Section 3

Environmental Protection (Natural Resources) and Open Space

INTRODUCTION

Every day in Middlefield, decisions are made that affect the future of land in our community – houses and building lots are bought and sold, building permits are issued and applications for land use changes are reviewed. These actions all help to shape the future of our town and the fate of its open spaces and farmlands. Our most important natural areas will be preserved only if we act as a community to protect them and to conserve the open space resources that give Middlefield its special character. This chapter is intended to capture a vision widely shared in the community of the importance of open space for our town's present and its future and to guide future land use decisions to help realize this vision.

In a 1988 survey conducted by the Conservation Commission, residents were asked what they liked BEST about living in Middlefield. The "rural setting" or "country atmosphere" was the first choice of 49 percent of those who responded to the survey. An additional 30 percent said that they liked the "beautiful scenery," "natural features,", "farmland," or "open space." Clearly, Middlefield residents value and want to preserve our town's natural resources, open spaces and rural character.

This chapter sets forth a set of guidelines to be used to help preserve and protect those natural resources most important to the future success and well-being of our town and its citizens. It is designed to assist the town in maintaining an optimum balance between natural resources and open space protection and cultural economic development.

Open Space Values

The value of our open space lands is both economic and intangible. People from all over Connecticut and surrounding states come to Middlefield to drive through scenic orchards, visit Wadsworth Falls and enjoy the peaceful rural atmosphere. Recreation and tourism are two very important economic concerns. Both are dependent on our open spaces and beautiful natural scenery. Our quality of life and peace of mind are enhanced by sharing our environment with birds and other wildlife, by opportunities to enjoy nature through hiking, walking, and cross-country skiing and by our daily views of fields and woodlands changing through the seasons. We depend upon clean water and air – not only to survive, but also to enjoy such activities as boating, fishing, and swimming. Outdoor recreation contributes to our health, our pleasure and our sense of community.

Farmlands and the Agricultural Community

Our farmlands are also an integral part of the unique quality of life we enjoy in Middlefield. They give us scenic vistas and fresh, locally grown food. They are a key aspect of our economy, not only through direct

production of farm products, but also because they contribute to the rural character that attracts tourism. Middlefield is favored in having a very high proportion of fertile, prime farmland. It would be desirable to protect this resource as a future source of food for our region of Connecticut. Good farmland is attractive and other uses are likely to provide much higher economic return than even the most profitable farm. Only by acting as a community to protect Middlefield's farmlands can we preserve our rich agricultural soils to produce food for future generations.

Simultaneously, the commercial farmers (family agriculture) must be supported in a manner which enables them to remain economically viable. Their livelihood of farming crops and tending poultry and livestock depends not only upon their lands but their ability to successfully navigate a multitude of regulatory and economic realities. As long as the agricultural community stays on course, much of the Town's prime agricultural land as established farmlands will remain as is. This is, in a sense, a form of open space preservation. See Section 9, "Agriculture," for additional information.

Growth and Open Space Planning

Middlefield is currently in transition from a rural to a suburban community. Though growth has slowed over the past few years, renewed development pressure is surely here now and in the future. Without a solid plan of what to preserve and protect, land with irreplaceable open space values could be lost forever.

Designation of private land in this open space plan does not affect the right of the owner to use that land. Rather, it raises specific concerns for consideration by town officials, landowners, developers and the general public. Protection of open space is a public responsibility, but it is one in which every private citizen shares through the ethics of individual land use decisions as well as through support of environmentally sound public policies.

If this plan is to be successful in protecting Middlefield's future, the town must make a commitment to its guidelines. This commitment must incorporate vision, sound fiscal planning and policy and the cooperation of all who participate in town government. The end result will be a sound investment in Middlefield's future.

MIDDLEFIELD'S CHANGING LANDSCAPE

Earth History

Middlefield's little piece of the earth is situated in a part of this continent that geologists call a rift valley. The rift is a great crack in the earth where the land shifted as the North American and the African continental plates collided and separated throughout early geologic history (according to the continental drift theory by which "continental plates" pulled apart and/or collided due to the earth's interior cooling and other forces). The Atlantic Ocean resulted from the widening rift between major continental plates. Hard crystalline rock found east and west of the Connecticut Valley (central lowlands) resulted from continental drift and mountain building eras that predate the formation of the central (rift) valley. The Central Valley, where Middlefield lies, was formed later due to faulting and subsidence (during the Triassic period 200 to 300 million years ago).

For millions of years as the Central Valley deepened, the land hinged on the Western side of the Valley, slanted downward along the Eastern Border Fault that passes just east of Middlefield. Abundant rainfall carried sediments from the surrounding highlands into the valley, where they hardened to form sedimentary

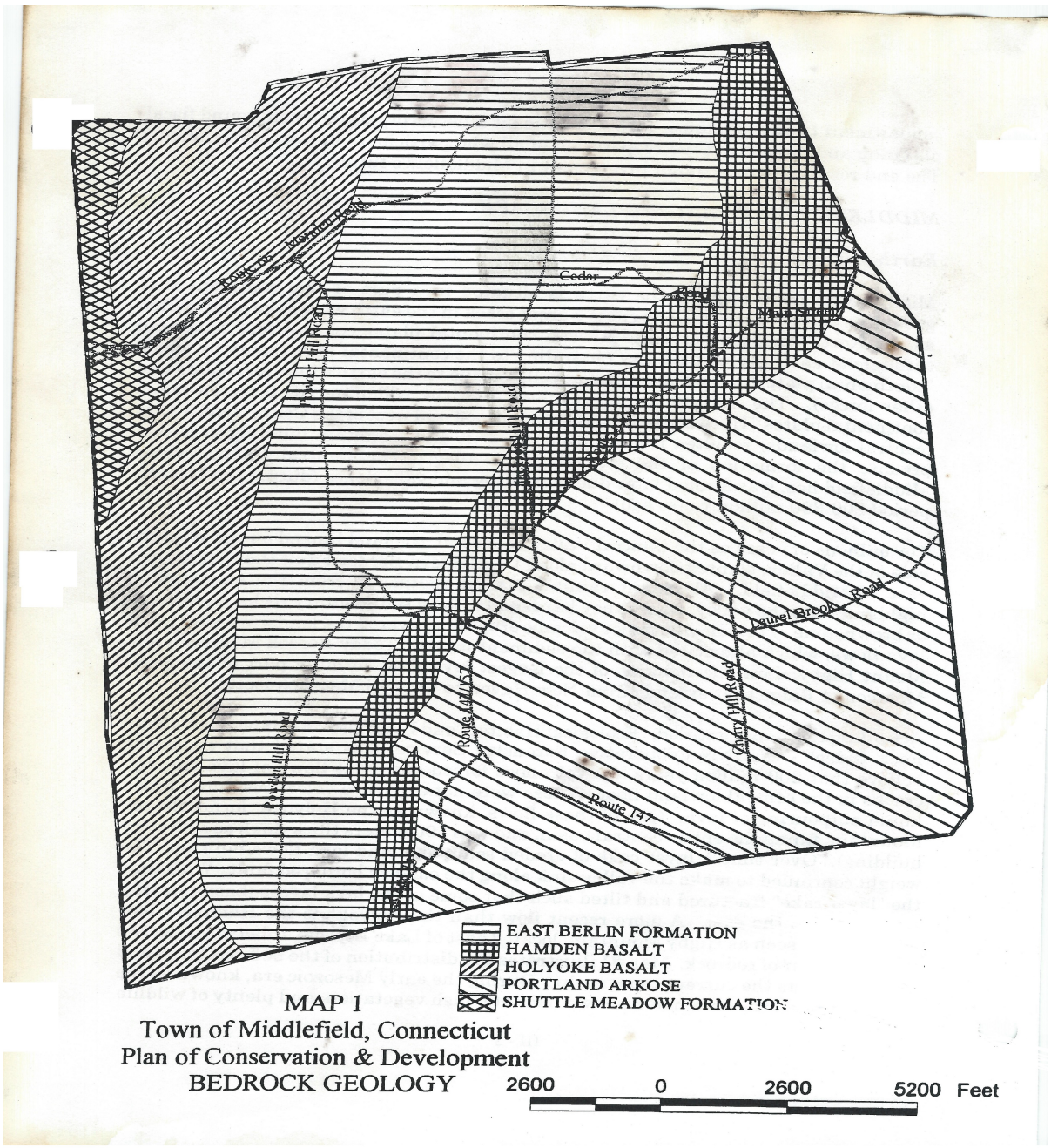
rocks, sandstone or brownstone. Periodically, major volcanic eruptions covered the landscape with great lava flows, which alternated with the sediment layers. Today, Beseck Mountain and Mount Higby show the remains of the largest lava flow, forming part of the great Metacomet Ridge that extends from New Haven to Central Massachusetts.

According to a paper entitled, "Ecological Habitats and Land Use on Connecticut's Trap Rock Ridge" – UCONN Cooperative Extension Service, it is stated that geologists believe that 200 million years ago volcanoes forced out great flows of lava through cracks in the central lowland floor. These were not explosive volcanoes, but a broad liquid outpouring of lava. One of these flows, known as the Holyoke, forms Beseck Mountain, filling the entire central basin, and was 100 meters thick (as high as a 35-story building). Over time, a layer cake of eroded sediments and lava flows built up. The weight continued to make the valley sink along the eastern bordered fault. With time, the "layer cake" fractured and tilted such that some of the lava layers (basalt or trap rock) tilted to the east. A more recent flow than the Holyoke is the Hampden flow which is now seen as Higby Mountain, located east of Lake Beseck. In between the two flows is a layer of redrock. Map #1 illustrates the distribution of the bedrock types and Map #2 depicts the current topography. During the early Mesozoic era, known as the Triassic period, the area had a hot wet climate, lush vegetation, and plenty of wildlife which left its tracks in the swamplands and red sediments (as evidenced at the Powder Hill Dinosaur Park). This later became shale and sandstone (sedimentary rocks). As the great era of volcanic activity in this part of the world ended, for millions of more years only the slow processes of erosion and sedimentation altered Middlefield's landscape.

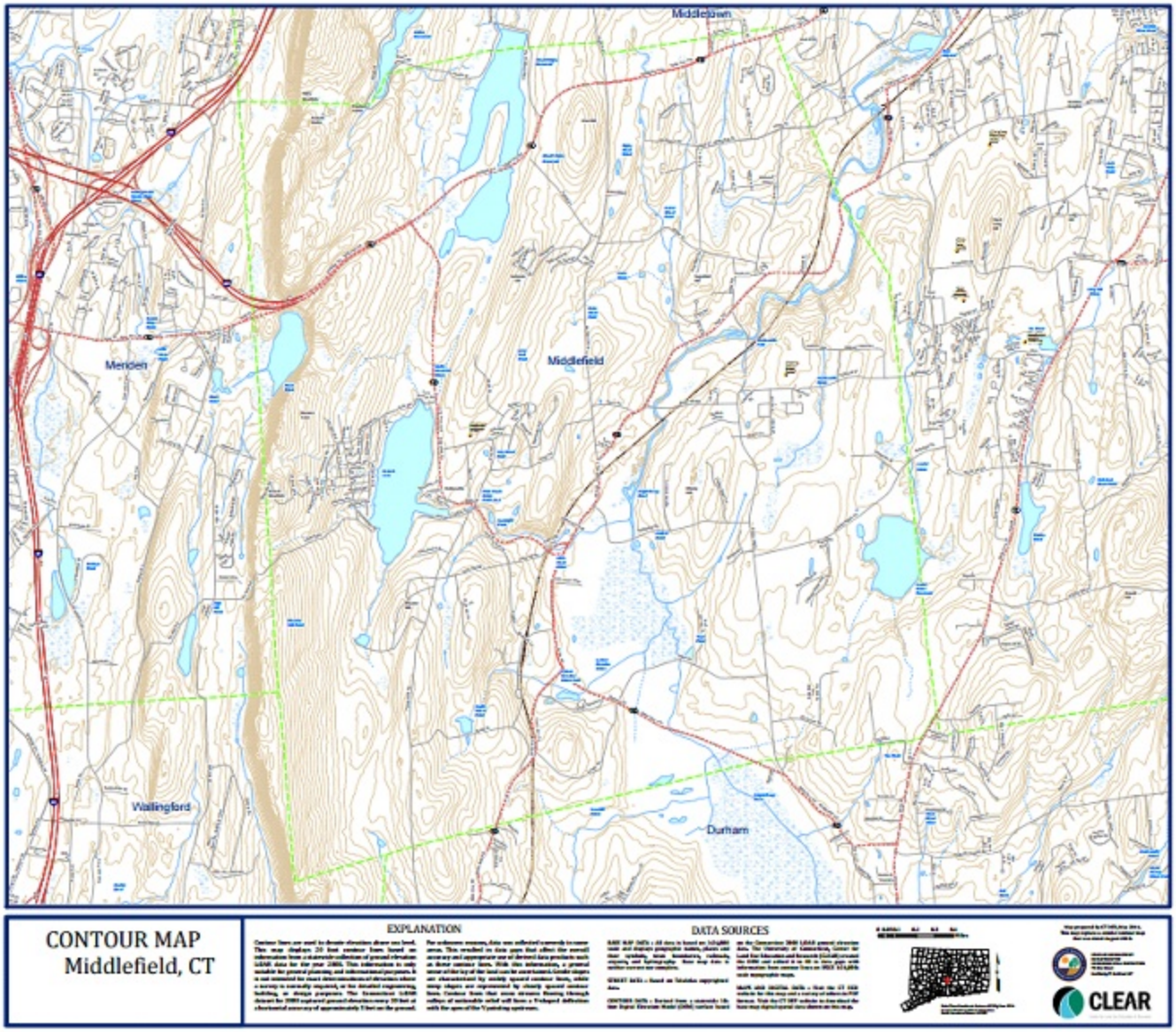
Then the world's climate began to cool and beginning about 5 million years ago, a series of glaciers moved down over Connecticut, scouring and shaping the land. The most recent of these glaciations began about 85,000 years ago and reached its peak about 25,000 years ago. Over the bedrock, bones that give the basic shape to our landscape, the glaciers dramatically rearranged soil, rocks and boulders, gouging out holes that would become first lakes, then swamps and other wetlands. Then, as the climate warmed and the glaciers retreated, their melting waters further modified the landscape, depositing the sand and gravel that today form the valleys of major rivers, like the Coginchaug, and that provide some of our most important farmland.

By 10,000 years ago or so, the land forms that give structure to Middlefield's landscape, hewn out of these geologic forces, were much as we see them today. Vegetation had returned in the glaciers' wake to create a great forest where native American people lived and hunted. Over thousands of years, these aboriginal residents of Middlefield wrought only small changes on the landscape.

State Archeologist Dr. Nicholas Bellantoni and others have found that "The Coginchaug meadows and river drainage's contain evidence of prehistoric native American occupation in the area for over 8,000 years" (12-plus sites). Archaic period natives are thought to have inhabited the Coginchaug area from 8,000 to 1,000 years ago and their more recent descendants occupied the area from 1,000 to about 200 years ago. Here they camped, hunted, fished, and foraged. See Map #3 "Cultural Areas of Significance."



MAP 1
Town of Middlefield, Connecticut
Plan of Conservation & Development
BEDROCK GEOLOGY


Middletown
Meriden
Middlefield
Wallingford
Durham
CONTOUR MAP
Middlefield, CT
EXPLANATION
DATA SOURCES
CLEAR

Colonization

Three hundred years ago, when the first English colonists came to what is now Middlefield, this land was part of one of the greatest northern hardwood forests in the world. It was a land abounding with a great diversity of plants and wildlife. Only the rocky mountain tops, lakes, rivers and marshes were open enough to afford distant views. The settlers began clearing this forest to build the farms that would be the principal means of livelihood in the area for nearly two centuries. By the time of the Civil War, Middlefield was an intensely agricultural community. More than three-quarters of its land was cleared and used for farming and grazing, leaving only the roughest and most infertile land to forest.

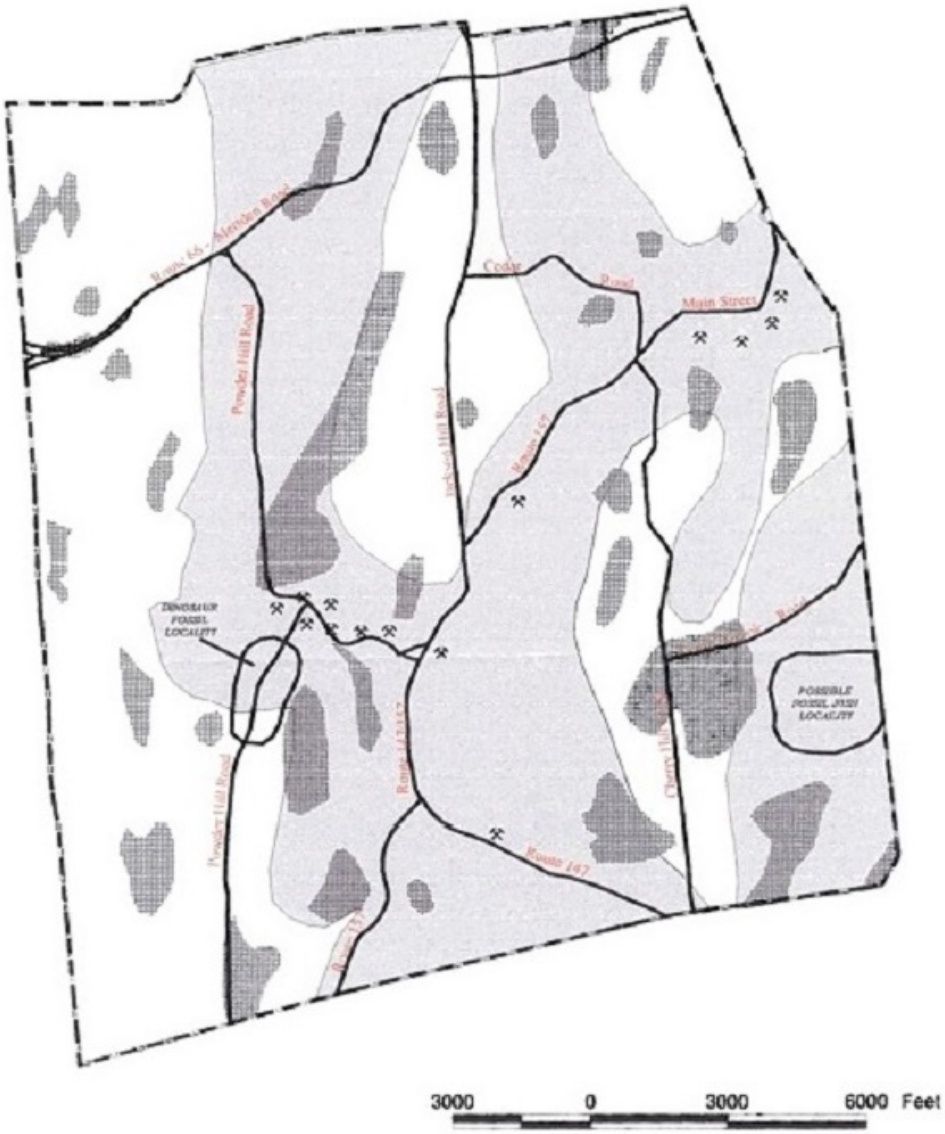
With the Civil War behind them, the descendants of many of Connecticut's early settlers were drawn by the opening of the west. Much of the state farmland was sold to new immigrants coming in from Europe. Increasing amounts of marginal farmland were simply abandoned as unproductive and allowed to revert to forest, which once again became the dominant feature of the Connecticut landscape. In Middlefield, we can see evidence of former farmland in stone walls winding through the woods. But Middlefield's landscape changed less during this era than that of most Connecticut towns. Its large areas of fertile farmland continued to be farmed often by descendants of its original settlers well into the twentieth century, long after less productive parts of the state were once more covered by forest.

The development and use of water-powered manufacturing along Middlefield's streams provided a new source of income for residents of the area. Lake Beseck was created in 1848 for powering a number of mills, which thrived until the early 1900s. In all, about 11 historical, industrial sites have been noted which include the Cherry Hill Dam and its predecessor, both upstream from Wadsworth Falls, and the three dam sites in the Rockfall Section (Pistol Factory, Powder Hill Paper Mill). These sites have been mapped as “Cultural Areas of Significance,” prepared by Dr. Nicholas Bellantoni, State Archeologist.

The appearance of electricity and the internal combustion engine initiated a new series of changes in Middlefield's landscape that are still at work today. The transportation and utility network we depend on today has largely “uncoupled” our land use decisions from the natural characteristics of the landscape. No longer must industry locate where the availability of power and natural resources dictates. No longer need we live close to where we work or to the source of our food. Cities and suburbs sprawl over the landscape and the best farmland becomes more economically valuable for bedroom community development, while our food is imported from megafarms hundreds of miles away.

During the past few decades, much of Middlefield's farmland, in agricultural use since colonial times, has been lost to development. As land has become more valuable for development, even areas too “rough” to farm, traprock ridges and wetlands and other vital natural areas, are once again being cleared, this time to build houses and roads.

Because we are today so independent of the natural constraints once imposed by the land, our open spaces can only be protected by the thoughtful and deliberate action of the community. Land use planning, regulations and municipal land acquisition, an increased understanding of natural processes and a vision of our community based on widely-shared land ethics are keys to assuring that Middlefield's future landscape is one we want to be part of. In the words of Aldo Leopold, “We abuse land because we think of it as a commodity belonging to us. When we see land as a community to which we belong, we may begin to use it with love and respect.”



HIGH ARCHEOLOGICAL SENSITIVITY

HIGH PROBABILITY AREAS

KNOWN ARCHEOLOGICAL SITE

Town of Middlefield, Connecticut
Plan of Conservation & Development
CULTURAL AREAS OF SIGNIFICANCE

Geographic Setting

Middlefield lies in the northwestern part of the Lower Connecticut River Council of Governments Region between the urbanized communities of Meriden and Middletown. The town has a total area of 13.3 square miles, or 8,448 acres. Middlefield is bordered on the north and east by Middletown, on the west by Meriden and Wallingford, and on the south by Wallingford and Durham. The topography of the western half of the town is characterized by long ridges running generally north-south. These ridges are dominated by Beseck Mountain with elevations approaching 800 feet above sea level. The eastern half of town is much more gently rolling with elevations generally reaching 250 to 300 feet above sea level.

Included in the 13.3 square miles are several large bodies of surface water which cover approximately 413 acres. The largest of these is the Mount Higby Reservoir, which covers 137 acres. Lake Beseck, a state-owned facility of 110 acres, is the second largest water body and provides both a swimming and boating area for town residents.

Drainage Basins

With a few exceptions, most of Middlefield drains into the Coginchaug River. The exceptions are as follows: Black Pond and the area to the north drains to the Quinnipiac River and Higby Reservoir drains (via Sawmill Brook) to the Mattabasset River. Subwater sheds to the Coginchaug are less than 2.0 square miles in area. Although endowed with scenic beauty, Middlefield's land forms pose many restrictions to development. Map #4 depicts the major and sub-basins in the community.

NATURAL RESOURCE CATEGORIES

Traprock Ridges

The two major bedrock types found in Middlefield are sedimentary (cemented clay, silt, sand and gravel, mainly shale and red sandstone) and igneous (formed by volcanic or magna flow which crystallizes as it cools and also known as traprock or basalt). Both rock types, aside from forming the landscape's backbone and giving rise to the scenic land forms, provides a source of construction rock (crushed traprock) and dimension stone (quarried redrock for architectural, construction and landscape use).

Middlefield's land form is dominated by a series of traprock ridges along the western border of the town, the most prominent of which is the combination of Higby and Beseck Mountains. Lesser hills are found running in a north-south direction through the central portions of Middlefield, notably Jackson Hill and Coe Hill, with elevations over 500 feet. The most prominent physical feature is the combination of Higby and Beseck Mountains from which hikers on the Mattabesett Trail are afforded spectacular views. The eastern portions of the community are characterized by generally rolling land with prominent features being Cherry Hill and Sugar Loaf Hill in the 200- to 300-foot range. A secondary traprock formation runs northeast to southwest through Rockfall-Middlefield Center and Route 157 at the Middlefield-Middletown town boundary. The remaining areas of Middlefield outside of traprock formations are underlain by Triassic sandstone and shale.

The critical habitat of the traprock ridge can be broken into the following components:

Talus slope – most diverse and unique habitat with hardwoods and hemlock, ferns, wildflowers. (Note: talus is also known as colluvial material in geologic terms.)

Cliff face – minimal soil cover, poison ivy, bluebells, ferns, oak, cedar, hemlock, reptiles including copperhead snakes.

Eastern slope – drier forest, oak, hickory, mountain laurel, blueberries, fox, raccoon, woodchuck, deer, mice, rates, chipmunk, squirrel, rabbit, and skunks.

Base of eastern slope – forest mountain ash, sugar maple, tulip, poplars, spring flowers, frogs and salamanders.

Critical habitat provided by the entire range of stages include turrey's mountain mint, wild confey, downy arrowwood, Virginia snakeroot, purple hairgrass and falcate orange tip butterflies.

Scenic Vistas

In August 1973, the Soil Conservation Service of the U.S.D.A. prepared a Streambelt Report for Middlefield. In it, a map identifies, among other things, scenic vistas. Five such locations are shown: four along Higby and Beseck Mountains and one along Powder Hill Road in Lyman's Orchards. These are the most dramatic vistas. Equally important are the lesser peaks and ridges which possess open space potential such as, Jackson Hill, Coe Hill, Sugar Loaf Hill and Cherry Hill.

A noteworthy paper entitled, “Ecological Habitats and Land Use on Connecticut's Trap Rock Ridges” by the UCONN Coop Extension System, explains the ridges’ geology habitats, aquifer recharge potential and recreational uses.

Recommendations

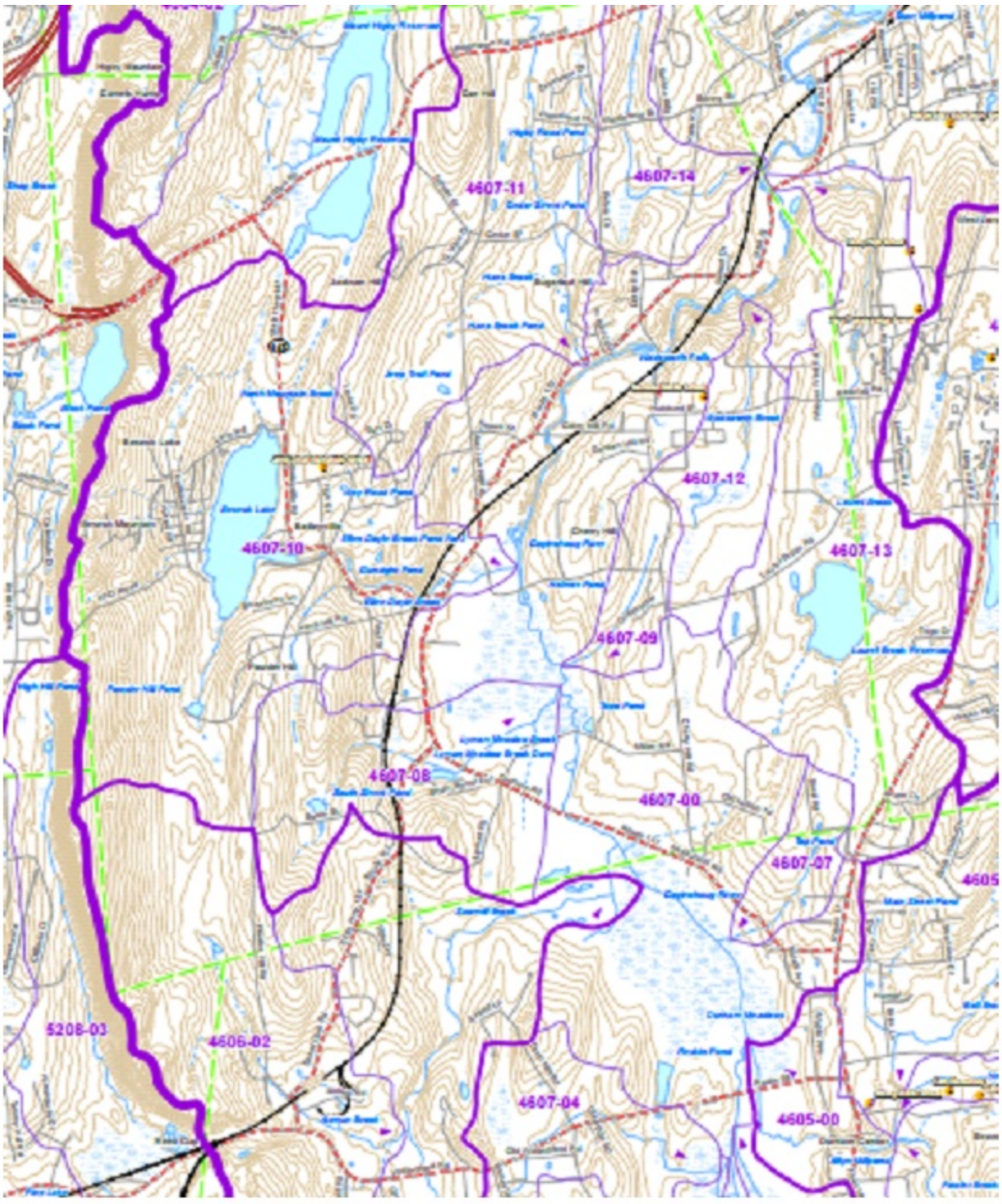
- In 1998, the Planning and Zoning Commission adopted ridgeline protection regulations consistent with PA 95-235. The areas covered by these regulations are limited and considerable portions of the east slope of Higby and Beseck Mountains remain unprotected. Additional regulations not based on PA 95-235 need to be developed to protect this important feature.

- Protect existing trails and develop new ones. This policy encompasses the Mattabesett Trail system which passes through Middlefield. It also suggests that new trails could be developed, not necessarily limited to ridgetops. However, occasional dramatic views are vital to the success of recreational trails, whether hiking or bicycling.

- Develop a comprehensive system of trails throughout the community using various forms of open space acquisition and the forementioned ridges.

NATURAL DRAINAGE BASINS

MAJOR, REGIONAL, SUBREGIONAL AND LOCAL
MIDDLEFIELD, CONNECTICUT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Surficial Geology

The surficial geology is the unconsolidated material above the rock bed and below the soil which, in Middlefield's case, is glacially deposited and deposited by erosion and streams since the retreat of the glaciers. This material (clay, silt, sand, gravel, boulders) is mapped on Surficial Geology Quadrangles much like the USGS topographic maps. These maps show different types of surficial deposits some from glacial lakes and kettle ponds, some from streambelts, riverbeds and their flood plain deposits (terrace alluvium), swamp deposits and glacial fill (that all too familiar mixture of everything from clay to boulders which often contains hardpan). Aside from being "parent material" for soil formation, surficial deposits include thick sand layers that serve as groundwater aquifers or as saturated or semi-permeable materials that underlie wetlands and also as a source of sand and gravel. Map #5 shows the actual distribution of these materials.

Soils

Much of the information contained in the following sections is based on the Detailed Soils Survey conducted by the U.S. Department of Agriculture, Soil Conservation Service. The soils inventory was prepared through careful on-site inspections and tests. The information obtained is representative of the first five feet of the land surface. According to the Soil Survey Manual by Soil Survey Division Staff USDA Handbook No. 18, dated 1993, "Natural Soil Bodies are the result of climate and living organisms acting on parent materials, with topography or local relief exerting a modifying influence and with time required for soil-forming processes to act."

The Soil Survey, Middlesex County Connecticut, dated 1979 contains aerial photographs which show approximate soil type boundaries plus text on the groups and nature of each soil and its limitations and uses for development of on-site sewage disposal, roadways, recreation, wildlife and agriculture.

As a planning tool, the soils data is an important factor in determining suitability of land for various uses, both urban and rural. However, it should not be used for a site-specific analysis. The inventory was made at a scale of 1 inch equals 132 feet and thus soil units of less than three to five acres are not delineated. For specific lots or parcels, on-site investigation and testing are still required. The interpretations of soil mapping unit limitations have been prepared by the Soil Conservation Service. Map #6 depicts detailed soil types for Middlefield.

The soil limitations for on-site sewage disposal denote problems in location, construction, design and performance. Accurate estimates of performance include such factors as water table, fragipan, bedrock depth, slope, degree of stoniness, frequency of rock outcrops and possible flooding hazards. Map #7depicts the soil types which have severe or very severe limitations for on-site septic systems. Much of the area shown is inland wetland or transitional soils and shallow to bedrock soils. A significant area of the town has been classified as having severe and very severe limitations.

Recommendation

- Modify the zoning districts to reflect more closely the inherent soil conditions of the town. This would suggest that larger lot zoning generally follows areas with severe and very severe limitations for development.

Wetlands and Watercourses

The Inland Wetlands and Watercourses Act of 1972 Connecticut General Statutes 22a36 to 22a-45, since amended, was passed to preserve, protect and maintain wetlands and watercourses by minimizing their disturbance and pollution.

Wetlands means land, including submerged land, which consists of any of the soil types designated as poorly drained, very poorly drained, alluvial and flood plain by the National Cooperative Soils Survey, as it may be amended from time to time, of the Natural Resources Conservation Service of the U.S. Department of Agriculture. Such areas may include filled, graded or excavated sites or made land which possesses a saturated acrid soil moisture regime, as defined by the Cooperative Soils Survey. Such soils are often referred to as "Hydric Soils" in the technical literature.

Middlefield is fortunate to have the Middlefield Wetlands Inventory, an analysis and inventory of 30 wetland areas, produced by David A. Robbins of the Yale School of Forestry and Environmental Studies in 1989. The study provides a soil, hydrologic, locational, functional and habitat description for each wetland and identifies each one using the U.S. Fish and Wildlife Service classification system, DEEP Bulletin No. 9 Methods for the Evaluation of Inland Wetlands in Connecticut. Watercourses means rivers, streams, brooks, waterways, lakes, ponds, marshes, swamps, bogs and all other bodies of water, natural or artificial, perennial, vernal or intermittent, public or private, which are contained within, flow through or border the town of any portion thereof. This is a sort of all-encompassing definition used in the wetland regulations which includes the wetlands just discussed. It also includes Middlefield's ponds, lakes, streams and rivers, specifically, Beseck Lake, Black Pond, Laurel Brook Reservoir, Coginchaug River, Wadsworth Brook, Laurel Brook, other smaller brooks and Mt. Higby Reservoir. The most noteworthy and most studied watercourse is the Coginchaug River which traverses the town on a north to south axis.

This entire system provides an enormous habitat for wetland and wetland-bordering vegetation and a nice variety of wildlife identified in both the Coginchaug Greenway Study and the Middlefield Wetland Inventory. Therein are grouped groups of flora and fauna that exist in different zones from aquatic areas watercourse - wetland - wetland fringe - streambelt area.

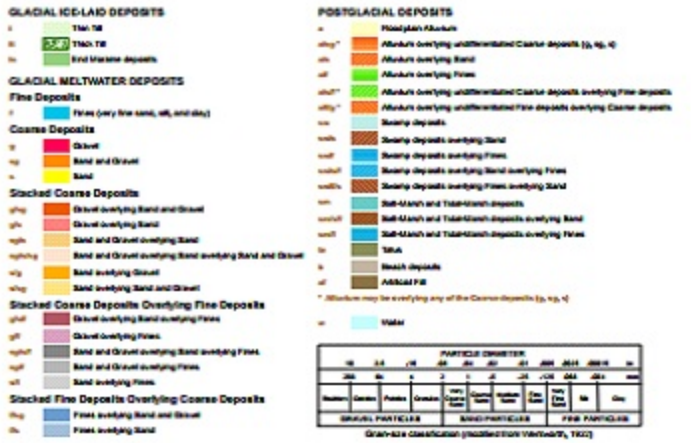
The Department of Environmental Protection has identified a number of "critical areas" along the Coginchaug River and its associated wetlands and along the Higby/Beseck traprock ridge. These generalized areas represent the presence of federal listed species, state endangered and threatened species, state species of special concern and natural communities.

The Coginchaug River Greenway

The proposed management plan dated 1992 by the UCONN Cooperative Extension System (Jim and Geoffrey Gibbons) and Milone and MacBroom, Inc., is an excellent information resource which provides a description of the Coginchaug River Watershed, its hydraulic cycle, its management, as well as historic and existing land uses, wildlife habitats, water quality, water testing, fishing potential and enhancement through improvements as well as local archeology.

In July of 2008, the United States Department of Agriculture-Natural Resources Conservation Service published the Coginchaug River Watershed Basin Watershed Plan. The executive summary of the report follows.

SURFICIAL MATERIALS
GLACIAL AND POSTGLACIAL DEPOSITS
MIDDLEFIELD, CONNECTICUT



EXPLANATION

Unconsolidated glacial and postglacial deposits, that range from a few feet to several hundred feet in thickness, overlie the bedrock surface of Connecticut (see Block Diagram).This map portrays the areal extent and subsurface grain-size (textural) distributions of these surficial materials. The map legend is designed to highlight the relationship between the depositional origins and the distribution and character of the materials portrayed. Most of Connecticut's surficial material is glacially derived, and can be divided into two broad depositional categories: Glacial Ice-Laid deposits (till& and moraine) which are generally exposed in the uplands, and are the most widespread surficial deposit in Connecticut; and Glacial Meltwater deposits (stratified deposits) which are most commonly concentrated in valleys and lowlands. A mapping emphasis is placed on stratified meltwater deposits because their distribution and character have historically influenced development patterns throughout the state.

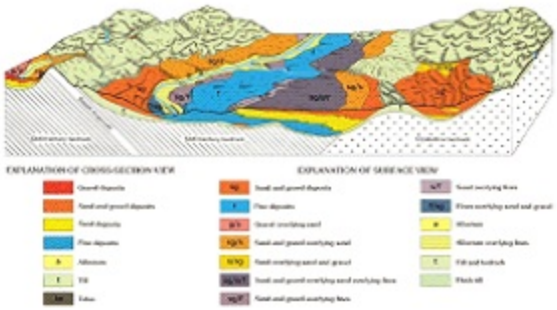
For a complete description of surficial materials map units, and further information concerning their thickness and modes of occurrence, please refer to the published Surficial Materials Map of Connecticut and the companion Quaternary Geologic Map of Connecticut and Long Island Sound Basin (see Data Sources).

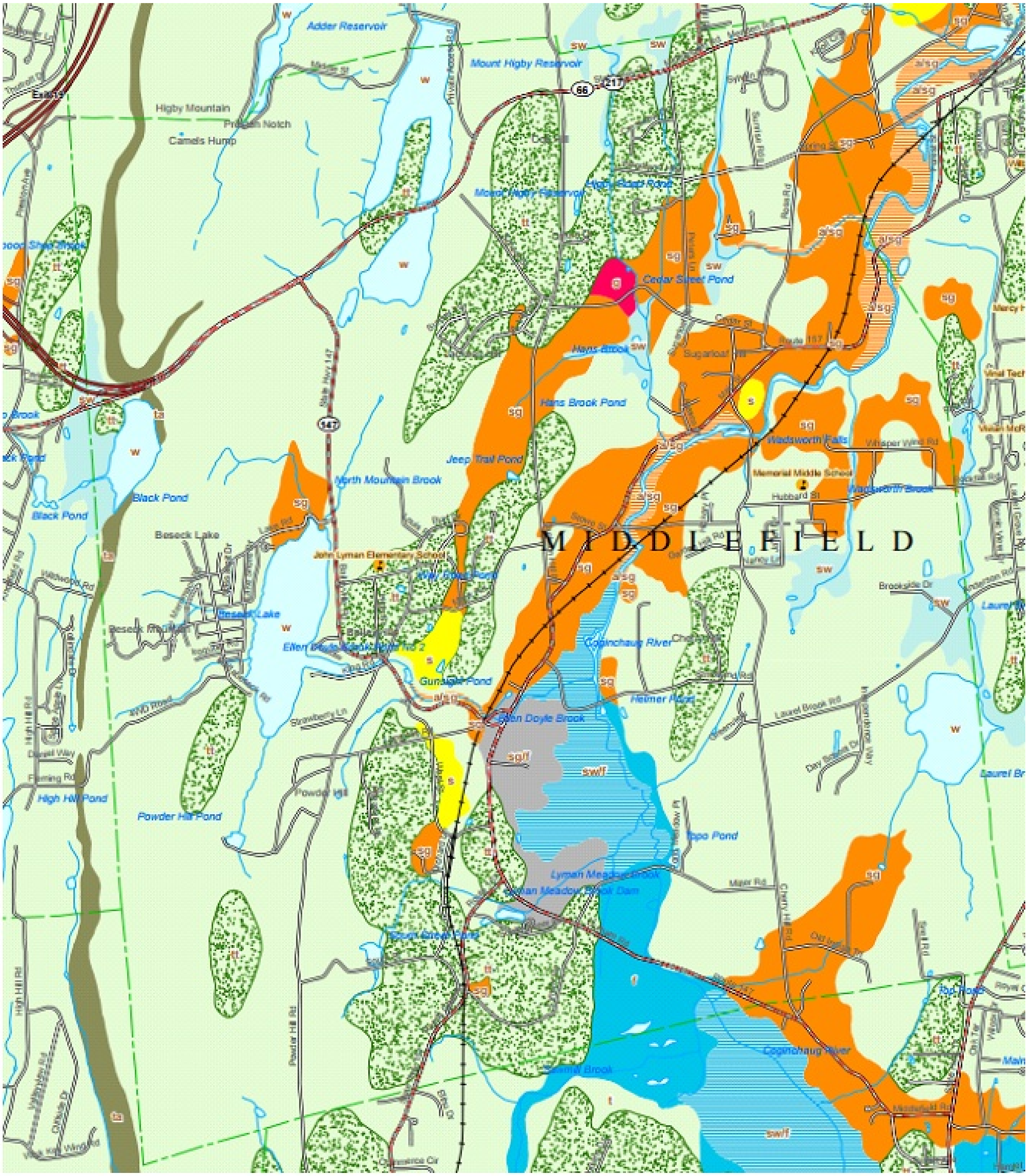
Glacial Ice-Laid deposits (till and moraine) were derived directly from the ice and consist of nonsorted, generally nonstratified mixtures of grain-sizes ranging from clay to large boulders. The matrix of most till is predominantly sand and silt and boulders can be sparse to abundant. Some till contain lenses of sorted sand and gravel and occasionally masses of laminated fine-grained sediment. The lack of sorting and stratification typical of ice-laid deposits often makes them poorly drained, difficult to dig in or plow, mediocre sources of groundwater and unsuited for septic systems. Till blankets the bedrock surface in variable thicknesses and commonly underlies stratified meltwater deposits (see Block Diagram). End moraine deposits (primarily ablation till) occur principally in southeastern Connecticut.

Glacial Meltwater deposits (stratified deposits) were laid down in glacial streams, lakes and ponds which occupied the valleys and lowlands of Connecticut as the last ice sheet melted away to the north. They are often composed of layers of well-to-poorly sorted sands, gravels, silts and clays with few to no boulders, and owing to their water-related depositional origins they have many characteristics that are favorable for development. Because water is a better sorting agent than ice, glacial meltwater deposits are commonly better sorted, more permeable, and better aquifers than ice-laid deposits. They can be good sources of construction aggregate, and are relatively easy to excavate and build highways and buildings on.

Meltwater deposits are depicted using four basic texturally-based map units: gravel, sand and gravel, sand, and fines. To the extent that it is known or can be inferred, the subsurface textural composition of meltwater deposits is shown for their entire vertical thickness. In many places similar conditions persisted for the entire time that a meltwater deposit was being laid down, and a single map unit (e.g. s- sand) is sufficient to describe the entire meltwater section. Areal and vertical textural variability can occur within the meltwater deposits because the amount of energy available to carry sediment varies with each meltwater setting (stream, delta, lake, etc.), and settings can change over time. High-energy depositional environments near glacial margins (proximal) tend to favor deposition of coarse material but as time passes, and the glacial margins melt back, less energy is available and finer grained distal deposits can become predominant. Where more complex stratigraphic relationships existed because of changing conditions during deposition, "stacked" map units are used to characterize the subsurface (e.g. sg/sf - sand and gravel overlying sand overlying fines). Where postglacial deposits overlie meltwater deposits, this relationship is also shown (e.g. a/s - alluvium overlying sand).

Postglacial Sediments (primarily floodplain alluviums and swamp deposits) are less widely distributed and are typically thinner than the glacial deposits that they overlie, but they are locally important ecological, agricultural, commercial, and recreational resources. Talus, a result of rockfall at the base of steep bedrock (primarily trap rock) cliffs, provides a cool damp ecological niche. Beach, marsh and swamp deposits are key ecological elements of coastal and poorly drained inland settings. Deposits of floodplain alluvium are largely composed of sands, gravels and silts that have been reworked from glacial deposits and mixed with organic matter which increases their fertility. Despite their flood-prone nature, low, flat, fertile floodplains have historically been attractive for agricultural uses and development related to water-dependent commerce.




MIDDLEFIELD
Adder Reservoir
Mount Higby Reservoir
Higby Mountain
Camels Hump
Black Pond
Beseck Lake
Cedar Street Pond
Hans Brook Pond
Jeep Trail Pond
North Mountain Brook
John Lyman Elementary School
Memorial Middle School
Wadsworth Falls
Wadsworth Brook
Coginchaug River
Powder Hill Pond
High Hill Pond
Lyman Meadow Brook
Topo Pond
Gunsight Pond
Laurel Brook Rd
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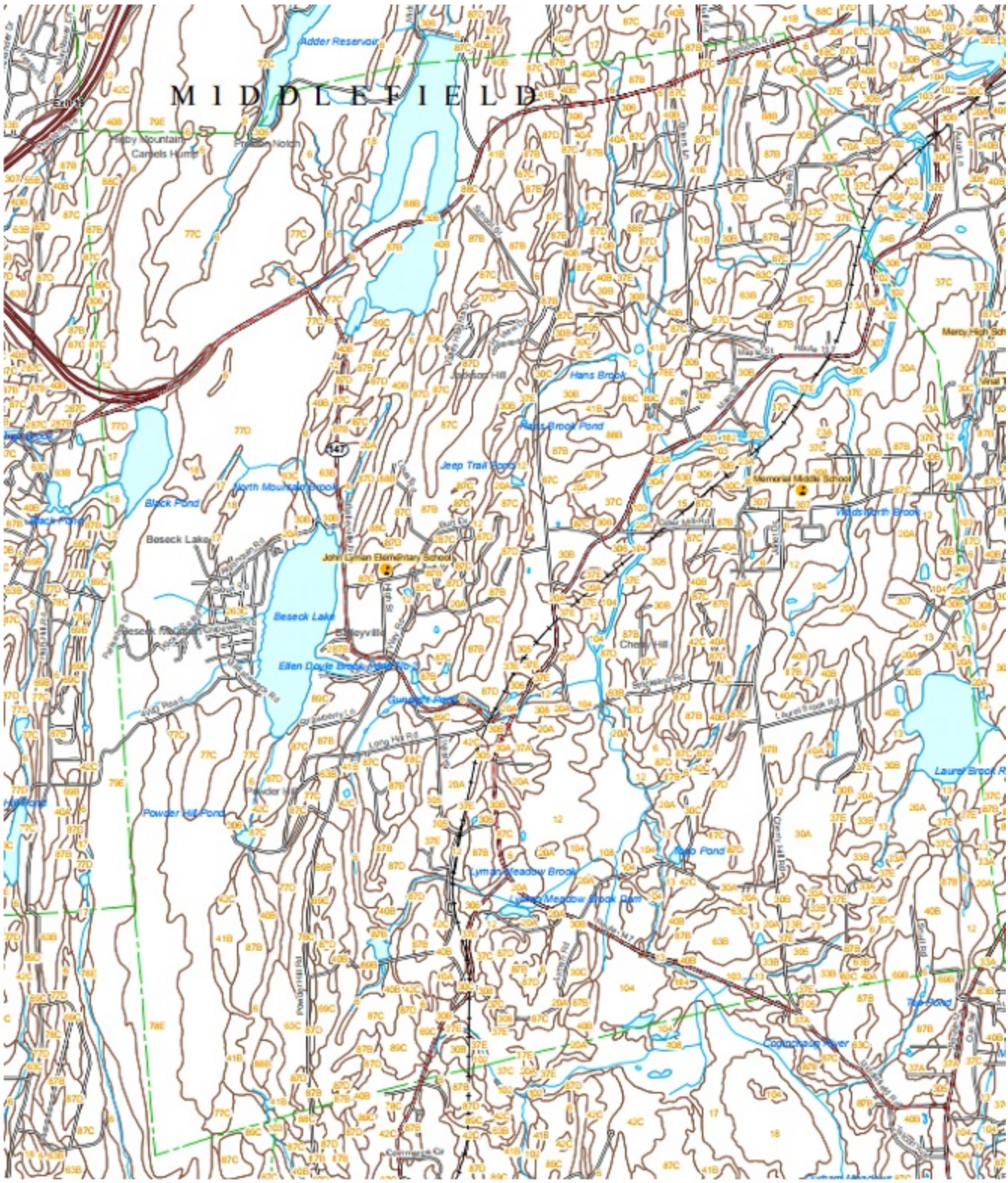

MIDDLEFIELD
Adder Reservoir
Kirby Mountain
Camels Hump
Hans Brook
Hans Brook Pond
Jeep Trail Pond
North Mountain Brook
Black Pond
Bosack Lake
John Lyman Elementary School
Bosack Lake
Ellen Doyle Brook
Gunsight Pond
Powder Hill Pond
Lyman Meadow Brook
Lyman Meadow Brook Dam
Memorial Middle School
Webb Horn Brook
Laurel Brook
Tee Pond
Coginchaug River

The Coginchaug River watershed is roughly 39 square miles (24,928 acres) in size and covers seven towns. Located in the central lowlands of Connecticut, the Coginchaug River main stem is approximately 15 miles long and flows northward through a relatively broad, flat valley bounded to the east and west with rolling hills until it meets with the Mattabesset River. In 2004, the State included the Coginchaug River in its April 28 final 303(d) Impaired Waterbody Listings. Bacterium was cited as the principal water quality concern to be treated with BMPs, with nitrogen inputs from storm water as a secondary targeted pollutant. In early 2005, the Connecticut USDA-Natural Resources Conservation Service (NRCS) and the Connecticut Department of Environmental Protection (CT DEEP) began discussing a cooperative effort to develop a watershed based plan to address the pollutants of concern. Using funding provided in part from Section 319 of the Clean Water Act, NRCS began, in April 2006, a watershed-based planning effort for the Coginchaug River. Working in partnership, the NRCS and CT DEEP established two primary goals for the project.

First, the project analyzed the watershed using a modified NRCS rapid watershed assessment model. Based on the analyses, NRCS identified Best Management Practices (BMPs) that could be implemented to address water quality concerns. The recommendations presented in this Watershed Based Plan (WBP) are made on two levels: BMPs suitable for implementation throughout the watershed and BMPs for particular sites within the watershed, identified as "place based" in the report. The "place-based" sites are considered potentially significant sources of pollutant loading. The WBP provides an estimate of the technical and financial resources needed to implement the recommended practices.

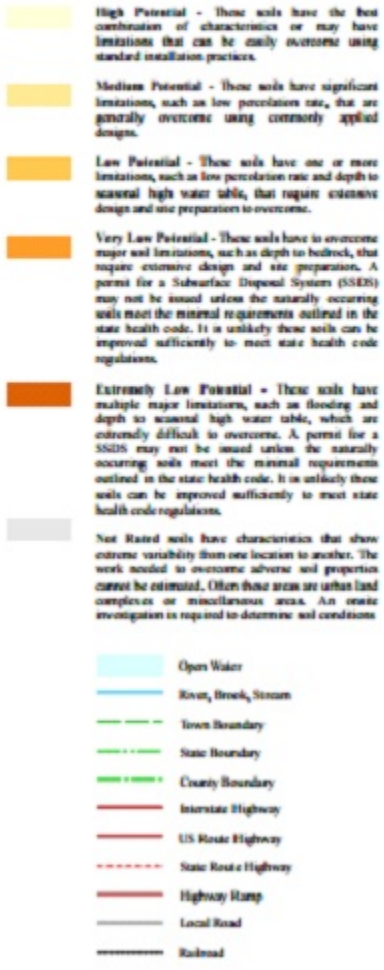
The second goal is to develop an effective and replicable watershed assessment model for planning and analysis. This WBP describes the methods and processes used in evaluating the Coginchaug River watershed. Establishing this model offers local decision makers a template for detailed, focused watershed analysis – something not generally found today for local stakeholder groups or municipalities.

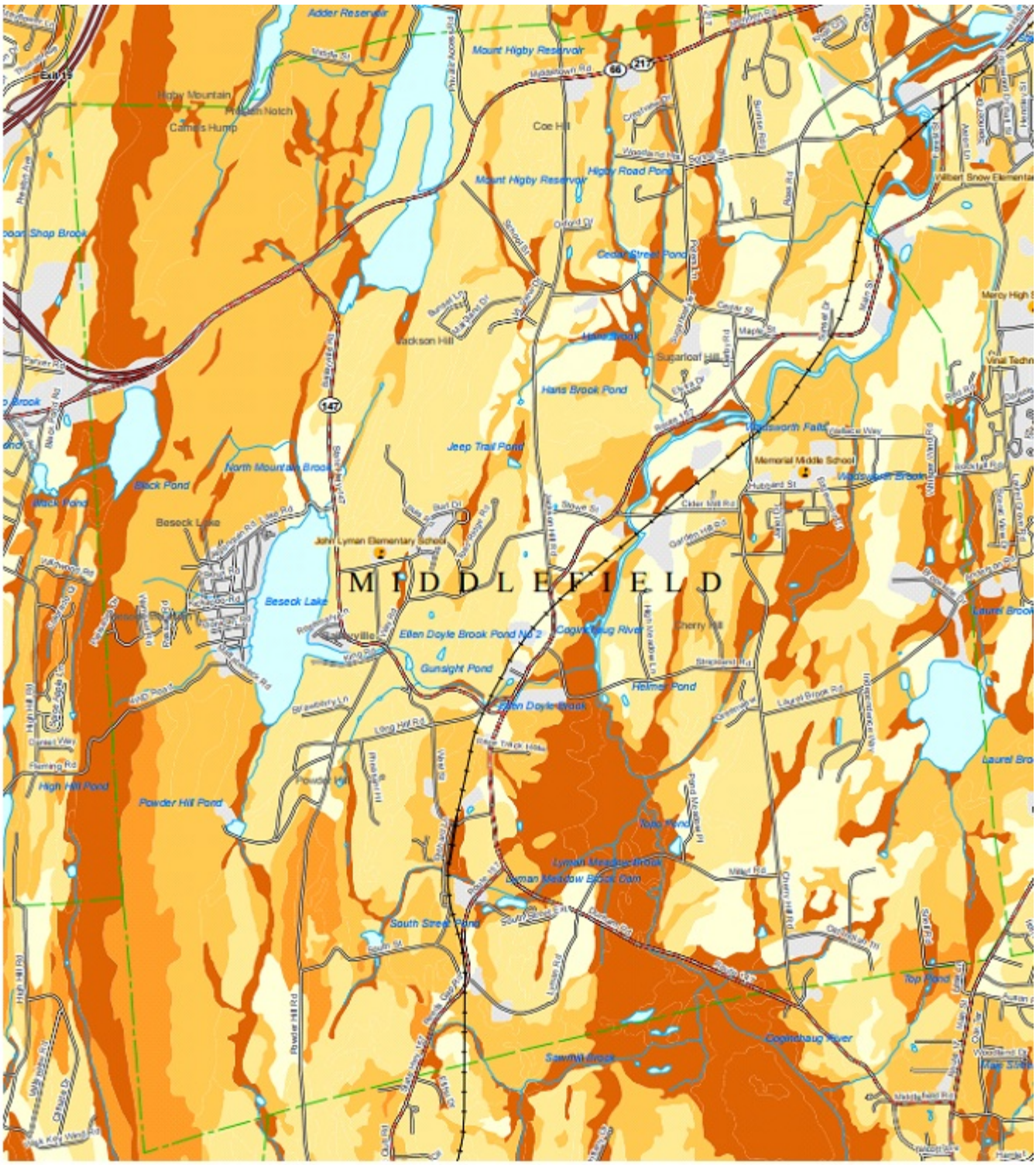
Since the report, the Connecticut River Coastal Conservation District has implemented two cattle crossing projects in Guilford, a drainage diversion project on a farm in Middlefield, funded the gaging station on Cider Mill Road on the Coginchaug River in Middlefield and instituted dog waste management at Wadsworth State Park. In addition, they provide educational programs for homeowners and professionals, do habitat-based assessments, management planning for evasive plants, agricultural nutrient management and well water quality monitoring in conjunction with River Watch.

POTENTIAL FOR SUBSURFACE SEWAGE DISPOSAL

MIDDLEFIELD, CONNECTICUT

LEGEND




MIDDLEFIELD
Adder Reservoir
Mount Higby Reservoir
Higby Mountain
Coe Hill
Higby Road Pond
Cedar Street Pond
Jackson Hill
Sugarloaf Hill
Hans Brook Pond
Jeep Trail Pond
North Mountain Brook
Black Pond
Beseck Lake
John Lyman Elementary School
Memorial Middle School
Wadsworth Falls
Ellen Doyle Brook Pond No 2
Coginchaug River
Gunsight Pond
Helmet Pond
Ellen Doyle Brook
High Hill Pond
Powder Hill Pond
Lyman Meadow Brook
Lyman Meadow Brook Dam
South Street Pond
Top Pond
Sawmill Brook
Laurel Brook
Cherry Hill
Exit 15
147
66
217

Water Quality

The following information was assembled by the Connecticut Department of Energy and Environmental Protection (DEEP) to help the Town of Middlefield better protect its watercourses. DEEP regularly conducts water monitoring across the state.

Water Quality Classifications

Water Quality Classifications have been compiled by the Connecticut Department of Energy and Environmental Protection (DEEP). The following table summarizes the designated uses and discharge limitations for both Inland Surface Waters and Groundwater:

Inland Surface Water Classifications	**Groundwater Classifications**
Class AA	**Class GAA**
Designated uses: existing or proposed drinking water supply, fish and wildlife habitat, recreational use (may be restricted,) agricultural and industrial supply.	Designated uses: existing or potential public supply of water suitable for drinking without treatment; base flow for hydraulically connected surface water bodies.
Discharges restricted to: discharges from public or private drinking water treatment systems, dredging and dewatering, emergency and clean water discharges.	Discharges limited to: treated domestic sewage, certain agricultural wastes, certain water treatment wastewaters.
Class A	**Class GA**
Designated uses: potential drinking water supply; fish and wildlife habitat; recreational use; agricultural and industrial supply and other legitimate uses including navigation.	Designated uses: existing private and potential public or private supplies of water suitable for drinking without treatment; base flow for hydraulically connected surface water bodies.
Discharges restricted to: same as allowed in AA.	Discharges restricted to: as for GAA and discharge from septage treatment facilities subject to stringent treatment and discharge requirements, and other wastes of natural origin that easily biodegrade and present no threat to groundwater.
Class B	**Class GB**
Designated uses: recreational use: fish and wildlife habitat; agricultural and industrial supply and other legitimate uses including navigation.	Designated uses: industrial process water and cooling waters; baseflow for hydraulically connected surface water bodies; presumed not suitable for human consumption without treatment.
Discharges restricted to: same as allowed in A and cooling waters, discharges from industrial and municipal wastewater treatment facilities (providing Best Available Treatment and Best Management Practices are applied), and other discharges subject to the provisions of section 22a-430 CGS.	Discharges restricted to: same as for A (Note; same treatment standards apply), certain other biodegradable wastewaters subject to soil attenuation.

Total Maximum Daily Loads

Total Maximum Daily Loads (TMDLs) are pollution reduction budgets developed for impaired water bodies in order to meet desired water quality standards. If the pollution budget is achieved through the recommended pollution reduction measures, then the water body is expected to meet the desired standards.

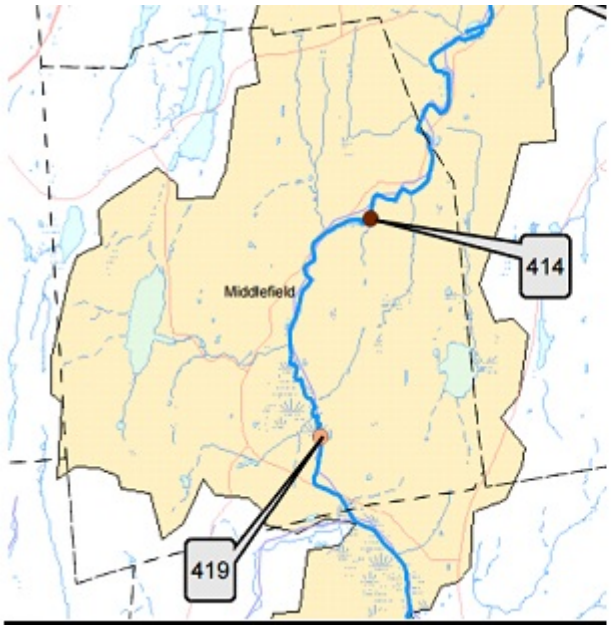
Water Quality Monitoring

The following information was assembled by the Connecticut Department of Energy and Environmental Protection (DEEP) to help the Town of Middlefield better protect its watercourses. DEEP regularly conducts water monitoring across the state. Regular monitoring for targeted pollutants in storm water provides an indication of potential water quality impacts and helps identify pollutant sources. Annual monitoring has been conducted since 2004 at six different locations throughout the town. The Connecticut Department of Energy and Environmental Protection (DEEP) used this information to evaluate the quality of the storm water and the potential impacts to surface waters.

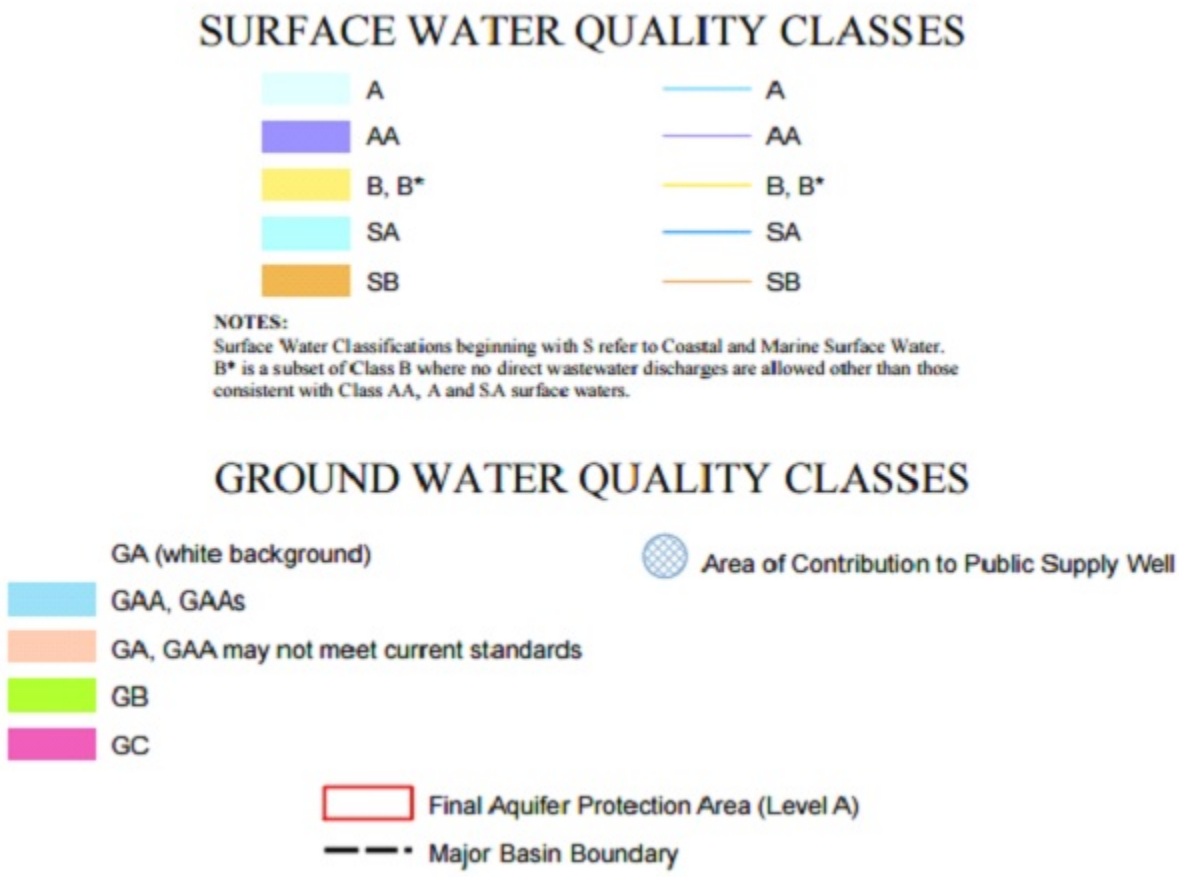
In the associated charts, individual sample results are shown in grey, while the averages of the samples collected on a particular day are shown in blue, with a line connecting the averages for the various sample dates. The bars show the statistical range of samples for each day, with the red squares showing results which were considered to be outliers (very different from other samples collected that day). The chart on the graph lists the sample dates and some basic statistics.

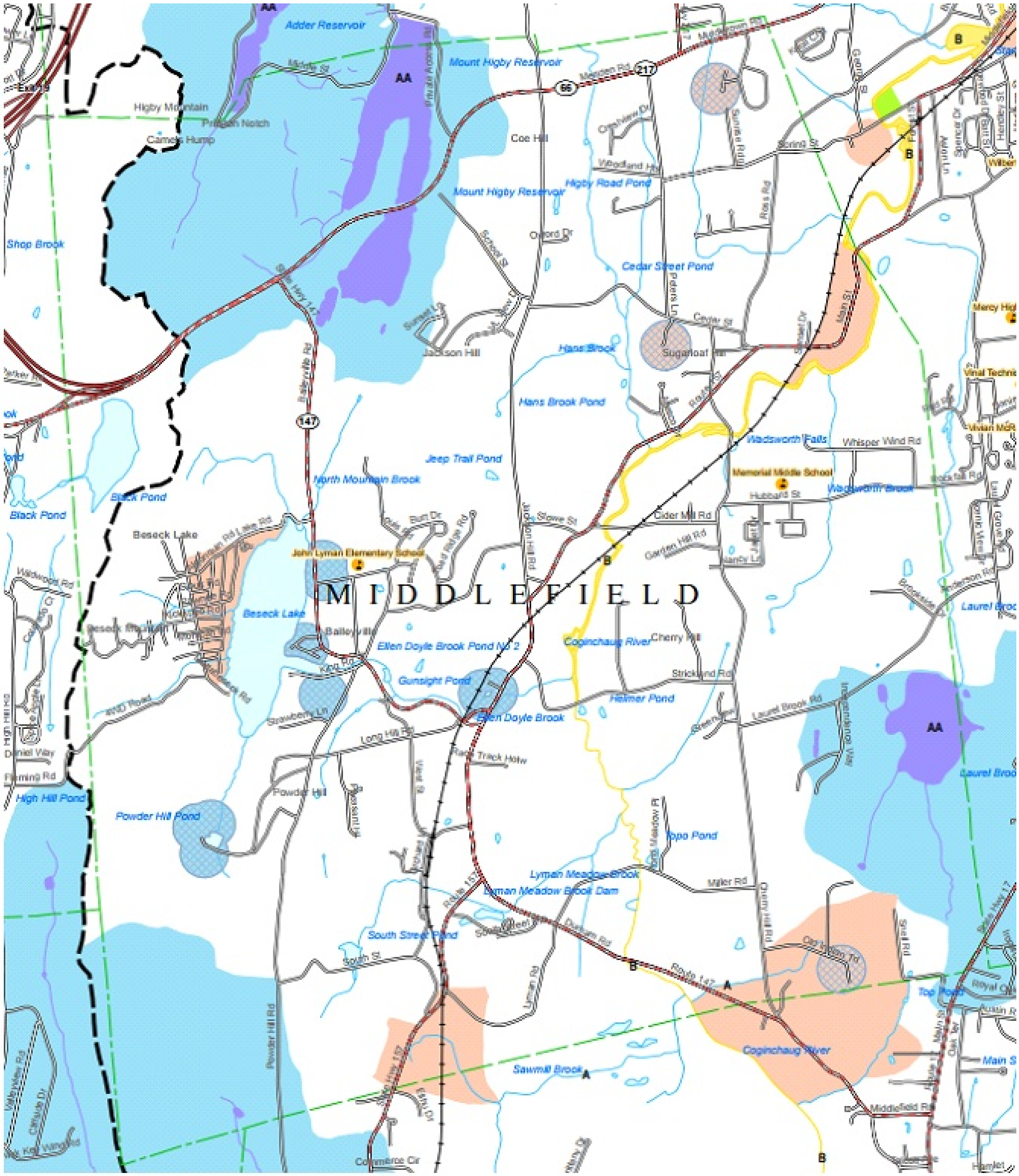
Bacteria

Escherichia coli (*E. coli*) is a bacteria that lives in the intestines of humans and other warm-blooded animals and is used to indicate the presence of fecal matter in surface waters. Some strains of *E. coli* and other pathogens found in fecal material cause serious illness to people coming in contact with them. For this reason, high amounts of bacteria will cause authorities to close beaches for swimming. Bacterium is measured as the number of colony-forming units (CFU's) per 100 ml of water. Any result that was reported as "too numerous to count" is included on the chart as 800,000 CFU/100 mL. At sampling site #414, there has been a 69 percent reduction in *E. coli* and in site #419 there has been a 62 percent reduction in *E. coli*.

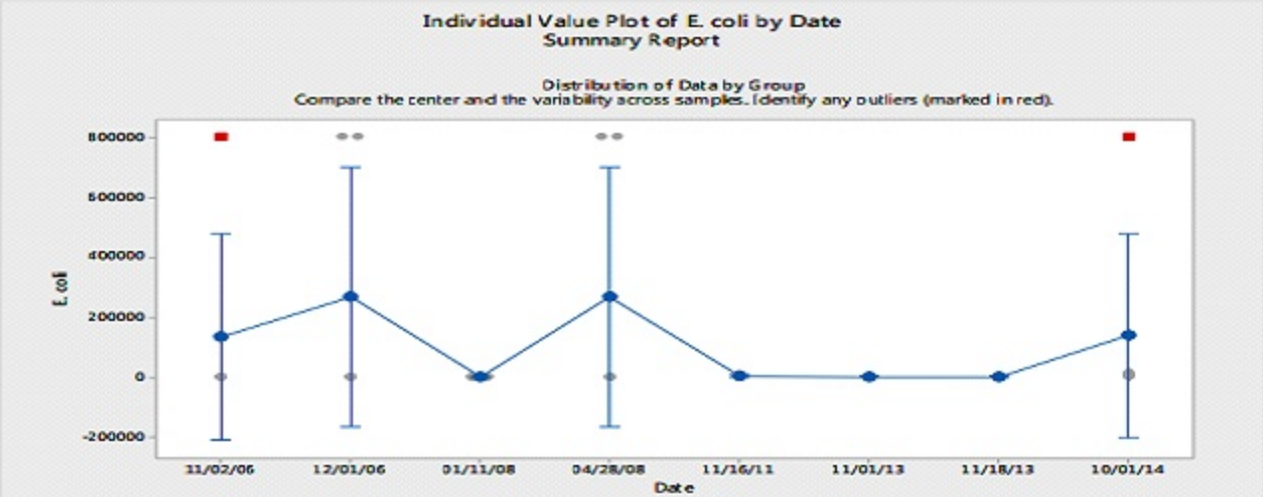


The following legend and map show the current surface water and groundwater classifications.




MIDDLEFIELD
Adder Reservoir
Mount Higby Reservoir
AA
Higby Mountain
Pinnacle Notch
Camels Hump
Coe Hill
Higby Road Pond
Shop Brook
Cedar Street Pond
Jackson Hill
Sugarloaf Hill
Hans Brook
Hans Brook Pond
Jeep Trail Pond
North Mountain Brook
Black Pond
Beseck Lake
John Lyman Elementary School
Wadsworth Falls
Memorial Middle School
Wadsworth Brook
Whisper Wind Rd
Hubbard St
Cider Mill Rd
Garden Hill Rd
Baileyville
Ellen Doyle Brook Pond No 2
Gunsight Pond
Ellen Doyle Brook
Coginchaug River
Cherry Hill
Strickland Rd
Helmer Pond
Laurel Brook Rd
Laurel Brook
Long Hill Rd
High Hill Pond
Powder Hill Pond
Powder Hill
Topo Pond
Lyman Meadow Brook
Lyman Meadow Brook Dam
Miller Rd
South Street Pond
South St
Durham Rd
Route 147
Coginchaug River
Sawmill Brook
Powder Hill Rd
Commerce Cir
Middlefield Rd
Meriden Rd
Spring St
Main St
Cedar St
Oxford Dr
School St
Sunset Ln
Baileyville Rd
Mercy High
Vinal Technical
Top Pond
B
A

Results of annual stormwater monitoring under MS4 permit for *E.coli* (CFU/ 100 mL of sample)
Town of Middlefield



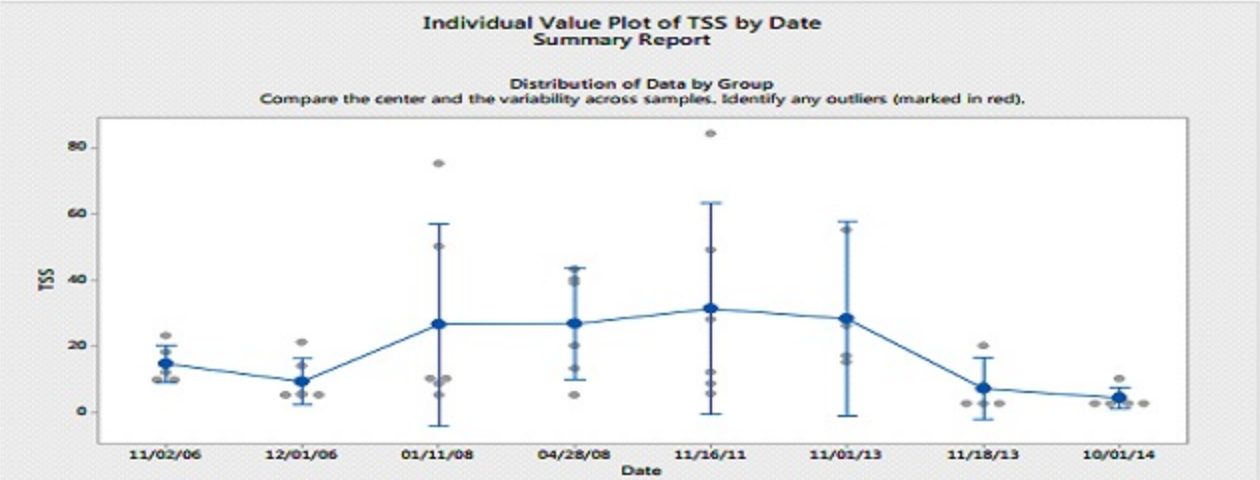
Statistics	11/02/06	12/01/06	01/11/08	04/28/08	11/16/11	11/01/13	11/18/13	10/01/14
N	6	6	6	6	6	4	5	6
Mean	133537	266878	206.67	266725	2713.3	562.5	828	137955
StDev	326499	412954	233.12	413073	3559.2	952.10	781.93	324379
Minimum	20	60	20	10	30	50	90	510
Maximum	800000	800000	640	800000	8660	1990	1940	800000

To support recreational uses of surface waters, the DEEP Water Quality Standards indicate that the average amount of *E. coli* found in a freshwater water body should be less than 126 CFU/100 mL and that a single sample tested for *E. coli* should be less than 235 CFU/100 mL at designated swimming areas and less than 410 CFU/100 mL in all other areas.

Total Suspended Solids

Total Suspended Solids (TSS) is a measurement of the amount of solids (including sand and silt) found in the stormwater sample. High concentrations of TSS can lower water quality in the receiving stream by transporting various pollutants to the waterbody where they can directly affect aquatic life or affect aquatic life by absorbing light, reducing photosynthesis and by making the water warmer. TSS can also clog fish gills and smother fish eggs and suffocate the organisms that fish eat. TSS comes from erosion and is found in agricultural, urban and industrial runoff. TSS can be reduced by protecting land from erosion and allowing stormwater time to settle before discharging to surface waters.

Results of annual stormwater monitoring under the MS4 general permit for TSS (mg/L)
Town of Middlefield

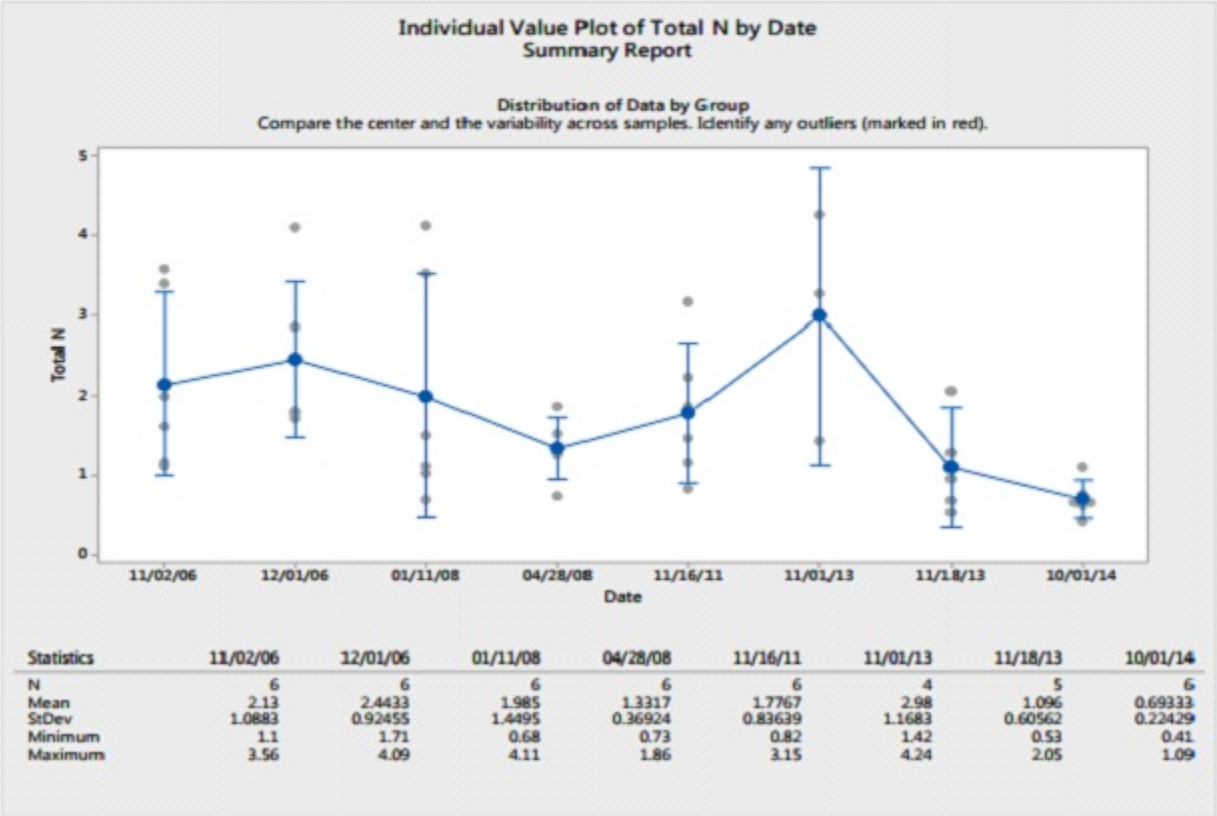


Statistics	11/02/06	12/01/06	01/11/08	04/28/08	11/16/11	11/01/13	11/18/13	10/01/14
N	6	6	6	6	6	4	5	6
Mean	14.5	9.25	26.417	26.667	31.167	28.25	7.1	4.1667
StDev	5.3104	6.7657	29.104	16.108	30.526	18.464	7.5944	3.0277
Minimum	9.5	5	5	5	5.5	15	2.5	2.5
Maximum	23	21	75	43	84	55	20	10

Total Nitrogen

High amounts of nitrogen can lead to excessive growth of water plants and algae, which reduces the amount of oxygen available to species living in these waters. Animal waste, failing septic systems, leaves, litter and fertilizers are common sources of high nitrogen. The responsible use of fertilizers, regular maintenance of septic systems and proper disposal of pet waste will help reduce nitrogen. Areas within the Town of Middlefield that have elevated nitrogen levels may be places to consider additional storm water management activities.

Results of annual stormwater monitoring under MS4 general permit for total nitrogen (Total N mg/L)
Town of Middlefield

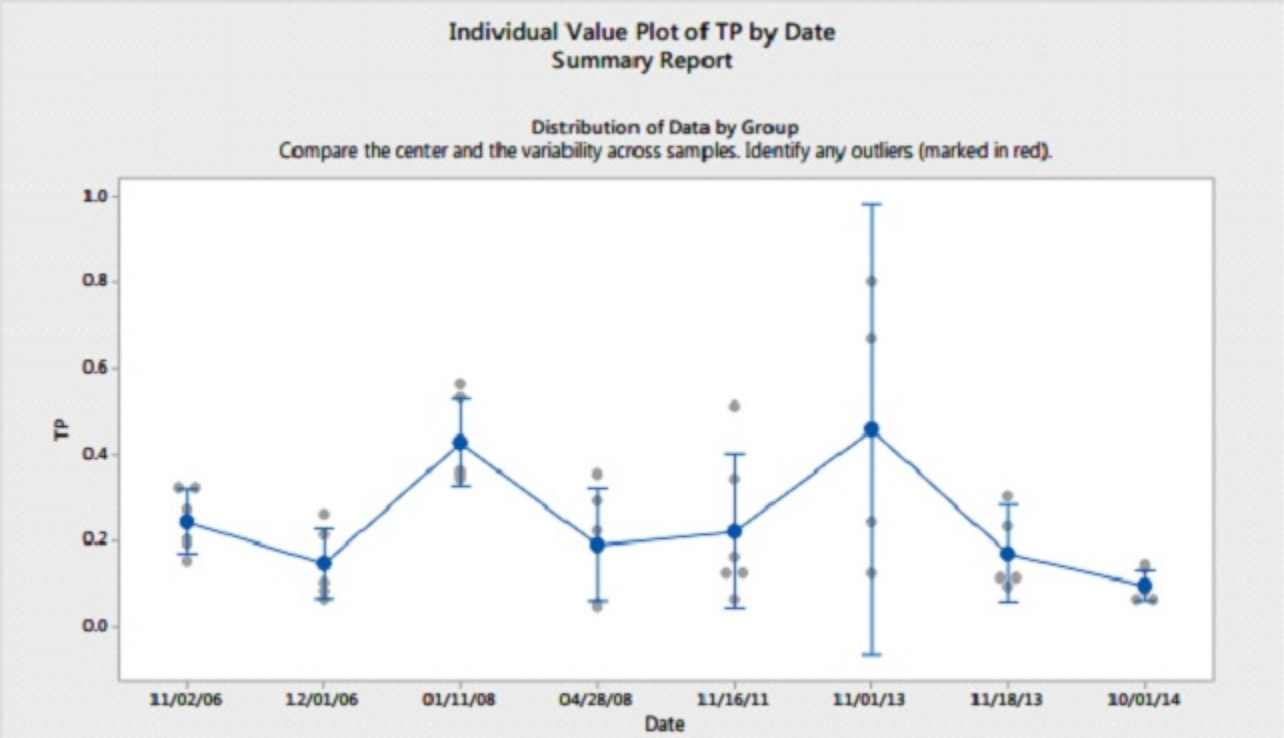


Statistics	11/02/06	12/01/06	01/11/08	04/28/08	11/16/11	11/01/13	11/18/13	10/01/14
N	6	6	6	6	6	4	5	6
Mean	2.13	2.4433	1.985	1.3317	1.7767	2.98	1.096	0.69333
StDev	1.0883	0.92455	1.4495	0.36924	0.83639	1.1683	0.60562	0.22429
Minimum	1.1	1.71	0.68	0.73	0.82	1.42	0.53	0.41
Maximum	3.56	4.09	4.11	1.86	3.15	4.24	2.05	1.09

Total Phosphorus

Phosphorus is an important nutrient necessary for growth in plants and animals in freshwater. Too much phosphorus in the water can throw off the balance of aquatic ecosystems causing excessive growth of water plants and algae blooms which reduces the amount of oxygen in the water, potentially harming fish and other species. These algae blooms may contain toxic forms of algae, which can be harmful to people and animals coming into contact with these blooms. Sources of high phosphorus can include unlawful discharges, fertilizers, litter, leaves, erosion and animal waste.

Results of annual stormwater monitoring under MS4 permit for total phosphorus (mg/L)
Town of Middlefield



Statistics	11/02/06	12/01/06	01/11/08	04/28/08	11/16/11	11/01/13	11/18/13	10/01/14
N	6	6	6	6	6	4	5	6
Mean	0.24167	0.14333	0.42667	0.18833	0.21833	0.4575	0.168	0.093333
StDev	0.071949	0.078655	0.096264	0.12545	0.17186	0.32847	0.092304	0.034448
Minimum	0.15	0.06	0.34	0.04	0.06	0.12	0.09	0.06
Maximum	0.32	0.26	0.56	0.35	0.51	0.8	0.3	0.14

Impaired Waters

The Connecticut Section 303d Waters List (CTWL) provides for the State's evaluation of surface water bodies for restoration and protection strategies, in accordance with the requirements of Section 303 of the Federal Clean Water Act (CWA). The CWA is the primary Federal law that protects our nation's surface waters, including lakes, rivers, and coastal areas. Through passage of the CWA, the United States Congress established a national goal of restoring and maintaining the chemical, physical and biological integrity of the Nation's waters by achieving and maintaining *"water quality which provides for the protection and propagation of fish, shellfish, and wildlife, and recreation in and on the water wherever attainable"* and preventing the discharge of toxic substances in toxic amounts (CWA Section 101).

Some water bodies in Middlefield have been classified as Category 4a. These water bodies are considered "impaired" because an established TMDL exists and a pollutant has been identified as the cause of the impairment. The following table provides test results for several of the water bodies in Middlefield:

Wadsworth Falls Pond (CT4607-00-UL_pond_01).is a small pond located within Wadsworth Falls State Park on the Middletown-Middlefield town border. The entire pond is impaired and is located east of the Coginchaug River, upstream of the confluence of the Coginchaug River and Laurel Brook, and downstream of the confluence of the Coginchaug River and Wadsworth Brook. Wadsworth Falls Pond is 1.37 acres and is located within Middletown and Lyman Meadows Brook (CT4607-08_01), begins at the outlet of South Street Pond north of South Street in Middlefield, flows east crossing under the railroad tracks, Route 157, and Route 147, and ends at the confluence with the Coginchaug River just downstream of Miller Road in Middlefield. Lyman Meadows Brook's impaired segment is 1.43 miles long and is located entirely within Middlefield. The impaired segments of Laurel Brook, Wadsworth Falls Pond and Lyman Meadows Brook have a water quality classification of A. Designated uses include potential drinking water supplies, habitat for fish and other aquatic life and wildlife, recreation, and industrial and agricultural water supply. These segments are impaired due to elevated bacteria concentrations, affecting the designated use of recreation. As there are no designated beaches on Laurel Brook or Lyman Meadow Brook, the specific recreation impairment is for non-designated swimming and other water contact-related activities. There is a designated swimming beach on Wadsworth Falls Park Pond and the specific recreation impairment is for designated swimming and other water contact-related activities. All segments listed on the Coginchaug River in Table 1 as not supporting for recreation and not included in this TMDL document were previously given load reductions. These calculations and supporting information can be found in the 2005 Mattabesset Regional TMDL.

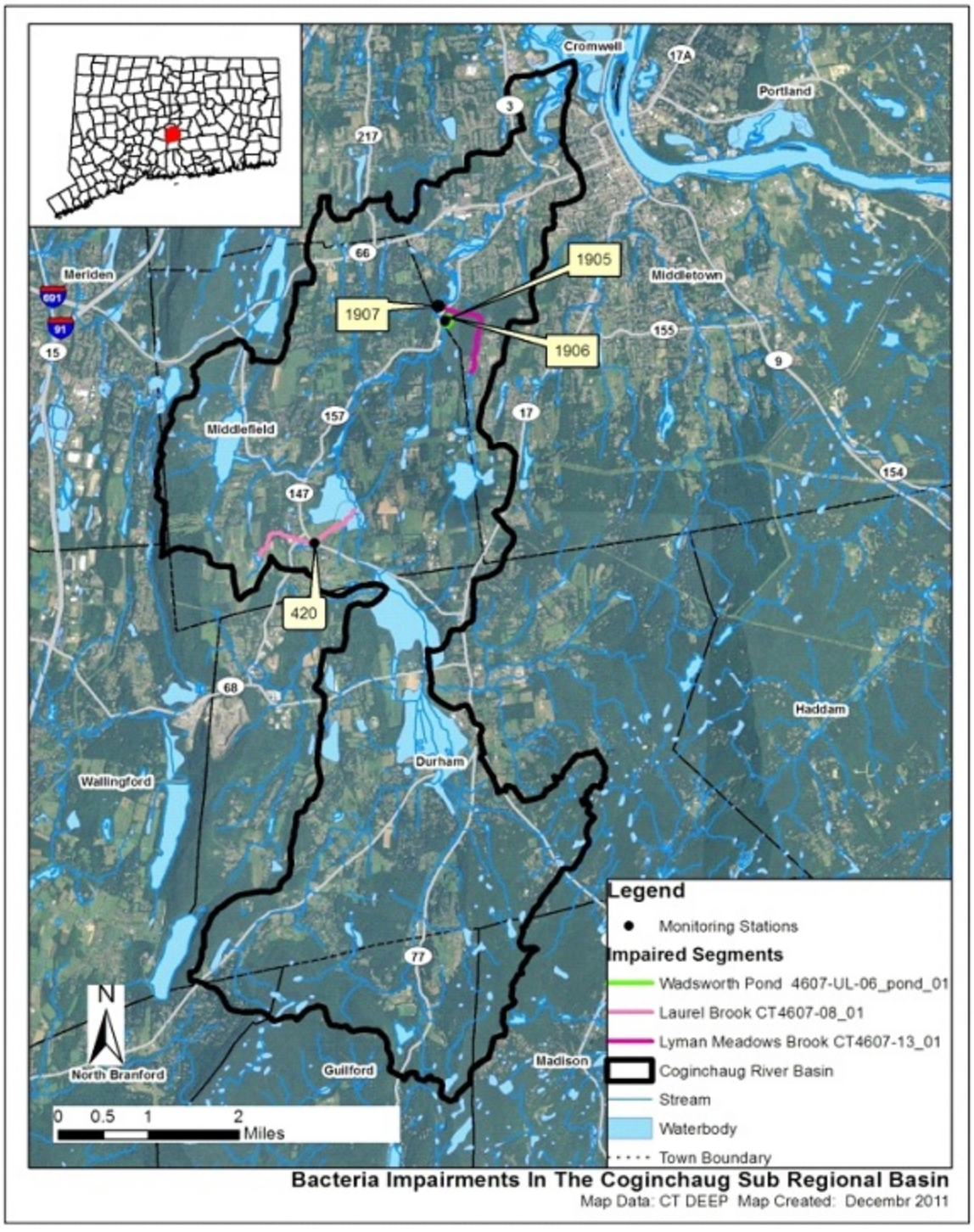
Table 1: Impaired Segments and nearby Waterbodies from the Connecticut 2010 Integrated Water Quality Report

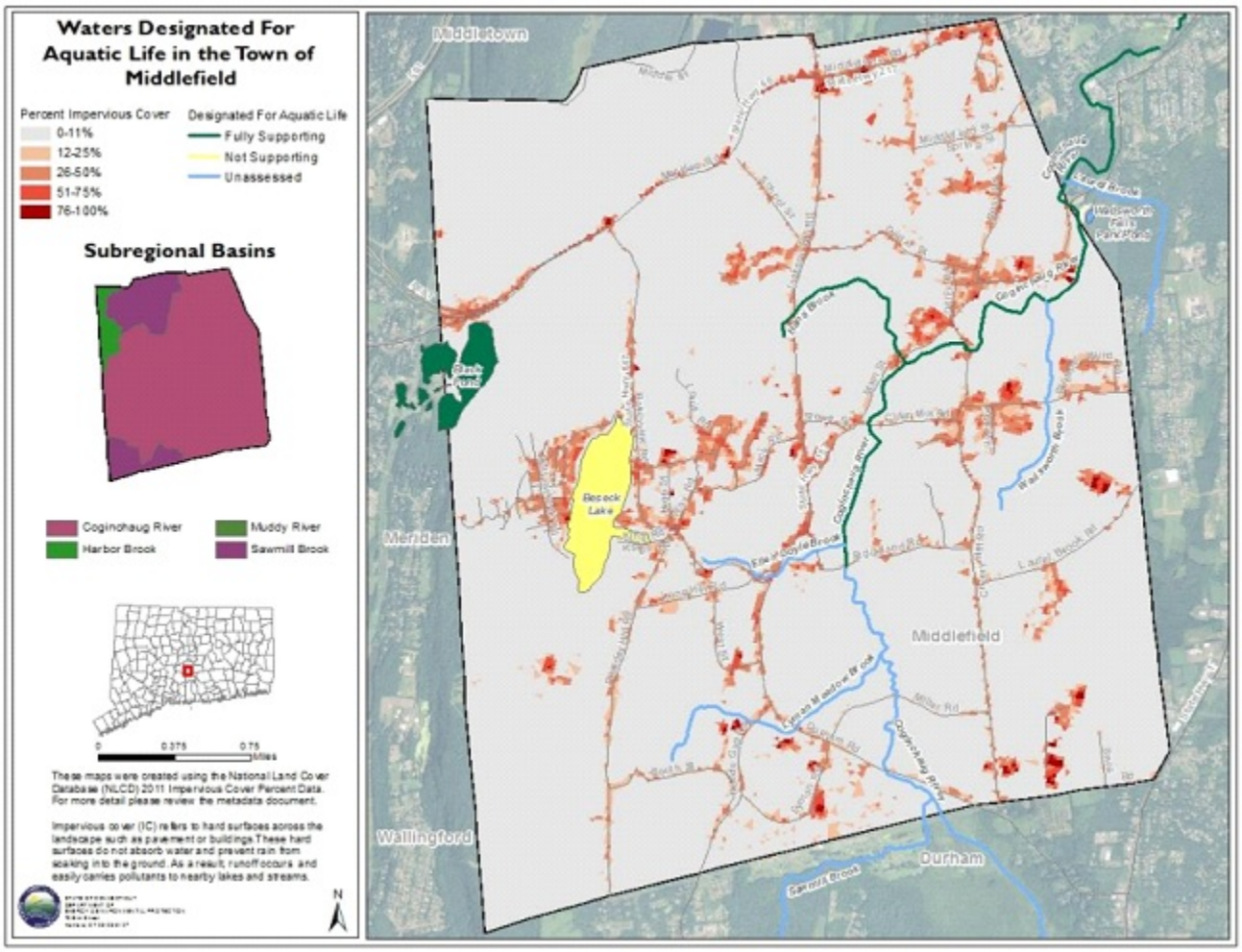
Waterbody ID	Waterbody Name	Location	Miles/ Acres	Aquatic Life	Recreation	Fish Consumption
CT4607-00-UL_pond_01	Wadsworth Falls Park Pond (Middletown)	Small pond within Wadsworth Falls State Park, between mouths of Laurel Brook and Wadsworth Brook, Middlefield.	1.37	U	NOT	U
CT4607-00_01	Coginchaug River-01	From mouth at Mattebessett River (at Cromwell border), US to downstream side of Route 3 crossing, Middletown.	1.87	U	U	FULL
CT4607-00_02	Coginchaug River-02	From downstream side of Route 3 crossing, US to downstream side of Route 66 crossing (just US of Veterans Memorial Park), Middletown.	0.75	U	NOT	FULL
CT4607-00_03	Coginchaug River-03	From downstream side of Route 66 crossing (just US of Veterans Memorial Park), US to Starr Mill Pond dam, Middletown.	0.6	U	NOT	FULL
CT4607-00_04	Coginchaug River-04	From Starr Mill Pond Inlet, US (past Wadsworth Falls) to Strictland Road crossing, Middlefield.	4.19	U	NOT	FULL

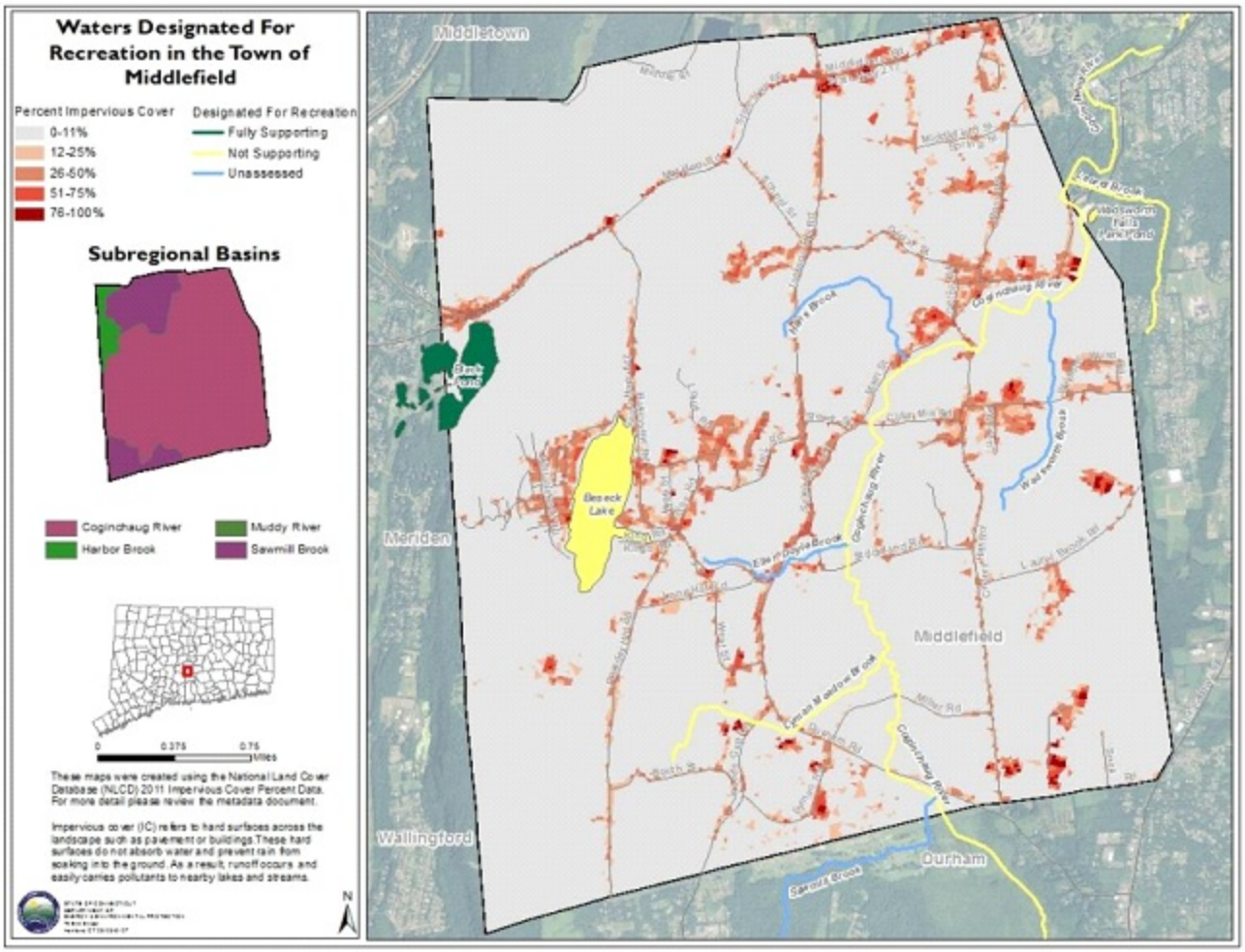
Waterbody ID	Waterbody Name	Location	Miles/ Acres	Aquatic Life	Recreation	Fish Consumption
CT4607-00_05	Coginchaug River-05	From Strictland Road crossing, Middlefield, US to Meeting House Hill Road crossing, Durham.	4.95	U	NOT	FULL
CT4607-00_06	Coginchaug River-06	From Meeting House Hill Road crossing, Durham, US to headwaters (US of Route 72 crossing, between Bluff Head and Broomstick Ledges), North Guilford.	3.59	FULL	NOT	FULL
CT4607-08_01	Lyman Meadows Brook (Middlefield)-01	Mouth on Coginchaug River, US of Coginchaug River crossing of Miller Road, US to outlet of South Street Pond, US of Railroad crossing, Middlefield.	1.43	U	NOT	FULL
CT4607-13_01	Laurel Brook (Middletown)-01	Mouth on Coginchaug River, in Wadsworth Falls State Park, parallel to swimming area, near Route 157, US to unnamed pond outlet, just US of Red Road crossing, Middletown.	1.17	U	NOT	FULL

Shaded cells indicate impaired segment addressed in this TMDL
FULL = Designated Use Fully Supported
NOT = Designated Use Not Supported
U = Unassessed

Figure 2: GIS map featuring general information of the Coginchaug River watershed at the sub-regional level




Waters Designated For Aquatic Life in the Town of Middlefield
Percent Impervious Cover
0-11%
12-25%
26-50%
51-75%
76-100%
Designated For Aquatic Life
Fully Supporting
Not Supporting
Unassessed
Subregional Basins
Coginchaug River
Muddy River
Harbor Brook
Sawmill Brook
0
0.375
0.75
Miles
These maps were created using the National Land Cover Database (NLCD) 2011 Impervious Cover Percent Data. For more detail please review the metadata document.
Impervious cover (IC) refers to hard surfaces across the landscape such as pavement or buildings. These hard surfaces do not absorb water and prevent rain from soaking into the ground. As a result, runoff occurs and easily carries pollutants to nearby lakes and streams.
N
Middletown
Meriden
Wallingford
Durham
Middlefield
Beseck Lake
Coginchaug River
Muddy River
Sawmill Brook



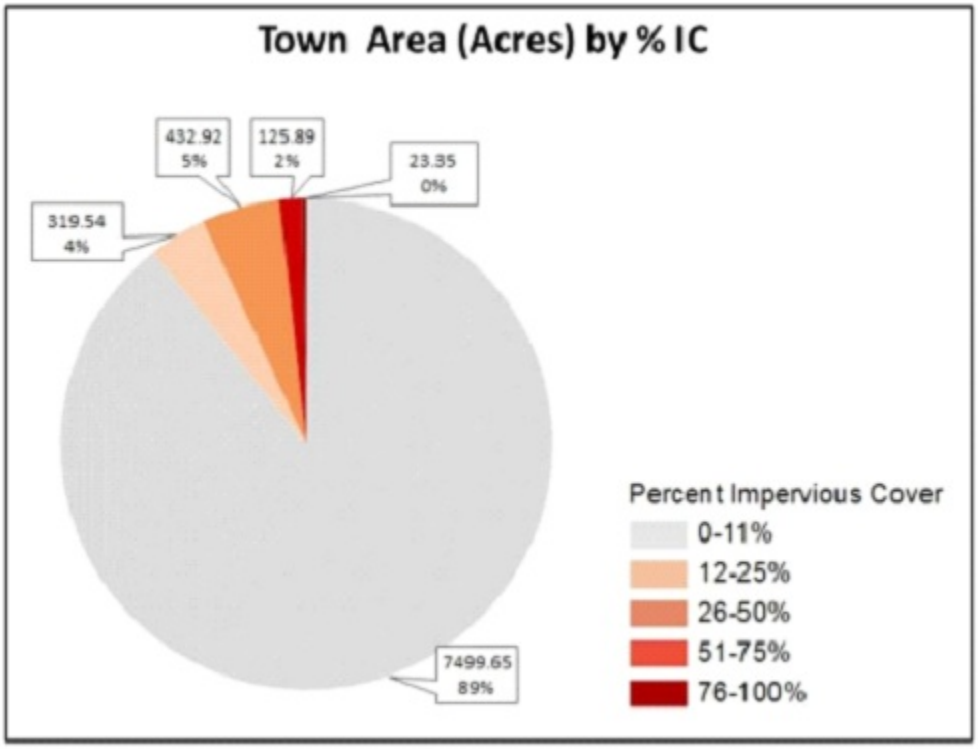
Impervious Cover

Impervious Cover (IC) refers to hard surfaces across the landscape such as roads, sidewalks, parking lots and roofs. Studies have focused on the amount of hard surfaces to evaluate the impacts of storm water runoff from these hard surfaces on water quality and found that IC affects both the quantity and quality of storm water. IC forces rain to run off the land, carrying pollutants quickly and directly to lakes and streams; instead of soaking into the ground and being filtered by the soil. In general, the higher the percentage of IC in a watershed, the poorer the surface water quality. Research in Connecticut strongly suggests that aquatic life will be harmed when the IC within an area exceeds 12 percent. Storm water pollution from IC is a likely cause of impairment for water bodies.

The following chart shows the amount of area within the Town of Middlefield that contains IC. Data is grouped by acres and percent IC. According to the chart, approximately 898 acres or 6 percent of the town exceeds the 12 percent recommended maximum for Impervious Cover. While all levels of IC can contribute storm water to streams, it is important to note that land with IC's greater than 12 percent are likely to be contributing enough storm water to streams to have a negative impact on their water quality. Middlefield

should aim to make storm water improvements in areas having IC greater than 12 percent to reduce the amount of storm water pollution reaching its surface waters and consider the development of regulations which encourage the use of non-impervious surfaces.

Amounts of Impervious Cover within the Town of Middlefield



Nonpoint Source Pollution

Nonpoint source pollution, unlike pollution from point sources, is diffuse in its origin and in the manner that it enters ground and surface waters. It originates from a variety of human activities that take place throughout Connecticut, affecting many different uses of water resources. These activities serve to increase the volume of runoff and often contribute pollutants to the runoff that may end up in surface waters or infiltrate into the groundwater. If nonpoint source contributions are high enough, surface or groundwater impairments may occur. Pollutant loadings from many nonpoint sources are closely linked to rainfall, thunderstorms or snowmelt and are, therefore, unevenly distributed in time and space, depending on weather conditions.

Categories and Sources of Nonpoint Pollution

Nonpoint sources are organized into several major categories, based on the types of activities that generate them. More specific sources of nonpoint pollution within the major categories are many and varied. The types of pollutants that a nonpoint source may generate are often specific to the activity, e.g., pesticides and fertilizers associated with agricultural activity or oil and grease associated with highway runoff. While chemical, physical and biological pollutants number in the tens of thousands, general groups of pollutants

are useful for describing nonpoint source problems, such as metals or pathogens. In Connecticut, three general land cover or land use categories have been useful to classify specific nonpoint sources. One category, comprised primarily of forests, wetlands and surface waters, is generally labeled as "Forested." This category is typically assumed to be a low contributor of nonpoint pollution and is not covered here. The land cover categories that are of concern include "Urban and Suburban," and "Agricultural." Other nonpoint sources outside of these categories also exist and are discussed in the "Other Sources" category which follows.

- *Urban and Suburban Sources*. Nonpoint sources in urban and suburban areas include contaminated runoff from impervious surfaces such as roadways, sidewalks, parking lots and roofs, storm water runoff and turf grass runoff that may contain pesticides and fertilizers. As a watershed becomes developed, impervious surfaces increase in area, causing an increase in the rate and volume of storm water to surface water bodies. This increased volume of storm water runoff can cause an increase in the frequency and severity of flooding, accelerated stream channel erosion, reduction in the base flow of streams and adversely affect aquatic life in streams. In addition to changes in volume distribution, runoff can carry a variety of pollutants including suspended sediments and solids, nitrogen, phosphorus, hydrocarbons, heavy metals, bacteria and road salts. Also, spills of hazardous substances during transport or from holding tanks are a serious hazard because many highways and urban areas are near Connecticut's surface waters. Other urban and suburban-related pollutants include road de-icing agents that can contaminate both surface and groundwater drinking water supplies and failing septic systems that may be sources of pathogens and nutrients.

- *Agricultural Sources*. Agricultural uses that generate nonpoint pollution include irrigated and non-irrigated crops, specialty crops, pastures, feedlots, animal holding and waste management areas, and washing and water processing areas. Typical pollutants generated from agricultural activities include nutrients, pesticides, sediment, and pathogen indicators. Water quality problems generally occur when agricultural operations use improper management techniques or implement inappropriate land uses. Harm to surface waters may be caused by erosion and sedimentation, poor waste management practices, overuse of fertilizers and pesticides, alteration of wetlands and watercourse and loss of riparian vegetation. Pollutants may be windblown, but primary transport mechanisms are with runoff or through infiltration into the groundwater.

- *Other Sources of Nonpoint Pollution*. Construction activities that disturb land surface and are not properly managed can result in erosion and sedimentation of a surface water resource. Suspended sediments increase turbidity, reduce light penetration, abrade or fill aquatic habitat, blanket food sources and commonly transport nutrients and other pollutants. Over fertilization at construction sites sometimes occurs when attempting to re-establish vegetative cover and improperly disposal of materials and liquids (e.g. lubricants, paints, solvents) on the ground or in holes can result in leaching of pollutants to groundwater or surface water bodies. Atmospheric deposition results from all types of precipitation and "dryfall." The most well-known form of atmospheric deposition is acid rain. Pollutants may be deposited directly onto surface waters or onto land where it is washed into surface or ground waters. Agricultural fields, landfills, fossil fuel burning, highways and urban areas all generate airborne pollutants that may subsequently be deposited on the Earth's surface. Of special concern in Connecticut are atmospheric deposition of nitrogen that are estimated

to contribute at least 15 percent of the nitrogen being discharged to Long Island Sound, and mercury, which has contaminated some species of fish to the degree that consumption advisories have been issued. A multimedia (air, land, water) analysis is essential to the resolution of atmospheric deposition relationships to water quality impacts. Natural sources, primarily water birds such as geese and gulls, can contribute unacceptable levels of nutrients, organic matter, and bacteria to many lakes, pond, rivers, and estuaries.

From a local regulatory point of view, the Town can directly manage the impacts of development under the "suburban" category of sources of nonpoint pollution and construction under the "other" category. Standard development can disrupt the water cycle and impact stream form and function. Many studies are finding a direct relationship between the intensity of development in an area – as indicated by the amount of impervious area and the degree of degradation of its streams. These studies suggest that aquatic biological systems begin to degrade at impervious levels of 12 percent, or at even lower levels for particularly sensitive streams. As the percentage of imperviousness climbs above these levels, degradation tends to increase accordingly. Previous studies on residential development in Middlefield have shown that, on average, for each lot developed, 2.3 to 2.5 acres of land is necessary on a gross basis. This intensity of development is below the maximum recommended 12 percent impervious surface. Construction-related sedimentation has been and continues to be a major concern and enforcement issue. The posting of bonds, periodic inspection and enforcement proceedings help control this nonpoint source of pollution. Further watershed impervious analyses are warranted to assure that the 12 percent imperious surface target not be exceeded now or in the future. At this time, Middlefield does not have an extensive piped storm water collection system and relies on the natural waterways to carry storm water away from developed areas.

Strategies for Coping with Polluted Runoff

Water resources can be protected by considering the location, extent, drainage and maintenance of impervious surfaces on the town, watershed and individual site levels. Natural resource planning, site design and use of best management practices form an effective three-tiered approach to the problem.

- *Plan development based on the town's natural resources*. Preventing pollution through planning is by far the least expensive and most effective way to protect Middlefield's waterways. To this end, a working knowledge of Middlefield's natural resources is critical to guiding appropriate development. A natural resource inventory is an essential first step. Identifying important natural resources and setting protection priorities provides a framework within which the impacts of proposed or existing development can be evaluated. Formal inclusion of these priorities in town plans and procedures is also important.

  Broad resources protection strategies applied at the town or watershed level, such as buffer zone and setback requirements, are recommended. With regard to impervious surfaces, local officials should consider a "budget" approach that sets an overall limit for key areas and above that limit requires increases in pavement on one site to be compensated for with decreases on another site (or some other acceptable method of compensation). This technique might be appropriate, for instance, in a watershed where analyses show a threat to critical water resources from future growth.

- *Minimize impacts through Site Design*. The site planning stage offers the best chance for local officials, designers and builders to work together to reduce polluted runoff from a site. Evaluate site plans with an eye to minimizing both impervious areas and disruption of natural drainage and vegetation. Cluster development, which reduces the total area of paved surfaces and increases open space, should be considered. Are the proposed sidewalks, roads and parking lot sizes absolutely necessary or could they be reduced? Brick, crushed stone or pervious pavement are often a viable alternative in low traffic areas. Are curbing and piping necessary or could drainage be directed to vegetated swales? Designs that reduce grading and filling and retain natural features should be encouraged. In addition to protecting waterways, such designs can often be less expensive and more pleasing to the eye.

Best Management Practices (BMPs)

Best management practices (BMPs) include a whole range of methods designed to prevent, reduce or treat storm water runoff. Choosing the correct BMPs is often highly site-specific, and may include the following:

- *Reduce storm water velocity*. This is the basic idea behind both detention basins, which are meant to slow and hold storm water before releasing it, and retention basins, which are designed to hold the water permanently until it infiltrates into the ground. In both cases, pollutant removal takes place through settling of particles and through chemical and biological interactions in the standing water or in the soil. As with any device, these BMPs must be correctly designed in order to work properly. For instance, basins must be large enough to treat runoff generated by the combination of local climate and site configuration.

- *Avoiding direct connections*. Break up the "expressway" of polluted runoff by using grass swales, filter strips or other forms of vegetative BMPs wherever possible in place of curbing and piped drainage. In many cases, these methods are most effective when used in combination with structural BMPs like detention ponds.

- *Ensure that regular maintenance is performed*. Most structural BMPs require regular maintenance to retain peak pollutant-removal efficiency. Maintenance ranges from the frequent, but simple (sweeping parking lots, cleaning storm drains) to the infrequent, but complex (sediment removal from detention/retention ponds), but in all cases it must be budgeted and planned.

- *Enforcement and Education*. It's important to make sure that contractors are following through on agreed-upon designs and methods. Don't underestimate things like storm drain stenciling and hazardous waste disposal days which can reduce pollution, raise public awareness and help to engender support for all Middlefield's water protection activities.

Ponds and Lakes

Beseck Lake is an artificially created (dammed) lake within the Coginchaug River Watershed - located west of Route 147 and east of Metacomet Ridge (Beseck Mountain). It measures approximately 119 acres in water surface area. The Planning and Zoning Commission should carefully review the "Beseck Lake Watershed Management Study," dated February 3, 2015, prepared by Milone & MacBroom, Inc., and in particular,

Chapter 6.0 “Conclusions and Recommendations.” The Commission will consider making revisions in the Zoning and/or Subdivision Regulations that would help to improve the water quality of Lake Beseck.

Mount Higby Reservoir is a public water supply reservoir located at the east side of Mount Higby. It is within the Mattabasset River Watershed and measures about 137 acres in water surface area. Much of its water comes from runoff and groundwater seepage from the traprock ridge.

Black Pond is located west of Mount Higby, due south of Route 66. It is within the Quinnipiac River Watershed. Its water surface area is approximately 61 acres. It is typical of ponds found below traprock ridges and is waterfed by runoff and groundwater recharge from the ridge.

Laurel Brook Reservoir is a public water supply reservoir located at the southeastern part of town. Its water surface area measures approximately 85 acres. Its surrounding vegetation is mostly forested and some open or agricultural land.

Streambelts and Floodzones

The Coginchaug River Watershed - Stream Belt Report, United States Department of Agriculture Soil Conservation Service, 1973, identifies streambelts and potential impoundment development sites and other significant features. The inventory divides the Coginchaug River Watershed into 18 subwatershed areas for study purposes.

The report concludes that within the Coginchaug River Watershed "there is evidence of stream belt encroachment and destruction of this ecologically vital resource." The report stresses that "urbanization will greatly increase the hazards of uncontrolled forms of development" and urges towns "to act now to preserve and develop wisely the natural resources of the streambelt."

Map #8 shows the identified streambelts. For the most part, a streambelt includes a watercourse, the adjacent wetlands and possibly additional setback and adjacent environmentally-sensitive land. Since the time the streambelt report was prepared, the U.S. Geological Survey has made available flooding data for the Department of Housing and Urban Development Flood Insurance Program. The flood plain for the 100-year storm is within plus or minus three feet of the 150-foot contour line from the dam at Cherry Hill Road to the Middlefield-Durham town line.

Recommendation

- The streambelt areas be included in the proposed land use plan as proposed open space.

Aquifers and Groundwater Recharge Areas

Aquifers and groundwater recharge areas are underground water "reservoirs." Two types are found in town: Stratified Drift Aquifer - bedded sand and gravel, and Bedrock Aquifer.

Stratified drift aquifers are categorized by the Department of Environmental Protection according to water quality and potential yield based on saturated thickness, grain size and hydraulic connection with recharge areas.

According to the DEEP "Groundwater Availability Map," there is an area of coarse-grained drift (high yield 50 to 2,000 gal/min) and an area of fine-grained drift (moderate yield of 1 to 100 gal/min) located along the west side of the Coginchaug River (Jim Murphy, DEEP).


Middletown
Meriden
Middlefield
Wallingford
Durham

CONNECTICUT INLAND WETLAND SOILS

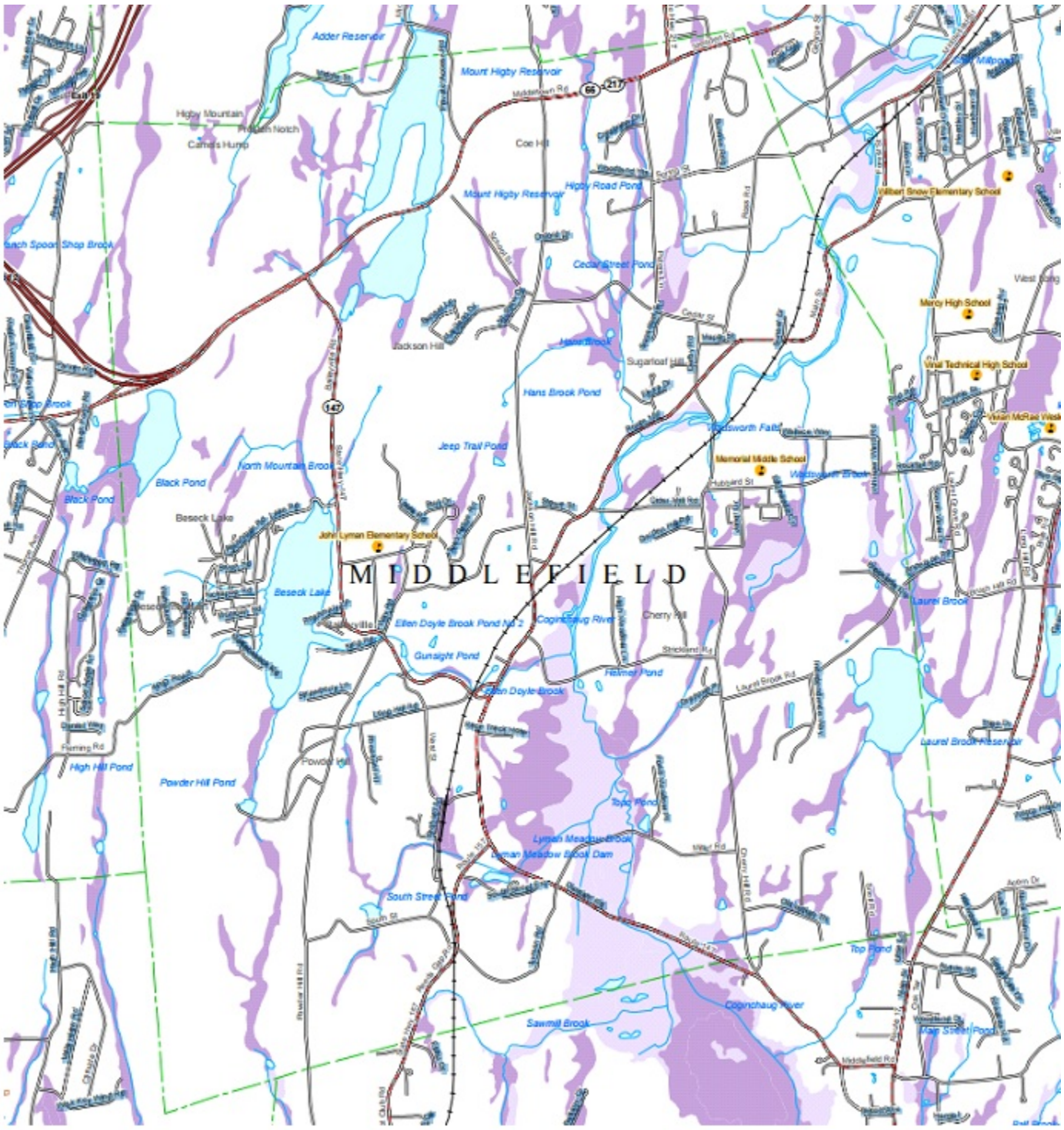
MIDDLEFIELD, CONNECTICUT

LEGEND

Poorly Drained and Very Poorly Drained soils - **Poorly drained** soils occur where the water table is at or just below the ground surface, usually from late fall to early spring. The land where poorly drained soils occur is nearly level or gently sloping. Many of our red maple swamps are on those soils. **Very poorly drained** soils generally occur on level land or in depressions. In these areas, the water table lies at or above the surface during most of the growing season. Most of our marshes and bogs are on these soils.

Alluvial and Floodplain soils occur along watercourses occupying nearly all level areas subject to periodic flooding. These soils are formed when material is deposited by flowing water. Such material can be composed of clay, silt, sand or gravel. Alluvial and floodplain soils range from excessively drained to very poorly drained.

- Open Water
- River, Brook, Stream
- Town Boundary
- State Boundary
- County Boundary
- Interstate Highway
- US Route Highway
- State Route Highway
- Highway Ramp
- Local Road
- Railroad


Adder Reservoir
Mount Higby Reservoir
Higby Mountain
Pratts Nolch
Cahills Hump
Coe Hill
Higby Road Pond
Mount Higby Reservoir
Wilbert Snow Elementary School
Cedar Street Pond
Mercy High School
Jackson Hill
Sugarloaf Hill
Vinal Technical High School
Hans Brook Pond
Jeep Trail Pond
Wadsworth Falls
Memorial Middle School
North Mountain Brook
Black Pond
Beseck Lake
John Lyman Elementary School
MIDDLEFIELD
Beseck Lake
Ellen Doyle Brook Pond No 2
Cherry Hill
Gunsight Pond
Ellen Doyle Brook
Laurel Brook
Laurel Brook Reservoir
High Hill Pond
Powder Hill Pond
Lyman Meadow Brook
Lyman Meadow Brook Dam
South Street Pond
Top Pond
Coginchaug River
Sawmill Brook
Main Street Pond

Middlefield area*	8,401.4
Area* of **Middlefield** covered by the 100ft Zone	697.3
Percent of **Middlefield** covered by the 100ft Zone	8.3%
Area* of **Middlefield** covered by the 300ft Zone	2,043.5
Percent of **Middlefield** covered by the 300ft Zone	24.3%

*All area is in acres.

Middlefield Land Cover In the Riparian Zone

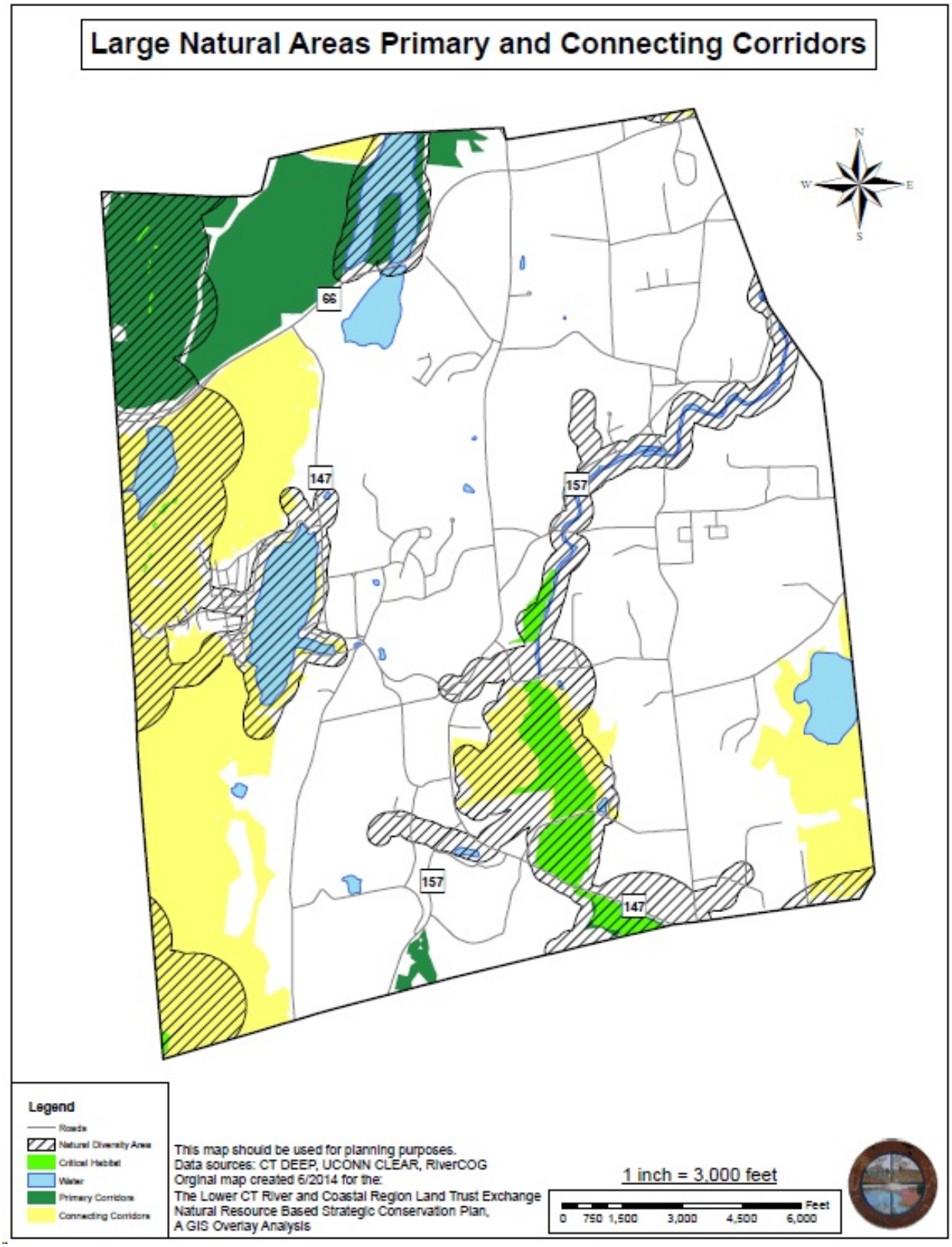
		Developed	Turf & Grass	Other Grass	Ag. Field	Forest*	Water	Wetland**	Barren
Town Wide	1985 Land Cover (acres)	1,005.3	835.7	138.5	2,114.7	3,866.0	414.9	19.0	7.1
	1985 Land Cover (%)	12.0%	9.9%	1.6%	25.2%	46.0%	4.9%	0.2%	0.1%
	2006 Land Cover (acres)	1,151.7	1,219.6	210.7	1,578.5	3,788.6	411.8	19.3	21.1
	2006 Land Cover (%)	13.7%	14.5%	2.5%	18.8%	45.1%	4.9%	0.2%	0.3%
	1985-2006 Change (acres)	146.3	383.9	72.2	-536.1	-77.4	-3.1	0.2	14.0
	1985-2006 Change (%)	1.7%	4.6%	0.9%	-6.4%	-0.9%	0.0%	0.0%	0.2%
100 Foot Zone	1985 Land Cover (acres)	96.4	46.6	12.1	88.8	397.1	53.6	2.5	0.2
	1985 Land Cover (%)	13.8%	6.7%	1.7%	12.7%	56.9%	7.7%	0.4%	0.0%
	2006 Land Cover (acres)	101.9	55.8	15.7	76.9	389.8	54.3	2.5	0.4
	2006 Land Cover (%)	14.6%	8.0%	2.3%	11.0%	55.9%	7.8%	0.4%	0.1%
	1985-2006 Change (acres)	5.5	9.2	3.6	-12.0	-7.3	0.7	0.0	0.2
	1985-2006 Change (%)	0.8%	1.3%	0.5%	-1.7%	-1.0%	0.1%	0.0%	0.0%
300 Foot Zone	1985 Land Cover (acres)	297.7	164.5	38.0	330.3	1,130.6	70.6	11.7	0.2
	1985 Land Cover (%)	14.6%	8.0%	1.9%	16.2%	55.3%	3.5%	0.6%	0.0%
	2006 Land Cover (acres)	324.5	204.0	61.8	261.9	1,109.1	69.3	11.9	1.0
	2006 Land Cover (%)	15.9%	10.0%	3.0%	12.8%	54.3%	3.4%	0.6%	0.1%
	1985-2006 Change (acres)	26.8	39.5	23.8	-68.3	-21.6	-1.3	0.2	0.8
	1985-2006 Change (%)	1.3%	1.9%	1.2%	-3.3%	-1.1%	-0.1%	0.0%	0.0

This table shows change in land cover from 1985 to 2006 town wide and in two riparian zones: 100 foot and 300 foot.

The change in percent is determined by subtracting the 2006 percent from the 1985 percent.

* Forest is a combination of the deciduous forest, coniferous forest, forested wetland and utility right-of-way classes.

** Wetland is a combination of the non-forested wetland and tidal wetland classes.


Large Natural Areas Primary and Connecting Corridors
N
W
E
S
66
147
157
157
147
Legend
Roads
Natural Diversity Area
Critical Habitat
Water
Primary Corridors
Connecting Corridors
This map should be used for planning purposes.
Data sources: CT DEEP, UCONN CLEAR, RiverCOG
Orginal map created 6/2014 for the:
The Lower CT River and Coastal Region Land Trust Exchange
Natural Resource Based Strategic Conservation Plan,
A GIS Overlay Analysis
1 inch = 3,000 feet
Feet
0 750 1,500 3,000 4,500 6,000

Bedrock Aquifer - to some extent, the fractured traprock layers store and can yield groundwater. It is thought that they may also serve as good groundwater recharge sources. Thus, the traprock ridges as well as other areas that rest above or upgradient from the stratified drift and bedrock aquifers should be protected from contamination.

FORESTLANDS, FARMLANDS AND WILDLIFE

Forestlands

The remainder of town is characterized by a mixed hardwood forest, typically oak, maple, hickory with some tulip, beech, birch, hemlock and pine. Farmlands including orchards with grass, crops or trees provide habitat for a wide variety of songbirds, birds of prey and game birds as well as deer, fox, raccoon and others.

Large Natural Areas and Primary Connecting Corridors

The most significant such corridor is found along Beseck and Higby mountains (traprock ridges). With the many traprock ridges, associated lakes and connection to the entire Metacomet Ridge, this corridor is regional. Second is the Coginchaug River Greenway and associated streams which provide a unique corridor which stretches towards Middletown and into Middlefield.

The Lower CT River and Coastal Region Land Trust Exchange Natural Resource Based Strategic Conservation Plan, a GIS overlay analysis mission statement to develop a plan that will enable effective collaboration towards the creation of large connected natural areas to provide wildlife habitat, to protect water quality and quantity, and to protect working and scenic lands. This plan was finished in 2014.

Overlay analysis, a type of suitability modeling, weights locations relative to each other based on specific criteria. They can be used to help find locations that are best suited for most anything. Good examples include shopping malls and schools or locations that provide the most favorable habitat for a particular species of bird. For this analysis, a subcommittee (the Committee) of nine of the 14 member land trusts of the Land Trust Exchange and representatives of their partnering organizations determined where they felt the Lower Connecticut River Region’s most important land-based natural resources are located within the constraints of available regional GIS data sets.

The large natural areas with an index of 4, 5, and 6 out of a scale of 12 were designated as Primary Corridors because of the extent of core forest area and buffered surface hydrology. The map depicts the important primary corridors within the Town of Middlefield.

Agriculture Land, Orchards and Farms

Middlefield's farmland is a key part of our town's character, providing its rural "feel," its pastoral landscapes that frame the wilder river corridor and ridgeline. The farms identified as Key Open Space are the town's largest – The Lyman Farm, Triangle A Ranch LLC, formerly known as Walnut Hill Farm, and the town-owned Strickland Farm – which range in size from a little over 100 to more than 1,000 acres.

Committed Open Space

Triangle A Ranch, LLC is a 189-acre former dairy farm. The State of Connecticut has purchased development rights on 172 acres of the farm under its Farmland Preservation Program. The farm has been sold and the new use will have an equestrian focus.

The Strickland Farm is a 169-acre parcel of land owned by the Town of Middlefield. The town voted to buy this portion of the 385-acre farm offered for sale by Linus Strickland in a close 93-86 vote at a 1977 Town Meeting. Following the purchase, the Farm and Land Management and Development Commission was formed to oversee management of the property. Many uses other than agriculture have been proposed for this land. Approximately 45 acres were subdivided for industrial lots. Most of the land, however, is presently leased to the Durham Fair Association and is in hay. Its rolling fields, hedgerows, majestic trees and wetlands provide a scenic panorama along Cherry Hill Road. The property is also used for passive recreation by local residents.

Other Significant Committed Open Space

The 95-acre King property on the easterly slope of Beseck Mountain has been owned and managed by the Town for decades. The recent acquisition of the 35-acre DiConstanzo and the 12-acre Pelkey properties have added to the protection of the ridge and will function as passive recreation areas along with the King Property. The most recent acquisition of committed open space is the 45-acre Strickland Property on the south side of Strickland Road. This parcel consists of agricultural fields separated by tree lines and a wetland forest area adjacent to the Coginchaug River. The parcel will also be dedicated to passive recreation uses.

In addition, Peckham Park, along with the abutting open space purchase, constitutes 57.5 acres and has adjacent to it, the 12.5-acre Lucy Strickland Skating Pond. The Town has also acquired a 38-acre parcel on the north side of School Street that is used for passive recreational purposes.

Uncommitted Open Space

The Lyman Farm is an 1,100-acre farm that includes one of the state's largest orchards. 1991 marked the 250th year this land has been farmed by the Lyman family. The pumpkin and strawberry fields that nestle in the Coginchaug Valley and the orchards climbing the hillside are an essential part of Middlefield's scenery. They also bring large numbers of tourists from across the state to shop at the Apple Barrel Farm Store or pick their own. A restaurant and golf courses have helped the Lymans diversify their operations and reduce the risks of their agricultural business.

Other active farmland in smaller parcels are an important long-term agricultural resource and they can be used for specialty farming (producing organic vegetables, Christmas trees or other specialty crops for nearby markets) and hobby farms (small orchards, pastures for equestrian horse or for lease to area dairy farms to grow hay and grain).

OPEN SPACE PLAN

The Open Space Plan designates two types of land for open space conservation.

Key Open Space is the backbone of Middlefield's open space system, the core areas that give the town its special character. These lands have unique natural values, perform many open space functions or especially critical ones and are essentially irreplaceable.

Areas of Conservation Interest are other areas that have significant natural resource values and that collectively help to shape the character of Middlefield.

Key Open Space

Middlefield's major open space systems have been designated as key open space. These are, for the most part, large areas of open land – the Coginchaug River Corridor, the Metacomet Ridge, public water supply lands and major farms that encompass many important natural resources, a wide variety of ecosystems and habitats and most of our major public and private outdoor recreation areas. The Town Green, however, is included in this category even though it has none of these characteristics.

The Town Green

The Town Green is a relatively tiny parcel of land, less than two acres, that is of little value to wildlife, contains no significant ecosystems, provides no water resources, agricultural produce, or forest products and offers only limited recreational opportunity. But, the Town Green is the open space at the heart of Middlefield, the center of our community, and a symbol of values.

The Green is a place to come together as a community to celebrate Earth Day, have a picnic or light the town Christmas tree. Aside from such special occasions, however, the Green receives little use. We drive past, enjoy the seasonal displays of flowers provided by the Midlea Garden Club and feel a little stir of pride in Middlefield, but rarely set foot on the Town Green. Although it lies among important public buildings like the library and town hall, our Green is not usually perceived as a place to stroll, relax or enjoy the outdoors. The property is owned by the Middlefield Congregational Church and maintained by the Town.

The Town Green is the northerly component of the Town Center Area along with the library. The next components are the 28 businesses along Main Street which employ approximately 85 people. The last and southerly component is Peckham Field, the principal recreation area in the community.

Recommendations

See Center Study Area section of the Proposed Land Use, Section 10.

Coginchaug River Corridor and its Greenway

Flowing through the heart of Middlefield, the Coginchaug River corridor is perhaps the town's most important open space. Our most extensive forests and wetlands and our most varied and productive wildlife habitat lie within this corridor. Its flood plains and marshes provide vast amounts of storage for flood waters, helping to prevent downstream flooding problems.

The "corridor," at a minimum, is all undeveloped land within 100 feet of the river or within 25 feet of any wetland contiguous with the river within 25 feet of the top of any steep slope (15 percent or greater) adjacent to the river without significant intervening wetland or swales.

The Coginchaug is our major fishery and the site of many of our town's most important recreation resources. Wadsworth Falls State Park, the Peckham Field complex of town recreational lands, Lyman Meadows Golf Course and the Middlefield Meadows are linked together by the river like an "emerald necklace." Framed by its extensive wetlands and rolling agricultural fields, the Coginchaug is the centerpiece of some of Middlefield's most scenic vistas. Because of ecological productivity, the southern part of the corridor was probably the major area of paleo-Indian activity in Middlefield, while the steeper northern sections bear the historical traces of water-powered industry.

Because almost all of Middlefield lies within its watershed, the Coginchaug tends to provide a focal point that pulls us together as a community. Similarly, almost anything we do to our land can affect the river. Maintaining and restoring the integrity of the Coginchaug corridor should be the town's highest open space priority.

Because of this potential recreational value, the Town of Middlefield should acquire land within and adjoining this corridor as opportunity arises with the long-term objectives of protecting water quality and creating a protected greenway and pedestrian trail that will interconnect key recreation areas.

Recommendations

- Acquire, whenever possible, wetlands and steep slopes abutting the river as well as adjacent buffer areas and lands that offer potential for improved public access.

- As an alternative to acquisition, use conservation easements to protect these areas where there is no potential for pubic access.

- Prevent sedimentation of the river, its tributaries and adjacent wetlands by requiring adequate erosion and sedimentation control measures at all construction and grading sites.

- Maintain long-term water quality by requiring adequate storm drainage management systems at all development and site improvement projects.

- Maintain the ecological integrity of wetlands adjacent to the river by assuring they are not encroached upon, sedimented, unnecessarily disturbed or polluted.

- Maintain the river and associated streambelt floodplain and floodzones to protect the existing flood storage capacity of the system. Avoid needless floodplain filling or channel constrictions.

- Restore and enhance fish and wildlife habitat, especially floodplain forest and shade cover along the river.

- Provide opportunities for public recreation and environmental education such as the proposed Coginchaug River Trail.

- Review all pertinent studies and documents for on-going protection of the river greenway.

Metacomet Ridge

Beseck Mountain and Higby Mountain, which run along Middlefield's western boundary, are part of the great Metacomet Ridge, a traprock ridge that cleaves Connecticut's Central Valley for north and south. Most of this ridge is wooded, one of Middlefield's two major areas of contiguous forest land. These forested ridges, part of an almost uninterrupted corridor of open space stretching from New Haven Harbor into Massachusetts, have incomparable value as wildlife habitat. The Mattabasset Trail, part of the sitewide Blue Trails system maintained by the Connecticut Forest and Parks Association, winds along the crest of the ridge. This trail offers some of the best ridgetop hiking anywhere in Connecticut with views extending from Long Island Sound to Hartford and across the breadth of the Central Valley.

Within this corridor lie some of Middlefield's most important scenic and recreational resources, including the town-owned King property and portions of the following: the Powder Ridge Ski Area and Lyman Orchards, Lake Beseck, Black Pond and the Higby Reservoir. Critical resources that provide water supply, recreation, wildlife habitat diversity and scenic enjoyment are among the water bodies that depend on recharge from the ridge, as do many private wells in the western part of Middlefield.

Our traprock ridges have been a natural barrier to the push of progress across the state, creating towering vistas of rocks and trees that lift our eyes and refresh our minds. But the ruggedness of the terrain is not sufficient to prevent inappropriate land uses that can destroy open space values. The fragile traprock ridge ecosystem needs to be protected by controlling its disturbance and by maintaining an unbroken corridor of forest and the associated scenic vistas and provide public access via designated trails and overlooks where such provisions do not adversely impact the ridge ecosystem.

Recommendations

- Protect an unbroken corridor of forested ridge (summit, slopes and base) through public ownership or conservation easement. Due to its unsuitability for development, the latter may be sufficient.

- Vigorously protect those areas of inviolate (pristine) interior forest which serve as critical habitat for rare, threatened or endangered species.

- Maintain a variety of recreational opportunities upon public and privately-owned lands by way of a cooperative and monitored access system: designated trails with overlooks that are for foot traffic only. The Powder Ridge Ski Area is a key property in this network along the ridge.

- Protect adverse impacts on water quality from existing and future development by controlling erosion, sedimentation and contamination from septic systems or other sources in order to protect the known aquifer recharge function of the traprock ridges.

PUBLIC WATER SUPPLIES

Surface Water

Two reservoir systems, Mount Higby and Laurel Brook, that provide drinking water for Middletown are located largely within Middlefield. The water utility land that surrounds these reservoirs helps to protect

water quality, but it also provides many other open space values. Only on these protected lands are there substantial acres of highly productive land, land that could support agriculture (or development) covered with undisturbed forest vegetation. These forested bottom lands, together with extensive undisturbed wetland and watercourses systems, and, at Mount Higby, steep traprock slopes, create diverse but integrated ecological systems that are unique for this area. Mount Higby also includes an important segment of the Mattabesett Trail, from which many hikers enjoy spectacular views along the mountain's western cliffs.

Dedicated to public water supply use, these reservoirs and the portion of their watersheds owned by Middletown are protected for the foreseeable future. Any change of use or ownership is regulated by the Connecticut Department of Health Services and the land closest to the reservoir and within streambelts, which is designated Class I land, may not be sold as long as these reservoirs are used as a water supply source. If any of the land is to be sold, it must by law be offered first to the Town of Middle field.

Recommendations

- Manage the public water supply land for water supply protection by preventing disturbance or contamination of the associated wetlands, streambelts and forestlands. Encourage selective-cutting type forestry where only appropriate.

- Protect the open space use of this land in a manner compatible with water quality maintenance. Protect critical and sensitive areas such as forests and wetlands from unnecessary disturbance. The Middletown Water Department should be encouraged to open the reservoir lands for passive recreational use by Middletown and Middlefield residents, including hiking, cross-country skiing and fishing where this activity can be adequately controlled to prevent risks to the water supply.

- Maintain buffers around the reservoirs of all land within 200 feet of the reservoir, land within 100 feet of any tributary to the reservoirs and land within 25 feet of any wetland or steep slope contiguous with these reservoirs or streams.

Other Key Open Space Areas

The following areas, although in DEEP ownership, are significant to the open space fabric of Middlefield.

Eastern Central:	Wadsworth Falls State Park, Middlefield to Middletown along southeast side of Coginchaug
Central:	Middlefield Meadows State Wildlife Area, South of Strickland Road
Western Central:	Black Pond State Wildlife
North Western:	Cockaponset State Forest (Mt. Higby)
South Western:	Powder Ridge. In December of 2008, the Town of Middlefield acquired the 245.5-acre resort. It was sold in September of 2012 to Powder Ridge Mountain Park and Resort, LLC, minus the 19-6 acres fronting on Powder Hill Road. Under the conditions of the sale of the property, it is limited to a maximum of four permanent

dwellings. The 19.6-acre parcel was sold in September, 2013 to an abutting equestrian property and, by deed, is limited to one dwelling.

Principal Farms

Middlefield's farmland is a key part of our town's character providing its rural "feel" and its pastoral landscapes that frame the wilder river corridor and the ridgeline. Farms identified as key open space are the town's largest: The Lyman Farm, Walnut Hill Farm and the town-owned Strickland Farm (ranging in size from 100 to 1,000 acres). Each farm was described in the Natural Resource Inventory part of this plan.

Most of Walnut Hill Farm (now known as Triangle Ranch) is presently protected under the state purchase of development rights (PDR) program providing a long term commitment to agricultural use. The Strickland Farm is publicly owned, but it is clear that this does not ensure its future use for farming. The Lyman Farm is protected only by the long commitment of the Lyman family to keeping the land in agriculture. Other than the state PDR program, the principal strategy to protect farmland is to reduce the cost of keeping land in agriculture and enhance the profitability of farming (crops, livestock, orchards).

Recommendations

- Continue to encourage agricultural landowners to participate in the state purchase of development rights program (PDR).
- Encourage the use of P.A. 490 designating, where appropriate, to reduce agricultural landowners' tax burden.
- Explore the use of Transfer of Development Rights (TDR).
- Encourage use of tax abatements to farmers by exempting farm buildings and for allowed public recreational access.
- Consider the use of "purchase of short-term conservation easements," a contract between the town and the agricultural landowner in which the owner is compensated for such agreement.
- Encourage agricultural and PA 490 land owners to continue to use valuable assistance resources (free of charge) such as the Connecticut River Coastal Conservation District, the University of Connecticut Extension System, the State DEEP Offices of Forestry, Fisheries, Wetlands and others as well as the Nature Conservancy, Audubon Society, Land Trusts and other Conservation Groups.
- Educate the public and encourage them to take part in events such as Strickland Farm Field Day. Stress how agricultural land can provide possible recreation via trails, but that such provision can only work if agricultural land operations are not disturbed.
- Review all development proposals adjacent to agricultural land for the provision of setbacks or buffers (by the developer) to prevent land use conflicts between farmer and homeowner.

- Maintain and support the continuation of the family and commercial agriculture and farm market operations (processing and expanding the retail marketing of products) to make it economically more feasible for the land to remain in agriculture.

- Encourage accessory commercial ventures such as Tourism Sites, Public Harvest, Equestrian Centers, Bed and Breakfast Inns and Retreat Learning Centers. Such building and activity sites should be clustered to maintain large surrounding open areas.

- Farming operations should be consistent with best management practices (BMPs) for soil and water conservation. Methods such as integrated pest management (IPM) and controlled fertilizer applications should be used to enhance wildlife values of farms.

- Diverse habitats associated with or surrounding farmlands should be maintained to enhance wildlife values of farms.

- A recreational trail system should be developed on the Strickland Farm interconnecting with existing trails at the neighboring Independent Day School and possible future recreational trails at Laurel Brook Reservoir. If these major farmlands should cease to be actively farmed, every effort should be made to keep them open and to return them to agricultural use.

Policies Related to Key Open Space

Key open space should be preserved in perpetuity and managed for its open space value to the people of Middlefield. The goal of 100 percent preservation of key open space is not likely to be fully achieved, but the town should ensure that losses are minimal and do not adversely affect the character and critical functions of Middlefield's key open space. The recommended policies are as follows:

1. Land identified as key open space should not be committed to development uses.

2. Key open space should be permanently protected, wherever possible, through public acquisition or through conservation easements or development restrictions.

3. The town should regularly appropriate monies to a non-lapsing fund for protection of key open space.

4. Under Middlefield's Charter, the Conservation Commission is the lead agency for identifying, obtaining and managing open space parcels. Setting priorities for expenditure of public funds for protection of key open space should be determined by the Conservation Commission and representatives from the Planning and Zoning, Inland Wetlands, Park and Recreation and other town agencies as appropriate. Priorities should be based on the following considerations:

    a. Natural resource value
    b. Public recreation potential
    c. Threat of conversion to an inappropriate use
    d. Opportunity for protection at a price advantageous to the town

5. Easements or development restrictions should be considered as an alternative to public ownership of open spaces that have little potential for public recreational use, or when potential recreation use is likely to be limited to an easily defined corridor such as a stream or trail. These options should be preferred to fee

ownership when (1) private ownership and management is likely to provide better protection of identified open space values than public management; (2) the parcel is isolated from other town landholdings and public recreation sites.

6. Key open space owned by the town should not be committed to development uses except under the following conditions:

   a. The land will provide greater public benefit in the proposed use than it does as open space;
   b. No land equally- or better-suited for the proposed use is available to the town at reasonable cost; and
   c. The loss of open space is compensated through town acquisition of other land of comparable open space value.

Areas of Conservation Interest and Their Protection

These are open lands or natural features that collectively contribute to the ecological balance, rural character and scenic beauty of Middlefield. Not surprisingly, a large proportion of the open land in Middlefield has been designated "Areas of Conservation Interest." The principal exceptions are small isolated parcels that do not play a major role in providing any of the natural resource values described in this section and areas that have been disturbed to the extent that their natural resource functions are negligible. Even some developed or degraded areas, when they fall within otherwise valuable natural corridors, have been included here with the hope of their eventual restoration as a functioning component of the ecosystem.

This broad approach to open space conservation does not imply that there should be no growth in Middlefield or that remaining open space should be "off limits" for development. Rather, it is a reminder that these lands have important natural values and that future land use should be sensitive to the specific open space functions of each parcel. Thus, future development should not be designed just to avoid building in wetlands, but to preserve the natural function of wetlands systems. Open space that is set aside for new developments should not only be the least buildable land, but also the most significant open space. The development should be designed to preserve its natural resource values as much as possible. Land preserved due to its agricultural value should be managed as active farmland, not abandoned to brambles. Wherever possible, recreational access to streams and rivers should be provided and scenic views should be preserved for the enjoyment of all. In areas of conservation interest, specific open space functions should be given careful consideration in future land use proposals. As a long-term goal, preferably at least one-half of this land should remain open and development within these areas should be designed in a manner that will preserve the overall integrity of open space systems to the greatest extent possible.

Categorically, the areas of conservation interest are as follows:

Wetlands and Streambelts

These areas encompass all of the wetlands and permanent streams tributary to the Coginchaug or other non-water-supply watercourses, including areas of steep slopes adjacent to streams and a protective buffer 50 feet in width to stream belts and 20 to 50 feet around wetlands.

Protection and Management Goal

As with the previous section listing the Coginchaug River Greenway, the primary goal here is to maintain the stability and improve the water quality of all wetlands and watercourses by keeping their water input clean, their channels unobstructed and their banks and buffers vegetated or otherwise stable.

Protection and Management Strategies

The SWCS and others offer a series of recommendations for the preservation of streambelts through land use planning as follows:

- Prevent such developments or land uses that would present possible or probable adverse environmental effects.

- Maintain natural drainage courses sufficient to carry normal flows of stormwater. In addition, the flood plain and flood prone areas should be retained in open space.

- Maintain a framework of high-quality environmental corridors with close proximity to neighborhood and population centers.

- Help stabilize stream flows by utilizing best management practices (BMPs). They include the use of stormwater discharge control systems such as retention basins, detention basins or direct discharge through energy dissipation structures at lower reaches of streams (ahead of peak flow). Also, construct "wetland retention basins" whenever possible to provide permanent stormwater filtration systems.

- Protect water quality and help preserve high-yielding groundwater areas that are important to water supply.

- Retain potential impoundment sites for beneficial water uses such as flood control, water supply, wildlife habitat, and recreation.

- Protect areas of vital importance in the preservation of significant ecological systems.

- Preserve areas of unique and scientific or historic interest for scientific study, ecological research and conservation or nature education.

- Protect and/or improve fish and wildlife habitats by re-establishing vegetation along unprotected reaches of stream to stabilize their streambanks and streambelts.

- Maintain a streambelt and wetland buffer of at least 50 feet on each side of streams and wetlands. This buffer area may vary depending upon site-specific conditions.

- Enforce town-wide controls on erosion and sedimentation to prevent adverse impact on water resources.

Ponds and Non-Public Water Supply Lakes

Included are Lake Beseck and Black Pond. Both are typical of the traprock ridge-controlled landform, the former was augmented by a mill dam. Black Pond is mostly surrounded by vegetation and has a stable buffer. Beseck Lake, however, is developed with houses and roads on three sides.

Protection and Management Goal

Maintain pond and lake water quality, buffer stability and recreational use. Follow recommendations listed.

Protection and Management Strategies

- Control lawn fertilizer use by little or moderate use of fertilizers around the lake where necessary. Discourage use of fertilizers on bare, highly-erodible slopes or very steep slopes along the lake.
- Sweep streams and clean catch basins in those areas that drain into the lake or pond via direct discharge or overland flow.
- Control use of farm fertilizer and pesticides within pond or lake buffer areas.
- Educate pond and lakeside residents with septic systems to use soaps and detergents low in phosphorus to increase leaching field life and to reduce lake/pond pollution.
- Control erosion and sedimentation from site grading in new construction upgradient from lakes and ponds by wise use of standard erosion control and soil stabilization techniques.
- Maintain and improve, when possible, lake/pond buffer vegetation, using groundcover, shrubs and trees recommended by the UCONN Extension Service.
- Encourage recreational use of ponds and lakes that are compatible with their limitations.
- Maintain, as is, undeveloped land within 100 feet of the lakeshore or within 25 to 50 feet of an associated tributary or wetland.

Aquifer (Groundwater) Recharge Areas

Although Middlefield has no high-yield aquifers or large wells that provide public water supplies, virtually the entire town depends on groundwater from private wells. Care is necessary throughout the town to protect groundwater resources. Those areas that are likely to be the most vulnerable to groundwater contamination or to have potential for future wells yielding enough water for community use are recommended for protection. These include stratified drift aquifers and exposed rock areas on traprock ridges, where cracks and fissures may provide aquifer recharge. Water filtering downward through the traprock and possibly through the sandstone rockbeds flows down gradient toward the stratified drift aquifer located in the Coginchaug River Valley. These "recharge areas" are vulnerable to contamination from surface pollutants such as salt, oil, gasoline, solvents, sewage effluent, bacteria and chemicals, pesticides, fertilizers and industrial chemicals, among others.

Protection and Management Goal

Protect known and potential aquifer recharge areas from pollution that may contaminate the aquifer. Keep present and potential groundwater sources safe for drinking water.

Protection and Management Strategies

- Promote and/or require State-mandated Best Management Practices (BMPs) for the use and storage of potential groundwater pollutants at existing commercial and industrial sites.

- Promote cautious use of agricultural chemicals and lawn care chemicals town-wide. Follow the Farm Resources Management Plans established by the DEEP for water management fuel and chemical storage and the proper use and handling of fertilizers and pesticides at agricultural sites.

- Promote and support the State's incentive to regulate underground residential fuel storage tanks. Adopt an ordinance which requires registration of all tanks and replacement of failing tanks and supply lines with above ground systems. Prohibit underground fuel storage tanks for all new construction.

- Encourage safe storage and use of salt, chemicals, fuels, oil, solvents and other potential groundwater pollutants of industrial, commercial and institutional land uses. Advocate cautious use of road salt on town roads.

- Encourage safe storage and use of detergents, solvents, oil, degreasers, antifreeze, fuels, etc. by all establishments and encourage those establishments to adhere to the State regulations for these substances.

- Inform the residents about the potential effects of disposing of household, home business and hobby-related chemicals into their septic systems. Emphasize the potential uptake of these substances by their own water wells. Also emphasize that potential pollutants should not be disposed into storm drains that empty into adjoining wetlands and watercourses.

Forest and Woodlands

Woodlands of approximately 20 to 100 acres have been designated as Areas of Conservation Interest. These woods are too small to provide interior forest habitat, but they are large enough to support species that cannot survive in suburban "edge" habitats and narrow strip forests. They are also large enough for possible economic resource management as woodlots.

Protection and Management Goal

Maintain woodlands of 20 to 100 acres to provide open space, habitat, recreation (if appropriate), scenic values, stormwater runoff control and timber.

Protection and Management Strategies

- Strive to keep the 20- to 100-acre woodlots contiguous or interconnected to provide wildlife corridors and to maintain habitat integrity. Keep them connected to the Coginchaug Greenway and the Metacomet Ridge, if possible.

- Encourage use of selective cutting to balance timber harvesting with wildlife enhancement.

- Prevent disturbance of critical habitats and rare species by timber harvesting by encouraging woodlot owners to seek the advice of DEEP Forestry Division before any tree cutting is done.

- Encourage the use of conservation easements, open space dedication or open space acquisitions as tools to maintain woodlands and forest. Consider formation of a land trust as an alternative means of assembling forestlands.

- Consult the DEEP Forestry Division, the Nature Conservancy, Audubon Society, the Trust of Public Land or any local and state conservation groups for assistance regarding forestlands.

Wildlife Corridors, Linkages and Greenbelts

Continuous corridors of open land, preferably at least 200 feet wide, are needed to allow wildlife to use a variety of habitats and to move freely between the major open space systems of the Coginchaug River and Metacomet Ridge. These consist largely of the interconnected wetlands, woods and farms throughout the towns, but special consideration should be given to ensuring that adequate wildlife corridors are preserved or restored in critical areas.

A special study identifying wildlife corridors was done by John Barclay and Scott Hobson of UCONN in cooperation with the Nature Conservancy. Undeveloped land that connects major open space areas is important in providing corridors that enable wildlife to move freely between these areas, enhancing wildlife diversity and permitting the survival of species that require large ranges. These open space corridors or greenbelts may also offer the potential for trails that connect outdoor recreation areas and they may help to separate developed areas and reduce possible undesirable environmental and scenic impacts of development. The following strategies are based upon the Barclay/Hobson study. Refer to Potential Wildlife Corridors Map.

Protection and Management Goal

Preserve and maintain adequate wildlife corridors which link designated open space areas, such as the Coginchaug River Greenway and the Metacomet Ridge.

Protection and Management Strategies

- Maintain wildlife corridors at least 200 feet wide connecting designated open space area where such corridors are one quarter mile or less in width or where they are one quarter to one mile in length and contain a stream, wetland or ridgetop. (CRITICAL)

- Provide recreation trail corridors at least 50 feet wide where possible between designated recreation areas or between designated recreation areas or between public roads and recreation areas that are one-half mile or less in length. (CRITICAL)

- Maintain wildlife corridors that are one mile or less in length between designated open space areas. (SIGNIFICANT)

- Maintain recreation corridors greater than one-half mile in length between designated recreation areas or between roads and recreation areas. (SIGNIFICANT)

- Maintain recreation corridors between open space areas that are potentially usable for possible recreation and wherever possible link them to residential areas.

Recreational Facilities and Linkages

In addition to the public recreation areas that are vital to the community, Middlefield has many private outdoor recreational facilities, including a ski resort, golf courses, riding stables, playing fields, skating ponds, swimming areas, fishing, trails for snowmobiling, jogging, hiking, nature study, cross-country skiing and bicycling that are an important part of what the town has to offer residents and visitors. Note: currently there are no public hunting or trapping lands in town according to the DEEP Wildlife Division, but there are a number of private landowners who permit hunting on their lands with permission. Middlefield's open lands also offer the potential to develop a network of community trails that link key recreation areas and that, in themselves, provide opportunities for pleasant recreation and enjoyment of nature. Often these linkages can be provided within open space protected for other purposes, such as streambelts and wildlife corridors, but where appropriate additional corridor segments have been designated for possible trails use.

Protection and Management Goal

Maintain existing recreational facilities/opportunities and their linkages and expand their extent where or when appropriate.

Protection and Management Strategies

- Wherever possible, connect local trails to the Metacomet Trail, which is a 62.7-mile, Blue-Blazed hiking trail that traverses the Metacomet Ridge of central Connecticut and is a part of the newly-designated "New England National Scenic Trail." Despite being easily accessible and close to large population centers, the trail is considered remarkably rugged and scenic. The route includes many areas of unique ecologic, historic and geologic interest. Notable features include waterfalls, dramatic cliff faces, woodlands, swamps, lakes, river flood plain, farmland, significant historic sites and the summits of Talcott Mountain and the Hanging Hills. The Metacomet Trail is maintained largely through the efforts of the Connecticut Forest and Park Association.

- Trail which currently traverses Mt. Higby and Beseck Mountain (on which motor vehicles, motorcycles, all-terrain vehicles and snowmobiles are prohibited).

- Develop a network of community trails that link key recreation areas (listed above) with significant streambelts, town open spaces and residential areas. Post trail limitation at appropriate locations.

- Coordinate all trail activities with the Parks and Recreation Commission, with input from the Conservation Commission.

Scenic Vistas

There are two requirements for scenic enjoyment: Something worth looking at and a viewpoint from which people can see it. This plan has identified some of the most important viewpoints and viewsheds in Middlefield, based in part on citizens' descriptions of their favorite views in the Conservation Planning Survey.

Scenic open space resources include large and small scale viewsheds, mountainsides and slopes, orchards and farms, trails, river and streambanks and lake and pond views. Equally important is accessibility to viewpoints. For a scenic resource to be valuable to the public, it must be visible from some public areas, whether a road, a trail or a recreation site.

Protection and Management Goal

Assure the preservation of Middlefield's Scenic Resources and Vistas.

Protection and Management Strategies

- Provide access to designated scenic overlooks via roadside access or trails; provided such access does not interfere with any public or private land uses.

- Maintain the scenic landscape of areas with significant or unusual features that are visible from public areas. Give careful consideration to such lands when they are planned for change or development in order to maintain an attractive view.

Archeological and Cultural Sites

As discussed in the section entitled Middlefield's Changing Landscape, there are about 11 identified mill sites, some with dams. Along with these sites, there may be yet-found artifacts or buried structures. There may also be colonial artifacts yet uncovered. According to State Archeologist, Dr. Nicholas Bellantoni, the river meadow and associated streambelts contain evidence of paleo (pre-8,000 years ago) and Archaic Native American (8,000-1,000 years ago) and recent Native Americans. Possible evidence would include campsites, hunting tools and hand tools, hunt remains and burial sites, among others. (Please refer to the map entitled "Archeological Areas").

Cultural open space resources also include significant town sites such as the Town Green, Center School Grounds, cemeteries, the library and other non-recreation public lands of special significance.

Protection and Management Goal

Preserve, to the fullest extent possible, Middlefield's cultural resources, present, past industrial and archeological.

Protection and Management Strategies

- Preserve known archeological sites and known industrial and colonial sites from disturbance. Contact the local historic society and the State Archeologist if any are accidentally disturbed or if previously unknown sites or artifacts are revealed or uncovered during grading or construction.

- Maintain sites that have historic ruins listed on National or State Registry of Historic Places or those identified by the Middlefield Historical Society as having outstanding value.

- Maintain the attractiveness and public use of public lands with cultural value. Where appropriate, enhance these areas with landscaping, pathways, benches and gardens.

- Contact the State Archeologist if any construction or land disturbance is proposed at on near a known archeological site to allow for a pre-construction field survey.

Agricultural Lands Less than 100 Acres

All active farmland that is not part of farms designated as Key Open Space, as well as recently abandoned farmlands with fertile soils, are included in this category. Collectively, these small areas of farmland are an important long-term agricultural resource and they can be used for specialty farms (producing organic vegetables, Christmas trees or other specialty crops for nearby markets), hobby farms (small orchards, pastures for equestrian horses) or for lease to area dairy farms to grow hay and grain.

Protection and Management Strategy

- Advise these agricultural landowners to seek assistance, if needed, from the Connecticut River Coastal Conservation District, the UCONN extension service and the State Department of Agriculture and the DEEP Forestry Division, Eastern District Office in Marlborough.

Community Forest Program

Trees and shrubs which naturally occur or are planted within town right-of-way or in the town-owned woodlands are overseen and maintained by the Tree Warden or Parks and Recreation Commission, depending on location. Tree and shrub planting efforts under the direction of these persons have been supported or done by various groups including Midlea Garden Club, Scout Troops and Northeast Utilities.

Open Space Protection

There are a wide range of financial and legal tools available for protecting land. A successful open space program will use many of these tools in combination, selecting those that effectively meet its protection goals at the lowest cost in order to use limited public (and private) funds efficiently. Some of the most useful of these tools are listed in this section.

Acquisition, Financing and Town Responsibility

Acquisition of areas designated as Key Open Space must be done on a case-by-case basis, making sure the subject parcel meets all the criteria established in this plan. Acquisition of such open space areas will require Middlefield to make a substantial financial commitment to protecting the town's future. Whether purchasing land from a private landowner or exercising the right of first refusal from a public or quasi-public entity, financing must be arranged. A departure from this reality is possible when land is "decided" or given to this town at no cost. However the goal is accomplished, it assures that designated areas will be set aside, under Town management, for natural resource protection, public education and for public recreational use, where appropriate.

Tools for Municipal Acquisition/Protection of Open Space

- Maintain and fund a capital improvement account for designated or undesignated parcels. (Note: up to 2 mills can be set aside by Statute.)

- Payment of fees in lieu of dedication of open space for development applications. (This mechanism has limited applicability as almost every application has land worthy of conservation).

- Apply for State grants through DEEP in conjunction with the required local match. (The current program will fund up to 50 percent of the fair market value of a parcel).

- Acquisition of Conservation Easements and Development Rights will protect Land of Conservation value and reduce the per-acre cost by purchasing a less-than-fee interest in the property and leaving it in private ownership.

- Encourage the participation of active farms in the State's program for the purchase of development rights on agricultural land.

- Dedication of fee or less than fee open space as part of the development application process. The use of cluster regulations already on the books can result in protection of up to 50 percent of the parcel.

- Application of flood hazard, ridgetop, storm water management, erosion and sedimentation control regulations also assist in protecting key open space. The Inland Wetlands permit and review process has been effective in maintaining buffers adjacent to wetlands and watercourses.

Other Tools for the Protection of Open Space

- Ownership of land by non-profit conservation organizations may be preferable to public ownership by some property owners. The Nature Conservancy, National Audubon Society and the Middlesex Land Trust have been active in Middlesex County. Certain income and estate tax benefits can accrue to a property owner donating land to these organizations in fee or less than fee.

- Expand the number of properties that can qualify as "open space" under Public Act 490. This mechanism does not protect land permanently.