King's Mark Environmental Review Team Report

Nonnewaug Falls Open Space and Agricultural Preservation Area

Bethlehem, Woodbury, and Watertown Connecticut

King's Mark Resource Conservation and Development Area, Inc.

Nonnewaug Falls Open Space and Agricultural Preservation Area

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Environmental Review Team Report

Prepared by the
King's Mark Environmental Review Team
of the King's Mark
Resource Conservation and Development Area, Inc.

for the
Council of Governments of the Central Naugatuck Valley
Waterbury, Connecticut

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Acknowledgments

This report is an outgrowth of a request from the Council of Governments of the Central Naugatuck Valley (COGCNV) to the Litchfield County Soil and Water Conservation District (SWCD) and the King's Mark Resource Conservation and Development Area (RC&D) Executive Council for Environmental Review Team assistance. The request was approved and the project reviewed by the King's Mark Environmental Review Team (ERT).

The King's Mark Environmental Review Team Coordinator, Elaine Sych, would like to thank and gratefully acknowledge the following Team members whose professionalism and expertise were invaluable to the completion of this report.

The field review took place on Tuesday, January 23, 2001.

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I would also like to thank Virginia Mason, COGCNV, Mary Barton, town planner, Watertown, Jean Donegan, land use analyst, Bethlehem, Christopher Wood, town planner, Woodbury, Dick Leavenworth, conservation commission, Woodbury, members of the Nonnewaug Falls Steering Committee, and other interested landowners and citizens for their cooperation and assistance during this environmental review.

Prior to the review day, each Team member received a summary of the proposed project along with location and soils maps. During the field review Team members were given additional information. Some Team members unable to attend the field review made visits on their own and others made additional field visits to the area. Following the review, reports from each Team member were submitted to the ERT coordinator for compilation and editing into this final report.

This report represents the Team's findings. It is not meant to compete with private consultants by providing site plans or detailed solutions to development problems. The Team does not recommend what final action should be taken on a proposed project - all final decisions rest with the towns and landowners. This report identifies the existing

resource base and evaluates its significance to the proposed use, and also suggests considerations that should be of concern to the towns. The results of this Team action are oriented toward the development of better environmental quality and the long term economics of land use.

The King's Mark RC&D Executive Council hopes you will find this report of value and assistance in the review of the proposed open space and agricultural preservation area.

If you require additional information please contact:

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Executive Summary

Introduction

- The Council of Governments of Central Naugatuck Valley (for the Nonnewaug Falls Steering Committee) requested environmental review team assistance in conducting a natural resource inventory for the Nonnewaug Falls Open Space and Agricultural Preservation Area.
- The study area is approximately 3000 acres in size within the towns of Bethlehem, Woodbury and Watertown. The study boundaries were determined by the steering committee and each town's planning commission.
- The object of the ERT study is to assist the Committee in a better understanding of the natural and cultural resources and in identifying threats and opportunities to meet their goal of preserving the region's heritage, natural landscape, watershed and agricultural lands and open space.

Land Use and Transportation Review

- Much of the project area is shown as an aquifer protection area on the State Plan of Conservation and Development because of the Hart Well Fields. The remainder is classified as rural land and conservation areas. The proposed project area appears to support these designations
- In 1967 the Central Naugatuck Valley Regional Planning Agency identified Nonnewaug Falls as one of seven Open Space action Areas in its 13 town region. Again in 1998 the Regional Plan of Conservation the area was recommended for recreation and open space preservation. A steering committee was formed in 1999 to look further into this proposal and expanded the project area to the size and scope reviewed by the ERT.
- The individual town plans look favorably upon the concept of open space preservation.
- Primary access to Nonnewaug Falls is from local public roads that will need improvement.
- The bridge on Falls Road over the Nonnewaug River is in poor condition and should be rehabilitated because of likely increased traffic to access the Falls.

- Parking at the Falls is limited and should be improved and clearly marked.
- The potential exists for linking trails on the Nonnewaug Falls property and possibly developing a large greenway if their is support from local landowners.

A Watershed Perspective

- By looking at the project area using a watershed perspective you can better understand and assess the impacts from land use activities or policies on water quality and quantity.
- Consideration should be given to expanding the project area to include other significant water resource features such as: the watershed north of Route 6, including the headwaters of the Nonnewaug River and the remainder of East Spring Brook, the Watertown Reservoirs, Big Meadow Pond, and any remaining areas of subregional and local watersheds not now in the project area.
- Within the project area surface waters are classified as A or B/A; and groundwater is classified as GA. Class A surface waters have overall excellent water quality, B/A indicates good water quality but it may not be consistently meeting all the criteria for Class A. Class GA groundwaters have overall excellent water quality.
- The 1991 CT DEP Fisheries Division Survey of watercourses within the project area indicated high water quality.
- Potential concern was raised in the Fisheries Survey for both East Spring Brook and an unnamed tributary for additional nutrient sources from sources such as agricultural and golf course runoff.
- It is suggested that a method to illustrate the benefits of preserving open space be developed. One way is to develop different scenarios showing how land conservation versus other land use activities allowed under current zoning could affect water resources.
- It should be recognized that some existing land uses may currently be impacting water quality. Certain farming practices can be a source of water quality problems.
- There are non-profit, state and federal agencies available to assist in voluntary ways to address water quality issues.
- It is recommended that each town in the project area adopt the concept of the agricultural and open space area into their plans of conservation and development and that "protection of water and quantity" be listed as one of the functions of the area.

- The steering committee should work with the Watertown Fire District to identify and protect lands which the water company feels are important to protecting the quality of its water supply.
- The steering committee should coordinate efforts with the Pomperaug River Watershed Coalition to address water resource issues with the towns and other stakeholders.

Natural Resource Overview

- Important natural resources and natural features
    - Nonnewaug Falls
    - Wetlands - 2 important wetland resources in or near the project area with 50 or more continuous acres of wetlands
    - Lewis Atwood Brook wetland system
    - Nonnewaug River wetland system
    - Ridgelines - areas over 800 feet in elevation
    - Prime farmland/important agricultural production area
- Recommendations
    - 2 upstream reservoirs and all of East Spring Brook watershed should be included in the project area
    - Preservation of high quality drinking water with control of non-point source pollution
    - Control streambank erosion along the Nonnewaug River
    - Open space preservation and careful zoning to control potential threats to drinking water quality.
    - The disturbed banks of the Nonnewaug River around the wellfield should be revegetated to create a buffer of native vegetation at least 25 feet wide.
    - Significant additional preservation efforts for agricultural land with high percentages of prime and important farmland soils would be beneficial including the use of CT Department of Agriculture's Purchase of Development Rights and the USDA Farmland Protection Program.
    - Protect critical wildlife habitats.
    - Protect high use areas (trails, Nonnewaug Falls) from erosion and soil compaction.

The Natural Diversity Data Base

- The Natural Diversity Data Base maps and site files showed no known extant populations of Federal or State Endangered, Threatened or Special Concern Species within the project area.

Topography and Geology

- The surficial geology consists of alluvium, stratified drift and glacial till.
- The bedrock geology consists of Ratlum Mountain Metasediments and Nonnewaug Granite.
- The Nonnewaug Granite has a number of unique and unusual features. The pattern formed by the principle minerals feldspar and quartz resembles Egyptian hieroglyphics referred to as "graphic granite". The granite is also characterized by extreme variations in grain size.

Soil Resource Inventory

- Approximately 25% of the project area is classified as Prime Farmland soils. These soils are the best for agricultural production and the project area has almost double the concentration than for the county as a whole. (Litchfield County is 13% prime farmland).
- Preservation of prime farmland should be given a high priority since it a valuable and productive natural resource that has no regulations (like those that protect inland wetland soils) to protect it.

Wetland Resources

- The wetland resources Team member calculated that approximately 12-13% of the project area is wetlands.
- It should be noted that East Spring Brook, the Nonnewaug River, Lewis Atwood Brook, Frank Atwood Brook and some of the larger tributaries have their headwaters outside of the boundaries of the project area.
- The overall health of the wetland systems appear good and little of the total wetland and watercourse acreage appears to be impacted by development.
- Wetland functions and values
    - nutrient retention and sediment trapping
    - wildlife and finfish habitat
    - groundwater recharge

    - flood control
    - education
    - passive recreation
    - aesthetics
- Quality of water issues from outside the area could impact the project area.
- Potential problem areas
    - loss of riparian areas from agricultural encroachment
    - loss of water quality from cattle, pesticide and fertilizer use
    - incomplete understanding of wetland systems and values within the project area
    - loss of water quality due to lack of inclusion of headwater streams in the project area
    - non-observation or establishment of wetland buffer or setbacks
- Suggestions
    - Agricultural Best Management Practices
    - obtaining a wetland evaluation to detail functions, values and remediation needs
    - include the headwaters or source wetlands for streams that begin outside the project area
    - observe typically accepted buffers/setbacks
    - obtain a copy of the National Wetland Inventory map

Aquatic Resources

- Sections of East Spring Brook, Lewis Atwood Brook, the Nonnewaug River and a number of unnamed tributary streams are found within the project area. All of these are physically characteristic of coldwater streams in Connecticut.
- Throughout much of the area dense growth of hardwoods and woody shrubs predominate as riparian vegetation and provide a nearly complete canopy.
- Riparian vegetation has been cleared to the top of bank along a number of streams through agricultural land.
- The limited development to date has provided a means of maintaining stream water quality.
- The headwaters of East Spring Brook, Lewis Atwood Brook and the Nonnewaug River are classified by DEP as Class AA surface waters. Lower sections are classified as B/A.

- These streams have had a DEP Fisheries Division survey conducted in summer/early fall 1991. They were found to support brook trout, blacknose dace, longnose dace, creek chub, white sucker and American eel which are commonly associated with coldwater streams. Also found were several species common to warmwater ponds and slow moving streams.
- Recommendations
    - creation of a protective buffer areas and managing land to protect valuable natural habitats such as coldwater stream systems.
    - the boundary of the project area should be redrawn to include the watershed (drainage basin) divides for each watercourse.
    - consider conservation easements or the purchase of riparian area habitat adjacent to water courses in lieu of complete property purchases.
    - foster a relationship with property owners along watercourses to make them aware of the importance in maintaining well vegetated buffers.

Wildlife Resources

- A variety of habitat types were identified and visited during the ERT review. It was not possible to inventory the entire project area so the following habitats were chosen as representative: hardwood forest, coniferous forest, forested wetland, riparian, old field, open field and agricultural areas.
- Hardwood forest - there appear to be several large unfragmented areas of forestland.
- Coniferous forest - are important for winter cover and nesting sites.
- Forested wetland - important areas for reptiles, amphibians, birds and bats.
- Riparian wetland - important habitat for aquatic based organisms, can provide a greenway and important travel corridor.
- Old field - contains a diversity of grasses and forbes and provides cover for small mammals.
- Agricultural areas/hayfield/pasture - large grasslands are disappearing quickly in Connecticut. Grassland specialist bird populations have declined drastically in recent years. These birds require large fields of hay or grasses to nest and feed in. This is a habitat type that should be preserved.
- General Recommendations

    - large blocks of habitat type are better than smaller blocks
    - connect these blocks via corridors
    - limit habitat fragmentation by clustering development
    - conserve wetlands; use riparian buffers
    - manage agricultural land for wildlife
    - manage early successional habitat
    - manage for a diversity of forest classes
    - manage large areas of sawtimber for area sensitive species
- Specific Management recommendations for old fields/pastures/hayfields
    - old fields must be maintained or they will revert to forest
    - hayfields - mowing should be delayed until July 15 or August 1 to allow adequate time for grassland birds to nest and fledge young or leave a section of field fallow
    - larger fields are more important to manage than smaller fields

Forest Vegetation

- Approximately 44% of the project area is tree covered, with the majority (77%) being characterized as mixed hardwoods. The remainder is agricultural land, residential areas, cemetery, wetlands and ponds.
- Only about 6% of the forested area are softwoods, primarily hemlock and white pine. These are located along the major drainageways. The major threat to this vegetation type is two sap-sucking insects that infest hemlocks. Hemlock scale was observed on the hemlock growing around Nonnewaug Falls and the hemlock wooly adelgid is known to be in the area.
- The Team forester is available for more detailed consultation on specific parcels and Tom Worthley, of the UCONN Cooperative Extension system, is available to make a presentation on the hemlock wooly adelgid.

Archaeological and Historical Review

- The State of Connecticut Archaeological Site Files and Maps show no known archaeological sites in the project area.
- However, the topographic and environmental aspects of the land suggest a high sensitivity for undiscovered archaeological resources including Native American campsites and historic Euro-American farmsteads.

- The Office of State Archaeology is prepared to provide technical assistance in conducting an archaeological survey for portions of the project site.

Introduction

Introduction

The Council of Governments Central Naugatuck Valley (for the Nonnewaug Falls Steering Committee) has requested assistance from the King's Mark Environmental Review Team in conducting a natural resource inventory of the Nonnewaug Falls Open Space and Agricultural Preservation Area. The study area is approximately 3,000 acres in size within the towns of Bethlehem, Woodbury and Watertown. Past land use studies identified the Nonnewaug Falls area as a significant regional resource which should receive special consideration for conservation and preservation.

A Steering Committee was formed in 1999 and the geographic boundaries of the study area were reviewed by each town's planning commission and revised. (Figures 1 & 2) The goal of the Steering Committee is to develop and implement a program to preserve the agricultural and open space landscape of the greater Nonnewaug Falls area. The borders of the three towns ... "meet amidst a relatively undeveloped region of forest and agricultural lands, highlighted by the beautiful and exciting falls of the Nonnewaug River. Here, the three

Towns, with other key partners, can preserve important pieces of the region's heritage, natural landscape, watershed lands, and open space." Some of the draft objectives of the Steering Committee include identifying and evaluating conservation targets and opportunities, setting criteria for conservation priorities, identifying threats to conservation targets and developing a long term plan of action to provide permanent protection for the highest priority parcels of land, creating protective buffers, providing passive recreation access, sustaining agricultural activities, and managing land to protect valuable natural habitats.

Objectives of the ERT Study

The Steering Committee requested that the ERT assist them by providing a natural resource inventory for the area with basic information on the topography, geology, soils, water resources, forest vegetation, aquatic resources, wildlife resources, land use, access, farmland and open space preservation and archaeological and historical significance to assist them in meeting their goals by better understanding the resources of the area. Team members also have included recommendations for refining the scope of the project area, opportunities and threats to goals and areas for further study.

The following sections of this report supply information on the requested topics, but because the study area is so large the scope of some of the material is very general. Several Team members are

available to assist with more detailed studies on specific areas or projects.

The ERT Process

Through the efforts of the COGCNV, this environmental review and report was prepared for the towns of Bethlehem, Woodbury and Watertown.

This report provides an information base and a series of recommendations and guidelines which cover the topics requested by the COG. Team members were able to review maps, plans and supporting documentation provided by the COG.

The review process consisted of four phases:

1. Inventory of the site's natural resources;
2. Assessment of these resources;
3. Identification of resource areas and review of plans; and
4. Presentation of education, management and land use guidelines.

The data collection phase involved both literature and field research. The field review was conducted on Tuesday, January 23, 2001. The emphasis of the field review was on the exchange of ideas, concerns and recommendations. Being on site allowed Team members to verify information and to identify other resources.

Once Team members had assimilated an adequate data base, they were able to analyze and interpret their findings. Individual Team members then prepared and submitted their reports to the ERT coordinator for compilation into this final ERT report.

Nonnewaug Falls Open Space and Agricultural Area

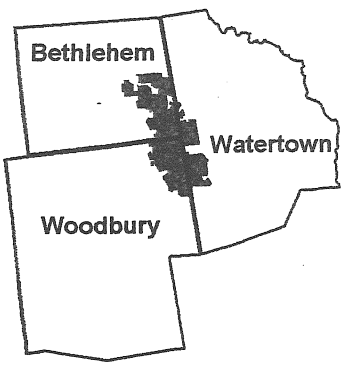

Figure 1

Scale: 1 inch = 3,200 feet

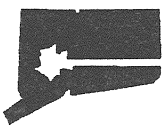

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Figure 2

Topographic Map

Scale 1" = 2000'

Land Use and Transportation Review

Land Use Plans

State Plan of Conservation and Development 1998-2003

Much of the 3,000 acres is shown on the state *Plan of Conservation and Development* as an aquifer protection area because of the Hart Well Fields of the Watertown Fire District. The remainder is classified as rural land and conservation areas. *Rural land is* defined by the State as remote from existing urban areas and lacking public water and sewer services as well as industrial, commercial or residential concentrations. Generally characterized by single family homes, it includes forest, wildlife habitat, and scenic values of general concern. *Conservation areas* are defined as land which needs proper management to provide the state with its "best opportunity for future need for food, fiber, water and other resources", including prime agricultural lands, trap rock ridges, scenic areas, and potential major outdoor recreational areas. The proposed open space and agricultural preservation area does not appear to be in conflict with this definition and would appear to support these designations.

Regional Plans

In 1967, The Central Naugatuck Valley Regional Planning Agency (CNVRPA) identified Nonnewaug Falls as one of seven Open Space Action Areas in its thirteen towns. Specifically, the CNVRPA identified 2,105 acres in Bethlehem, Woodbury and Watertown as a regional resource and recommended a variety of uses such as a golf course, arboretum, and trails. In 1976, the CNVRPA revisited the proposal in its Regional Plan. No changes were made at that time. In developing its *1998 Regional Plan of Conservation and Development,* the COGCNV again recommended a Nonnewaug Falls Open Space area as a priority recreational and open space preserve. All specific proposals for its use were dropped.

A Steering Committee was formed in September 1999 to look further into this proposal, and it recommended preserving the land as an Open Space and Agricultural Preservation area. The geographic boundaries were reviewed by each town's planning commission, and the total acreage was expanded by almost 50%. Much of the new area is farms in Bethlehem. The steering committee approved this new concept and study area.

Town Plans

Woodbury's 1988 *Plan of Development* and its 1999 *Plan of Conservation and Development* have endorsed the concept of a Nonnewaug Regional Park for several parcels north of Route 6. The town open space plan is still under consideration. The Town of Watertown

included a portion of the Nonnewaug Falls Regional Park in its 1992 Plan of Development, and the 1999 Bethlehem Town Plan calls for its consideration as a "very high priority for open space preservation."

Transportation Issues

Roadway access to Nonnewaug Falls

Primary access to Nonnewaug Falls is at the Bethlehem/Woodbury town line off Route 61 (see Figure 3), a well-maintained state road. The Leever property, which comprises the falls proper, is accessed off of Falls Road. Falls Road, although a local road, is not well maintained. From Route 61, Porter Hill Road to Nonnewaug Road must be taken to get to Falls Road. Porter Hill Road, Nonnewaug Road, and Falls Road are all local roads. Public ownership of Nonnewaug Falls will necessitate improving these local roads.

Bridges

The bridge on Falls Road over Nonnewaug River (Bridge #05170) is in poor condition. According to the Department of Transportation: "Both barrels of the steel pipe culvert have heavy rust with progressive loss of the pipe inverts" (February 22, 2001 letter from James Byrnes, Chief Engineer, Bureau of Engineering and Highway Operations). In an October 20, 1997 letter, Chief Engineer Byrnes wrote, "It should be noted that the Department has advised the Town of the poor condition of this structure in letters dated August 7, 1995, August 31, 1993, and

July 22, 1991." With increased traffic over this bridge to access Nonnewaug Falls, this bridge should be rehabilitated. Nonnewaug Falls is a natural resource with regional significance.

Parking at Nonnewaug Falls

Parking is limited. Signs instructing visitors where to park are nonexistent. Parking should be made available off Falls Road on the west side of Nonnewaug Falls, and the parking area should be clearly marked with signs to prevent scattered parking.

Roads through the Nonnewaug Falls Open Space and Agricultural Area

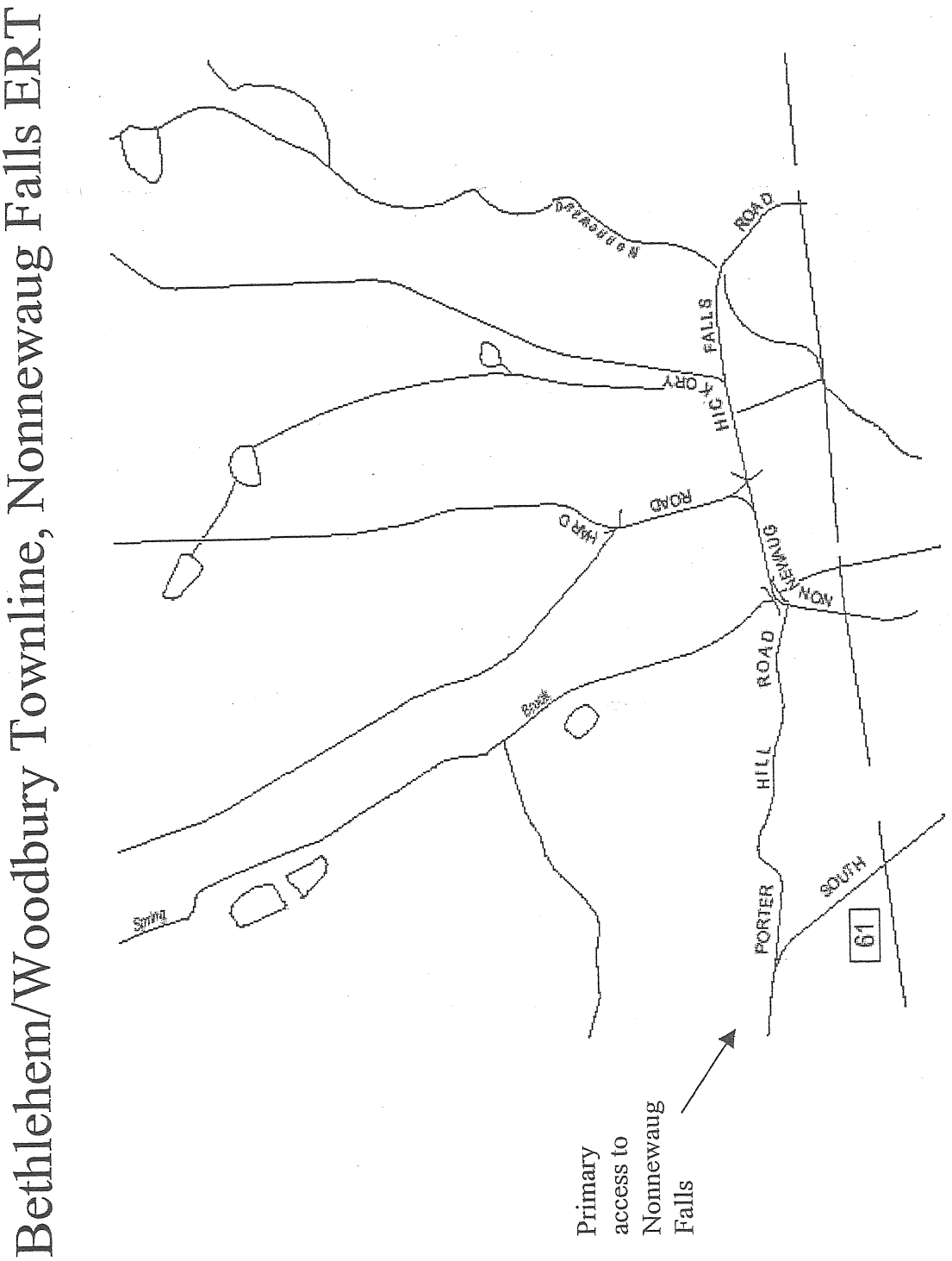
Major roads through Bethlehem, Watertown, and Woodbury are indicated in Figure 1 Route 6 in Woodbury (Main Street North) and Watertown (Woodbury Road) and Route 61 in Bethlehem (Main Street South) and Woodbury (Bethlehem Road) are the primary arterial roads through the Nonnewaug Falls Open Space and Agricultural Area. Hardhill Road South in Bethlehem, Magnolia Hill Road in Bethlehem, Nonnewaug Road in Bethlehem, Hickory Lane in Bethlehem, Judd Farm Road in Watertown, Guernseytown Road to Platt Road in Watertown, Artillery Road in Watertown, and Quassapaug Road and Bethlehem Road in Woodbury are the local roads providing the best access to Nonnewaug Falls Open Space and Agricultural Area.

Traffic generators are largely residential units. Farm vehicles and Watertown Fire Department vehicles accessing the Hart Well Fields also use the road system.

Greenways

The potential for linking existing trails and woods roads throughout Nonnewaug Falls proper exists. Greenway development on working farmland is less feasible, although possible with support from private landowners.

Figure 3


Bethlehem/Woodbury Townline, Nonnewaug Falls ERT
Primary access to Nonnewaug Falls
ROAD
FALLS
HILL
ROAD
PORTER
SOUTH
61
NONNEWAUG
Spring
Brook

A Watershed Perspective

Introduction

This section of the report provides an overview of water resources and related activities within the proposed Nonnewaug Falls Open Space and Agricultural Area Preservation Area and is based upon Connecticut Department of Environmental Protection (CT DEP) data and knowledge of the region. This information is mostly presented within a watershed context which takes a broad view of water quality and quantity, and the effects that various policies and land use activities may have upon these resources. Suggestions are also offered as to how this information may be applicable to the proposed Area.

Water Resource Information and Activities and Conservation Area Considerations

Drainage Basins

As a way of describing Connecticut's water resources in terms of the landscape, CT DEP has divided the state along natural drainage divides into eight "major basins" or watersheds. These, in turn, are divided

into increasingly smaller watersheds which are described as "regional", "subregional" and "local" drainage basins. At each level, these watersheds are named after the brook, river or waterbody into which all of the water within that topographically defined area ultimately flows. In other words, every water feature, no matter how small, has its own distinct watershed. Smaller watersheds make up larger watersheds which, in turn, make up even larger watersheds.

The proposed Area is located entirely within the Housatonic Major Basin (No. 6).[1] Within this larger watershed, the Area lies predominately within the Pomperaug Regional Basin (No. 68) while a very small portion falls within the Naugatuck Regional Basin (No. 69).

Within the Pomperaug Regional Basin, the Area falls primarily within the Nonnewaug[2] River Subregional Basin (No. 6802), with a smaller section lying within the East Spring Brook Subregional Basin (No. 6801). The portion of the Area located within the Naugatuck Regional Basin, lies entirely within the Steele[3] Brook Subregional Basin (No. 6912). (Local basins are not described here. See the section of this report entitled "Wetland Resources" for a discussion of local drainage features.)

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[1] Connecticut Geological and Natural History Survey. (Compiled by Marianne McElroy). 1981. Natural Drainage Basins in Connecticut (Map). CT DEP Natural Resources Center in cooperation with the USGS, Hartford, CT.

[2] "Natural Drainage Basins in Connecticut" (1981) as well as the "Water Quality Classifications" map (2000) both use the spelling Nonewaug (one "n" rather than Nonnewaug (two "n's").

[3] "Natural Drainage Basins in Connecticut" (1981) uses the spelling Steel (no "e") rather than Steele (with an "e").

Considerations:

By examining water resource issues from a drainage basin or watershed perspective, one is better able to understand and assess the cumulative impacts that assorted land use activities or policies may have upon water quality and quantity. The proponents of the Area (the proponents) may wish to identify the water resource benefits provided by preserving agricultural use and open space within this approximately 3,000 acre area, especially since it is located in the headwater region of the Pomperaug River. (Headwater streams are particularly sensitive to watershed changes.) The proponents may also wish to consider expanding the proposed Area to include other significant water resource features within the smaller watershed areas such as the Bronson E. Lockwood Reservoir and the Bethlehem Reservoir (a.k.a. Watertown Reservoir) at the head of East Spring Brook.

Water Quality and Fisheries Surveys

Per Connecticut's Clean Water Act, the State has adopted Water Quality Standards[4] which establish policy for water quality management throughout the state. The state's surface and ground water quality classifications are based upon these standards. Among other things, the standards describe the designated uses and criteria associated with each water quality class. Within the proposed Area, surface waters are classified as Class A or B/A; ground waters are classified as GA.

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[4] CT DEP Bureau of Water Managment - Planning and Standards Division. Effective 1996 & 1997. Water Quality Standards. CT DEP. Hartford, CT.

Class A surface waters have overall excellent water quality and the following designated uses: potential drinking water supply; fish and wildlife habitat; recreational use; agricultural, industrial supply and other legitimate uses, including navigation. Class B waters have good to excellent water quality and the following designated uses: recreational use, fish and wildlife habitat, agricultural and industrial supply and other legitimate uses including navigation. In the case of waters classified B/A, B represents the current water quality and A represents the water quality goal for that surface water resource. This designation indicates that although water quality is good, it may not be consistently meeting all the Class A water quality criteria. Class GA ground waters have overall excellent water quality and the following designated uses: existing private and potential public or private supplies of water suitable for drinking without treatment; baseflow for hydraulically connected surface water bodies .

According to the State of Connecticut "Water Quality Classifications" map[5], the surface water quality of the upper part of the Nonnewaug River is classified as A until East Spring Brook joins it at which point it becomes B/A. (See accompanying State Water Quality Classifications map - Figure 4) East Spring Brook, a headwater tributary of the Nonnewaug River, is classified as B/A. According to the "Leachate and

[5] CT DEP Environmental and Geographic Information Center. Adopted March 1999 (Version 01/24/00-1). Water Quality Classifications - Housatonic River, Hudson River, and Southwest Coastal Basins (Sheet 2 of 3) (Map). CT DEP, Hartford, CT.

Wastewater Discharges" map[6], a closed mixed waste landfill in Bethlehem is the reason why East Spring Brook is not designated Class A. Throughout the state, landfill sites - whether active or not - are generally identified as known or suspected causes of water quality degradation with regard to Class A water quality criteria. Although CT DEP does not consider Class B uses of East Spring Brook to be impaired by this landfill, it may preclude the stream's use as a drinking water supply. In order to upgrade East Spring Brook to Class A, the leachate and wastewater sources would have to be removed or remediated such that the natural conditions associated with a Class A stream can be achieved and maintained.

Lewis Atwood Brook, another tributary to the Nonnewaug, is also classified B/A. In this case, the known or suspected causes of water quality degradation may be attributed to two causes: the Watertown closed mixed waste landfill, now "inactive"; and an industrial lagoon, also "inactive" and located at the former Watertown landfill.[7] Ground water quality in the general Conservation Area is classified as GA. However, just outside of the Conservation Area are several areas classified GA*, meaning that the water resource "may not meet current standards".

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[6] CT DEP Environmental and Geographic Information Center. 1997 Version. Leachate and Wastewater Discharges - Housatonic River, Hudson River, and Southwest Coastal Basin (Sheet 2 of 3) (Map). CT DEP, Hartford, CT.

[7] In addition to the Leachate and Wastewater Sources described in this section, other potential sources of pollution in the vicinity of the proposed Conservation Area are shown on the accompanying "State Water Quality Classifications" map.

The foregoing water quality information can also be considered with regard to the 1991 CT DEP Fisheries Division stream and river survey for the lower Housatonic River and Naugatuck River Drainages.[8] This was part of six year comprehensive survey of streams and rivers for the entire state. The survey was conducted specifically to have a better understanding of the State's coldwater and warmwater fisheries resources and stocking potential. In the Pomperaug Regional Basin, surveys were carried out on several streams in or near the Area, including East Spring Brook, a (nameless) tributary to East Spring Brook, a (nameless) tributary to the upper Nonnewaug River and Lewis Atwood Brook. Although these surveys focused on fisheries resources, some of the information may also be helpful in assessing water quality. For example, at all of these sites, brook trout and dace were found. These are considered "indicator species" associated with high water quality in swift moving streams. During these fisheries surveys, data was also collected on macroinvertebrates.[9] This information can also be useful as an indicator of water quality.

The survey reports for each site also include a general note as to whether or not the immediate stream area may be subject to additional nutrient sources such as agricultural or golf course runoff. The report comments for both the East Spring Brook and (nameless) tributary to the Nonnewaug sites indicate that additional nutrient sources could be a potential concern.

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[8] Hagstrom, Neal T., Michael Humphreys and William A. Hyatt. 1991-92. A Survey of Connecticut Streams and Rivers - Lower Housatonic and Naugatuck River Drainages. CT DEP Fisheries Division. Hartford, CT.

[9] The invertebrate surveys were not published in the report. However, this information is available by contacting CT DEP staff.

Considerations:

In theory, the proposed Area is protective of water quality and quantity. By preserving open space, land uses which might impair water resources would be preempted. To help illustrate the benefits the Area would provide, proponents of the proposed Area might wish to develop different scenarios showing how land conservation versus other land use activities allowed under existing zoning regulations (carried to "total build-out") could affect water resources.

At the same time, proponents should also recognize that some existing land uses within the proposed Area may currently be a source of water resource degradation. For example, certain farming practices can lead to water quality problems (i.e. - improper manure storage and handling, improper fertilizer and pesticide application, etc.). General notes in the fisheries survey reports for two streams sites indicate nearby nutrient sources are a potential concern. In addition to the goal of preserving agricultural areas, the proponents might also want to encourage farmers to work with appropriate entities such as the Litchfield County Conservation District and the USDA Natural Resources Conservation Service to find voluntary ways to address these issues. There may be other existing land uses within the proposed Conservation Area which require similar attention.

Assuming the Towns of Bethlehem, Watertown and Woodbury support creation of the Area, each municipality should be encouraged to incorporate this concept into their respective plans of "conservation

and development" if they have not done so already. In describing the purpose of the Area, it is recommended that the plan description include "protection of water quality and quantity" as one of the functions of this area.

The information gathered through the fisheries surveys may help serve as a general baseline indicator of water quality and aquatic biological resources in this region. If future surveys are conducted by CT DEP or others using the same protocols the results could be compared to the previous findings. The findings could then be used to judge the success of land conservation activities in the proposed Conservation Area.

Aquifers and Public Water Supplies

Narrow deposits of coarse grained stratified drift are located along sections of the upper Nonnewaug River within the proposed Area and are or have the potential to be high yielding groundwater supply

aquifers.[10] The Hart Farm Well Field, operated by the Watertown Fire District (WFD), is located within one of these stratified drift aquifers just below the confluence of East Spring Brook with the Nonnewaug River. Although the Hart Farm Well Field is actually comprised of eleven wells, three of these wells are connected by piping and are basically considered one well. As a result, the operation is sometimes described as consisting of nine wells. This well field is also rather unique in that it includes two weirs which direct water from the Nonnewaug River to two separate infiltration basins which were created to help recharge groundwater supplies in the vicinity of the wellheads. Flow to the Nonnewaug River, and therefore the well field, is augmented by water releases from the Bronson E. Lockwood Reservoir which is owned by WFD and located at the head of East Spring Brook.

The Hart Farm Well Field is an active, year-round facility which pumps on an "as needed" basis to a storage tank. The water is then piped to Watertown. The well field is registered with the CT DEP to divert up to 1.73 million gallons per day (mgd). Although the water within this water supply system ultimately remains within the Housatonic Major Basin, this operation constitutes an "out of basin transfer" at the regional drainage basin scale because water is transported from the Pomperaug Regional Basin to the Naugatuck Regional Basin.

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[10] Connecticut Geology and Natural History Survey (Daniel B. Meade). 1978. Groundwater Availability in Connecticut (Map). CT DEP Natural Resources Center in cooperation with the USGS. Hartford, CT.

River flow data measurements demonstrate that pumping at the Hart Farm Well Field does have a measurable impact on the Nonnewaug River in terms of flow levels.[11] In addition, since the surface water classification of the Nonnewaug River adjacent to the well fields is classified as B/A, periodic testing and monitoring has been conducted to determine whether surface water quality is impacting groundwater quality. According to the 1996 Water Supply Plan prepared for the WFD, all testing to date had revealed a "low risk of quality impact from surface water".[12] None-the-less, WFD must keep a close eye on potentially risky land uses that could impact surface or ground waters that travel to and replenish the aquifer in which the well field is located. Although the WFD owns the land within at least a 200' radius around each well head, contamination can travel great distances from within the upstream and hydrologically connected portions of the surrounding watershed and impact water quality at the well field. In the Water Supply Plan, a number of existing or potential land uses are identified that could affect the Hart Farm Well Field.

As already mentioned, a Water Supply Plan has been developed for WFD. Water Supply Plans are required by State statute and this policy is administered by the Connecticut Department of Public Health (CT DPH). State law has also established an Aquifer Protection Area Program to protect wells which serve more than 1,000 people and are located in stratified drift. This program is administered by CT DEP. As required by

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[11] Leggette, Brashears and Graham, Inc. January 1996. (Revised May 1996; Approved July 1996). Water-Supply Plan, Watertown Fire District, Watertown Fire District. Prepared for Watertown Fire District. Trumbull, CT. p.12.

[12] Leggette, et al. p. 19.

the legislation, WFD has completed preliminary mapping - known as "Level B mapping" - for the Hart Farm Well Field which basically identifies the most critical area within the aquifer from which the well field withdraws water. Eventually, WFD will be required to refine this map even further to "Level A" mapping. If proposed aquifer protection regulations drafted by CT DEP are approved and adopted at the State level, certain risky land use activities will be restricted or prohibited in the aquifer protection area surrounding the well field. In addition, under the 1996 Source Water Assessment Program (SWAP) of the federal Safe Drinking Water Act, the State is required to look at every public water supply throughout the state and evaluate risks with regard to contamination. This survey must be completed by CT DPH by May 2003.

Considerations:

In general, it seems as though the Hart Farm Well Field could only benefit by creation of the proposed Area in terms of providing some degree of protection to its water sources. The actual benefit conveyed, however, will ultimately depend on which properties receive open space protection and their proximity or hydrologic connection to the well field. If they have not done so already, the proponents of the Area should consider working with the WFD to identify and protect lands which the water company feels are important to protecting the quality of its water supplies. In turn, perhaps WFD would agree to place permanent conservation easements on its properties which could then be incorporated into the Area.

Local Watershed Initiatives

It is also important that the proposed Area be considered in relation to other watershed conservation activities within the region. Formed in 1999 by the towns of Bethlehem, Woodbury and Southbury, the Pomperaug River Watershed Coalition (PRWC) is a nonprofit organization comprised of a diversity of stakeholders and dedicated to addressing water resource issues of the Pomperaug Watershed. Toward this end, the group has just completed a "state of the watershed" report with the support of the Council of Governments of the Central Naugatuck Valley. This report, which will be updated periodically, is to serve as a tool to educate those who live within the Pomperaug Watershed or otherwise use its water resources.

Along the same lines, PRWC is also conducting a stream survey with the help of the USDA Natural Resource Conservation Service. Based on visual observations by volunteers, this survey will provide PRWC with a "snapshot" of the condition of the Pomperaug River and some of its major tributaries. The results of this survey will also help direct watershed protection and restoration efforts. In conjunction with a recent Connecticut Siting Council decision involving an out-of-basin transfer of water, PRWC is also trying to initiate a series of studies to better quantify the water resources of the Pomperaug Watershed and also determine aquatic flow needs for maintaining healthy rivers and streams.

Considerations:

Needless to say, it would probably be advantageous for the proponents of the Area to coordinate their efforts with PRWC. Given their interest and knowledge in water resources at the local level, PRWC may have some specific suggestions to offer. As a starting point, the proponents may wish to compare their goals with resource values and issues identified in the "state of the watershed" report. In addition to helping set priorities, PRWC may also be able to help facilitate discussions with the towns and other stakeholders.

For More Information on ...

- **Connecticut's Water Quality Standards,** contact the CT DEP Bureau of Water Management, Aquifer Protection and Water Quality Standards Program at (860)424-3020.

- **The Fisheries River and Stream Survey,** contact the CT DEP Bureau of Natural Resources, Inland Fisheries Division at (860)424-3474 and/or the CT DEP Bureau of Water Management, Water Monitoring and Assessment Program at (860)424-3020.

- **Agricultural Nutrient and Waste Management,** contact the Litchfield County Soil and Water Conservation District at (860)626-7222; and/or the USDA Natural Resource Conservation Service (Torrington office) at (860)626-8258.

- **Aquifers and Aquifer Protection,** contact the CT DEP Bureau of Water Management, Aquifer Protection and Water Quality Standards Program at (860)424-3020.

- **Water Supply Planning,** contact the CT DPH Water Supply Planning Section at (860)509-7333.

- **The Pomperaug River Watershed Coalition.** contact PRWC at (203)267-1700 or view their website at www.pomperaug.org

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CT DEP Bureau of Water Management - Planning and Standards Division. Effective 1996 & 1997. Water Quality Standards. CT DEP. Hartford, CT.

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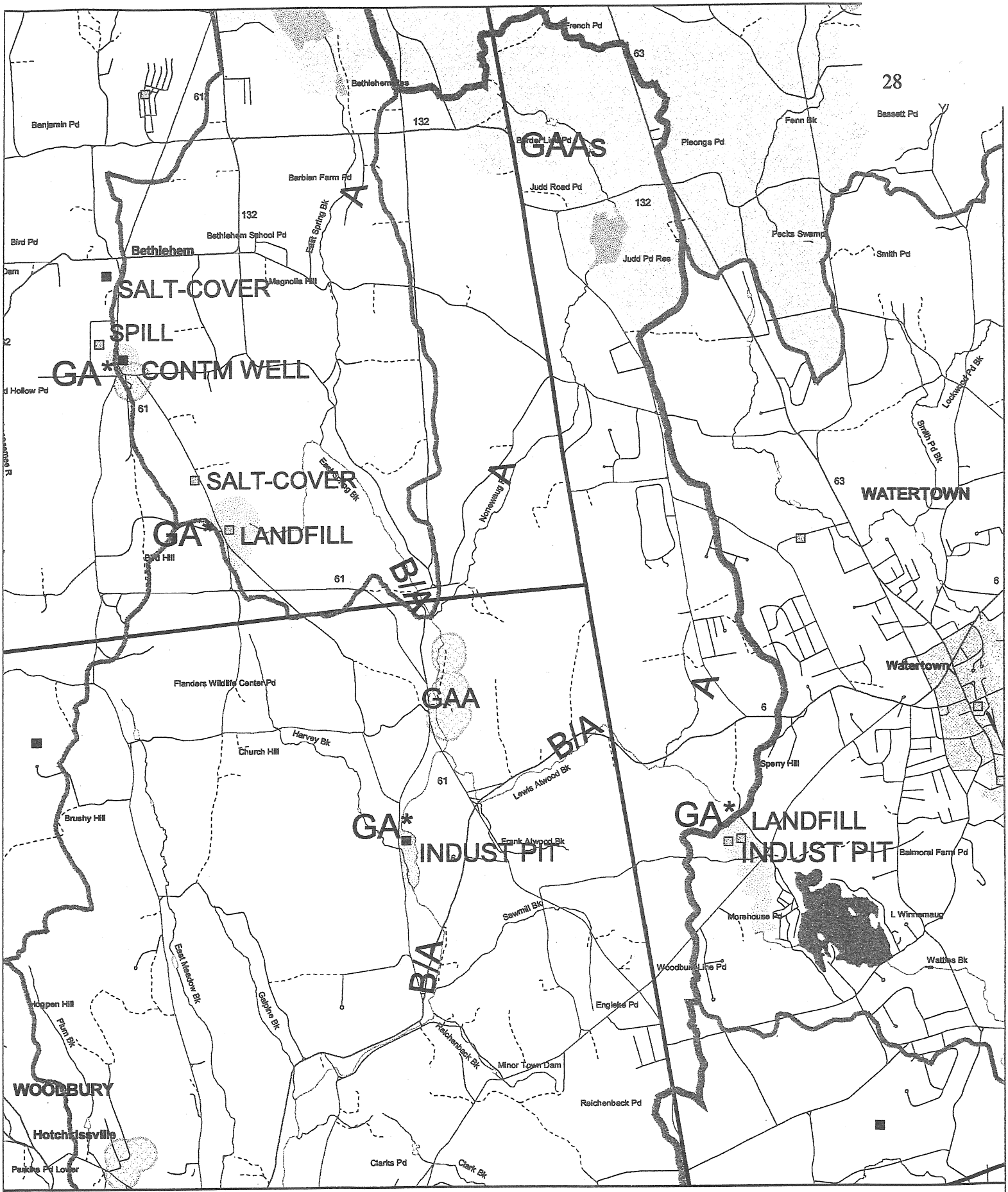

State Water Quality Classifications

Known or potential pollution source shown

Figure 4

1830 0 1830 3660 Feet

1:43922

Map printed 3/27/2001

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Natural Resource Overview

The Towns of Bethlehem, Watertown and Woodbury have expressed a desire to preserve the natural landscape, the watershed lands, the open space areas and the heritage of their towns. They have focused on the Nonnewaug Falls Area as a high priority for preservation. The preservation techniques they are considering include: preserving high priority parcels as open space, providing protective buffers, providing for recreational access, and protecting natural habitats. Some of the important resources and natural features of the Nonnewaug Falls Area are described below:

Natural Landscapes

Nonnewaug Falls - The Falls provide scenic beauty and provide a great focal point for passive recreational activities.

Wetlands - Wetlands and vernal pools are important habitats in need of protection. The CT DEP Natural Resource Protection Project Habitat Resources Map shows two important wetland resources in or near the Nonnewaug Falls Priority Area that have 50 or more continuous acres of wetlands.

• *Lewis Atwood Brook Wetland System* - This wetland system is at the headwaters of Lewis Atwood Brook, near Platt Road in Watertown.

• *Nonnewaug River Wetlands* - There is an important system of inland wetlands located along the Nonnewaug River and its tributaries, near the Hart Farm Well field. These wetlands are linked by the watercourses. The wetlands are a critical natural resource in this area. Some of these wetlands provide water to Nonnewaug Falls, and probably help to sustain water to the Falls during low flow periods.

Ridgeline - The Nonnewaug Falls Area is crossed by numerous ridgelines. No one ridgeline runs throughout it. The land areas that are over 800 feet in elevation are seen from many areas and are dominant scenic landscape features. Areas over 800 feet occur in Bethlehem along the northern section of the Nonnewaug Falls Area Map, occur south of Mt. Olivet Cemetery in Watertown, and occur north of Artillery Hill Rd. in Woodbury.

Watershed Lands

Nonnewaug River

- The Hart Farm Well Field is located along the Nonnewaug River. the well field supplies public drinking water. The well field is

recharged directly with water from the Nonnewaug River. Two reservoir areas are also located upstream in this watershed. They are the Bronson E. Lockwood Reservoir, and the Judd Pond Reservoir (a.k.a. Big Meadow Pond). The reservoir areas are currently outside the area of consideration. Including the two reservoirs in the Nonnewaug Falls Priority Area is recommended.

- Preservation of the high quality drinking water is critical for this resource. Water quality threats to this resource can come from pollutants in this watershed, especially those in the B level aquifer area. Not all of the the B level aquifer protection zone is included in the Nonnewaug Falls priority area. Agricultural and backyard conservation practices are recommended to control non-point source pollution. These practices may include but are not limited to erosion control practices, nutrient management, reduced use of pesticides, and buffers of natural vegetation along streams and wetlands.

- Stream bank erosion is occurring at several sites along the Nonnewaug River. If the watershed is developed in the future it is likely that the stream bank erosion will become more severe due to increased storm water runoff. There will likely be more non-point source pollution from future developed areas with roads and lawns. Open space preservation and careful zoning can help control these potential threats to water quality.

- The Nonnewaug River banks have been disturbed around the well field. A buffer of native vegetation at least 25 feet wide is receommended for this area.

- One high-risk site for water pollution, is located on the Natural Resource Protection Project threats to Resources Map (Kreykes, 4/97), along the Nonnewaug River southwest of the well field. According to the map, this area may contain any or all of the following: a Superfund Site, RRA or Federal Facility, Municipal Solid Waste or a site listed in the DEP's Leachate Wastewater Discharge Inventory.

Lewis Atwood Brook

- Threats to the water quality of Lewis Atwood Brook are sand, salt and heavy metals washing off of Route 6, erosion from unpaved roads, agricultural and backyard runoff.

- Conservation practices are recommended to control non-point source pollution. These practices may include but are not limited to erosion control practices, nutrient management, reduced use of pesticides, and buffers of natural vegetation along perennial streams and wetlands.

- NRCS designed a stream bank erosion control project, which was installed along Lewis Atwood Brook in 1990. Flash floods and stream bank erosion are common in this sub-watershed.

East Spring Brook

- Only part of the East Spring Brook watershed is currently included in the Nonnewaug Falls priority area. East Spring Brook is a tributary to the Nonnewaug River. Including the rest of the watershed for this important water source would be beneficial.

- NRCS designed a stream bank erosion control project, which was installed along East Spring Brook in 1995. Flash floods and stream bank erosion are common in this sub-watershed.

- Threats to water quality may come from agriculture, aquaculture, and development.

- One high-risk site for water pollution, is located on the Natural Resource Protection Project Threats to Resources Map (Kreykes, 4/97), along Route 61 in Bethlehem. According to the map, this area may contain any or all of the following: a Superfund Site, RRA or Federal Facility, Municipal Solid Waste or a site listed in the DEP's Leachate and Wastewater Discharge Inventory.

Open Space Areas

Farmland

The Nonnewaug Falls Priority area is home to an important agricultural production area for the State of Connecticut. The farms are concentrated along Hard Hill Road in Bethlehem, Guernseytown Road and Route 6 in Watertown, and Artillery Road in Woodbury. There is a high percentage of Prime Farmland Soils on these farms. This soil designation is a rating for the best soils in the country for agricultural production.

Locally produced food is better for the environment than food produced far away, because there is less fuel used in transportation and U.S. farmers adhere to U.S. pesticide guidelines. Locally produced food also has societal benefits of local jobs, local income, scenic beauty and maintenance of the rural New England character. Local farms keep people from being disconnected to the land and their food production. Land is expensive in this area. Most local farmers are dependent on rented farmland for the survival of their businesses.

Some farms in this area have already been preserved through the CT Department of Agriculture's Purchase of Development Rights (PDR) program and the USDA Farmland Protection Program including Young's Farm and a portion of the Logue Farm. The McCleary Farm, just outside of the Nonnewaug Falls Priority Area

is also preserved through the PDR program. Significant additional preservation efforts would be beneficial in preserving this important agricultural district. The farmland areas are shown on the Natural Resource Protection Project Map of Agricultural Resources (Kreykes, 4/97).

Agricultural conservation practices that may be important for environmental protection in this area are listed at the end of this section.

Wildlife Habitat

The CT Resource Protection Project Map (Kreykes, 4/97) shows an area that is a generalized location of listed species and significant natural communities on the west side of Big Meadow Pond. This area is an important wildlife resource to preserve. This area is currently not included in the Nonnewaug Falls Priority Area.

Water Company Lands

There is land owned by the Watertown Fire District around the Hart Farm Well Field, around Big Meadow Pond and around the Bronson E. Lockwood Reservoir. This land provides a buffer from non-point source pollution around these important water resources.

Passive Recreation

The existing system of unpaved roads, trails, and the power line through the central portion of the Nonnewaug Falls Priority Area offers the opportunity to create a looped trail system. Land ownership and owner interest needs to be determined. High foot traffic on trails, or at scenic locations can lead to soil compaction. Soil compaction can limit the growth of plants.

Summary

The Nonnewaug Falls area contains some important habitats, excellent agricultural soils, important wetlands, and spectacular views of nature. It is clear why the communities chose this area to be a high priority for protection. Increasing the priority area boundary to include the Nonnewaug River Watershed north of Route 6 would include many additional important natural resources. These additional resources include the Watertown Reservoirs, Big Meadow Pond, the rest of the level B aquifer area, the critical wildlife habitat west of Big Meadow Pond, the watershed effecting water quality of the target area, and significant additional farmland.

The high priority parcels to protect include:

- Farms with a high percentage of prime and important farmland soils
- Critical wildlife habitats

- Buffers along streams, open water bodies, vernal pools and other wetlands
- Wetlands, especially large groupings of wetlands and vernal pools
- The Falls
- A trail system, using existing roads, trails. or other openings to reduce land disturbance.

Threats to conservation targets include:

- Development pressure destroying or fragmenting the habitats, leading to neighbor complaints for farmers, increasing pollution and runoff
- Increased stormwater runoff leading to stream bank erosion and flooding
- Non-point source pollution from roads, yards and farms reducing water quality
- Point source pollution (as noted by DEP map) reducing water quality
- Soil compaction in high use areas such as the Falls
- Non-native invasive plants taking over and altering the environment.

Agricultural Conservation Practices for the Nonnewaug River Watershed

The following conservation practices are described in the Natural Resources Conservation Service (NRCS) Technical Guide available in NRCS Field Offices or on the internet at http://www.ftw.nrcs.usda.gov/nhep_2.html. Some updated standards specifically for Connecticut can be found at http://neirnt.ct.nrcs.usda.gov/tecguide/sect4.html. Technical and financial assistance may be available through the USDA for farmers who would like to install conservation practices and for organizations that wish to preserve farmland. The USDA-NRCS office can be contacted for more information on these programs at (860) 626-8258.

Erosion Controls

- Crop rotations of corn
- Contour strip cropping
- Waterways
- Diversions
- Filter strips
- Buffer strips
- Cover crops

Agricultural Waste Management

- Agricultural Waste Storage
- Composting
- Silage Leachate Collection Systems
- Roof Runoff Management
- Diversions
- Milk Room Washwater Treatment Facility

- Waste Utilization

Nutrient Management

Integrated Pest Management

Buffers

- Riparian Forest Vegetation
- Contour strip cropping
- Waterways
- Diversions
- Filter strips
- Buffer strips

The Natural Diversity Data Base

The Natural Diversity Data Base maps and files have been reviewed for the project area. According to our information, there are no known extant populations of Federal or State Endangered, Threatened or Special Concern Species that occur at the site in question.

Natural Diversity Data Base information includes all information regarding critical biologic resources available to us at the time of the request. This information is a compilation of data collected over the years by the Environmental & Geographic Information Center's Geological and Natural History Survey and cooperating units of DEP, private conservation groups and the scientific community. This information is not necessarily the result of comprehensive or site-specific field investigations. Consultations with the Data Base should not be substituted for on-site surveys required for environmental assessments. Current research projects and new contributors continue to identify additional populations of species and locations of habitats of concern, as well as, enhance existing data. Such new information is incorporated into the Data Base as it becomes available.

If you have further questions concerning the Natural Diversity Data Base please call (860) 424-3592.

Topography and Geology

The ±3000 acres of the proposed Nonnewaug Falls Open Space and Agricultural Preservation Area straddles a broad NNW-SSE trending ridge which is diagonally intersected by the valley of the Nonnewaug River. The uplands are mantled by a thick veneer of glacial till and the flat-bottomed stream valleys are underlain by stratified sands and gravels deposited by glacial meltwaters. Outcrops are plentiful on steep slopes of the valley sides where the till cover is discontinuous, either because it was never deposited or because it was stripped away by subglacial steams during the retreat of the ice sheet 13,000 years ago. The picturesque gorge along which Nonnewaug Falls is located must have been formed by one of these glacial meltwater torrents as the current stream, draining an area of only 500 acres, does not have the erosive power to have incised such a ravine.

The distribution of the surficial deposit of glacial till and stratified sands and gravels has been carefully mapped by Warren (1970a, 1970b). (see Figure 5). Glacial till is the ground-up rock debris smeared and dragged along at the base of the mile thick continental ice sheet that covered the area 20,000 years ago. It is compact, essentially structureless and homogeneous, very poorly sorted (consisting of rock

fragments ranging from clay to boulder sized), and is quite impervious to groundwater flow. The stratified sands and gravels that fill the bottom of the deep valleys were deposited by rapidly running meltwaters, they are well sorted and highly permeable.

From a geological point of view the most noteworthy aspect of the proposed Area is its bedrock (see Figure 6). The granite that underlies much of the area possesses a number of unique and unusual features that have earned the rock its official name - the Nonnewaug Granite. Like all granites the principal minerals found are feldspar and quartz, but in the Nonnewaug Granite the pattern formed by their intergrowth resembles Egyptian hieroglyphics - a fairly unusual texture often referred to as "graphic granite." The Nonnewaug Granite is also characterized by extreme variations in grain size - from fine grained to extremely coarse pegmatite. Some of the individual crystals in the graphic intergrowths are several feet across and in places plumes of muscovite (mica) crystals reach 18 inches or more in size.

The Nonnewaug Granite outcrops as a roughly elliptical body nine by three miles in plan. It appears to have been emplaced as a molten mass into highly deformed and metamorphosed metasediments about 300 million years ago.

References

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Warren, Charles R., 1970b, Surficial Geology of the Woodbury Quadrangle, USGS **GQ-896**

Bedrock Geology:

Gates, Robert M., 1951, The Bedrock Geology of the Litchfield Quadrangle, Connecticut Geological and Natural History Survey **QR-1**, 13p.

Gates, Robert M., 1951, The Bedrock Geology of the Woodbury Quadrangle, Connecticut Geological and Natural History Survey , , 8p.

Nonnewaug Falls Open Space And Argricultural Area
Surficial Geology

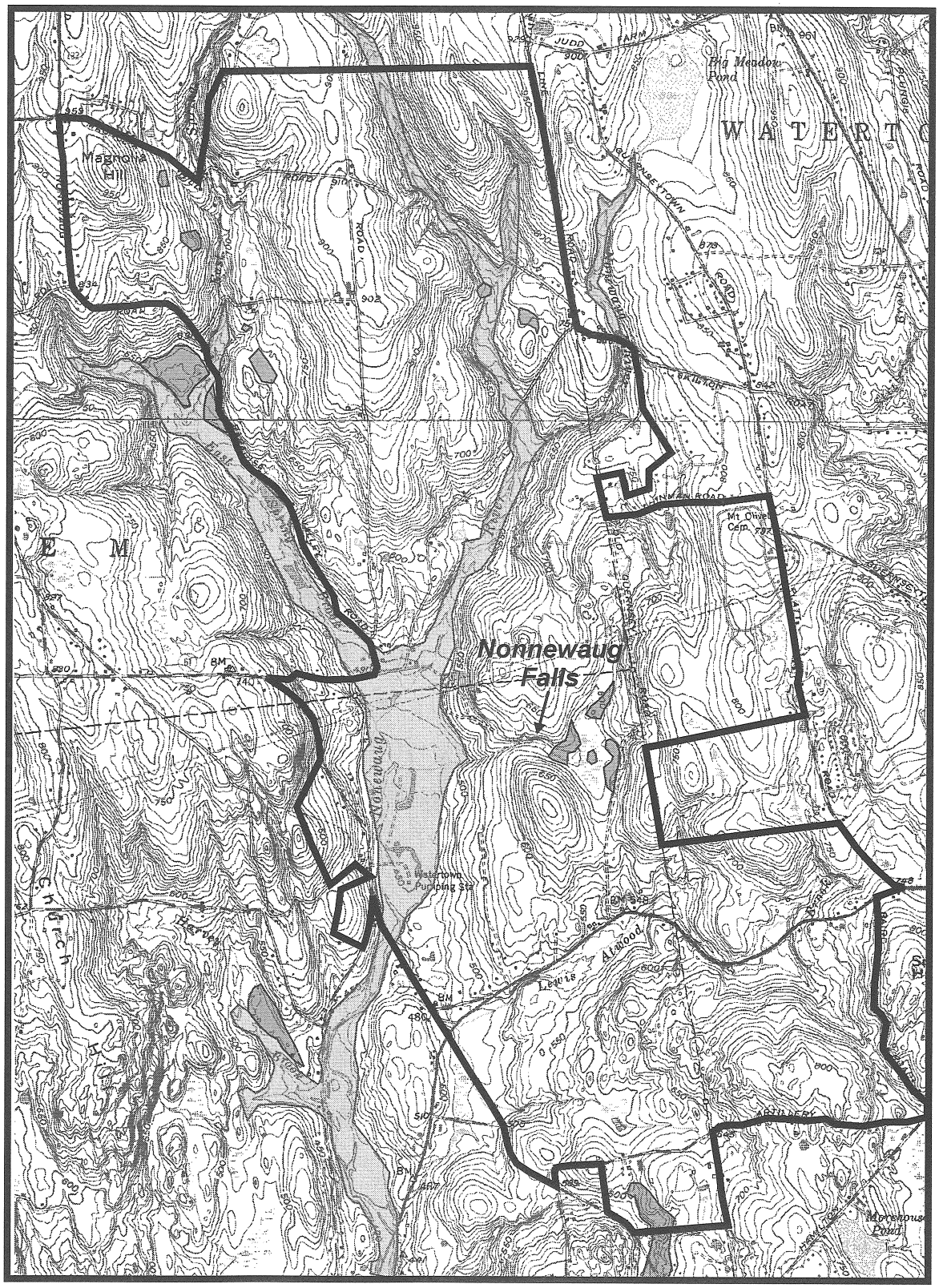
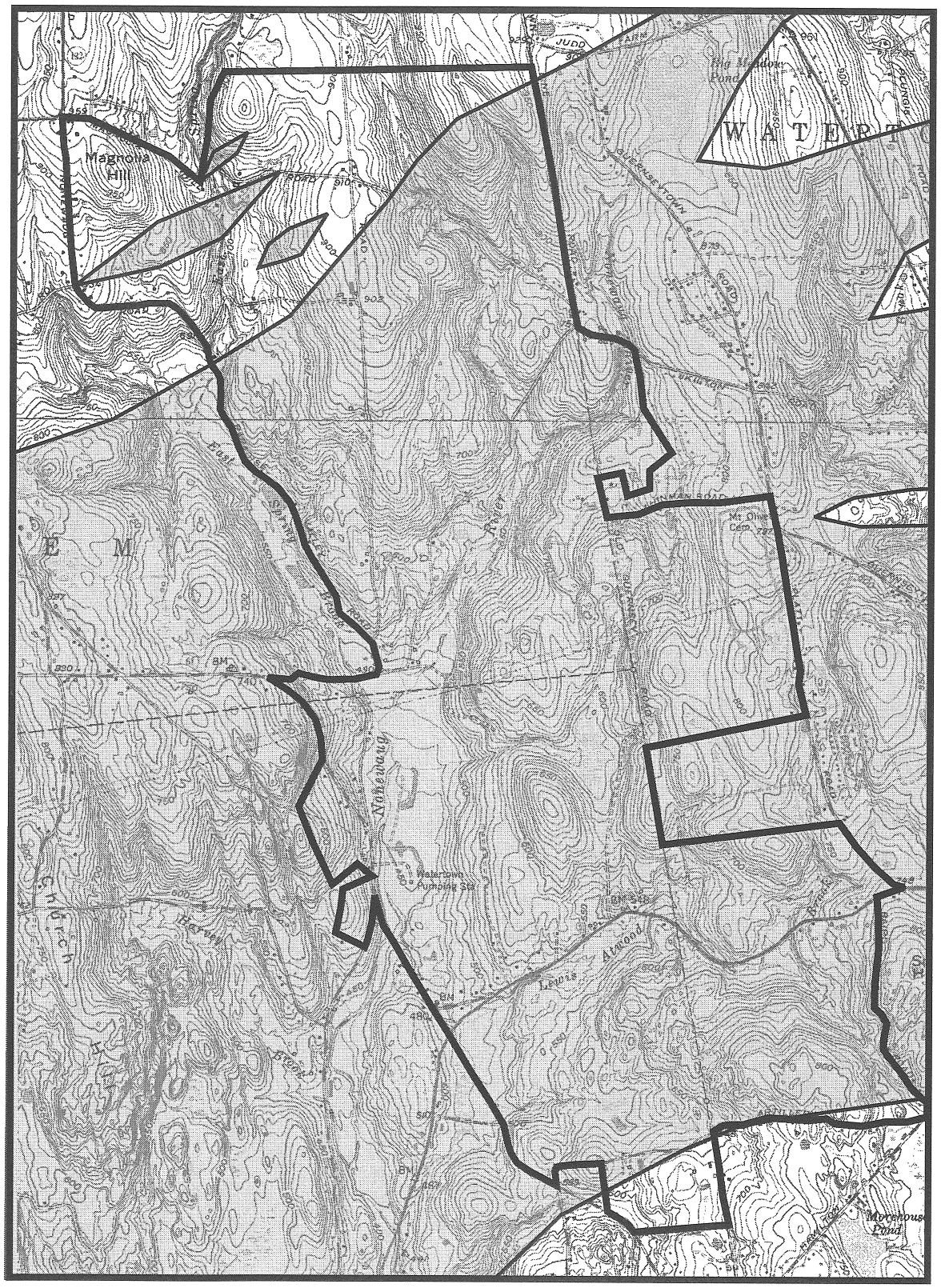


Figure 5

Nonnewaug Falls Open Space And Argricultural Area
Bedrock Geology



0 2000
feet

Nonnewaug Granite

Ratlam Mountain Metasediments
Interbedded mica-quartz schists and mica quartzites

Figure 6

Soil Resource Inventory

The Nonnewaug Falls Open Space and Agricultural Area is approximately 3000 acres. Included in this area are 750 acres of Prime Farmland and 450 acres of soils that are potentially classified as Wetlands by the State of Connecticut. In other words ~25% of the Nonnewaug Falls Open Space and Agricultural Area is Prime Farmland and ~15% is wetlands.

Wetland Soil Types

To calculate the coverage of Wetland soils in the Nonnewaug Falls Open Space and Agricultural Area, four individual soil groups were sorted out of all soil groups occurring in the area. The four soil groups are alluvial, flood plain, poorly and/or Very Poorly drained soils. To identify a Wetland soil type that occurs in the area see the attached table (list of Map Units That Qualify as hydric Soils in Litchfield County) which lists all the wetland soil types that occur in Litchfield County.

Prime Farmland Soil Types

To calculate the coverage of Prime Farmland soils in the Nonnewaug Falls Open Space and Agricultural Area, all soil types that are classified as Prime Farmland were sorted out of all soil groups occurring in the area. To identify a Prime Farmland soil type that occurs in the area see the attached table (List of Map Units That Qualify as Prime Farmland Soils in Litchfield County) which lists all the Prime Farmland soil types that occur in Litchfield County. Soils Types classified as Prime Farmland only occur on slopes of less than 8%. Therefore, the attached list breaks down each Prime Farmland soil type into individual slope sub-categories. Many of the soil types appearing on this list have steeper (greater than 8% slope) slope sub-categories, however, these would not be considered Prime Farmland.

Conclusion

Litchfield County covers about 600,500 acres. The United States Department of Agriculture has calculated that there are ~83,000 acres of Prime Farmland in Litchfield County. Therefore, Prime Farmland soils represent ~13 % of Litchfield County. The Nonnewaug Falls Open Space and Agricultural Area has almost double the concentration of Prime Farmland which makes up ~25% of the Nonnewaug Falls Open Space and Agricultural Area. Many Federal, State and local regulations exist to protect the wetland soils of Connecticut; however there are no comparable regulations that protect Prime Farmland. Given the high

concentration of such a valuable and productive natural resource, everything possible should be done to protect it.

Soils Map

Scale 1" =1320'

Figure 7

Soils Map

Scale 1" =1320'

⇑

Figure 7

Wetland Resources

The Nonnewaug Falls Open Space and Agricultural Preservation Area (the Area) is approximately 3,000 acres in size and lies within the towns Bethlehem, Woodbury and Watertown. It measures roughly four miles north to south, averaging about a mile and a half in width. Its boundaries for the most part are dictated by the parcel boundaries of the landholders. Of the approximately 3,000 acres, between 12 and 13 percent are calculated to be wetlands by this Team member.

The Nonnewaug River is the dominating watercourse in the Area. It serves as a rough land-use divide for this area with agriculture dominating northwest of the river, while southeast of the river land-use is split about 50/50, forest and agriculture.

The highest elevation is in the northern section with some high points exceeding 1,000 feet above sea level. To the east and south the highest points exceed 800 feet. The lowest point is less than 440 feet above sea level and occurs along the west south-central border in Woodbury, just south of the Watertown Fire District well field. The nature of this amphitheater-like topography results in nearly all of the wetlands and

watercourses in the Area draining to this low point in a dendritic pattern. Most all of the surface water exits the Area from here.

The diverse wetlands and watercourses in the Area form, and are considered in this review to be part of, a combined hydraulic system; not viewed as individual ponds or marshes and segmented lengths of stream. When considered in combination, one integral to the other, a systematic overview and understanding of water flow and water quality may be obtained.

Drainage

East Spring Brook and its tributaries drain the northwestern section of the Area. The Nonnewaug River and its tributaries drain the northeast and east. Lewis Atwood Brook and its tributaries drain the furthest eastern boundary, the southeast and south central portions of the area. Frank Atwood Brook drains the southern-most section. It is notable that these four named streams, as well as some of their larger tributaries, have their headwaters outside the bounds of the Area.

The watercourses which flow across the Area typically begin from a headwater wetland and proceed down hill to the small plain by the well field. These streams often drop 50 to 100 feet in elevation for each 1000 linear feet of streambed. It is this steep stream profile that results in the Nonnewaug Falls.

The largest open water wetland units visible from aerial photographs and mapped on the U.S. Fish and Wildlife Service National Wetland Inventory (NWI) maps are:

- the large open water body which is part of the Nonnewaug River tributary system in the east-central area just south of Hinman Road, and

- the four smaller open water ponds which lie a little over half mile west and are also part of the Nonnewaug tributary drainage system, the three western-most being systematically connected by the watercourse like beads on a necklace.

Less conspicuous on aerial photos are the forested wetlands. These occur in:

- the area along the East Spring Brook in the northwest corner just below the south pointing dip in the west-east Area boundary,

- the Nonnewaug River where it enters the Area on the east border and another a little more than one half mile due west of that point along an unnamed tributary of the Nonnewaug River,

- most of the Nonnewaug River drainage itself offers good riparian buffer down to its mouth,

- both the Lewis Atwood Brook and Frank Atwood Brook south of Route 6 feature well forested riparian areas.

The upland wetland soils in this area are principally underlain by till (unsorted glacial debris) or thick till. Some reaches of the Nonnewaug River, its major tributary, and the plain or level area around the pumping field are floodplain soils underlain by alluvial/sand and gravel.

Most of the wetlands have their headwaters on till. The NWI maps classify these watercourse-wetland systems as palustrine, which they define as: ". . . all nontidal wetlands dominated by trees, shrubs, persistent emergents . . . also includes wetlands lacking such vegetation, but with the following characteristics: area less than 20 acres; and water depth in the deepest part less than two meters at low water." In other words, in this Area, wetlands are generally shallow water (less than two meters), narrow, as described above because of the steepness of slope, and frequently featuring emergent, scrub shrub, or forested vegetation.

In addition, the Area embraces a few small ponds - often one acre or less in size. These are frequently shallow open water or shallow scrub shrub wetlands, some having emergent vegetation. It is assumed from the mapped resources that those few not hydraulically connected to watercourses are farm ponds.

Assessment of Wetland Resources

The overall health of the wetlands system appears to be good, although, due to the nature of the field visit, first-hand exposure to the many and diverse wetlands was not possible. Still, the nature of the area, the view from the road, and the observation of the systems from the available resource mapping show generally healthy wetland systems. Much to the credit of the landowners, little if any of the watercourses have been channeled or buried. Little of the wetlands and watercourses total acreage is impacted by road crossings, road placement, industry or housing.

Wetland Functions and Values

A mapped resources review of the wetland systems, which for the most part have remained generally intact within the Area, yields the following comments about the health of its functions and values:

- Nutrient retention and sediment trapping are likely of elevated value here since agriculture is such a common land use,

- Ecological integrity, wildlife habitat, and finfish habitat, are likely to be strong especially around the intact sections of wetland systems. Decreases in these values will come from pollution impacts and unmitigated decreases in their original size.

- Groundwater recharge values are also likely to be high since surface and groundwater retained in the wetland system are released or reintroduced into the streams at times of low flow, thus moderating what could otherwise be drought, dry-summer, or other typical low-flow conditions.

- Flood control is likely to be strong since the hydraulic connection between the wetlands and the watercourses remains intact and the storage capacity of the wetlands seems to be only slightly impacted due to land use.

- The values for education, passive recreation (bird watching, fishing, hiking, etc.), aesthetics and noteworthiness are all equally likely to be strong because of the size, extent, condition, and diversity of the wetlands.

In many of the more heavily urbanized watersheds in the state, studies are made of the amount of impervious surface and the resulting decrease of water recharge from rainfall as it relates to water quality. A review of the aerial photography shows the accumulation of impervious surface is not even close to being a concern in this Area due to the current nature of the land use. Nonetheless, there are quality of water issues outside the bounds of the Area that impact it as a whole.

The surface water quality (which includes the wetlands and watercourses) of the area has been mapped by the CT Department of Environmental protection as follows:

East Spring Brook in the northwest corner is class A, but

East Spring Brook where it reenters the area just north of the Bethlehem-Woodbury border is class B/A;

The Nonnewaug River and its tributaries above its confluence with East Spring Brook is class A; but

The Nonnewaug River below its confluence with East Spring Brook is class B/A;

Lewis Atwood Brook where it flows south along Platt Road is class A; but

Lewis Atwood Brook below its confluence with the unnamed tributary just west of Baird Road degrades to class B/A;

Frank Atwood Brook (which crosses under Artillery Road in the south part of the area) is class A along its entire run.

(Class A water may be suitable for drinking water supply and/or bathing as well as other uses where water character is uniformly excellent but may be subject to absolute restriction on the discharge of pollutants. Class B water is suitable for swimming, other recreational purposes and agricultural uses; excellent for fishing and wildlife habitats.)

A preliminary review of the DEP Leachate and Wastewater Discharge map shows the likely cause of degraded water quality classifications for both of these watercourses is inactive/closed mixed waste landfills near the headwaters of the affected tributaries.

Potential Problem Areas and Suggestions

Loss of riparian areas in the study area:

It is often typical of agriculture to encroach upon wetland and watercourse riparian areas. The *Manual of Best Management Practices for Agriculture* (Ag BMPs) states that the maintenance and/or reintroduction of riparian areas where lost will help ". . . maintain or improve surface water quality by removing or buffering the effects of sediment, nutrients organic matter, and some pesticides from surface water runoff . . . ." Further, "loss of riparian areas can also result from land clearing or wetland drainage associated with agricultural operations. Riparian areas play an important role in protecting surface water quality."

Impacts on water quality:

The impact of cattle, which have free access to the running waters of the Area, on water quality can be tremendous (nutrient enrichment and resulting oxygen depletion). Water quality can also be compromised due to pesticide and fertilizer runoff from row crops, including corn, and

from orchards and nurseries. The Ag BMP's state in part, "Runoff from agricultural operations may contain sediments, plant nutrients such as nitrogen and phosphorus, bacteria, pesticides, acid silage leachate, petroleum products and other pollutants. When such runoff reaches lakes, reservoirs, streams, and other wetlands, it can cause impacts to drinking water quality, fish kills depletion of dissolved oxygen and other less drastic problems." Avoidance of these known impacts through regulations will go a long way towards maintaining water quality.

Incomplete understanding of the wetland systems and their functions in the Area:

Only by obtaining a wetland evaluation for the Area will the nature, function and value of the existing wetlands be understood. An evaluation will serve to define both the strongest functions as well as areas that need remediation from past degradation. A complete evaluation becomes an important planning tool for planning future land use in the Area.

Loss of water quality due to lack of inclusion of the stream headwaters areas:

Consideration should be given to enlarging the boundaries of the Area to include the headwaters, or at least the source wetlands, for the streams that begin outside the Area boundaries. It is likely this will not be completely possible, but part of the mapped resources should

include the bounds of the land that contributes runoff to the drainage of the watercourses that flow through the Area (the watersheds).

Observing typical accepted setbacks:

Preservation of the wetland resources includes urging of the use of setbacks or buffers from the wetlands and watercourses by property owners interested in participating in the Areas' future. There should be a requirement for wetland buffers/setbacks for all land trust property and municipally held open space. The pay back will come in the form of improved water quality, wildlife habitat and aesthetics. These setbacks or buffer areas are typically 75 feet, often 100 feet for wildlife and fisheries needs, from the edge of all mapped wetlands and watercourses.

Understand the National Wetland Inventory Classifications:

It would be desirable to maintain a copy of the NWI map or similar updated information in the planning documents for the Area. These maps enable the user to visualize the connectivity between the wetlands and watercourses, and understand the implications of their classifications and the resulting impacts to wetland systems from poor land use practices.

Aquatic Resources

Watershed and Watercourse Characteristics

The Nonnewaug Falls Open Space and Agricultural Area (the Area) encompasses a 3000 ± acre tract of land within the towns of Bethlehem, Watertown and Woodbury. Sections of East Spring Brook, Lewis Atwood Brook and the Nonnewaug River along with a number of unnamed tributary streams are found within the bounds of the Area. These streams converge into the Nonnewaug River mainstem in the south-western quadrant of the Area.

East Spring Brook, Lewis Atwood Brook, the Nonnewaug River and unnamed perennial streams within the Area are physically characteristic of coldwater streams in Connecticut. These characteristics are moderate to steep gradient channels, surface flow of moving pool interspersed by riffle and a substrate composed of boulder, cobble, gravel, coarse sand, and sand-silt fines.

Throughout much of the Area, dense growths of hardwoods and woody shrubs predominate as riparian vegetation and provide the streams with a nearly complete canopy. However, riparian vegetation has been

cleared to the top of bank along a number of stream reaches flowing through land under agricultural use. Physical instream habitat is provided by the water depth in pools, boulders, undercut banks, and fallen or overhanging riparian vegetation.

Although residential development has occurred, land use within the Area remains a mix of agriculture and forest. The limited development to date provides a means of maintaining stream water quality. The Department of Environmental Protection classifies the headwaters of East Spring Brook, Lewis Atwood Brook and the Nonnewaug River along with a number of unnamed tributary streams as *Class AA* surface waters. Designated uses for surface water of this classification are existing or potential public drinking water supply, fish and wildlife habitat, recreational use, agricultural and industrial supply, and other purposes. Recreational uses may be restricted.

Lower sections of East Spring Brook, Lewis Atwood Brook and the Nonnewaug River however, are classified as *Class B/A* surface waters. Surface waters of this designation may not be meeting *Class A* water quality criteria or one or more designated uses. The goal of such waters is an upgrade to a *Class A* designation; the uses of waters so classified are potential drinking water supply, fish and wildlife habitat, recreational use, agricultural and industrial supply and other legitimate uses including navigation.

Aquatic Resources

As mentioned previously, East Spring Brook, Lewis Atwood Brook, the Nonnewaug River and unnamed perennial streams within the Area can be classified as coldwater streams based upon channel grade, morphology, and substrate composition. These streams have been subject to formal Fisheries Division surveys with the most comprehensive surveys conducted during the summer and early fall of 1991. The following are brief summaries of watercourse surveys within or closely adjacent to the Area identifying the fish species composition. Complete summaries of each survey site are at the end of this section.

East Spring Brook

The survey site was within the 315± foot reach of stream immediately upstream of the Magnolia Hill Road crossing in Bethlehem. The stream was found to support brook trout (*Salvelinus fontinalis),* blacknose dace *(Rhinichtys atratulus),* longnose dace *(Rhinichtys cataractae*), creek chub (*Semotilus atromacultus*), white sucker *(Catostomus commersoni),* and American eel *(Anguilla rostrata).* These fish species are commonly associated with coldwater stream in Connecticut.

Also collected were banded killifish *(Fundulus diaphanus)* and brown bullhead *(Ameiurus nebulosus).* These species are resident to warmwater ponds and large, slow moving rivers and streams; they are considered a transient species in fast flowing watercourses.

Unnamed East Spring Brook Tributary

The survey site was within the 164± foot reach of stream immediately downstream of the Green Hill Road crossing in Bethlehem slightly west of the Area bounds. The stream was found to support brook trout and blacknose dace. Also collected were minnows *(Cyprinids)* which were too small in size to positively identify to species.

Lewis Atwood Brook

The survey site was within the *164±* foot reach of stream immediately upstream of the Route 6 crossing in Bethlehem. The stream was found to support brook trout, blacknose dace and creek chub.

Also collected were golden shiner (*Notemigonus crysoleucas*) a species resident to warmwater ponds and large, slow moving rivers and streams; they are considered a transient species in fast flowing coldwater stream systems such as Lewis Atwood Brook.

Nonnewaug River

The survey site was within the *492±* foot reach of stream immediately upstream of the Minortown Road (a.k.a. High Street) crossing in Woodbury, a distance south of the Area. The stream was found to support brook trout, brown trout *(Salmo trutta),* blacknose dace, longnose dace, creek chub, fallfish (Semotilus corporalis), common

shiner *(Luxilus cornutus),* fathead minnow *(Pimephales promelas),* tessellated darter (*Etheostoma olmstedi*), white sucker, and American eel. Also collected were minnows which were too small in size to positively identify to species. A fish population of these species is routinely associated with larger coldwater streams within Connecticut.

Also collected were largemouth bass (*Micropterus salmoides*), bluegill (*Lepomis macrochirus*), pumpkinseed sunfish *(Lepomis gibbosus),* golden shiner, yellow perch (*Perca flavescens*) and brown bullhead. These species are resident to warmwater ponds and large, slow moving rivers and streams; they are considered a transient species in fast flowing watercourses.

Unnamed Nonnewaug River Tributary

The survey site was within the *164±* foot reach of stream immediately downstream of the Hickory Lane crossing in Bethlehem. The stream was found to support brook trout, brown trout, blacknose dace, longnose dace, and creek chub.

Recommendations

The reported goal of the Nonnewaug Falls Open Space Steering, Committee is to develop and implement a program aimed at preserving the agricultural use and open space landscape of the Nonnewaug, Falls Open Space and Agricultural Area. The creation of protective buffer

areas and managing the land to protect valuable natural habitats (i.e. coldwater stream systems). As previously mentioned limited development within the Area has maintained water quality and physical habitat conditions within the watercourses at levels supportive of intolerant fish species such as brook trout and brown trout. The preservation of open space and creation of protective buffers would be an extremely effective mechanism to assure the long term viability of the Area's aquatic habitats and resources.

The following are recommended to the Nonnewaug Falls Open Space Steering Committee to increase the level of success at achieving the protection of natural habitats and specifically aquatic habitats:

- The bounds of the Nonnewaug Falls Open Space and Agricultural Area need to be redrawn. The bounds should follow the watershed (drainage basin) divides of each watercourse rather than following the local roadway system as currently proposed.

- Consider conservation easements or the purchase of riparian habitat adjacent to the watercourses in lieu of complete property purchase. Research has indicated that a 100 foot wide buffer zone along perennial watercourses prevents damage to aquatic ecosystems that are supportive of diverse species assemblages. Buffers absorb surface runoff, and the pollutants they may carry, before they enter wetlands or surface waters. The buffer zone boundaries should be measured from either, (1) the edge of riparian inland wetland as determined by Connecticut inland wetland soil delineation methods

or (2) in the absence of riparian wetlands, the edge of the stream bank based upon bank-full flow conditions. Please refer to the attached documentation presenting Inland Fisheries Division policy and position regarding riparian buffers for additional information.

- Foster relationships with owners of property with watercourse frontage, make them aware of the importance of maintaining well vegetated riparian buffers and provide them with information pertaining to opportunities to secure Federal, State and non-governmental assistance relating to the enhancement of riparian habitat conditions.

STATE OF CONNECTICUT

Department of Envrionmental Protection

Bureau of Natural Resources

Fisheries Division

Federal Aid in Sport Fish Restoration F-66-R-4

Annual Performance Report

Project Title: A Survey of Connecticut Streams and Rivers

Job 2. Stream Survey

Job 3. Angler Survey

Period Covered: April 1, 1991 to March 31, 1992

Prepared by: Neal T. Hagstrom, Fisheries Biologist

Michael Humphreys, Fisheries Technician

William A. Hyatt, Supervisor Fisheries Management

Date Submitted: _____

Approved by: _____

Ernest E. Beckwith, Jr.
Director, Fisheries Division

_____

John Spencer
Bureau Chief, Bureau of Natural Resources

STREAM NAME : EAST SPRING BROOK SITE #: 3028
SITE DESCRIPTION: UPSTREAM OF MAGNOLIA HILL RD., BETHLEHEM.
(BOULDER-HEMLOCK AREA)
SAMPLE LENGTH : 96. SAMPLE DATE: 08/15/1991

PHYSICAL		CHEMICAL	MEAN	STD
AIR TEMP. . . .	24.00 (C)	DISSOLVED OXYGEN (mg/l). .	9.67	0.06
WATER TEMP. . .	22.00 (C)	pH	7.00	0.17
VELOCITY. . . .	0.200 (m/s)	COND . . . . . (uS/cm3). .	110.00	0.00
DISCHARGE . . .	0.087 (m3/s)	ALKALINITY .(mg CaCO3 eq/l):		

	MEAN	STD	
WIDTH.	4.35	0.89	(m)
DEPTH.	10.13	7.41	(cm)

DOMINANT SUBSTRATE TYPE. . :	4	POOL/RIFFLE RATIO . .:	0.57
TYPE THREE SUBSTRATE . . . :	7.7 (%)	AIR/WATER TEMP. RATIO:	1.09
EMBEDDEDNESS OF TYPE THREE :	83.33 (%)		
OVERHEAD CANOPY. . . . . :	0.94 (%)		
INSTREAM SHELTER . . . . . :	15.980 (m2)		

BIOLOGICAL

SPECIES	POPULATION SIZE (Number/ha)	STANDARD ERROR (Number/ha)
Anguilla rostrata	23.	0.0
Ameiurus nebulosus	23.	0.0
Salvelinus fontinalis	71.	0.0
Rhinichthys atratulus	2155.	42.6
Semotilus atromaculatus	191.	0.0
Fundulus diaphanus	23.	0.0
Rhinichthys cataractae	191.	0.0
Catostomus commersoni	71.	0.0

STREAM NAME : TRIB TO EAST SPRING BROOK SITE #: 3122
SITE DESCRIPTION: DOWNSTREAM OF GREEN HILL RD., BETHLEHEM.

SAMPLE LENGTH : 50. SAMPLE DATE: 07/09/1991

PHYSICAL		CHEMICAL	MEAN	STD
AIR TEMP. . . .	22.00 (C)	DISSOLVED OXYGEN (mg/l). .	7.67	0.21
WATER TEMP. . .	17.00 (C)	pH	7.20	0.20
VELOCITY. . . .	0.023 (m/s)	COND . . . . . (uS/cm3). .	170.67	17.04
DISCHARGE . . .	0.001 (m3/s)	ALKALINITY .(mg CaCO3 eq/l):	45.60	1.40

	MEAN	STD	
WIDTH.	1.94	1.04	(m)
DEPTH.	2.45	2.56	(cm)

DOMINANT SUBSTRATE TYPE. . :	4	POOL/RIFFLE RATIO . .:	0.67
TYPE THREE SUBSTRATE . . . :	20.0 (%)	AIR/WATER TEMP. RATIO:	1.29
EMBEDDEDNESS OF TYPE THREE :	6.67 (%)		
OVERHEAD CANOPY. . . . . :	0.99 (%)		
INSTREAM SHELTER . . . . . :	0.000 (m2)		

BIOLOGICAL

SPECIES	POPULATION SIZE (Number/ha)	STANDARD ERROR (Number/ha)
Salvelinus fontinalis	2268.	0.0
Rhinichthys atratulus	5463.	0.0
Unknown cyprinid	515.	0.0

STREAM NAME : LEWIS ATWOOD BROOK SITE #: 3079
SITE DESCRIPTION: UPSTREAM OF RTE 6, BETHLEHEM.

SAMPLE LENGTH : 50. SAMPLE DATE: 07/22/1991

PHYSICAL		CHEMICAL	MEAN	STD
AIR TEMP. . . .	25.00 (C)	DISSOLVED OXYGEN (mg/l). .	9.23	0.38
WATER TEMP. . .	23.00 (C)	pH	8.10	0.26
VELOCITY. . . .	0.020 (m/s)	COND . . . . . (uS/cm3). .	155.67	5.13
DISCHARGE . . .	0.002 (m3/s)	ALKALINITY .(mg CaCO3 eq/l):	33.93	0.90

	MEAN	STD	
WIDTH.	1.29	0.74	(m)
DEPTH.	6.30	7.31	(cm)

DOMINANT SUBSTRATE TYPE. . :	4	POOL/RIFFLE RATIO . .:	2.13
TYPE THREE SUBSTRATE . . . :	41.7 (%)	AIR/WATER TEMP. RATIO:	1.09
EMBEDDEDNESS OF TYPE THREE :	44.00 (%)		
OVERHEAD CANOPY. . . . . :	(%)		
INSTREAM SHELTER . . . . . :	1.470 (m2)		

BIOLOGICAL

SPECIES	POPULATION SIZE (Number/ha)	STANDARD ERROR (Number/ha)
Salvelinus fontinalis	2635.	0.0
Rhinichthys atratulus	55969.	1839.0
Semotilus atromaculatus	17519.	334.1
Notemigonus crysoleucas	155.	0.0

STREAM NAME : NONEWAUG RIVER SITE #: 3029
SITE DESCRIPTION: UPSTREAM OF HIGH ST. BRIDGE, WOODBURY. (SMALL BOULDER AND COBBLE, CHANNELIZED)
SAMPLE LENGTH : 150. SAMPLE DATE: 07/29/1991

PHYSICAL			CHEMICAL	MEAN	STD
AIR TEMP. . . .	20.00	(C)	DISSOLVED OXYGEN (mg/l). .	9.50	0.10
WATER TEMP. . .	18.00	(C)	pH	7.30	0.26
VELOCITY. . . .	0.079	(m/s)	COND . . . . . (uS/cm3). .	113.00	1.00
DISCHARGE . . .	0.202	(m3/s)	ALKALINITY .(mg CaCO3 eq/l):	19.83	0.67

	MEAN	STD	
WIDTH.	7.66	2.16	(m)
DEPTH.	16.98	16.26	(cm)

DOMINANT SUBSTRATE TYPE. . :	4		POOL/RIFFLE RATIO . .:	0.81
TYPE THREE SUBSTRATE . . . :	14.3	(%)	AIR/WATER TEMP. RATIO:	1.11
EMBEDDEDNESS OF TYPE THREE :	17.00	(%)		
OVERHEAD CANOPY. . . . . :	0.69	(%)		
INSTREAM SHELTER . . . . . :	40.950	(m2)		

BIOLOGICAL

SPECIES	POPULATION SIZE (Number/ha)	STANDARD ERROR (Number/ha)
Anguilla rostrata	17.	0.0
Ameiurus nebulosus	8.	0.0
Lepomis macrochirus	87.	0.0
Salvelinus fontinalis	17.	0.0
Rhinichthys atratulus	6231.	78.4
Salmo trutta	130.	0.0
Semotilus atromaculatus	417.	10.2
Luxilus cornutus	2854.	132.1
Unknown cyprinid	931.	128.5
Semotilus corporalis	469.	10.1
Pimephales promelas	8.	0.0
Notemigonus crysoleucas	52.	0.0
Rhinichthys cataractae	4630.	80.8
Micropterus salmoides	26.	0.0
Lepomis gibbosus	60.	0.0
Etheostoma olmstedi	200.	0.0
Catostomus commersoni	2454.	84.2
Perca flavescens	52.	0.0

STREAM NAME : NO NAME TRIB. TO NONEWAUG R. SITE #: 3103
SITE DESCRIPTION: DOWNSTREAM OF HICKORY LA., BETHLEHEM.

SAMPLE LENGTH : 50. SAMPLE DATE: 07/08/1991

PHYSICAL			CHEMICAL	MEAN	STD
AIR TEMP. . . .	26.00	(C)	DISSOLVED OXYGEN (mg/l). .	7.57	0.81
WATER TEMP. . .	19.00	(C)	pH	7.17	0.06
VELOCITY. . . .	0.095	(m/s)	COND . . . . . (uS/cm3). .	118.67	1.15
DISCHARGE . . .	0.005	(m3/s)	ALKALINITY .(mg CaCO3 eq/l):	34.50	0.62

	MEAN	STD	
WIDTH.	1.87	0.73	(m)
DEPTH.	6.32	5.59	(cm)

DOMINANT SUBSTRATE TYPE. . :	4		POOL/RIFFLE RATIO . .:	1.09
TYPE THREE SUBSTRATE . . . :	46.2	(%)	AIR/WATER TEMP. RATIO:	1.37
EMBEDDEDNESS OF TYPE THREE :	12.50	(%)		
OVERHEAD CANOPY. . . . . :	0.79	(%)		
INSTREAM SHELTER . . . . . :	0.060	(m2)		

BIOLOGICAL

SPECIES	POPULATION SIZE (Number/ha)	STANDARD ERROR (Number/ha)
Salvelinus fontinalis	534.	0.0
Rhinichthys atratulus	26310.	0.0
Salmo trutta	855.	0.0
Semotilus atromaculatus	4812.	0.0
Rhinichthys cataractae	534.	0.0

DEPARTMENT OF ENVIRONMENTAL PROTECTION
INLAND FISHERIES DIVISION

POLICY STATEMENT
RIPARIAN CORRIDOR PROTECTION

I. INTRODUCTION, GOALS, AND OBJECTIVE

Alteration and exploitation of riparian corridors in Connecticut is a common event that significantly degrades stream water quality and quantity. Inasmuch as riparian ecosystems play a critical role in maintaining aquatic resource productivity and diversity, the Inland Fisheries Division (Division) recognizes that rigorous efforts are required to preserve, protect, and restore these valuable resources. Consequently, a riparian corridor protection policy has been developed to achieve the following goals and objective:

Goals

Maintain Biologically Diverse Stream and Riparian Ecosystems, and

Maintain and Improve Stream Water Quality and Water Quantity.

Objective

Establish Uniform Riparian Corridor Buffer Zone Guidelines.

II. DEFINITIONS

For the purpose of implementing a statewide riparian corridor protection policy, the following definitions are established:

Riparian Corridor: A land area contiguous with and parallel to an intermittent or perennial stream.

Buffer Zone: An undisturbed, naturally vegetated area adjacent to or contained within a riparian corridor that serves to attenuate the effects of development.

Perennial Stream: A stream that maintains a constant perceptible flow of water within its channel throughout the year.

Intermittent Stream: A stream that flows only in direct response to precipitation or which is seasonally dry.

III. RIPARIAN FUNCTION

Naturally vegetated riparian ecosystems perform a variety of unique functions essential to a healthy instream aquatic environment. The delineation and importance of riparian functions are herein described. Vegetated riparian ecosystems:

* Naturally filter sediments, nutrients, fertilizers, and other nonpoint source pollutants from overland runoff.

* Maintain stream water temperatures suitable for spawning, egg and fry incubation, and rearing of resident finfish.

* Stabilize stream banks and stream channels thereby reducing instream erosion and aquatic habitat degradation.

* Supply large woody debris to streams providing critical instream habitat features for aquatic organisms.

* Provide a substantial food source for aquatic insects which represent a significant proportion of food for resident finfish.

* Serve as a reservoir, storing surplus runoff for gradual release into streams during summer and early fall base flow periods.

IV. RIPARIAN CORRIDOR BUFFER ZONE GUIDELINES

Recognizing the critical roles of riparian corridors, the Division provides buffer zone guidelines that are designed to bring uniformity and consistency to environmental review. The guidelines are simple, effective, and easy to administer. The following standard setting procedure should be used to calculate buffer zone widths.

Perennial Stream: A buffer zone 100 feet in width should be maintained along each side.

Intermittent Stream: A buffer zone 50 feet in width should be maintained along each side.

Buffer zone boundaries should be measured from either, (1) edge of riparian inland wetland as determined by Connecticut inland wetland soil delineation methods or (2) in the absence of a riparian wetland, the edge of the stream bank based on bank-full flow conditions.

The riparian corridor buffer zone should be retained in a naturally vegetated and undisturbed condition. All activities that pose a significant pollution threat to the stream ecosystem should be prohibited.

Where the Division policy is not in consonance with local regulations and policies regarding riparian corridor buffer zone widths and allowable development uses within these areas, local authorities should be encouraged to adopt the more restrictive regulations and policies.

12/13/91
Date

James C. Moulton
Acting Director

POSITION STATEMENT
UTILIZATION OF 100 FOOT BUFFER ZONES TO PROTECT RIPARIAN AREAS IN CONNECTICUT

BY
BRIAN D. MURPHY
TECHNICAL ASSISTANCE BIOLOGIST
INLAND FISHERIES DIVISION

I. INTRODUCTION

One tenet of the Inland Fisheries Division Policy on Riparian Corridor Protection is the utilization of a 100 foot buffer zone as a minimum setback along perennial streams. The adoption of such a policy is sure to be controversial. Laymen, developers and natural resource professionals alike will ask questions such as: Why was a standard setting method adopted? What's magical about 100 feet? Will 100 feet be sufficiently protective, or will it be overly protective? In response, this paper outlines the ramifications of adopting a riparian corridor policy including the use of a 100 foot buffer zone.

II. STANDARD SETTING VERSUS SITE SPECIFIC BUFFER ZONES

There are two approaches for determining buffer zone width; standard setting and site specific. Standard setting methods define an area extending from the streambank edge or highwater mark to some landward fixed point boundary. Site specific methods utilize formulas that incorporate and consider special site specific land characteristics, hence, the calculation of a variable width buffer zone. In both case, buffers are employed to define an area in which development is prohibited or limited.

A major advantage of standard setting methods is that they are easy to delineate and administer, thereby improving the consistency and quality of environmental assessments. Furthermore, valuable staff time would not be required to determine site specific buffer zones along each and every watercourse of concern.

The exact width of a buffer zone required for riparian corridor protection is widely disputed (Bottom et al. 1985 and Brinson et al. 1981). Buffer width recommendations found in the literature vary from as little as 25 feet to as great as 300 feet (Palfrey et al. 1982). The 100 foot buffer is widely accepted in Connecticut having been adopted by numerous inland wetland and conservation commissions as an appropriate minimum setback regulation for streambelts. In addition, Division staff have been recommending the utilization of the 100 foot buffer zone to protect streambelts since the early 1980's. Scientific research has not been generated to dispute the adequacy of utilizing 100 foot buffer zones to protect Connecticut's riparian corridors. In fact, to ensure that riparian functions are not significantly altered, recent scientific information points towards maintaining buffer zones that would be at a minimum, 100 feet in width (see section III).

Site specific methods define buffer widths according to the character and sensitivity of adjacent streamside lands. These buffer widths, also referred to as "floating buffers," consider physical site characteristics such as slope, soil type, and vegetative cover. The advantage of site specific methods is that buffer widths are designed using site characteristics and not an arbitrary predetermined width. Unfortunately, there is no "one" universally accepted formula or model and none have been developed for use in Connecticut. Most formulas are based on the degree to which sediment can be removed or filtered by natural vegetation, thus, the primary useage is sediment control. Other weaknesses of site specific techniques are (1) all areas must be evaluated on a case-by case basis and, (2) the subjectivity of different techniques (i.e. if the evaluation technique is inadequate, the buffer width will also be inadequate).

Additionally, these formulas only concentrate on one specific riparian function at a time and do not take into account multiple riparian functions, especially those of inland fisheries values as discussed in Section III. Consequently, site specific formulas approach riparian function on a single dimension rather than taking a more realistic, holistic approach.

In the absence of a scientific model to determine buffer widths suitable to protect Connecticut's riparian corridors, the utilization of a standard setting method is environmentally and politically prudent.

III. RIPARIAN FUNCTION

To assess the efficacy of a 100 foot buffer zone, the literature was searched to identify studies which have applied a quantitative approach to buffer width determination. Literature was searched for studies which both support and dispute the 100 foot zone. The following is a summary "by riparian function" of quantitative studies which assess buffer widths.

Sediment Control

Width, slope and vegetation have been cited as important factors in determining effectiveness of buffer zones as sediment filters (Karr and Schlosser 1977). Wong and McCuen (1981), who developed and applied a mathematical model to a 47 acre watershed, found that a 150 foot zone along a 3% slope reduced sediment transport to streams by 90%. Mannering and Johnson (1974) passed sediment laden water through a 49.2 foot strip of bluegrass and found that 54% of sediment was removed from the water. Trimble and Sartz (1957) developed recommendations as to width of buffer areas between logging roads and streams to reduce sediment load. They determined a minimum strip of 50 feet was required on level land with the width increasing 4 feet for each 1% slope increase. Buffer widths as determined by Trimble and Sartz (1957) have been characterized as evaluated guesses rather than empirically defined widths (Karr and Schlosser 1977). Rodgers et al. (1976) state that slopes greater than 10% are too steep to allow any significant detention of runoff and sediment regardless of buffer width. After a critical review of the literature, Karr and Schlosser (1977) determined that the size and type of vegetative buffer strip needed to remove a given fraction of the overland sediment load cannot be universally quantified. Existing literature does suggest that 100 foot riparian buffers will assist with sediment entrapment, although efficacy will vary according to site conditions.

Temperature Control

Brown and Brazier (1973) evaluated the efficacy of buffer widths required to ameliorate stream water temperature change. They concluded that angular canopy density (ACD), a measure of the ability of vegetation to provide shading, is the only buffer area parameter correlated with temperature control. Results show that maximum angular canopy density or maximum shading ability is reached within a width of 80 feet. Study sites were 9 small mountain streams in Oregon that contained a conifer riparian vegetative complex. Whether or not maximum angular canopy density is reached within 80 feet in a typical Connecticut deciduous forest riparian zone is doubtful. Tree height in Connecticut riparian zones is smaller than in Oregon (Scarpino, personal communication), therefore buffers greater than 80 feet in width would be required for temperature maintenance in Connecticut.

Nutrient Removal

Nutrient enrichment is caused by phosphorous and nitrogen transport from, among other things, fertilized lands and underground septic systems. Most research on nutrient enrichment has focused on overland surface flow. Karr and Schlosser (1977) report that 88% of all nitrogen and 96% of all phosphorous reaching watercourses in "agricultural watersheds" were found to be attached to sediment particles; thus, successful nutrient removal can be accomplished through successful sediment removal. There are conflicting reports on the ability of buffer widths to remove nutrients with most research being tested on grass plots. Butler et al. (1974) as cited by Karr and Schlosser (1977) found that a 150 foot buffer width of reed canary grass with a 6% slope caused reductions in phosphate and nitrate concentrations of between 0–20%. Wilson and Lehman (1966) as cited by Karr and Schlosser (1977) in a

study of effluent applied to 300 m grass plots found that nitrogen and phosphorous concentrations were reduced 4 and 6%, respectively. Studies on subsurface runoff as cited in Clark (1977) found high concentrations of nitrates at 100 feet from septic systems with unacceptable levels at 150 feet. Clark (1977) recommended that a 300 foot setback be used whenever possible, with a 150 setback considered adequate to avoid nitrate pollution. Environmental Perspective Newsletter (1991) states that experts who commonly work with the 100 foot buffer zone set by the Massachusetts Wetlands Protection Act are increasingly finding that it is insufficient since many pollutants routinely travel distances far greater than 100 feet with nitrate-nitrogen derived from septic systems moving distances of greater than 1000 feet. Research indicates that the adoption of 100 foot buffer widths for Connecticut riparian zones will assist with the nutrient assimilation; albeit, complete removal of all nutrients may not be achieved.

Large Woody Debris

The input of large woody debris (LWD) to streams from riparian zones, defined as fallen trees greater than 3 m in length and 10 cm in diameter has been recently heralded as extremely critical to stream habitat diversity as well as stream channel maintenance. Research on large woody debris input has mainly been accomplished in the Pacific Northwest in relation to timber harvests. Murphy and Koski (1989) in a study of seven Alaskan watersheds determined that almost all (99%) identified sources of LWD were within 100 feet of the streambank. Bottom et al. 1983 as cited by Budd et al. (1987) confirm that in Oregon most woody structure in streams is derived from within 100 feet of the bank. Based on research done within old-growth forests, the Alaska region of the National Marine Fisheries Service, recognizing the importance of LWD to salmonid habitat, issued a policy statement in 1988 advocating the protection of riparian habitat through the retention of buffer strips not less than 100 feet in width (Murphy and Koski 1989). All research findings support the use of a 100 foot buffer zone in Connecticut for large woody debris input.

Food Supply

Erman et al. (1977) conducted an evaluation of logging impacts and subsequent sediment input to 62 streams in California. Benthic invertebrate populations (the primary food source of stream fishes) in streams with no riparian buffer strips were compared to populations in streams with buffer widths of up to 100 feet. Results showed that buffer strips less than 100 feet in width were ineffective as protective measures for invertebrate populations since sediment input reduced overall diversity of benthic invertebrates. Buffer strips greater than 100 feet in width afforded protection equivalent to conditions observed in unlogged streams. The ultimate significance of these findings is that fish growth and survival may be directly impacted along streams with inadequate sized riparian buffer zones. All research supports the feasibility of implementing a 100 foot buffer zone in Connecticut to maintain aquatic food supplies.

Streamflow Maintenance

The importance of riparian ecosystems in terms of streamflow maintenance has been widely recognized (Bottom et al. 1985). In Connecticut, riparian zones comprised of wetlands are of major importance in the hydrologic regime. Riparian wetlands store surplus flood waters thus dampening stream discharge fluctuations. Peak flood flows are then gradually released reducing the severity of downstream flooding. Some riparian wetlands also act as important groundwater discharge or recharge areas. Groundwater discharge to streams during drier seasonal conditions is termed low flow augmentation. The survival of fish communities, especially coldwater salmonid populations is highly dependent upon low flow augmentation (Bottom et al. 1985). Research, although documenting the importance of riparian zones as areas critical to streamflow maintenance, has not investigated specific riparian buffer widths required to provide the most effective storage and release of stream flows.

IV. OTHER POLICY CONSIDERATIONS

Measurement Determination

The proposed policy states that buffer zone boundaries should be measured from either the edge of the riparian inland wetland as determined by Connecticut inland wetland soil delineation methods or in the absence of a riparian wetland, the edge of the streambank based on bank–full flow conditions. This boundary demarcation is absolutely necessary to ensure that all riparian wetlands are protected. For example, if all measurements were to start from the perennial stream edge and extend landward for a distance of 100 feet, many riparian zones that contain expansive wetlands greater than 100 feet in width would be left unprotected.

Also, since boundary demarcation includes wetland delineation, the ultimate width of the buffer will vary according to site specific features. Consequently, buffer width determination as stated by Division policy is a "hybridization" of both standard setting and site specific methods. This hybridization of methods is advantageous since it acknowledges the sensitivity of streamside wetlands.

Home Rule

Where the Division policy is not in consonance with local regulations and policies regarding riparian corridor buffer zone widths, local authorities would be encouraged to adopt the more restrictive regulations and policies. This feature incorporates flexibility to acknowledge the importance of local "home rule" regulations or policies already in accepted practice. Conversely, towns and cities without accepted policies and regulations could choose to enact the Division policy.

Allowable Uses in Buffer Zones

The Division policy states that "the riparian corridor buffer zone should be retained in a naturally vegetated and undisturbed condition and that all activities that pose a significant pollution threat to the stream ecosystem should be prohibited." In essence, the buffer zone becomes an area where no development should be allowed. For this policy to be effective, there should be no exceptions, a blanket restriction of all uses would be recommended. Further clarification and more precise definitions of allowable uses will, however, be required in the future if the policy evolves into a departmental regulation.

Recently, the Connecticut Supreme Court has ruled that local agencies can prohibit specific development within buffer zones. The *Lizotte v. Conservation Commission of the Town of Somers, 216 Conn.320 (1990)* decision ruled that the construction or maintenance of any septic system, tank, leach field, dry well, chemical waste disposal system, manure storage area or other pollution source within 150 feet of the nearest edge of a watercourse or inland wetland's seasonal high water level can be prohibited (Wetlands Watch 1990). If this decision is a precursor of the future, Connecticut courts will continue to the support the use of buffers, especially those which restrict or prohibit detrimental activities.

V. CONCLUSIONS

The following actions are required to preserve, protect, and restore Connecticut's riparian corridors:

1. The Inland Fisheries Division needs to adopt and implement the proposed policy so that staff can use it as a guideline to assist cities, towns, developers and private landowners with making sound land use decisions. This policy will act to solidify a collective position concerning riparian corridor protection.

2. While the proposed policy in its "current form," represents a recommendation from the CTDEP Inland Fisheries Division, the ultimate goal of the Division should be to progressively implement this policy as either a CTDEP regulation or State of Connecticut statute.

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Wildlife Resources

Introduction

A site visit was conducted on January 23, 2001 and February 16, 2001 to evaluate existing wildlife habitats on the proposed approximate 3000-acre collection of parcels for open space preservation. A variety of habitat types were identified: hardwood swamp, hemlock stand, mixed hardwood forest, open field, old field and riparian type habitat. The variety of habitat types provide wildlife with a diverse mix of food, water, and cover.

Due to the uncertainty of ownership, future use, and protection/conservation status of all the parcels included in the environmental review request, it is not possible to inventory the entire outlined area. The site visit provided a few examples that are assumed to be representative of the entire area. Therefore, the discussion of habitat types will be limited to the areas visited.

Habitats and Wildlife Use

Wildlife habitat is said to be the complex of vegetative and physical characteristics that provide for all the requirements of wildlife, that

is food, shelter, resting, nesting and escape cover, water and space. Generally, the greater the habitat diversity and degree of interspersion of various habitat types, the greater the variety of wildlife there will be using an area. Conversely, while there may be fewer wildlife species, large unbroken expanses of one habitat type provide important habitat for many species of wildlife including species that avoid edges. For instance, some species of migratory birds, for which population declines have been noted, will only nest in forest interiors at a certain distance from the edge, while other species need large expanses of grasslands or shrublands. There are many factors to consider when determining habitat use and quality of an area for different species, including habitat types, size of habitat types and their quality, overall size of the study area, location, degree of isolation, diversity, and juxtaposition with other neighboring habitat types, etc.

Hardwood Forest Habitat

Hardwood forests provide an abundance of food in the form of mast; berries, buds, insects, and catkins. Cover value for wildlife is greatly enhanced by the presence of snags (dead standing trees), cavity trees and large diameter den trees. Wildlife likely using the mature hardwood forest include scarlet tanager, ovenbird, white-breasted nuthatch, black-capped chickadee, black and white warbler, eastern wood-peewee, hairy and downy woodpecker, pileated woodpecker, American redstart, barred owl, broad-winged hawk, red-backed salamander, and black rat snake. Mast produced by oaks provides excellent forage for a

variety of animals such as white-tailed deer, gray squirrel, wild turkey, white-footed mouse and eastern chipmunk.

Aerial photos also show a couple of large unfragmented areas of forestland. Some wildlife species require large blocks of contiguous habitat to successfully breed and have a viable population in. Therefore, managing these blocks as large unbroken expanses is important to maintaining the usefulness of the whole open space preserve.

Coniferous Forest Habitat

Conifer trees, such as hemlock and pine, on the property provide winter cover and nesting sites for songbirds, hawks, owls and wild turkeys.

Forested Wetland Habitat

Forested wetlands (hardwood swamps) typically contain a mix of vegetation including sedge tussocks, herbaceous vegetation, shrubs and trees, interspersed with standing water, depending on the time of year. These areas produce an abundance of insects providing food for reptiles, amphibians, birds and bats. Many species of birds use forested wetlands at varying times of the year for breeding, feeding, and shelter. Examples include wood thrush, northern water thrush, common yellowthroat, and the eastern phoebe. Other wildlife likely using this habitat for food and cover are raccoons, star-nosed moles, wood frogs, pickerel frogs, spring peepers, gray tree frogs and eastern garter snakes.

Riparian Habitat

Riparian habitat, a greenway of trees, shrubs and herbaceous plants, that follows the edge of streams, rivers, lakes and ponds provides habitat for many aquatic-based organisms such as frogs, salamanders, toads, ducks, herons, muskrat, otter and mink. Vegetative diversity along the edges of watercourses provide valuable cover for wildlife as well as a diverse source of berry producing shrubs and vegetation for foraging. The vegetation found in this habitat is tolerant to periodic flooding and its presence causes floodwater to slow down and allows the soil to absorb the excess water. This zone of vegetation along a stream or river is often the only remaining contiguous vegetation within a developed area, especially in a densely populated state like Connecticut. It may continue for miles through cities, suburbs and farmland, providing an important travel corridor for wildlife and connecting one habitat to another.

Old Field Habitat

Old field habitat provides a variety of food sources by way of grasses, forbs and berry producing shrubs/trees. This habitat has diversity in the forms of cover it provides; sapling trees, shrubs and grasses. Wildlife likely to use this habitat are wild turkeys, coyotes, northern bobwhite, red fox, eastern bluebird, rose-breasted grosbeak, and cottontail rabbits.

Open Field Habitat

Open field habitat contains a diversity of grasses and forbs and provides cover for small mammals. These open areas attract numerous insects, a major food item for songbirds. Open fields can serve as nesting areas for birds that specialize in grassland habitats if they are large enough. Wildlife using open field habitats and their associated edges include white-tailed deer, woodchuck, red fox, coyote, cottontail rabbit, skunk, meadow vole, eastern bluebird, American goldfinch, field sparrow, mockingbird, flycatchers, eastern towhee, American robin, American kestrel and red-tailed hawk.

Hayfields, Pastures and Agricultural Areas

As was mentioned during the field meeting, one of the purposes of this open space preserve is agricultural preservation. Agricultural land is often the first land developed because it is the easiest land to develop due to the flat topography and lower site development costs. Therefore, many farms end up as housing developments. Keeping the land in active agricultural open space will maintain the uniqueness of the area, which are its open fields. Connecticut's landscape has changed dramatically in the last two hundred years. It has gone from a primarily forested landscape to an agriculture-based landscape back to a forested landscape. Taking agricultural land out of production will result in the land to reverting back to mature forest. Conserving a variety of wildlife habitats in a small, highly developed state like Connecticut, must be a priority.

The aerial photos of the proposed open space preserve contain large amounts of haylands, pasture and agricultural fields that are currently in agricultural use or reverting back into herbaceous/shrubby vegetation. The hay fields are assumed to be cut annually to provide a hay crop. The pasture areas used by livestock are dominated by short grass due to grazing with areas of weedy growth around the rocks.

Large grasslands and shrublands are disappearing quickly in Connecticut and across New England due to reforestation and development. Also, agricultural land is being farmed more intensively than in years past. Where fields were once left fallow to rotate crops, with the use of fertilizers they are now used year after year.

A group of birds, collectively known as grassland specialists, because of their dependence on open grassland and/or hayland habitat type, have showed drastic declines in their populations in recent years. While many people are concerned with the decline of neotropical migrants, the documented declines for populations of many grassland birds in Connecticut and throughout the northeast are far greater.

These grassland birds require large fields - the larger the better - of hay or grasses to nest and feed in. They generally begin nesting in May, but may not be done nesting and fledgling young until the end of July. Traditional farming which calls for cutting hay two or three times during the summer beginning in late May or early June, and can cause the demise of a population using a particular field. In many cases,

modification of the haying dates (no earlier than July 15th, preferably August 15th) and/or leaving an uncut refuge area within a field or an entire field uncut can provide at least some habitat for these birds to nest and fledge young in. So while haying practices have impacted the viability of these bird populations, outright habitat loss is the greatest threat.

Based on the current habitat on these sites (especially Hart's well fields), large open hay fields provide the type of habitat required by some of these grassland specialists. A grassland specialist like the bobolink (which is the least specialized of the grassland species, it only requires a minimum of 5 acres) (Jones and Vickery 1997) could be expected to utilize these sites for foraging and nesting along with other field-associated species like the kingbird and bluebird. While some of the grassland specialists may not have been able to successfully nest and fledge young each year due to the past haying schedule, the hayfields still provide important foraging habitat for birds that may be nesting nearby. Birds moving through on migration could also be expected to utilize these areas for stop over habitat. These fields could offer excellent nest sites for some of the grassland specialists, if the size of the field is large enough and if adequate time for the nesting period was ensured.

Pastures usually have areas of weedy and shrubby growth around the rock outcroppings. These provide small areas of cover for small mammals and foraging and perching spots for birds. Predators like fox and coyote take advantage of these hedgerows and weedy rock

outcroppings to hunt for the abundant small mammal populations found there.

General Recommendations for Maintaining Wildlife Habitat and Diversity for the Proposed Open Space Preserve

- Large blocks of a habitat type are better than smaller blocks
- Connect these blocks via corridors if at all possible
- Limit habitat fragmentation as much as possible by clustering areas of development
- Conserve wetlands; riparian buffers are recommended to be 100 feet minimum
- Manage agricultural land for wildlife
- Manage for early successional habitat
- Manage for diversity of forest classes
- Manage large areas of sawtimber for area sensitive species

Specific Management Recommendations for Old Fields/Pastures/Hayfields

Old fields: must be maintained or they will revert back to forest. Mowing with a heavy-duty brush hog periodically is one technique for maintaining/restoring shrublands.

Hayfields: the agricultural practice of taking multiple cuttings of hay per growing season does not allow adequate time for grassland birds to nest and fledge young. Ideally, in order to allow time for these birds to nest, mowing should be delayed until July 15th with August 1st being the preferred date. If this is not a possibility then leave a section of field fallow.

Larger fields, more than 5 acres, are more important to manage than smaller fields.

Suggestions for Other Parcels to be Protected

The protection of riparian habitat along major watercourses such as the Nonnewaug River would create a greenway, or corridor, of vegetation that would serve as not only a source of wildlife habitat but as a migration route for large mammals and stop-over area for migratory birds. As human development pressure continues these corridors become increasingly important to wildlife, for food, water, shelter, breeding areas and migration routes. Also, riparian habitat is a vegetative buffer for the filtration of pollutants/runoff and erosion control.

Conclusion

The protection of these properties from development would protect the existing wildlife habitat and various wildlife species utilizing it.

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Forest Vegetation

The review area is approximately 3000 acres of which 44% or 1332 acres is tree covered. The remaining 56% or 1668 acres are comprised of agricultural lands, residential areas, cemetery, wetlands and ponds.

The acreage of the study area and the forest cover types were scaled from aerial photographs taken in April of 1995. The forest cover typos were delineated from the these photographs. There was little ground reconnaissance of the trees found in the types due to the size of the study area and the amount of snow cover present. The perimeter of the study area was driven to observe the kinds of trees growing there.

The forested vegetation description for the study area can be divided into five cover types:

- Mixed Hardwood - 1,025 acres
- Old Field - 163 acres
- Mixed Softwood - 77 acres
- Softwood Plantation - 37 acres
- Power Line Right-of-Way - 30 acres

- ***Mixed Hardwood***

  This type comprised 77% or 1025 acres of the total forested acres. The predominately sawtimber size hardwood species present are red oak, black oak, white oak, scarlet oak, chestnut oak, red maple, sugar maple, silver maple, Norway maple, black birch, white birch, yellow birch, white ash, green ash, hickories, aspen, yellow poplar, black cherry, butternut, beech, elm, sycamore, sassafras, shadbush, black gum, and black locust. Softwood species found in the main canopy are hemlock and white pine. The understory may contain saplings and seedlings of hardwood and softwood, and shrubs of witch hazel, mapleleafed viburnum, mountain laurel, spice bush, Japanese barberry, multiflora rose, autumn olive, winged euonymus. Vine species present may be grape, poison ivy, Virginia creeper, oriental bittersweet, and Japanese honeysuckle.

- ***Old Field***

  This type comprises 12% or 163 acres of the total forested acres. Trees range in size from sapling to widely scattered sawtimber. Much of this type may still be used as pasture. Tree species present are aspen, white ash, gray birch, white birch, red maple, sugar maple, apple, black cherry, hickories, butternut, red cedar, white pine, and juniper. Shrubs present are multiflora rose, Japanese barberry, honeysuckle, blackberry, staghorn sumac,

autumn olive, privet, highbush blueberry, and dogwoods. Vine growth present is grape, poison ivy, and oriental bittersweet.

- ***Mixed Softwood***

  This type comprises 6% or 77 acres of the total forested acres. The sawtimber sized softwood species that make up the main canopy are hemlock and white pine. Hardwood species found in the main canopy are black birch, yellow birch, sugar maple, beech, red oak, white oak, and yellow popular. The understory of this type is generally open especially in the areas with a hemlock canopy. This type is located along the major drainage of the study area. The major health threat to this type is two sap-sucking insects, which infest hemlock, the hemlock wooly adelgid and the hemlock scale. The hemlock scale was first observed on the hemlocks growing around Nonnewaug Falls. The hemlock wooly adelgid is known to be in the study area. There is no practical way to control these insects in a forest setting.

- ***Softwood Plantation***

  This type comprises 3% or 37 acres of the total forested acres. There are two types of softwood plantings that make this type. The first is the older sawtimber sized plantations of white pine and Norway spruce. The second are what appear to be abandoned Christmas tree plantations that may contain white spruce, blue spruce, and douglas fir. The Christmas tree plantations will eventually be shaded out by invading hardwood species and converted to mixed hardwood stands.

- ***Power Transmission Line Right-of-Way***

  This type comprises 2% or 30 acres of the total forested acres. The species found in this type are the same as those in the mixed hardwood cover type but are limited in size to saplings due to the vegetation management requirements of the right-of-way. Softwood species and shrub species are favored in this type.

The Team forester is available for more detailed consultation on individual properties within the study area. He may be contacted at: 860-485-0226.

(Coordinator's Note)

Also, Tom Worthley, a UCONN Cooperative Extension Educator in Residence for Stewardship Forestry is available to make a 45 minute to one hour presentation entitled "Gray Ghosts - Hemlock and the Wooly Adelgid" which provides information about hemlock as a species, its special characteristics and role in the environment. Topics covered include:

- Hemlock - identification and life history
- Wooly Adelgid - identification and history of infestation
- Research - USDA Forest Service biological controls
- Management - types of controls, silvacultural considerations

Also, a "Decision-Making Matrix" is introduced to assist with narrowing and prioritizing options when dealing with infested hemlocks.

Finally, advice is offered on how to proceed once a decision to salvage has been reached. Tom may be contacted at (860) 345- 4511.

Archaeological and Historical Review

A review of the State of Connecticut Archaeological Site files and maps show no known archaeological sites in the project area. However, this is more a reflection of the fact that the area has not received a great deal of archaeological attention in the past. Historically, archaeologists have concentrated their efforts along the coast and major river valleys. As a result, we have very little information on secondary drainages like the Nonnewaug River.

Nonetheless, the Nonnewaug Falls Open Space and Agricultural Area is extensive and offers a number of ecozones which would have provided excellent opportunities for Native American economic adaptive strategies, especially for the hunting of wild game and the gathering of natural plants as food resources. Topographic and environmental aspects of the land suggest a high sensitivity for undiscovered archaeological resources including prehistoric Native American campsites and historic Euro-American farmsteads.

The Office of State Archaeology recommends an archaeological survey for any areas that may have ground disturbing developments. While the open space land use should have little effect on below-ground cultural

resources, an archaeological survey of selected portions of the property may yield important information of the past. The Office of State Archaeology is prepared to provide any technical assistance in conducting a survey for portions of the project area.

Please contact them at (860) 486-5248 for questions or assistance.

ABOUT THE TEAM

The King's Mark Environmental Review Team (ERT) is a group of environmental professionals drawn together from a variety of federal, state and regional agencies. Specialists on the Team include geologists, biologists, soil scientists, foresters, climatologists and landscape architects, recreational specialists, engineers and planners. The ERT operates with state funding under the aegis of the King's Mark Resource Conservation and Development (RC&D) Area - an 83 town area serving western Connecticut.

As a public service activity, the Team is available to serve towns within the King's Mark RC&D Area - *free of charge*.

Purpose of the Environmental Review Team

The Environmental Review Team is available to assist towns in the review of sites proposed for major land use activities or natural resource inventories for critical areas. For example, the ERT has been involved in the review of a wide range of significant land use activities including subdivisions, sanitary landfills, commercial and industrial developments and recreation/open space projects.

Reviews are conducted in the interest of providing information and analysis that will assist towns and developers in environmentally sound decision making. This is done through identifying the natural resource base of the site and highlighting opportunities and limitations for the proposed land use.

Requesting an Environmental Review

Environmental reviews may be requested by the chief elected official of a municipality or the chairman of an administrative agency such as planning and zoning, conservation or inland wetlands. Environmental Review Request Forms are available at your local Soil and Water Conservation District and through the King's Mark ERT Coordinator. This request form must include a summary of the proposed project, a location map of the project site, written permission from the landowner/developer allowing the Team to enter the property for the purposes of a review and a statement identifying the specific areas of concern the Team members should investigate. When this request is reviewed by the local Soil and Water Conservation District and approved by the King's Mark RC&D Executive Council, the Team will undertake the review. At present, the ERT can undertake approximately two reviews per month depending on scheduling and Team member availability.

For additional information regarding the Environmental Review Team, please contact the King's Mark ERT Coordinator, Connecticut Environmental Review Team, P.O. Box 70, Haddam, CT 06438. The telephone number is 860-345-3977.