that lies mostly east of Route 122 and South of Route 2. This recharge area extends south well into New Salem.

Traces of trichloroethylene (TCE) were detected in Well #3 in the range of 2.8 ppb (parts per billion.) Although this is not a dangerous level (wells cannot be used if levels exceed 5 ppb on a quarterly basis), the presence of this chemical raises concern for potential hazards. The Massachusetts Department of Environmental Protection did an extensive survey and, according to the Orange Water Department (D. Kilhart; 2000) could not find any potential source for the contaminant.

Low yield aquifers also exist surrounding Moss and Orcutt Brooks in West Orange, West Brook, and the West and East Branches of the Tully River as well as Tully and Packard Ponds. There is also a large high yield aquifer, which follows the West Branch of the Tully River from the Millers River to the confluence of Fish Brook.

C.6 Analysis

A healthy watershed can cycle water from precipitation, to vegetation and soil, to groundwater, to aquifers, ponds, streams, and lakes, and finally back to the atmosphere. A healthy watershed holds enough clean water in all of its surface waters and ground waters to support the native plant and animal life. Our presence within the watershed impacts the hydrologic cycle, which defines the natural flow of water from the

atmosphere, to the ground and back, and needs to be tempered. The ways we manage our demand for water and uses of the land within the watershed should work to minimize impacts on the hydrologic cycle.

An ailing watershed may demonstrate problems with both the quality and quantity of water within surface and ground waters. The sources of contamination that place the Millers and Tully Rivers on the Massachusetts 2006 Integrated List of Waters (303(d) list) are priority organics and heavy metals. These include PCB's and mercury. In both cases, these contaminants are most likely from sources outside of Orange. The solutions to these water quality issues must be addressed on a watershed level. Now that there is no longer a Massachusetts Watershed Initiative, the Millers River Watershed Council could work together with the communities in the region, and perhaps in concert with the Connecticut River Watershed Council, to urge and work with the Department of Conservation and Recreation, to address the issue of PCBs and mercury.

Lake Rohunta is on the on the Massachusetts Integrated List of Waters list due in part to the presence of large populations of noxious plants. Normally these are non-native aquatic plants that are present due to heightened levels of nutrients, which may be leaching from fertilized lawns or, from failing on-site septic systems. These are examples of non-point source pollution that the Town of Orange can address through regulating land uses around wetlands and surface waters.

Non-point source pollution in Orange can also impact drinking water. There is a direct link between above ground land use and below ground water quality. For example, lawns actually facilitate the movement of rainwater across the ground's surface instead of providing an easy entry point to the soil. Pavement produces even more runoff because it is impervious. Normally, as a community grows the amount of impervious surfaces increase. When precipitation runs off a surface like asphalt, the rainwater may pick up and carry contaminants into streams, ponds, lakes, and into the groundwater. Some of the groundwater moves through subsurface soil layers into streams, while other seeps down into water-filled gravel layers called aquifers.

The drinking water wells in Orange tap into aquifers. Thus, Orange should adopt practices that minimize the percentage of impervious surfaces in Town and find ways to encourage people and businesses to be aware of, and work to minimize, all of the potential origins of non-point source pollution. The Town of Orange should also work with the Millers River Watershed Council in establishing a water quality-monitoring program for their brooks, ponds, and lakes. Finally, the Town should try to minimize the amount of impervious cover and find ways of diverting storm water runoff to retention areas so sediments and highway related pollutants can settle out before being transported to surface and ground waters. The Town installed the new Riverfront Park in 2006 which shows numerous Low Impact Development (LID) techniques that developers, and owners of commercial and residential properties can use to improve and reduce the amount of impervious surfaces in Orange that hamper the flow of stormwater.

The quantity of water that is available within the watershed is not a stable figure. For instance, as the percentage of impervious surfaces increases the quantity of water that is available for consumption decreases because more of the water that should be entering the ground water is being quickly whisked away to surface waters. Also, as the demand for water for industrial processing and human consumption increases, this further limits the supply. In Section 3, Community Setting, the build out analysis showed that the demand for drinking water could go as high as an additional two and a half million gallons per day. The safe yield for their current system is approximately 1,717,000 gallons per day. Therefore, tapping other aquifers in abutting sub watersheds would probably be required. What would this level of water consumption do to stream and wetland levels? Also, how would it affect the availability of water from the Swift River which is part of the Quabbin Reservoir system? In fact the build-out analysis shows that by allowing unlimited residential development in Orange, both the quality and the quantity of water will be compromised.

New standards for development could require the use of low impact development techniques in new developments and when property owners go to retrofit buildings or redevelop parking areas or drive configurations.

Permanently protecting critical parcels of land from development is the most important thing the Town of Orange can do to:

- minimize the percentage of impervious surfaces,
- maximize the amount of available surface and ground water,
- improve the quality of all water, and
- ensure public access to rivers and streams.

D. VEGETATION

The Town of Orange has vegetative cover types that are consistent with other areas in the Millers River Watershed in that they are made up of large uninterrupted patches of second- and third-growth forests; agricultural lands; forested wetlands; and tree canopies fragmented from residential development. Based on the MassGIS 1971 land use data layer, forest covered approximately 12,898 acres, which was 60 percent of the entire land area in Orange. By 1997, there were 558 less acres of forest, or a drop of almost 3 percent.

Orange is situated in north central Massachusetts, which is in the Transition Hardwoods-White Pine Forest Region (USDA; 1992). Northern hardwoods including yellow and paper birches, American beech, and sugar and red maple, are the major species, while northern red oak and hickories are found on the warmer and drier sites. Eastern hemlock is found on the cooler sites while white pine is characteristic of the well-drained sandy sites. Red maple and black ash can be found on the poorly drained sites. The transition

hardwoods-white pine forest type commonly occurs up to an elevation of 1,500 feet above sea level in upland central Massachusetts and southern New Hampshire, northward through the Connecticut River Valley.

Orange currently has many large patches of interior forest, which when combined with forest edges, fields, early successional tree growth, wetlands, and riparian corridors, are best for maximizing regional biodiversity. Larger contiguous patches provide more interior area for deep forest-dwelling species. Larger patches are also important for the more specialized species that cannot survive with excessive disturbances from outside factors, and that rely on other interior species for food. The interior areas provide habitat for specialist predators and larger mammals that require larger home ranges. This species diversity in turn attracts more wildlife, which in turn contributes to the overall health of the system.

There are two unusual forest types in the Town of Orange that merit discussion: a black gum community in southwestern Orange on top of North Pond Ridge and a black ash stand near Cook's Cove, which is south of the Millers River along the Town's border with Athol. Black gum (*Nyssa sylvatica*) swamps usually occur on mineral, shallow muck, or peat soils that are either seasonally flooded to saturated. These swamps occur in depressions where the water seeps from groundwater, rainwater, or seasonal intermittent streams. In the Quabbin watershed, swamps dominated by black gum are rare or non-existent. Certain rare mammals (southern bog lemming and water shrew), birds (Cooper's and Sharp-shinned hawks), amphibians (Blue-spotted, Four-toed, Jefferson, and Marbled salamanders), and reptiles (Spotted and Wood turtles) are common to black gum swamps.

The second unusual forest community in the Town of Orange is a black ash (*Fraxinus nigra*) stand located within a red maple swamp adjacent to Cook's Cove. This potentially unique community type was identified in the Millers River Greenway Natural Resources Inventory Final Report prepared in 1997 by Hickler and Small. Red maple also occurs with larger trees but at a much lower density than the black ash. Other tree species include yellow birch and eastern hemlock. The black ash trees range in size from saplings to trees up to nine inches in diameter. The shrub and herbaceous layers are composed of alder, red osier dogwood, tussock sedge and sensitive fern. Although black ash is not itself a rare tree species for this region, it is generally found as a component of other stands along seeps and the borders of swamps.

The Town of Orange has extensive forestlands near Chestnut Hill and in northwest Orange. This should translate into hunting grounds and linkages between protected open spaces that may provide opportunities for hiking and wildlife viewing. These values depend on the accessibility of the land, whether the land is privately or publicly owned.

As the Town of Orange proceeds to work to protect forestland for its multiple values, the differences between public and private ownership will become important. Protected land held in private ownership may ensure that there is wildlife habitat, the potential for working forests to continue to produce timber, income for the landowner, and property

taxes for the Town. Public ownership helps to ensure public access to these resources for recreational activities and may also provide payments in lieu of taxes for the Town. The Town of Orange should consider this network of healthy forests, and these areas of interior forest as most important for protection.

The vegetative covers of wetlands, riverine, and lake/pond areas in Orange are typical of wetlands and water bodies in western Massachusetts. These areas increase the overall biodiversity of the Town and region by providing a great variety of important habitat types. The vegetation that lines these shores and grows in the water is important to the health of the water bodies. It also provides crucial habitat for edge species where water and land meet. This habitat is enhanced because the plants that grow there reduce bank erosion and keep the nutrient and oxygen levels of the water in balance.

Pasture and crop lands are also important vegetation types for Orange. In 1997, cropland represented 19 percent of the Town's total land area, while pasture and orchards together covered about 2 percent cropland and pasture accommodate the majority of game species, both within the parcels and along their edges. Pastures provide important habitat for many bird and insect species, which are important to the residents who enjoy observing wildlife as a recreational activity. These values underscore the benefits of keeping existing farmlands in production and maintaining pasture and orchards. They are important for food production, which is part of the local economy, for recreation, and for their significant historical and scenic landscapes that contribute to the Town's rural character.

A third unique vegetated area is the Orange Municipal Airport. According to the Division of Fisheries and Wildlife (DFW), Natural Heritage and Endangered Species Program, the Orange Municipal Airport supports species of grassland birds, some of which are rare in the state. They consider the current management to be appropriate to maintain the grassland birds and the vegetation they depend on. DFW encourages the Town to recognize the wildlife value of the airport and to continue the current stewardship.

D.1 Rare and Endangered Plant Species

Although the Massachusetts Division of Fisheries and Wildlife have rare plant records from early on in the 20th Century from Orange, they did not specify where in Town they occurred. In addition, these species have not been rediscovered in likely habitats. According to the state agency, species appear to have been lost in Town in the past century. The muskflower *(Mimulus moschatus (Dougl.))*, which is Threatened and the New England blazing star (*Liatris Scariosa var. novae-angliae*), of Special Concern, were last reported in 1910 and 1932, respectively.

Other rare plants listed by the Division of Fisheries and Wildlife include:

Scientific Name	Common Name	MESA Status	Most Recent Observation
Potamogeton diversifolius	Variable Pondweed	E	2002
Viola adunca	Sand Violet	SC	2003
Mimulus moschatus	Muskflower	E	1910
Clematis occidentalis	Purple Clematis	SC	2003
Adlumia fungosa	Climbing Fumitory	SC	2005
Liatris scariosa var. novae-angliae	New England Blazing Star	SC	1931

SC – Special Concern; WL – Watch List; E – Endangered.

D.2 Analysis

Vegetation covers the soil as trees, grasslands, cropland, and orchards. It is a significant component of any ecosystem, habitat, landscape, aquifer, or wellhead recharge area in Orange. Forests cover a large portion of Orange's land surface. Large areas of contiguous forestland provide habitat for a wide variety of wildlife species, game and non-game, generalist species and those that require specific habitat types. Forests also protect the tributaries of the Town's coldwater fisheries. Forests also represent significant scenic backdrop to every activity in Town. Orange officials should explore ways of ensuring that the forestland owners who want to manage their land to enhance biodiversity or to produce regular income from timber harvesting, get the support they require to do so. Anything that continues to engage landowners in the stewardship of their forestland in a meaningful way will help to keep that land in its natural state.

Supporting agricultural activities in Orange will have the same effect. By aiding local farmers through local tax incentives, purchasing farmland development rights, or establishing buy local or agri-tourism campaigns, the remaining farmers in Orange could continue to farm and might be able to sell or lease their lands to young farmers when they are ready to retire. By helping to conserve the remaining prime farmland soils the Town will retain its agricultural heritage, its historically significant landscapes, its hunting grounds, and grassland, meadow, and open space habitats that are quite different than the more extensive forestland.

Every town in America has a few special, unique or unusual habitat areas that provide a rare combination of conditions that result in communities of a kind not found elsewhere. Orange has three unique vegetative communities: the Black Gum Swamp and the Black Ash Type, which are considered natural, and the third, a maintained grassland at the Orange Municipal Airport. Each community provides habitat for a rare collection of wildlife, some of which require access to adjoining habitat areas. The Town of Orange

should seek to protect these special vegetated communities as well as abutting lands for the purposes of maintaining the diversity of life.

E. FISHERIES AND WILDLIFE

Orange contains a large amount of upland and bottomland wildlife habitat. The forests of the Town consist of large unbroken tracts of dense forest that allow for good species movement within Orange and with the surrounding region. The Town still has a sizable number of active agricultural areas, which provide an important ecological function for the maintenance of edge species (those species that require this transitional zone for daily activities.)

The following species of wildlife have been observed in Orange at least once as members of migrating, wintering, or breeding populations. The lists were based on information presented in New England Wildlife: Management of Forested Habitats by R.M. DeGraaf et al., published in 1992, which correlates wildlife with the major forest type in the area. The species are listed by category (amphibians, reptiles, birds, or mammals), then by type of habitat, and then by size of home range. This method has been augmented with information provided by an additional source, the Wildlife Habitat Analysis of the Chestnut Hill Project. The Biodiversity Days Spring 2000 Survey results for Orange are included in the appendix. However, even with these additional sources, it is by no means a complete inventory of all species that may be found in Orange.

E.1 Amphibians

These species are found in forest, wetland, and open upland habitats and require a home range 1-10 acres in size:

Red-spotted Newt	Northern Two-lined Salamander	Pickerel Frog
Northern Dusky Salamander	Eastern American Toad	Bullfrog
Redback Salamander	Fowler's Toad	Green Frog
Four-toed Salamander	Northern Spring Peeper	Wood Frog
		Gray Tree Frog

Jefferson Salamander, Blue-spotted Salamander, Tremblay's Salamander, and Northern Spring Salamander may be present.

This species is found in forest habitats and requires a home range 11-50 acres in size:

Spotted Salamander

E.2 Reptiles

These species are found in forest, wetland, and open upland habitats and require a home range 1-10 acres in size:

Wood Turtle
Spotted Turtle
Eastern Painted Turtle
Northern Redbelly Snake
Eastern Garter Snake
Eastern Ribbon Snake
Northern Ring-neck Snake
Northern Water Snake
Northern Black Racer
Eastern Smooth Green Snake

This species is found in forest, wetland, and open upland habitats and requires a home range 11-50 acres in size:

Common Snapping Turtle

This species is found in forest, wetland, and open upland habitats and requires a home range >50 acres in size:

Eastern Milk Snake

E.3 Birds

These species are found in forest /nonforested habitats and require a home range 1-10 acres in size:

Common Goldeneye
Hooded Merganser
Common Merganser
Ruby-throated Hummingbird
Yellow-bellied Sapsucker
Downy Woodpecker
Hairy Woodpecker
Northern Flicker
Eastern Wood-Pewee
Yellow-bellied Flycatcher
Alder Flycatcher
Willow Flycatcher
Least Flycatcher
Eastern Phoebe
Black-capped Chickadee
Boreal Chickadee
Tufted Titmouse

House Wren
Carolina Wren
Winter Wren
Golden Crowned Kinglet
Ruby Crowned Kinglet
Blue-gray Gnatcatcher
Eastern Bluebird
Bobolink
Veery
Hermit Thrush
Wood Thrush
American Robin
Brown Thrasher
Cedar Waxwing
Solitary Vireo
Yellow-throated Vireo
Warbling Vireo
Philadelphia Vireo
Red-eyed Vireo
Blue-winged Warbler
Tennessee Warbler
Nashville Warbler
Northern Parula
Yellow Warbler
Chestnut-sided Warbler
Black-throated Blue Warbler
Yellow-rumped Warbler
Black-throated Green Warbler
Blackburnian Warbler
Prairie Warbler
Blackpoll Warbler
Black-and-White Warbler

American Redstart
Worm-eating Warbler
Ovenbird
Northern Waterthrush
Song Sparrow
Lincoln Sparrow
White-throated Sparrow
Dark-eyed Junco
Common Grackle
Brown-headed Cowbird
Northern Oriole
Rufous-sided Towhee
Purple Finch
Scarlet Tanager
Northern Cardinal
Rose-breasted Grosbeak
Indigo Bunting
Great Crested Flycatcher
Eastern Kingbird
Tree Swallow
Blue Jay
Mourning Warbler
Common Yellowthroat
Wilson's Warbler
Canada Warbler

Chipping Sparrow
Field Sparrow
Grasshopper Sparrow
Henslow's Sparrow
American Goldfinch
Gray Catbird
Great Blue Heron
Green-backed Heron
Wood Duck
American Black Duck
Green-winged Teal
Mallard
Northern Pintail
Blue-winged Teal
American Wigeon
Canvasback
Ring-necked Duck
American Goldfinch
Evening Grosbeak
American Redstart
Red Crossbill
European Starling
Killdeer
Spotted Sandpiper
Common Snipe
Northern Mockingbird
Pied-billed Grebe
American Bittern
Eastern Phoebe
Mourning Dove
Pine Siskin
Northern Waterthrush
Virginia Rail
Eastern Kingbird
Sora

<u>These species are found in forest/nonforested habitats and require a home range 11-50 acres in size</u>:

Ring-necked Pheasant
Ruffed Grouse
Upland Sandpiper
Black-billed Cuckoo
Yellow-billed Cuckoo
Common Nighthawk
Whip-poor Will
Northern Rough-winged Swallow
Bank Swallow
Barn Swallow
Red-breasted Nuthatch
White-breasted Nuthatch
Brown Creeper,
Swainson's Thrush
American Woodcock
Pine Grosbeak
Horned Lark

<u>These species are found in forest/nonforested habitats and require a home range >50 acres in size</u>:

Turkey Vulture
Bald Eagle
Sharp-shinned Hawk
Cooper's Hawk
Northern Goshawk
Red-shouldered Hawk
Broad-winged Hawk
Red-tailed Hawk
American Kestrel
Peregrine Falcon
Wild Turkey
Great Horned Owl
Barred Owl
Long-eared Owl
Northern Saw-whet Owl
Pileated Woodpecker
American Crow
Common Raven
Chimney Swift
Belted Kingfisher
Northern Harrier

These species are found in forest/nonforested habitats with unknown home ranges:

American Tree Sparrow, Bohemian Waxwing, Northern Shrike, Common Redpoll.

E.4 Mammals

These species are found in forest habitats and require a home range 1-10 acres in size:

Eastern Cottontail	Beaver	Least Shrew
Snowshoe Hare	Deer Mouse	Water Shrew
Eastern Chipmunk	White-footed Mouse	Muskrat
Gray Squirrel	Meadow Vole	
Red Squirrel	Star-nosed Mole	

These species are found in forest habitats and require a home range 11-50 acres in size:

Virginia Opossum, Porcupine, Ermine, Long-Weasel.

These species are found in forest habitats and require a home range >50 acres in size:

Woodchuck	Raccoon	River Otter
Coyote, Red Fox	Fisher	Bobcat
Grey Fox	Mink	White-Deer
Black Bear	Striped Skunk	Moose

These species are found in forest/nonforested habitats with unknown home ranges:

Little Brown Myotis, Silver Haired Bat, Eastern Pipistrelle, Big Brown Bat

E.5 Rare and Endangered Wildlife Species

According to the Division of Fisheries and Wildlife's Natural Heritage and Endangered Species Program, Orange provides habitat for thirteen state-listed species.

Three species are endangered, four are threatened, and six are species of Special Concern.

Taxonomic Group	Scientific Name	Common Name	MESA Status	Most Recent Observation
Amphibian	Hemidactylium scutatum	Four-toed Salamander	SC	1996
Bird	Botaurus lentiginosus	American Bittern	E	2005
Bird	Pooecetes gramineus	Vesper Sparrow	T	2000
Bird	Ammodramus savannarum	Grasshopper Sparrow	T	2000
Butterfly / Moth	Rhodoecia aurantiago	Orange Sallow Moth	T	2005
Dragonfly / Damselfly	Gomphus abbreviatus	Spine-crowned Clubtail	E	2004
Dragonfly / Damselfly	Ophiogomphus aspersus	Brook Snaketail	SC	2003
Dragonfly / Damselfly	Neurocordulia yamaskanensis	Stygian Shadowdragon	SC	2006
Dragonfly / Damselfly	Stylurus scudderi	Zebra Clubtail	E	2005
Dragonfly / Damselfly	Stylurus spiniceps	A Clubtail Dragonfly	T	2005
Fish	Notropis bifrenatus	Bridle Shiner	SC	2000
Mussel	Alasmidonta undulata	Triangle Floater	SC	2006
Mussel	Strophitus undulatus	Creeper	SC	2003

SC – Special Concern; WL – Watch List; E – Endangered.
Source: Natural Heritage and Endangered Species Program 2008 List.

E.6 Analysis

All of these animals require food, water, space, mates, and shelter. Some species require areas of forest, or open areas, or wetlands that are less than ten acres in size. Does this mean that the fragmentation of the landscape, which is commonly the result of development and road building, should be looked upon as favorable to sustaining wildlife populations? On the contrary, a home range is not equal to the extent of the habitat but the amount required by that one individual. Accordingly, this information does not represent the needs of the population, the total number of individuals of that species within a particular geographic area. An individual wood frog may require a portion of a wetland or wooded habitat one to ten acres in size, but what of the other members in its population? A sustained population of wood frogs would require areas of wetland and of forestland much larger than one acre. The point is that the acreage figures are presented only as a range of habitat block size required by each individual of a species. These

ranges also suggest that all sizes of open space greater than an acre provide habitat value; but, to support the breadth of native species populations, it is important to include a diversity of larger forest, wetland, and upland open areas.

The Town of Orange is fortunate for having open space areas greater than fifty acres in size in the west around Chestnut Hill and in the northwest that are still considered "wild." State conservation agencies and private land trusts have been focusing attention on a large regional corridor that already partially exists in Orange. This regional greenway is made up of state forests and privately owned lands from Warwick to Erving. An eastern branch skirts along the western flank of Orange to New Salem to arrive at the MDC lands of the Quabbin. The western branch moves south from Erving to Wendell, then to Montague and finally connects to the Connecticut River Greenway (please refer to the Protected Open Space Map).

The Town of Orange should protect large forested patches in north, west, and southwestern Orange to conserve wildlife habitat, current and future aquifer recharge areas, and opportunities for recreational activities (like hunting and backpacking) that require very large undeveloped landscapes. In addition, certain other areas are important for wildlife conservation. The upland open fields and orchards provide a habitat type for species that require early successional vegetation. The Millers River is home to a diverse number of wildlife species including some species of Special Concern. Other rivers, including West and Tully Rivers, should be seen as riparian corridors that provide habitat and routes of movement for area wildlife.

In summary, the Town of Orange has a network of large forest patches in the north and west that are void of significant sections of residential development. In addition, there is an east-west migration route along the Millers River for cold-water anadramous fish species, mammals, and birds.

F. SCENIC RESOURCES AND UNIQUE ENVIRONMENTS

The characteristics that allow a stranger to distinguish Orange from other towns in the region may be different than the unique qualities and special places that only residents can really know. This section identifies the scenic resources and unique environments that most Orange residents would agree represent the essence of Orange's character.

In many ways the history of Orange – how people came to settle the land, use its resources, and enjoy its forests, streams, and lakes – can be seen in the landscapes that have retained a sense of the past. Often the most scenic views include old farm buildings, fields cleared long ago, orchards, and undeveloped hillsides and mountains. Red brick mill buildings, and historic homes provide a sense of the Town's culture and the work of our ancestors.

The unique environments in Orange play a very important role in providing residents with a sense of place that is different than Athol, Erving, or Warwick. Rivers, mountains, wetlands, and town and village centers provide markers on the landscape for residents and visitors alike.

There are many examples in Orange where a scenic landscape is also important because of its location to a drinking water supply, or because it contains rare species habitat. The purpose for inventorying the scenic resources and unique natural environments in Orange is to provide the basis for prioritizing resource protection efforts. For this reason the following section includes information about the different values associated with each scenic resource and natural environment and identifies areas where there are multiple values represented in one landscape. Those landscapes that contain, for example, scenic, wildlife, and cultural values may be seen as having a higher priority for protection than a landscape that contains only one value.

Orange residents completed an inventory of the natural and cultural resources that they value. The best scenic views (to and from) and the more prominent hills, were identified along with stream corridors, water bodies, wetlands, open meadows, farmland, old village centers, and scenic roads. They noted that there were many types of significant landscapes with important natural or ecological values. These included ridegtops and special geologic features (monadnocks and the "Plains"). Similar to the geological features, a landscape's wildlife habitat values were differentiated. In this case, it is noted whether an area is an official Priority Habitat of Rare Species, as established by the Massachusetts Natural Heritage and Endangered Species Program or whether it is highly valued by Orange residents due to the presence of important habitat components, like edge, riparian corridors, or large blocks of contiguous forest. In addition, the landscapes that have important cultural (i.e. recreational) or historical values are included as well. The 1992 Franklin County Rural Historic Landscape Preservation Plan Report was used as the main reference for the location and type of significant historical landscapes in Orange.

These documented resources include historic structures, landscapes, roads, and special places. This inventory is based on a formal landscape survey done in 1992. The 1992 Franklin County Rural Historic Landscape Preservation Plan Report was created by the Franklin County Commission (now the Franklin Regional Council of Governments). It describes the status of historic landscapes in the region, the historic context that was used in its determination, and the methodology used in rural historic landscape reconnaissance. It distinguishes between the types of landscapes assessed (*agricultural, community development, recreational, conservation, industrial, transportation, scientific, religious, and engineering*), identifies in general terms the locations of rural historic landscapes in each town, and provides examples of direct and indirect preservation strategies.

This methodology for identifying significant historical landscapes was based on the National Park Service criteria including area of significance, period of significance, and historical integrity. The National Park Service classifies landscapes into four different categories: landscapes that reflect major patterns of a region's history (e.g. agricultural landscapes), landscapes that are associated with historically significant individuals (e.g. institutional grounds and buildings), landscapes that are important due to their design or physical characteristics (e.g. an 18th century Colonial Period Connecticut Valley rural farm), and landscapes that yield or have the potential of yielding significant information on pre-history or history (e.g. a native American encampment site).

Table 4-3 lists the different landscapes based on their location and describes their scenic, natural/ecological, and cultural/historical values. The Scenic Resources and Unique Environments Map shows the overlap of these scenic, ecological, and cultural values where different hatching patterns are layered. The numbers in Table 4-3 correlate with the map showing the location of each scenic landscape feature in Orange. The text that follows the table addresses the common themes associated with the greatest concentration of values as displayed in both the map and the table. For example, the relationship between the high elevation points or ridgetops, and the wildlife habitat values of these areas is important. The wildlife value is in part due to the presence of large contiguous blocks of undisturbed forest, which are more prevalent along the region's ridgelines and higher elevation plateaus than anywhere else.

In some cases, the landscapes are described as being Historical *Agricultural* Landscapes. When the word *agricultural* is in italics, it means that this landscape has been documented as a significant historical landscape based on the National Park Service standards, which are different than those applied by the Orange Open Space Committee. In the far right column of Table 4-3, the landscape's protection status is estimated. For the purposes of this Open Space Plan, a landscape is defined as a land area with a particular land use pattern (farmland), or a physiological landform (monadnock) distinguishable from adjoining areas. Often ownership patterns do not coincide with the boundaries of a landscape. A ridgeline may have portions of it protected while the rest is in unprotected. Landscapes that contain parcels in the Ch. 61, 61A, or 61B programs are important because the Town has the right of first refusal to purchase these properties. This right may be passed onto a third party, such as a conservation land trust.

Table 4-3: Significant Scenic/Historic/Natural Landscapes/Environments in Orange

Map #	Location of Landscape	Landscape w/Significant Scenic Value	Landscape w/Significant Natural/Ecological Value	Landscape w/Significant Cultural/ Historical Value	Protection Status
1	**Farmland on Tully Road Blissville**	Farmland		Historical *Agricultural* Landscape, the D.A. Harrington Farm, c. 1871	Unprotected
2	**Warwick State Forest in Northeast Orange**		Wildlife Habitat	Warwick State Forest is an Historical *Recreation/Conservation Landscape*	Permanently Protected
3	**Beech Hill, Fall Hill, Temple Hill and Orange State Forest**	Views of, and from, Hills	Ridge top and Unique Habitats (Northwestern slopes + large blocks of contiguous forest)		Mostly Unprotected
4	**Western side of Tully Road, just north of intersection with Creamery Hill Road**	Open Meadow	Edge Habitat	Agricultural Heritage	Unprotected, though several large Ch. 61 and 61A parcels
5	**Tully Road**	Scenic		Historical *Agricultural* Landscape	Northern ½ w/ some protected land and Ch. 61's but Southern ½ is unprotected
6	**Tully Mountain**	Views of, and from, Hills	Geologic- Monadnock/ Ridge top/ Wildlife Habitat	Major Recreational Trail System and Linkages	Largely Protected
7	**Town Farm Road**	Scenic		Agricultural Heritage	Unprotected, with one large Ch. 61A parcel
8	**Creamery Hill Road**	Scenic		Part of the North Orange Center Historical *Community Development* Landscape	Unprotected
9	**Aquifers**		Water Supply		Only slightly protected
10	**Tully Village**	Old Village Center		Historical Village Center	Unprotected w/ some Ch. 61 parcels
11	**Tully Trail Access**	A 22-mile trail with access to scenic views and landscapes		Regionally-important trail system	Largely protected
12	**Royalston Road**	Scenic			Unprotected w/ some Ch. 61 parcels
13	**East Branch of the Tully River**	Stream Corridor	Excellent Cold Water Fishery	High Recreational Value	Unprotected except through Rivers Protection Act

Map #	Location of Landscape	Landscape w/Significant Scenic Value	Landscape w/Significant Natural/Ecological Value	Landscape w/Significant Cultural/ Historical Value	Protection Status
14	**Williams Pond**	Water Body			Unprotected
15	**North Orange Village, Creamery Road and Athol Road**	A cross-road village center		Historical *Community Development* Landscape	Unprotected
16	**Oxbow Road**	Scenic			Unprotected to the north
17	**Orange Wildlife Management Area**	Wetland	Great Blue Heron Rookery		Permanently Protected
18	**North Main Street**	Scenic		Agricultural Heritage	Mostly unprotected
19	**Town Pound off of East Road**	Town Pound		Historical *Agricultural* Landscape	Unprotected
20	**Athol Road**	Scenic		Agricultural Heritage	Unprotected, with one large Ch. 61A parcel
21	**West Branch of the Tully River**	Stream Corridor	NHESP Priority Habitats for Rare Species	Recreational Value	Northern ½ partially protected, southern ½ unprotected except through Rivers Protection Act
22	**Little Tully Mountain**	Views of Hills	Geologic-Monadnock/ Ridge top		Unprotected, some parcels in Ch. 61
23	**Fryeville Road**	Scenic			Unprotected
24	**Temple Road**	Scenic			Unprotected
25	**Jones Cemetery Road**	Scenic			Unprotected
26	**Farm School**	Farmland	Edge Habitat	Agricultural Heritage	Unknown
27	**Moore Farm**	Farmland	Edge Habitat	Agricultural Heritage	Unprotected, many Ch. 61A parcels
28	**Johnson's Farm on Wheeler Avenue**	Farmland	Edge Habitat	Agricultural Heritage	Unprotected, many Ch. 61A parcels
29	**Western side of East Road, south of Ward Road also at intersection of Wheeler and Ward Road**	Open Meadow/Cropland	Edge Habitat	Historical *Agricultural* Landscape: W.A. Ward Property c. 1871	Unprotected, though many Ch. 61A parcels
30	**East Road**	Scenic			Unprotected though many Ch. 61A parcels

Map #	Location of Landscape	Landscape w/Significant Scenic Value	Landscape w/Significant Natural/Ecological Value	Landscape w/Significant Cultural/ Historical Value	Protection Status
31	**Wheeler Avenue**	Scenic Road		Historical *Agricultural* Landscapes	Unprotected
32	**Wendell Depot Road**	Scenic		Historical *Agricultural* Landscapes	Southern ½ unprotected, Northern ½ protected
33	**Warwick Road (Rte. 78)**	Scenic		Historical *Agricultural* Landscapes	Unprotected, though some Ch.61 Forestland and a small conservation easement
34	**West Orange Cemetery**			Historical Village Center	Large areas of protected land surrounding village
35	**Farmland to the west of Route 78, on 2A**	Farmland	Edge Habitat	Agricultural Heritage	Unprotected
36	**Downtown South Orange Center along Millers River**	Industrial village layout		Historical *Community Development* Landscape	National Historic District
37	**Millers River**	Stream Corridor	NHESP Priority Habitats for Rare Species	High Recreational Value	Unprotected except through Rivers Protection Act
38	**Riparian Corridors along all Streams and Brooks**	Stream Corridor	Wildlife and Fisheries Habitat	Recreational Value	Some protected, most unprotected except through Rivers Protection Act
39	**Coolidge Swamp**	Wetland	Great Blue Heron Rookery		Unprotected
40	**Aquifers**		Water Supply		Only slightly protected
41	**Zone I & II Recharge Areas**		Drinking Water Supply		Well#1+#2 – Partially protected. #3 -Unprotected
42	**North Pond Brook**	Wetland	Connectivity with Orange Well #1 + #2		Mostly Unprotected, except through Rivers Protection Act
43	**Crystal Springs**	Wetland	Past Drinking Water Supply Source		Limited Protection

Map #	Location of Landscape	Landscape w/Significant Scenic Value	Landscape w/Significant Natural/Ecological Value	Landscape w/Significant Cultural/ Historical Value	Protection Status
44	**Chestnut Hill and Orange State Forest**	Views of, and from, Hills	Ridge top and Unique Habitats (Northwestern slopes + large blocks of contiguous forest)	Orange State Forest is an Historical *Recreation/Conservation Landscape*	Western ½ Partially Protected (Orange State Forest) Eastern ½ unprotected
45	**Bicentennial Park**	Wetland			Mostly protected
46	**Lake Mattawa Road**	Scenic		Historical *Agricultural* Landscapes	Mostly unprotected
47	**Black Ash, Cooks Cove**		Unusual Natural Community		Unprotected
48	**Gidney Road**	Scenic			Unprotected w/some Ch. 61 parcels
49	**Chestnut Hill Trail Access**	A new trail system in Southwestern Orange open to the public		Locally important trail system	Largely protected
50	**Western slopes of Walnut Hill from Lake Mattawa**	Views of Hills	Ridge top		Unprotected with Two parcels in Ch. 61
51	**Walnut Hill Road**	Scenic		Historical *Agricultural* Landscapes	Mostly unprotected
52	**Orange Municipal Airport**	Open Meadow	NHESP Priority Habitats for Rare Species	High Recreational Value	Partially: FAA protected
53	**Chestnut Hill Road Upper, Chestnut Hill Lower**	Scenic		Historical *Agricultural* Landscapes	Southern ½ protected, Northern ½ unprotected
54	**Lake Mattawa**	Water Body	Excellent Cold Water Fishery	High Recreational Value and is an Historical *Recreation Landscape*	Mostly developed and unprotected
55	**Black Gum Swamp**		Unusual Natural Community		Unprotected but with a large Ch. 61
56	**Eastern slopes North Pond Ridge from Lake Mattawa**	Views of Hills	Ridge top and Wildlife Habitat		Northern ½ protected, southern ½ in Ch. 61
57	**Bullard Farm off Route 202**	Farmland	Edge Habitat	Agricultural Heritage	Partially protected w/ most acreage in Ch. 61A
58	**Magoon Hill**	Views of Hills	Ridge top		Unprotected, in Ch. 61

Map #	Location of Landscape	Landscape w/Significant Scenic Value	Landscape w/Significant Natural/Ecological Value	Landscape w/Significant Cultural/ Historical Value	Protection Status
59	**Hunt Farm at Routes 202 and 122**	Farmland	Edge Habitat	Agricultural Heritage	Unprotected, many Ch. 61A parcels
60	**Zone I & II Recharge Areas**		Drinking Water Supply		Well#1+#2 – Partially protected. #3 -Unprotected
61	**Lake Rohunta**	Water Body	NHESP Priority Habitats for Rare Species	High Recreational Value	Unprotected, most shoreline in Ch. 61
62	**Orange Riverfront Park**				

Source: Franklin County Rural Landscape Preservation Plan Report; and 1992, Orange Open Space Committee; 2000.

Several themes emerge from both Table 4-3 and the Scenic Resources and Unique Environments Map. Scenic resources and valued natural environments naturally fall into several categories as described in the following sections.

F.1 Bordering Hills

The hills in the western, northwestern and northern borders of Orange including Chestnut, Beech, Fall, Temple, and the hill located due east of Tully Mountain contain landscapes with a great concentration of values: scenic views of and from these hills; natural/ecological values (large contiguous blocks of forest, other unique wildlife habitats, ridgetops, and small stream corridors); and in a few cases, cultural/historical values (presence of the Orange State Forest).

The Chestnut Hill Area from Route 2 south to the New Salem border, west to the line with Wendell and east to Holtshire Road contains scenic views of the hills from Lake Mattawa, and far away views to Mount Wachusett from Chestnut Hill itself. In between Holtshire Road and Old Depot Road, in Wendell, there exists over three miles of forestland unbroken by a paved road. This area also contains Coolidge Swamp to the north and the Black Gum Swamp to the south. There are scenic views of farm fields at the intersection of Chestnut Hill Road and Gidney Road. Although Orange State Forest covers a significant portion of the western most portion of this area, the predominant natural and scenic resources remain unprotected.

Beech Hill and Temple Hill in northwestern Orange are valued for both scenic and ecological resources. Temple Hill in particular provides the backdrop for several historical agricultural landscapes on Town Farm and Tully Roads. The forests of these hills help maintain stream flow in Poor Farm Brook, West Brook, and the West Branch of the Tully River. In addition, groundwater from these hills helps to recharge the wetlands

that lie north and south of the Orange Wildlife Management Area. These hills are owned almost entirely by private woodland owners, a majority of which have their lands in the Ch. 61 Program.

F.2 North/South Ridgelines

There are three dominant north/south ridgelines in Orange including Walnut Hill, Magoon Hill, and the ridgeline just east of East Road. The western aspects of Walnut Hill are visible from Lake Mattawa, the eastern from South Orange. The western slopes of Magoon Hill are also visible from Lake Mattawa. Both hills run north south and are valued by Orange residents for their scenic ridge-like elevations. The East Road ridge is valued for its scenic value but also because of its wildlife habitat, known especially as a good hunting area.

F.3 Monadnocks

Little Tully Mountain and Tully Mountain are both considered monadnocks, which are hills or mountains of resistant rock that rise above a peneplain. A peneplain is a large land area of slight relief that has been created through erosion processes. Through the efforts of the Mount Grace Land Conservation Trust, the majority of Tully Mountain is protected from development. The Trust is the steward of the Foye conservation restriction, which covers 212 acres and protects a significant section of the West Branch of the Tully River as well as wetlands north of Tully. The Trust also owns a 30 acre parcel of land that protects the hilltop of Tully Mountain. The recent purchase of 348 acres to the east of Tully by the Division of Fisheries and Wildlife (DFW) ensures that this unique ecological and recreational resource will be conserved. While Tully Mountain is mostly permanently protected from development, Little Tully Mountain is unprotected. Both monadnocks are valued for their scenic views, to and from the peaks, wildlife habitat, and unique geological value (the fact that they are monadnocks.

F.4 Important Wetlands

Wetlands like the black gum and black ash swamps usually contain a greater diversity of plant and animal life than surrounding landforms. They are also often connected to extensive watercourse networks both above and below ground (North Pond Brook swamp). Wetlands provide basic ecosystem services such as water retention, and water purification, and flood water control. Sometimes they are carbon sinks, and often they provide rare species habitat (Lake Rohunta). Orange residents consider all of the wetlands as being particularly scenic. Wetlands are also some of the places people have traditionally hunted in Orange. For all these reasons wetlands should be valued in Orange. The Rivers Protection Act provides partial protection from land uses that may have a negative impact on the long-term viability of flora and fauna in wetlands.

However, since wetlands are often in low lying areas of the landscape, their normal water flows and the quality of the water can be greatly influenced by the use of nearby lands. Winter salt and sand use on Orange's roadways can, over time, kill trees and vegetation that depend on the maintenance of specific growing conditions like alkalinity, which can be affected by salts and oils originating from road surfaces.

F.5 Riparian Corridors and Aquifers

Orange residents value all the riparian corridors of rivers, streams, and brooks for the ecological contributions they provide. Riparian corridors are simply the combination of the water body, the streambed, banks, and surrounding vegetation, which is significantly different than the surrounding uplands.

The main rivers in Orange are the Millers and the East and West Branches of the Tully River. They provide wildlife habitat, scenic views, recreational opportunities, and they are connected to the main aquifers in Orange. The Millers River has historical and cultural significance to residents because of the community's industrial history and an annual civic event, the River Rat Race from Athol to Orange. Public access to the rivers is often dependent on town or state owned land with river frontage. The Orange Riverfront Park, which was completed in 2007, and a ramp further up East River Road for motorized boats provides much needed access to the Millers River. The East Branch of the Tully River is another excellent cold-water fishery that is deep running unlike many of the brooks in North Orange. The river represents the Town line between Orange and Athol where there are no publicly owned lands to provide access to the river. The best access is actually gained from Route 32 in Athol. However, this river is polluted with priority organics and metals, which lowers its value as a fishery. The West Branch of the Tully occurs in the same area as the main aquifer in eastern Orange.

There are many other streams and brooks in Orange. West Brook and other brooks, which flow through the predominantly agricultural landscapes of east central Orange may be the waterways most in jeopardy in the future. Unless efforts to protect additional farmland is successful, future residential development will likely take place on large lots within the former fields and meadows along Wheeler Avenue, Temple Road, Jones Cemetery Road, East Road, and Athol Road. On-site septic systems and lawn fertilizers and pesticides are two sources of non-point source pollution, which affect rivers and wetlands. These are often associated with large lot residential development on former agricultural lands.

Aquifers are simply the below-ground water bodies, which accumulate in sand and gravel deposits. Aquifers that contain a lot of water, which can be accessed by way of a well, are used to provide public drinking water supplies. There are many kinds of aquifers, but they all can be impacted by what humans do above ground. For that reason, it is important for Town Officials to take lessons from other communities in the region and seek to restrict types of development, which store or utilize hazardous materials. The

level of protection needed for these aquifers varies. The Town of Orange may also want to consider an overlay district that actually limits development density within the recharge areas and over the aquifers of any known future water supply sources.

F.6 Agricultural Lands

Most of the agricultural lands in Orange are unprotected from development. Although there is a recent trend of farmers interested in selling their development rights to the Agricultural Preservation Restriction Program, it would be prudent for the Town to support this effort since active farmland also provides the community with scenic values, input to the local economy, wildlife habitat, hunting areas, and the maintenance of the original settlement and land use patterns reflecting the community's origins.

Proponents for the protection of agricultural land in Orange cannot rely on the same interest that has been expressed by state and private conservation agencies for large blocks of contiguous forest that could be part of a regional greenway. Orange has a chance to have its last remaining farmland permanently protected from development. An effective way of conserving farmland would be to prioritize the parcels of those landowners that want their land protected. By contributing five percent of the cost of the development rights as a match to the funds put up by the APR Program, the Town will be more competitive in gaining access to this state funding.

F.7 Historic Village Centers

Orange residents identified the historic village centers of West, North and South Orange and Tully as being areas of cultural and historic value. These village centers combine scenery, historic land use patterns, historic structures, and cemeteries within landscapes that often have ecological, and scenic values of their own. Like scenic roads or drives, village centers provide Orange residents access to historical and natural resources. This is true for downtown Orange. To the tourist, the downtown area draws forth images of the late 19th Century with its brick mill buildings.

F.8 Scenic Roads

There are many scenic drives throughout Orange. Along Wheeler Avenue, there is the old Wheeler summer house with its large rhododendron garden, an operating sugar shack, saplings of historic maple trees bordering the road, and a beautiful view of the Johnson Farm. Just south of the intersection of Wheeler Avenue and Main Street offers a fine view of area mountains and ridge tops. Holtshire Road also offers scenic views of Lake Mattawa and a beaver pond.

Often roads link Orange's most scenic and significant historical landscapes. Since residents most often view the landscape as it passes outside their vehicle's window, roads play an important role in linking us to scenic views. Local scenic road designation provides limited protection to historic and scenic resources along local byways. Once designated, the Planning Board must give written approval before any repair, maintenance, construction, or paving of the road is allowed if that activity would involve the cutting or removal of trees, or the tearing down or destruction of stone walls in the public Right of Way. The roads in Orange that could potentially receive designation as a Local Scenic Road include: Gidney Road, North Main Street (north of Clark Ave.), Wheeler Avenue, Walnut Hill Road, Temple Road, East Road, Main Street, Creamery Hill Road, Tully Road, Chestnut Hill Road, Wendell Depot Road, Oxbow Road, Jones Cemetery Road, Athol Road, Royalston Road, Fryeville Road, Town Farm Road, Lake Mattawa Road, Warwick Road, and portions of Holtshire Road.

F.9 Unusual Natural Environments

Often the most unusual natural environments have obvious scenic features and sometimes they include rare ecological areas that are kept hidden by design. With care, Orange could seek assistance from DCR, DFW, Mount Grace Land Conservation Trust and citizens to protect these special places without putting rare plants, animals, or habitats in jeopardy.

Table 4-4: Unusual Natural Environments

Site or Name of Environment	Type of Feature	Protection Status	Comments
Millers River, Cooks Cove	Ecological	Unprotected	Rare Black Ash Swamp
Black Gum Swamp	Ecological	2/3 Protected	Rare habitat area
Orange Municipal Airport	Ecological, Recreational	Limited Protection	Unique grasslands habitat
Lake Mattawa	Recreational	Access is protected	Excellent cold water fishery Ensure long term water quality
Lake Rohunta	Recreational	Shoreline is in Ch. 61	Unique area for kayaking and wildlife viewing

The unusual natural environments presented in Table 4-4 represent areas with special ecological, recreational, and scenic values. Cooks Cove, which is partially protected by the Rivers Protection Act, contains a rare black ash swamp among other important habitats and is connected to the Millers River on the Athol/Orange Town Line.

Lake Mattawa is a cold water fishery attracting anglers from across the state. Public access to the Lake is excellent from roadways and a Town-owned beach. However, the potential for negative impacts from non-point source pollution is real. Route 2 passes within several hundred feet of its northeastern bank. Three other sides of the lake are flanked by roadways. In addition, cottages with their own on-site septic systems built in the early 1900s crowd the eastern, western and southern shore of the lake.

Another unique environment is found within the Orange Municipal Airport parcel. According to Dave Small, with the Department of Conservation and Recreation, the grassland habitats that are found within and alongside the airport's runways, although created through human intervention, are very unique and provide rare and endangered species the type of vegetation they require. These values may be in conflict with the economic development of the airport depending on the design of future land uses.

F.10 Analysis

Orange contains concentrations of scenic, ecological, cultural, and historical values. The areas that contain the most concentrations of values should be prioritized for protection.

- bordering hills
- north/south ridgelines
- lone monadnocks
- important wetlands
- riparian corridors
- aquifers
- agricultural lands
- historic village centers
- scenic roads
- unusual natural environments.

There is a model of landscape planning called "aggregate with outliers," which is described in Richard T.T. Forman's Land Mosaics, published in 1995. The "aggregate with outliers" model is based on the concepts that human communities, farmland, and forestland should be aggregated where possible to be most efficient and to provide the greatest opportunity for high sustained levels of biodiversity. This means that within Orange, most of the farmland would be found in one general area, there would be large forested areas of town, and most of the people would live in a concentrated place, like Orange Center. The outlier component of the model addresses the true nature of our landscapes. We will have farmland near and around the edges of forests. We will have people who like to live near forest and farm edges. And there will be bits of nature, special wooded areas, wetlands, and lakes that provide special and unique habitats for plants and animals. There is also room for movement of people and animals across the landscape. Riparian and forested corridors are used to connect large patches of forest. Roads travel across most of the landscape but stay out of the interior forest.

In many ways, the "aggregate with outliers" model of landscape planning is reflected in Orange's land use patterns today and in the portions of Town that residents already want to conserve. The Scenic Resources and Unique Environments Map identifies the areas with the most concentrations of ecological and historical values. When combined together these areas form a greenway. A greenway represents areas where residents would like to concentrate their land protection efforts. For example, the Town could help willing landowners to protect their properties, which abut, or are between, parcels of land already protected from development. By making the contiguous areas that are already protected larger, the wildlife habitat, scenic views, aquifers, and hiking trail systems that depend on extensive acreage or linear elements in the landscape will be conserved in

perpetuity. Not all land within a greenway will be protected. Some of the properties within the greenway, which is identified on the Scenic Resources and Unique Environments Map, are already developed. This greenway matches, and is therefore supported by, the Franklin County Regional Open Space and Greenbelt Map and the preliminary greenway model used by the North Quabbin Regional Landscape Partnership (NQRLP). Both the Franklin County Greenbelt Map and the NQRLP represent the collective insight and intentions of the major land protection agencies in the County and the region. This may provide opportunities for collaboration between Orange, other municipalities, and federal, state, and non-profit conservation agencies that have similar land protection goals.

The Town of Orange should consider the greenway in prioritizing which parcels of land to protect, whether in the bordering hills, on the monadnocks and north/south ridges, or bordering the wetlands, riparian corridors, and unique natural environments. Active prime farmland should be considered the exception to the greenway and be prioritized because of its multiple values. The Town should also decrease the density of development around and within the land that covers the water supply recharge areas and the aquifers. Even if these areas were protected there would still be a significant amount of land that could be developed. As a result of protecting these areas, historical residential development patterns would be strengthened, concentrating around South Orange and existing village centers but there would also be opportunities for people to live around farm and forestland. Lastly, the Town of Orange might consider studying whether the town should adopt the Community Preservation Act, which can help raise local and state funds to protect important lands, habitat, and historical and cultural resources.

G. ENVIRONMENTAL PROBLEMS

G.1 Negative Impacts of Unplanned Development

Although there may not be agreement as to its severity or solution, the overarching environmental problem for the Town of Orange that is worth considering is the potential for future growth in the region and the sprawl of residential development. The build-out analysis in Section 3 forecasts that new unbridled residential development will produce negative fiscal impacts on the municipal budget. This would be due to the costs of community services like education, being greater than the revenues that would be received through property taxes. In addition, residential growth could create greater and unsustainable demands on the Town's drinking water supply. Residential development across Town will increase the prevalence of non-point source pollution, reduce the rural character and cause a reduction in the acreage in, and value of remaining, wildlife habitat. Sprawl will also increase runoff (potentially including toxic substances such as road salt), decrease the amount of water available as ground water, decrease stream flow, and probably result in excess erosion and the lowering of the biodiversity of first and second

order streams. This in turn will result in a Town-wide reduction in water quality. The solution to the problem may be a combination of zoning techniques to encourage development in appropriate areas and open space protection to keep houses away from the areas with the greatest scenic, ecological, cultural, and historical values.

G.2 PCBs

Within this larger environmental concern of unplanned growth are two critical environmental issues requiring specific action. The first concerns water quality in the Millers River. Currently, the Millers River contains high levels of poly-chlorinated biphenyls (PCB's) and mercury that impair its full potential as a Class B fishable and swimmable water body. Every stream, brook, and river in Orange continues to be threatened by non-point source pollution from urban runoff to sedimentation. Working cooperatively with the Millers River Watershed Council and other communities would be a good first step since the ultimate clean-up of the river will need to be a continuous, watershed-wide effort.

G.3 Risk of Contamination to Community Drinking Water Supplies

The second critical environmental issue concerns the danger of hazardous materials in transit. There have been several transportation accidents in the past two years involving the release of hazardous materials into major rivers in Franklin County. Route 2 bisects the DEP Approved Zone II and III recharge areas for Wells #1, #2, and #3. The Town should require a cooperative emergency management plan to be developed by MassHighway and the Orange Highway Department and Board of Selectmen to help ensure that these drinking water supplies do not get contaminated by hazardous materials that are being transported on Route 2.