

CHAPTER 3: NATURAL RESOURCES – HAMPSHIRE COUNTY

Introduction

Traversing the hills of western Massachusetts, the Route 112 Scenic Byway features abundant natural resources of regional and national significance. These resources include the Westfield River (a National Wild and Scenic River), four state forests, Gardner State Park, four state wildlife management areas, beautiful waterfalls at Shelburne Falls and South Worthington, many trout streams, hiking trails, and kayaking routes. From rushing rivers and streams to small water holes, windy hilltops and silent old-growth forests, arises a diverse flora and fauna. According to the Massachusetts Natural Heritage and Endangered Species Program, the corridor is home to 21 rare animal species and 15 rare plant species. These environmental assets all contribute to the overall character of the landscape and make the Route 112 corridor unique.

This chapter provides an inventory of the Byway corridor's rich natural resources, highlighting some especially significant features. While the inventory focuses on the natural resources within the corridor, there are several nearby lakes and ponds that are important enough to the region to be included here. The chapter concludes with a listing of findings and recommendations to address some of the threats and issues facing the preservation of the Byway's natural and environmental assets.

Geologic Resources

The geology and soils of the region make for dynamic terrain that has helped shape the natural and cultural scenery all along the Byway. For the most part, the road conforms closely to the terrain. The northern reaches of the Byway pass through stretches of farmland and pastureland and bucolic rolling hills. This shifts into a more rugged landscape as the road heads south, climbing and carving through steep, forested terrain. Frequent rock outcroppings appear along the side of the road, covered with seeping water and moss in the summer and large ice flows in the winter. The road climbs up and down the hills of the Bryant Homestead as it travels through Cummington, then edges along several sections of the Little River, a tributary of the Westfield River, and eventually parallels the Westfield River in Huntington. At some flatter, low-lying spots, the road passes farms or travels through villages.

Geology

The Route 112 Byway corridor lies within the transition zone between the Berkshire hills to the west and the Connecticut River Valley to the east. The region has a physiographic

classification as the “New England Upland Section,” which was a plateau millions of years ago, but has been uplifted to approximately 1,000 to 2,000 feet above sea level. ¹

The bedrock of the Byway is part of the eroded core of an ancient chain of mountains that is approximately 400-500 million years old and extends from Long Island Sound through Western Massachusetts and Vermont into Quebec. Most of the bedrock in the region is schist, which is compressed and heated shale; gneiss, a light and dark coarse-grained metamorphic rock characterized by bands of minerals; and granite. There are also several inclusions containing limestone and coarse crystalline veins of quartz, and occasional thin beds of marble.



Bedrock outcroppings along Route 112 add to the region's natural beauty.

Like almost all of New England, great ice sheets thousands of feet thick once covered the Byway corridor. These continental glaciers melted about 12,000 years ago, scouring the landscape, deepening and widening the valleys. Lakes and ponds formed in depressions left by stagnant glacial ice. Successions of vegetation have since filled some of these, causing the formation of swamps, bogs, and marshes. The retreating glaciers eroded the bedrock and left extensive surface deposits, called glacial till, over most of the New England landscape. The two basic types of deposits in the Byway corridor are logement till and stratified drift. Logement till formed when glaciers overrode and compressed the earth and is an unsorted mixture of sand, clay, pebbles and boulders, no more than three feet thick. Stratified drift refers to deposits of sand and gravel formed during the final days of the Ice Age when melting ice formed torrential streams with the power to carry large loads of sand and gravel formerly trapped in ice. When the velocity of a stream would diminish, as when entering a lake or flat area, its load would settle and form deposits of sand and gravel. These stratified deposits are much more productive sources of groundwater. The glacial till in this region varies in thickness. In some areas bedrock is exposed, and in others the till is as much as 100 feet thick.

Soils

While more than 60 soil classifications are found in the Byway corridor, two major associations dominate in Hampshire County: the Lyman-Tunbridge association and the Peru-Marlow association.

¹ Soil Survey of Hampden and Hampshire Counties, Western Part, Massachusetts. Department of Agriculture, Natural Resources Conservation Service. December 1995.

The Lyman-Tunbridge soils are frigid, loamy soils formed in firm glacial till derived from schist, gneiss, and granite. They can range from shallow to very deep, can be well drained to excessively drained, and gently sloping to very steep. These soils are mostly forested. Because of the stones on the surface and the areas of exposed bedrock, the Lyman-Tunbridge soils are poorly suited to farming.

The Peru-Marlow association consists of frigid, loamy soils formed in firm glacial till derived from schist, gneiss, and granite. They are very deep. These soils can range from moderately well to well drained, and gently sloping to very steep. Similar to the Lyman-Tunbridge soils, this association is also mostly forested, and not well-suited to cultivating crops because of the surface stoniness.

The quantity of stones in the soils is enough to limit the agricultural development of many areas. Rock outcrops are prominent landscape features, and many stones and boulders are on the surface. However, in some locations along the Byway corridor, slopes are less steep and stones are less frequent, creating small pockets of good farmland. The basic textures and structure of these soils (especially Peru and Marlow loams) allow ready root penetration, adequate drainage, and good moisture-holding capacity, all of the factors necessary for crop production. But these pockets of agricultural land are small – less than 5 percent of the total land use in this portion of Hampshire County. The combination of the soils and the humid climate make the Byway corridor a prime forest region – and approximately 77 percent of the total land use in this region is forestland. By the same token, this extreme stoniness, along with steep slopes, constrains development. Because of their characteristics, these soils are well suited as sites for wells, but they present severe limitations to septic absorption fields and building construction. Due to the soils' permeability, any wells in this area must be located far enough away from potential sources of pollution, including septic systems, to avoid contamination.

The characteristics of the soils and geology along the Byway corridor combine to determine the types of activities and development that can take place. To a great extent, these features and the terrain they create have dictated the locations of villages and other settlements, farms, rivers, and of the route of the Byway itself. Hampshire County advisory committee members have noted that despite the constraints, increasing pressure is leading to development in some of these more difficult and sensitive places.

Water Resources

Water is a dominant landscape feature along Route 112, be it flowing, rushing, or seeping. The Westfield River and its tributaries carve through the rocky hillsides and deep valleys along the Byway corridor, creating many of the region's most scenic vistas. The road edges along over 15 miles of river, crossing it four times on large bridges which provide scenic views up- and down-stream. Other significant features of the landscape are created by

water as well. Where the road winds through steep terrain, countless small brooks seep and trickle down rock outcroppings. Waterfalls such as Shelburne Falls and the falls in South Worthington provide beautiful photo opportunities; and there are multiple trout streams, fishing and swimming holes, and kayaking routes along the corridor.

These water resources can be powerful landscape features – both because of the eroding forces they impose on the terrain, shaping and carving out the landscape, and also because of what they offer as scenic and recreational assets. In addition, these valuable resources are a source of drinking water and could be used for small-scale energy production.

Rivers and Streams

In Hampshire County, one river basin dominates the Byway corridor: the Westfield.

Westfield River

Water along the entire stretch of the Byway corridor through Hampshire County drains into the Westfield River. The Westfield River has been designated a National Wild and Scenic River, an honor that requires that a river have at least one “outstandingly remarkable” natural, scenic, or cultural value. The Westfield far surpasses that standard with values that encompass scenic, geologic, historic, fishery, and recreational resources, water quality and flow, and rare and endangered species.



The Westfield River was the first National Wild and Scenic River in Massachusetts.

In 1993, 43 miles of the Westfield River in Becket, Chester, Chesterfield, Cummington, Middlefield, and Worthington were designated as the first National Wild and Scenic River in Massachusetts. In 2002, 35 additional miles were designated in Becket, Huntington, Savoy, Washington, and Windsor.

The Westfield River consists of three main branches: East; Middle; and West. The Westfield River’s East Branch enters the corridor in Cummington, and is the only branch to run the length of the Byway corridor in Hampshire County. It flows west, paralleling Route 112 before being joined by the Swift River at which point the East Branch turns south and leaves the road. For most of the rest of its length, until it reaches the Knightville Dam in Huntington, the East Branch passes through a series of state forests and wildlife management areas. In Worthington, some small streams come together to form Little River. The Little River then merges with the Westfield River, just north of the Knightville Dam. The East Branch passes through Knightville Dam in Huntington at which point it is once again adjacent to Route 112. Convergence of the East and Middle branches occurs about two

miles before the end of Route 112. Just before joining the East Branch, the Middle Branch passes Littleville Dam and together they join slightly outside Huntington's village center.

With several sections of the route paralleling the East Branch or its tributaries, a trip along the Byway corridor showcases some spectacular views and topography. The rivers and streams within the corridor cut through the landscape, exposing bedrock and creating small falls visible from Route 112 in certain spots. The route is also punctuated by several bridges, most notably in Cummington, where a stately bridge crosses the East Branch just outside of the village center; in South Worthington, where an old mill building's wooden bridge crosses Little River; and in Huntington, where a large iron beamed bridge crosses the West Branch in the village center. Several smaller, scenic streams also drain into the East Branch along much of the Byway corridor.

Though outside the Byway corridor, the Chesterfield Gorge in Chesterfield and Glendale Falls in Middlefield are important natural features in the region. Both of these properties are now owned by the Trustees of the Reservations. The Chesterfield Gorge is located 4 miles southeast of the intersection of Route 112 and 143 in Worthington. Initially carved from metamorphic bedrock by the torrents of glacial melt-water, the gorge today continues to be shaped by the waters of the East Branch of the Westfield River. Glendale Falls, located about 6 miles west of Route 112 in Worthington, is one of the longest waterfall runs in Massachusetts. According to the Trustees of the Reservations, the spring waters of Glendale Brook roar down 150 feet of rock ledges before joining the Middle Branch of the Westfield River.

Lakes and Ponds

Though no lakes or ponds are visible while traveling on Route 112, there are several within a short drive or hike from the road. Visitors can find opportunities to spend a summer day swimming, boating, or fishing on one of the corridor's many lakes or ponds – with these sites distributed up and down the entire route.

The following table lists each pond within the Byway corridor, by town:

Table 3-1: Ponds within the Route 112 Scenic Byway Corridor—Hampshire County

Goshen		
Pond Name	Naturally Occurring (Y/N)	Area (acres)
Lily Pond	Y	12.1
Sears Meadow Pond	N	11.4
Upper Highland Lake	N	51.2
Lower Highland Lake	N	90.7
Hammond Pond	N	38
Damon Pond	Y	77.6
Worthington		
Little Galilee Pond	N	9.8
Conwell Pond	Y	1.0
Beaver Pond (near old post road)	?	28
Huntington		
Littleville Lake	N	252
Norwich Pond	Y	116

Wetlands and Riparian Areas

Many wetlands, vernal pools, and other smaller bodies of water are scattered across the landscape, primarily along streams and in wooded areas. These water bodies offer valuable and unique wildlife habitat, and provide recreational opportunities to visitors and residents.

There are approximately 212 acres of wetlands in the Hampshire County section of the Byway corridor. The most notable is the series of discontinuous swampy areas, Fuller Swamp and Jackson Swamp, located along the border of Worthington shared with Chesterfield and Huntington. Wetland habitats in the Byway corridor occur primarily along the streams and rivers as well as in lands adjacent to the major lakes and ponds. If open waters are included in this accounting, the total acreage of wetlands in or near the Byway corridor in Hampshire County rises to 843.5 acres.

Riparian corridors, where the vegetated banks meet the rivers and streams, support a large range of species and are transition zones between habitats. As such, these corridors both link habitats and provide unique habitat important to many species, most notably birds and amphibians. The value in maintaining vegetative cover and uninterrupted riparian corridors goes beyond wildlife preservation. These corridors and associated wetlands provide many significant public health benefits for the entire community, including:

- Flood mitigation for crops and structures by storing and slowing runoff;

- Water supply protection, through effective filtration of pollutants, such as phosphorous and nitrogen;
- Erosion control by absorbing and slowing storm runoff;
- Groundwater replenishment;
- Regulation of water levels in watersheds; and
- Open space corridors and recreational opportunities, such as fishing, boating, and hunting.

The Massachusetts Wetlands Protection Act and the Rivers Protection Act limit development activity in the inner riparian area. The Rivers Protection Act offers additional protection of lands in the area between 100 feet and 200 feet of the mean high water mark of any stream or river that flows throughout the year. This outer riparian zone is susceptible, however, to limited development in certain instances.



The banks of the Little River, like those of other rivers and streams in the region, provide important habitat for wildlife and plants.

Water Quality

The Westfield River provides the main drainage for the area and boasts some of the cleanest water in the state, contributing to its status as a federally-designated National Wild and Scenic River. All the streams and rivers within the Westfield River watershed are safe for swimming, fishing, boating and recreating according to the Department of Environmental Protection's 2005 Watershed Water Quality Assessment Report.²

The Middle Branch of the Westfield River is categorized as Class A, meaning that it is designated as a source of public water supply. Class A waters are excellent habitat for fish, other aquatic life, and wildlife; are suitable for primary and secondary contact recreation; and have excellent aesthetic value. These waters are designated for protection as Outstanding Resource Waters (ORWs) by the Commonwealth. The designation of ORW is applied to those waters with exceptional socio-economic, recreational, ecological and/or aesthetic values. ORWs have more stringent requirements than other waters because the existing use is so exceptional or the perceived risk of harm is such that no lowering of water quality is permissible.

² Westfield River Watershed 2001 Water Quality Assessment Report. Massachusetts Department of Environmental Protection, Division of Watershed Management. April 2005.

Other rivers and streams within the Byway corridor are all Class B waters, meaning that they are designated as a habitat for fish, other aquatic life, and wildlife, and safe for primary and secondary contact recreation. Where designated, they are also suitable as a source of water supply with appropriate treatment, and for irrigation and other agricultural and industrial uses. These waters have consistently good aesthetic value. The East Branch of the Westfield River is classified as a Class B Cold Water Fishery, and is regularly stocked by the Massachusetts Department of Fish and Wildlife with salmon fry and trout.

In order to prevent degradation of the area's water quality, it is essential to protect rivers and streams from the negative effects of development, aging septic systems, informal recreation areas without toilet facilities, current and former agricultural uses and road runoff. The Route 112 Byway Advisory Committee for Hampshire County has noted that C.M. Gardner State Park has been posted for "no swimming" during the past two summers; and Hammond Pond, Damon Pond, and Norwich Pond are all at risk due to overdevelopment of the shoreline.

Table 3-2: Lake & Pond Water Quality—Hampshire County

Goshen		
Pond Name	Water Quality Classification	Potential Threats
Lily Pond	Not listed	
Sears Meadow Pond	Not listed	
Upper Highland Lake	Category 2	
Lower Highland Lake	Category 3	
Hammond Pond	Category 3	Aging Septic Systems
Damon Pond	Category 3	Aging Septic Systems
Worthington		
Little Galilee Pond	Not listed	
Conwell Pond	Not listed	
Huntington		
Littleville Lake	Category 3	
Norwich Pond	Category 3	Aging Septic Systems

Source: Massachusetts Year 2008 Integrated List of Waters

Category 2 Waters are defined as "Attaining some uses, others uses not assessed"

Category 3 Waters are defined as "No uses assessed"

Stormwater runoff from roads and parking lots is a particular threat to the Byway's natural resources. Traditionally the main priority of roadway stormwater management systems has been to shed water off the travel ways as quickly as possible. For much of the Byway, stormwater runoff is directed as sheet flow into the surrounding landscape. In other areas, runoff is directed through man-made swales into culverts, after which it is discharged untreated into the nearest waterway.

Runoff from parking lots and roads alters natural hydrological regimes with stormwater moving at higher velocities and volumes over these impervious surfaces into nearby rivers and streams. Runoff can also be a major source of pollution, contributing significant amounts of sand and salt from winter maintenance activities, petrochemicals and heavy metals from traveling vehicles, and warmer waters flowing off pavements heated by the summer sun. The chemical and temperature changes are of special concern for cold water fisheries.

Because the natural resources of the corridor are such an integral part of the scenic values of the Byway, all practices and projects within the Byway corridor, including MassHighway redevelopment projects, should incorporate improved stormwater management techniques. At a minimum, catch basins should be replaced with deep sump catch basins, and other stormwater best management practices, such as infiltration and detention techniques, should be considered in every roadway project within the Byway corridor. Road runoff discharges into cold water fisheries and rare species habitat should be especially scrutinized. Improved treatment of runoff should also include ancillary areas along the Byway such as pull-offs and parking areas.

Dams

At least 21 dams in Hampshire County are distributed throughout the Byway corridor with many others nearby. The two largest dams, Knightville Dam, on the East Branch of the Westfield River, and Littleville Dam, on the Middle Branch of the Westfield River, were established in tandem as flood control for downstream communities. According to the U.S. Army Corps of Engineers, the dams helped to prevent an estimated \$11 million in flood damage during one storm event in April 1987. Springtime release schedules at the Knightville and Littleville dams are timed to provide challenging flows during the Westfield River Wildwater Races.

Dams generally pose a number of hazards related to potential failure events, including damage to human life and property, and release of hazardous substances contained in the silt behind the dam. Dams also present costs to the ecological health of a river system. By impeding the flow of water, they obstruct the movement of sediment and nutrients, increase water temperature, and decrease oxygen levels thereby altering populations of fish and other species. They also block the movement of fish from one segment of the river to another.

The following table lists the dams within the Route 112 corridor in Hampshire County by town.

Table 3-3: Dams in the Route 112 Scenic Byway Corridor—Hampshire County

Hampshire County	Fish Passage (Y/N)
Goshen	
Sears Meadow Dam	Unknown
Upper Highland Lake Dam	Unknown
Upper Highland Lake Dike	Unknown
Lower Highland Lake Dam	Unknown
Hammond Acres Pond Dam	Unknown
Twining Brook Pond Dam	Unknown
Williams Pond Dam	Unknown
Cummington	
Cummington Activity Center Dam	Unknown
West Cummington Reservoir Dam	Unknown
Bryant Homestead Dam	Unknown
Shire Village Dam	Unknown
Worthington	
Little Galilee Pond Dam	Unknown
Chesterfield Road Lot Pond Dam	Unknown
House Lot Pond Dam	Unknown
Smith Farm Lower Pond Dam	Unknown
Smith Farm Upper Pond Dam	Unknown
Ward Stream Dam	Unknown
Earthen Dam at Old Port Road/Radacher Road	Unknown
Huntington	
Littleville Dam	Y*
Knightville Dam	Y*
Norwich Pond Dam	Unknown

Source: Massachusetts Office of Dam Safety, July 2007 and local knowledge.

*Some stocked fish are able to pass downstream, but there is no provision for upstream movement.

Plant and Animal Species

The Route 112 Scenic Byway corridor boasts miles of forests, meadows, and farmlands that support a wide variety of wildlife and vegetation. These landscapes are important not only for their scenic beauty, but also because of the habitat they provide. As the agricultural economy has slowed in the region, expansive forests, once cleared for farming and grazing, have returned along with healthy populations of forest species, including birds, fish, and

many other animals. Biodiversity, and the habitat that supports it, are vital resources for the region and key factors in attracting tourists seeking to experience the region's natural beauty.

The proliferation of wildlife management areas, state parks, state forests, and privately-owned conservation areas along the Byway corridor serve as tremendous assets for wildlife and humans alike. These habitats are some of the least fragmented in the entire state, creating many unique and important areas for protecting flora and fauna, as well as opportunities for visitors to view them. (See Outdoor Recreational Resources chapter for information on specific state parks, forests, and wildlife management areas.)

Vegetation

Lands within the Byway corridor support a variety of coniferous and deciduous forests, grasslands, wetlands, and riparian vegetation. The Massachusetts Natural Heritage and Endangered Species Program (NHESP) has mapped ecologically significant natural communities, and there are eight different natural communities along the Byway corridor in Hampshire County. These include:

- Spruce-Fir Boreal Swamp – forested wetlands dominated by Red Spruce and Balsam Fir.
- Level Bog – dwarf shrub peatlands, generally with pronounced hummock and hollow formations.
- Rich, Mesic Forest – northern hardwood forest, dominated by Sugar Maple with a diverse herbaceous layer and many spring ephemerals, unusual plants that appear only in spring, in a moist, nutrient-rich environment.
- Forest Seep – hardwood forests found on wet slopes, where groundwater seeps out of the earth, many wetland ferns, shrubs occur.
- Riverside Seep – mixed herbaceous community that occurs at the base of steep riverbanks where groundwater seeps out of the bottom of the upland slopes.
- High-Energy Riverbank – sparse, open communities dominated by grasses and related species, found on cobble and sand deposits along fast-flowing rivers that experience severe flooding and ice scour.
- Northern Hardwoods-Hemlock-White Pine Forest – mix of evergreen and deciduous trees, with a closed, full canopy, and sparse shrub and herbaceous layers.
- Riverside Rock Outcrop – sparsely vegetated areas in crevices on riverside rock outcrops where soil accumulates.

According to NHESP reports, the examples of these natural communities throughout this region are some of the best in the state. The more common natural communities are in a relatively pristine state, a rare occurrence in New England. They are not fragmented by roads or development, and free of invasive species. Some of these natural communities, like level bogs, are exceptionally uncommon, and to find them within thousands of acres of protected land is even more unique.

More specifically, approximately 13 miles, encompassing almost 4,000 acres, of the Byway corridor in Hampshire County is flanked by what NHESP terms “core” or “support” habitat. These are areas where combinations of natural communities exist, creating unique habitat.

The forests along the Byway corridor are some of the least fragmented and most intact in all of Massachusetts. Approximately 14,414 acres, or 77 percent, of the region is forested. Much of the forest is approaching maturity after being cleared in the 1800s. It contains a mix of species that vary with the topography. Common species include white pine, red oak, red maple, black birch, white birch, white ash, sugar maple, yellow birch, beech, hickory, black cherry, white oak, aspen gray birch, cedar, hop hornbeam, and pitch pine. Stands of white pines may be found in former clearings and abandoned fields.

Often forestlands in the region also boast woody shrubs like blackberry, blueberry, and crabapple. The herbaceous plants of the forest are mostly spring blooming perennials and include Canada mayflowers, anemones, bloodroots, trilliums, violets, columbines, star flowers, dog-toothed violets, lady slippers, jack-in-the-pulpits, wood asters and many more. Up to 25 species of ferns, club mosses and horsetails may be found in the region’s forests, limestone pockets and ravines may contain rare species. Various uncommon plants in the region include: purple fringed orchid, marsh cinquefoil, sundew, rattlesnake plantain, spotted wintergreen, white baneberry, new marigold, and spotted coralroot.

Protecting and enhancing these forest resources can provide long term economic benefits as well as providing protection for the diversity of wildlife species that are dependent on them. The economic value and greater value of the forest resources to the community as a whole extends beyond lumbering and sale of forest species. Trees not harvested for commercial applications provide flood mitigation, water supply filtration, air quality improvements, erosion control, visual buffers, habitat and resources for wildlife, and recreation opportunities. Thus active forest management for all of these uses benefits residents and businesses alike in the area.

Another major land type within the Byway corridor is open fields, meadows, or pastureland. Approximately 4 percent of the land, or 616 acres, is pastureland. The areas are sometimes farmed for grain, seeded crops, and legumes, or overtaken by grasses, herbs, shrubs and vines. Examples of field and pasture vegetation include corn, wheat, oats, barley, fescue, lovegrass, bromegrass, clover, and alfalfa.

The region has large expanses of open space, totaling approximately 15,840 acres, much of which lines the Byway corridor as it weaves through the region.

Wildlife

The corridor has a diversity of major wildlife habitat types. Its rivers, wetlands, forests, meadows, and hill-top ridges provide sustenance, mating grounds, and vegetated cover for wildlife. Since many species rely on a variety of habitat types during different periods of their life cycle, species diversity is greatest in areas where several habitat types occur in close proximity to one another.

Habitat changes and exploitation in the past resulted in a drastic reduction or even disappearance of many animals, such as white-tailed deer, black bear, fisher, mountain lion, timber wolf, and wild turkey. As habitats once again became favorable, many of these species are returning. The return of some species, such as wild turkey, required human intervention, while others, such as mountain lion and timber wolf, have yet to return. Eastern coyote, a newcomer to Massachusetts, has filled this large predator niche.

The most conspicuous inhabitants of the wooded areas are birds. At the peak of the spring migration in May, a good observer with a little luck could see more than 100 species of birds in one of these areas in a single day. Some of the more common species are wood thrush, veery, ovenbird, red-eyed vireo, yellow-bellied sapsucker, blue jay, black and white warbler, and Swainson's thrush. The mammalian inhabitants of the forests include white-tailed deer, gray squirrel, red squirrel, chipmunk, porcupine, black bear, snowshoe hare, eastern cottontail rabbit, striped skunk, raccoon, and coyote. The most common reptiles and amphibians are red eft (juvenile red-spotted newt), red-backed salamander, American toad, spring peeper, wood frog, northern brown snake, northern red-bellied snake, and eastern milk snake.

Open fields, meadows, and pastured areas are favorite habitats for numerous species, including many of those that inhabit forested areas. Some common birds prevalent in fields and meadows are the song sparrow, savannah sparrow, crow, tree swallow, barn swallow, bobolink, kestrel, and bluebird. The most common mammals are red fox, woodchuck, meadow vole, short-tailed shrew, and meadow jumping mouse. The most common reptiles and amphibians are smooth green snakes, eastern garter snake, leopard frog, and pickerel frog.

In addition to terrestrial wildlife, the region boasts several species of aquatic animals, birds, and of course, fish. The region is abundant with streams, rivers, ponds, swamps, and vernal pools – all unique and important aquatic habitats. Among the non-waterfowl found in aquatic habitats are red-winged blackbird, song sparrow, swamp sparrow, common grackle, and tree swallow. Waterfowl include Canada goose, wood duck, black duck, and hooded merganser. A few of the rarer species are American bittern, bald eagle, common loon, and long-billed marsh wren. Beaver, otter, mink, and muskrat are common mammalian inhabitants. The most common aquatic amphibians and reptiles include the snapping turtle, painted turtle, northern water snake, red-spotted newt, bull frog, and green frog. No fewer

than twenty species of fish inhabit the ponds, lakes, and rivers in the area. Common pond species are pumpkinseed, yellow perch, chain pickerel, largemouth bass, and brown bullhead, while blacknose dace, longnose dace, slimy sculpin, white sucker, and brook trout are widespread in streams and rivers.

Rare Species

Although some species in the area now thrive in greater numbers than during the pre-colonial past, others have become threatened. Habitat loss due to physical barriers to breeding, competition from invasive species, forest fragmentation, human development activities, global warming, and meadow succession is the major factor in the decline of these species. The following table outlines which species are facing some threat for survival in the region:

**Table 3-4: Documented Rare Animals along the Route 112 Scenic Byway Corridor
Hampshire County**

Common Name	Scientific Name	Taxonomic Group	Rating
Four-toed Salamander	Hemidactylium scutatum	Amphibian	Special Concern
Jefferson Salamander	Ambystoma jeffersonianum	Amphibian	Special Concern
Twelve-spotted Tiger Beetle	Cicindela duodecimguttata	Beetle	Special Concern
American Bittern	Botaurus lentiginosus	Bird	Endangered
Golden-winged Warbler	Vermivora chrysoptera	Bird	Endangered
Mourning Warbler	Oporornis philadelphia	Bird	Special Concern
Sedge Wren	Cistothorus platensis	Bird	Endangered
Sharp-shinned Hawk	Accipiter striatus	Bird	Special Concern
Ostrich Fern Borer Moth	Papaipema sp. 2 nr. pterisii	Butterfly/Moth	Special Concern
Arrow Clubtail	Stylurus spiniceps	Dragonfly/Damselfly	Threatened
Harpoon Clubtail	Gomphus descriptus	Dragonfly/Damselfly	Endangered
Ocellated Darner	Boyeria grafiana	Dragonfly/Damselfly	Special Concern
Riffle Snaketail	Ophiogomphus carolus	Dragonfly/Damselfly	Threatened
Ski-tailed Emerald	Somatochlora elongata	Dragonfly/Damselfly	Special Concern
Zebra Clubtail	Stylurus scudderi	Dragonfly/Damselfly	Endangered
Bridle Shiner	Notropis bifrenatus	Fish	Special Concern
Lake Chub	Couesius plumbeus	Fish	Endangered
Longnose Sucker	Catostomus catostomus	Fish	Special Concern
Water Shrew	Sorex palustris	Mammal	Special Concern
Creeper	Strophitus undulatus	Mussel	Special Concern
Wood Turtle	Glyptemys insculpta	Reptile	Special Concern

Source: Natural Heritage and Endangered Species Program, March 2007.

**Table 3-5: Documented Rare Plants along the Route 112 Scenic Byway Corridor
Hampshire County**

Common Name	Scientific Name	Taxonomic Group	Rating
Barren Strawberry	Waldsteinia fragarioides	Vascular Plant	Special Concern
Black Cohosh	Actaea racemosa	Vascular Plant	Endangered
Dwarf Scouring-rush	Equisetum scirpoides	Vascular Plant	Special Concern
Foxtail Sedge	Carex alopecoidea	Vascular Plant	Threatened
Hairy Wood-mint	Blephilia hirsuta	Vascular Plant	Endangered
Hitchcock's Sedge	Carex hitchcockiana	Vascular Plant	Special Concern
Hooded Ladies'-tresses	Spiranthes romanzoffiana	Vascular Plant	Endangered
Muskflower	Mimulus moschatus	Vascular Plant	Endangered
Purple Giant Hyssop	Agastache scrophulariifolia	Vascular Plant	Endangered
Slender Cottongrass	Eriophorum gracile	Vascular Plant	Threatened
Spurred Gentian	Halenia deflexa	Vascular Plant	Endangered
Threadfoot	Podostemum ceratophyllum	Vascular Plant	Special Concern
Tuckerman's Sedge	Carex tuckermanii	Vascular Plant	Endangered
Wild Senna	Senna hebecarpa	Vascular Plant	Endangered
Woodland Millet	Milium effusum	Vascular Plant	Threatened

Source: Natural Heritage and Endangered Species Program, March 2007.

Preventing the extinction of these species is critical to maintaining biodiversity in the region. A biologically diverse native ecosystem is important to ensure stability of all plant and animal species. On a global scale, it is essential for human health as well. As the number of species within an ecosystem decline, the remaining species become more dependent upon fewer resources for survival. In many cases, the elimination of one species leads to the demise of others when such species cannot adapt to the changes in their environment.

In order to maintain the diversity of landscape and wildlife we now have, a wide variety of habitats should be protected, such as wetlands, forests and open areas. If possible, protecting contiguous parcels of diverse land is better than protecting isolated ones. Land that contains features such as temporary spring ponds that facilitate reproduction of various wildlife species and stands of old nut trees that provide valuable winter food are especially valuable.

Another factor to consider is that, due to natural causes, environmental conditions will always be changing and decisions will have to be made about whether to actively manage an area. Entire species such as the chestnut may disappear due to diseases and others such as purple loosestrife, an invasive European native, may appear and take over large areas. Marshes accumulating silt and organic matter over the years can turn into swamps and then

into forests. If fields and pastures are to be protected, they have to be actively managed or they will eventually return to forest.

Cold Water Fisheries

Recent work by MassWildlife, a section within the Massachusetts Division of Fisheries and Wildlife, has identified streams in the state that are particularly important for cold water fisheries. Such “Cold Water Fisheries Streams” are located all along the Route 112 Scenic Byway corridor in Hampshire County. These cold water fisheries include many waterways: Pond Brook, Little River, Watts Stream, Wards Stream, Bronson Brook, Steven Brook, Childs Brook, Kearney Brook, Swift River main stem, Swift River north branch, Stones Brook, Meadow Brook, Mill Brook, and the Mill River. These fisheries also include all branches of the Westfield River. These waterways support trout, which require cold, clean water to survive, and which are especially sensitive to pollution. It is therefore essential that cold water streams be protected from the negative impacts associated with development and roadway/parking lot runoff. One specific issue of concern is the pollution caused by stormwater runoff from the roadways, parking lots and pull offs within the Byway corridor.

To safeguard these cold water streams, MassWildlife is recommending maximum protection, including strict enforcement of the 200-foot riverfront area, which is a regulated resource area under the Massachusetts Rivers Protection Act. Protections can include maintaining or increasing vegetated buffers between roadways and waterways, improving the stormwater drainage system along the Byway, and careful consideration of potential to restore habitat through dam removal and through improvements at road crossings.

Vernal Pools

Vernal pools are ephemeral wetlands that fill annually from snowmelt, rain and the rising groundwaters of spring and early summer. In most years, the pools completely dry out by mid to late summer. Many woodland amphibians and reptiles need both aquatic and terrestrial habitats to complete their lifestyles, and numerous species have evolved life cycles that exploit the temporary nature of this wetland without the predation of fish. In many upland areas, where the nearest wetland or other waterbody is thousands of feet away, vernal pools are the only aquatic breeding grounds in the area. Some of the state’s rarest amphibians are completely dependent upon vernal pools for their breeding grounds, including the mole salamanders (Jefferson, spotted, marbled salamanders) and some species of freshwater snails, clams and other invertebrates.

Vernal pools are indispensable to biodiversity, both locally and globally. For a species with a narrow or small distribution, a specific vernal pool may be the only place in the region or on earth that the creature is found. If that pool is destroyed, that specific population of creatures could become locally extinct. Examples exist in the scientific literature of a species identified from one vernal pool, but not found again after the destruction of that pool (Kenney & Burnes, 2000). Because many of the region’s rarest amphibians rely completely on vernal pools, it is important to identify vernal pools and prioritize those known to support rare species for protection.

The most effective way to protect vernal pools is to study and certify them. NHESP certification provides the pools and their surrounding area some protection from development. There are no certified vernal pools in Hampshire County's study corridor, but there are 34 sites that have been identified as possible vernal pools. Potential Vernal Pools within the Byway corridor are located in Goshen (2), Cummington (5); Worthington (16); and Huntington (11). Those Potential Vernal Pools that are in clusters and in the most easily developed areas, such as long roadways, should be targeted for study. Purchase of lands with vernal pools would make particularly good acquisitions for protecting the biodiversity of the Byway region.

Habitat Fragmentation

The towns along the Route 112 Scenic Byway are fortunate in that they contain relatively large tracts of unfragmented forest interspersed with streams, ponds and wetlands. These forests can provide cover and travel corridors for a wide variety of animals, including rare species. A serious threat to the ecological integrity of the region's natural resources is habitat fragmentation. Clearing for development or for new roads interrupt and create barriers for wildlife migration and dispersion. The Byway is itself a barrier, resulting in injury or death to wildlife as they cross the road. In order to maintain current wildlife populations and to limit rare species loss, large contiguous and interconnecting tracts of land should be targeted for protection.

The impacts to wildlife movement and mortality are significant. As stated by Scott Jackson of the University of Mass. Department of Conservation Resources,

As long linear features on the landscape, railways, roads and highways have impacts on wildlife and wildlife habitat that are disproportionate to the area of land that they occupy. In addition to impacts on habitat, highways and railways are sources of road mortality that threaten wildlife populations. Indirect effects on wildlife include reduced access to habitat due to road avoidance and human exploitation. Transportation infrastructure also undermines ecological processes through the fragmentation of wildlife populations, restriction of wildlife movements, and the disruption of gene flow and metapopulation dynamics.

This impact to habitat extends to the waterways located throughout the Byway corridor. Modification of stream channels with culverts to accommodate bridge crossings can seriously compromise ecological health. If not properly constructed, culverts can act to restrict or increase natural stream flow, cause scouring and erosion, and prevent the movement of fish, amphibians, and other biota from one stream segment to another. The Massachusetts Riverways program has noted that, "Crossings should be essentially 'invisible' to fish and wildlife—they should maintain appropriate flow and substrate through the crossing and not constrict a stream."

Natural Resource Protection

Natural resources in the Byway corridor are afforded protection by national, state, and local laws. The following is a list and description of these regulations.

National Park Service, Section 7 of the Wild & Scenic Rivers Act

National Park Service review required if federal funds, permits or assistance to an activity or project within .25 miles of a designated National Wild & Scenic Rivers Segment.

Clean Water Act , 33 U.S.C. §1251 et seq. (1972)

The Clean Water Act establishes the basic structure for regulating discharges of pollutants into the waters of the United States and regulating quality standards for surface waters. Under the Clean Water Act, EPA's National Pollutant Discharge Elimination System (NPDES) permit program requires the implementation of controls designed to prevent harmful pollutants from being washed by stormwater runoff into local water bodies. Many operations and communities, depending on size and density, throughout Massachusetts must obtain NPDES permits. Regulated entities must obtain coverage under a NPDES stormwater permit and implement stormwater pollution prevention plans (SWPPPs) or stormwater management programs (both using best management practices (BMPs)) that effectively reduce or prevent the discharge of pollutants into receiving waters.

Massachusetts Wetlands Protection Act, M.G.L. c. 131, §40; and Wetlands Regulations, 310 CMR 10.00

Massachusetts law limits the impacts of construction and alteration activities in wetlands through enforcement by the local conservation commission. Proponents of projects within a wetlands or within the 100-foot buffer zone of the wetlands must apply for an Order of Conditions from the local conservation commission. Development proposals are reviewed and occur only at the discretion of the conservation commission. State law does not protect non-bordering vegetated wetlands, called isolated wetlands, unless they are certified vernal pools.

Massachusetts Rivers Protection Act, 310 CMR 10.58

The Rivers Protection Act offers additional protection of land between 100 feet and 200 feet of the mean high water mark of a qualifying stream or river. The Rivers Act does not provide absolute protection from development, which can occur in this zone under certain circumstances.

Massachusetts Stormwater Regulations

In early 2008, the state of Massachusetts issued updated stormwater regulations in accordance with revisions to the Wetlands Regulations, 310 CMR 10.00, and the Water Quality Regulations, 314 CMR 9.00. The 10 stormwater standards set forth in the regulations and in the Massachusetts Stormwater Handbook are applied in areas subject to the jurisdiction under the Massachusetts Wetlands Protection Act.³ The state is currently proposing additional stormwater regulations for 314 CMR 21.00 that apply to any property owners or developers proposing impervious surfaces of 5 acres or more. Through local bylaws, some municipalities are applying these standards to upland areas.

As a state numbered highway, stormwater regulations for the Jacob's Ladder Trail Scenic Byway itself come from MassHighway. The MassHighway Stormwater Handbook for Highways and Bridges dates from May of 2004.⁴ This handbook focuses on how MassHighway can meet the state's stormwater standards based on the inherent and unique constraints and opportunities presented by existing roadways. Most work on Route 112 entails either routine maintenance, where stormwater management standards do not apply, or redevelopment of previously developed sites, which "...must meet the Stormwater Management Standards to the maximum extent practicable. However, if it is not practicable to meet all the Standards, new (retrofitted or expanded) stormwater management systems must be designed to improve existing conditions." The MassHighway handbook will be updated to include the new state standards toward the end of summer 2009.

Massachusetts Endangered Species Act, M.G.L. c. 131A; Massachusetts Endangered Species Act Regulations and List of Endangered, Threatened, and Special Concern Species, 321 CMR 10.00

The Massachusetts Endangered Species Act (MESA) prohibits any alteration of significant habitat of any protected species that may reduce the viability of the habitat. The Act is administered by the Natural Heritage and Endangered Species Program (NHESP) with the Massachusetts Department of Fish and Game. If a project is proposed in habitat of rare or endangered species, as delineated by the NHESP data base, a Rare Species Information Request form must be submitted to NHESP. Projects are screened by NHESP using Priority Habitat, which is delineated based on records of state-listed species observed within the last 25 years prior to delineation and contained in the NHESP data base. NHESP will determine the rare species present in the estimated habitat and recommend measures to protect them. Note that Estimated Habitat is included within Priority Habitat and includes only those areas delineated as habitat for wildlife species (including invertebrates) having wetland-habitat requirements.

³ The *Massachusetts Stormwater Handbook* can be viewed at:
<http://www.mass.gov/dep/water/laws/policies.htm#storm>.

⁴ The *MassHighway Stormwater Handbook for Highways and Bridges* can be viewed at:
<http://www.mhd.state.ma.us/downloads/projDev/swbook.pdf>.

Massachusetts Forest Cutting Practices Act, M.G.L. c. 132, §40-46; and Forest Cutting Plans, 304 CMR 11.00

Land-use projects that are conducted within Priority Habitat, but consist only of cutting and removal of trees for the purpose of selling the trees or their derivative products may be exempt from MESA project filing requirements when the project is carried out on land maintained in forest use. This exemption requires that the forestry project be conducted in accordance with an approved Forest Cutting Plan under the provisions of the Forest Cutting Practices Act and its implementing regulations. Forest Cutting Plans are submitted to the Department of Conservation and Recreation (DCR) for review and approval. However, under 304 CMR 11.04(6), DCR shall forward a Forest Cutting Plan to the NHESP whenever the harvest area proposed in the plan coincides with Priority Habitat. The NHESP reviews the plan to determine whether there is reasonable potential for harvesting activities proposed in the plan to result in direct or indirect harm to state-listed species. The NHESP issues a letter (commonly called a "determination") to the DCR that explains whether there is potential for harvesting activities to adversely impact state-listed species, or whether additional information is needed to complete the review. When the NHESP does not expect adverse impacts, it makes no recommendation for modification of the Forest Cutting Plan. When there is reasonable potential for adverse impacts, the NHESP provides a list of recommended modifications of the plan to avoid a "taking" of state-listed species. The DCR then modifies the plan accordingly prior to final approval.

Massachusetts State Building Code

The State Building Code requires the elevation of structures in the floodway—the floor of the lowest habitable area in the structure must be above the base elevation for floodwaters during a 100-year storm event. The code also reinforces the overlay district regulations by prohibiting any change in the flood storage capacity of the area.

Title 5 of the State Environmental Code, Minimum Setback Distances for Septic Tank, Holding Tank, Pump Chamber, Treatment Unit, Grease Traps, and Soil Absorption System, 310 CMR, §15.211

Minimum setback requirements in Title 5 for disposal facilities include surface waters, bordering vegetated wetland, reservoirs and impoundments, tributaries to surface water supplies, wetlands bordering surface water supply or tributary thereto, and certified vernal pools.

Massachusetts Environmental Policy Act (MEPA) 310, CMR 11.00

Large development projects or those that exceed certain environmental thresholds are often reviewed through the Massachusetts Environmental Policy Act (MEPA).

This act requires that state agencies reviewing the project study the environmental consequences of their actions, including the issuance of permits and the awarding of state funds. The review process, which is open to public comment, requires the developer to take

all feasible measures to avoid, minimize and mitigation damage to the environment. Natural resource thresholds that typically trigger this public review process include alteration of more than 25 acres of land, and significant impacts to wetlands, water supplies, and rare species.

Floodplain Overlay District

Cummington, Worthington, and Huntington have floodplain overlay districts that increase oversight of development within the 100-year floodplain and also limit most types of development. The overlay district sets additional submittal standards for those wishing to build in the district but does not disallow underlying uses.

River Protection Overlay District

Like the floodplain overlay district, the river protection overlay districts in Cummington, Worthington, and Huntington increase oversight of development and also limit some kinds of development. The Town of Goshen has no such overlay district.

Local Stormwater Bylaw

Goshen, Cummington, Worthington, and Huntington do not have local stormwater and erosion control bylaws that would extend state standards to upland areas. In Worthington, the Community Development Plan recommends adoption of such a bylaw, and in Huntington, both the Community Development Plan and the Open Space and Recreation Plan recommend adoption of such a bylaw.

Local Wetlands Bylaw

Communities in Massachusetts are enabled by state statute to develop local wetlands bylaws that contain stricter standards than the state wetlands protection regulations. None of the Byway communities have a local wetlands bylaw.

Scenic Mountains Act and Scenic Ridgeline or Scenic Uplands Overlay District

Development along steep slopes and ridges can negatively impact the scenic and rural nature of the Byway. Inappropriate development on steep slopes and upland ridges can also cause accelerated erosion, leading to sedimentation of lands and water resources down slope, and possibly degrading water clarity and quality. Sediment deposits in roadways can be safety hazards, and maintenance and repair on these areas can drain already strapped municipal budgets.

Local bylaws can be enacted to guide or limit development in steep, sensitive terrain. Usually called a scenic uplands or scenic ridgeline overlay district, such a bylaw limits development to protect scenic and natural resources. To date the efforts to move forward such protections in Huntington and Cummington, in particular, have failed. It appears that the rationale for such protections of views needs to be more compelling and simply stated so that everyone understands the benefits.

Findings and Recommendations

Findings	Recommendations
<p>Thirteen miles of the Route 112 Scenic Byway is flanked by some 4,000 acres of what the Massachusetts Natural Heritage and Endangered Species Program has identified as “core” or “support” habitat areas where combinations of natural communities exist, creating unique habitat for rare and endangered species.</p>	<p>Identify and explore opportunities to preserve the integrity of core and priority habitat areas, collaborating with The Nature Conservancy (TNC), The Trustees of Reservations (TTOR), Massachusetts Department of Fish and Game, and other non-profits, state agencies, or communities.</p> <p>For lands adjacent to core and priority habitat areas, towns should consider adopting a by-right cluster zoning bylaw or open-space residential development so that development is sited on the least ecologically sensitive land and the remainder is preserved for wildlife habitat. Other strategies should include outreach and education to residents about tax incentives available through conservation restrictions, and Chapter 61 for forest land.</p>
<p>NHESP has identified 34 potential vernal pools in the Route 112 corridor.</p>	<p>Work with NHESP to investigate potential vernal pools and apply for certification where eligible.</p>
<p>Bridges, culverts, and dams effectively fragment wildlife habitat, impeding animal movement from one location to another. The Byway is itself a barrier, resulting in injury or death to wildlife as they cross the road. These barriers to wildlife passage have been identified in a study by the University of Massachusetts, Department of Natural Resources Conservation.</p>	<p>Address barriers to terrestrial and aquatic wildlife passage, including dams and roadways. At dams, explore potential for fish passage or removal. For roadways, work to ensure that stream crossings and the associated bridges and culverts do not present obstacles to wildlife movement. Also for roadways, provide safe passage at well used wildlife crossings when possible.</p>
<p>Route 112 parallels the Westfield River and key tributaries for many miles. Runoff from rainfall and snowmelt, carrying pollutants, including roadsalt, are concerns for water quality. The warmer temperatures introduced by summer rainfall runoff moving over impervious surfaces are a concern for cold water fisheries.</p>	<p>Help to develop a more complete and clear understanding of the bylaws governing the area along the Westfield River through a series of workshops for Byway towns. These workshops should involve members of planning boards, conservation commissions, code enforcement officers, chief elected officials, highway departments, and boards of health. Follow up to these workshops might include some bylaw recommendations that offer clarification and better protection of natural resource values.</p>

Findings	Recommendations
	<p>Town planning boards should adopt local stormwater bylaws that require mitigation of stormwater impacts using Best Management Practices (BMPs).</p> <p>Actively pursue upgrades in stormwater BMPs for any road improvement projects proposed along the Byway. Also, define an overall river protection strategy wherever Route 112 parallels or crosses the Westfield River or its tributaries.</p> <p>Work with Mass Highway and local Departments of Public Works to adopt reduced road salt policies or determine alternatives in environmentally sensitive areas.</p> <p>Work with the Natural Resources Conservation Service and willing farmers to implement practices that limit agricultural stormwater runoff.</p>
<p>Informal recreation areas without toilet facilities could negatively affect water quality and recreational opportunities. Aging septic systems, especially those associated with residences around area lakes and ponds, also threaten water quality and recreational opportunities.</p>	<p>Research and develop strategies for managing informal recreation areas without toilet facilities that may be impacting water quality. Byway communities can tap into several possible grant and loan sources for upgrading septic systems. These include: Community Development Block Grants; U.S. Department of Agriculture; and the Massachusetts Department of Environmental Protection’s state revolving loan fund.</p>
<p>Increased recreational use of natural areas could damage assets if not properly managed in terms of proper disposal of litter, and erosion control.</p>	<p>Provide education for Byway tourists and visitors, through informational kiosks along the route, tourism brochures, and information for boaters, wildlife-watchers and fishermen. A possible funding source for this work could be the National Scenic Byways Program.</p>
<p>Key natural resource areas along the Byway are in private ownership, and not accessible to the public.</p>	<p>Work with local land trusts and landowners on conservation strategies, such as donation of conservation restrictions and recreational easements.</p>

Findings	Recommendations
<p>Exotic invasive flora and fauna are widespread in some of the more settled parts of the Byway and pose a threat to the core habitat areas in the region.</p>	<p>Map invasives to identify species and locations where control measures can be implemented to control spread and/or reduce coverage. Confer with the Nature Conservancy’s programs called <i>Weed it Now</i>, which focuses on removal of invasives, and <i>Keep it Clean</i>, which monitors areas in the forest core not yet infested by non-native species.</p>