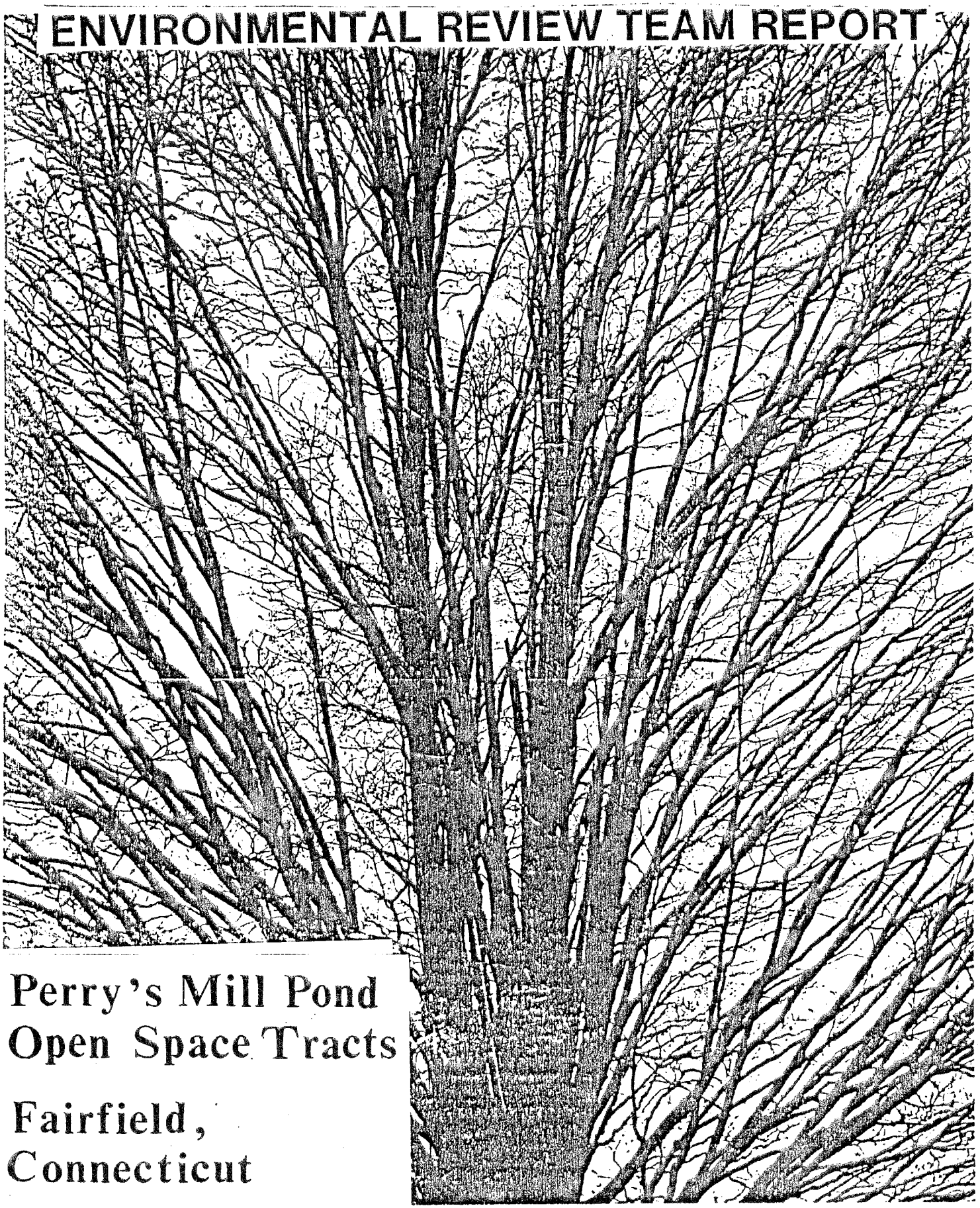
ENVIRONMENTAL REVIEW TEAM REPORT



Perry's Mill Pond Open Space Tracts

Fairfield, Connecticut

KING'S MARK RESOURCE CONSERVATION AND DEVELOPMENT AREA, INC.

PERRY'S MILL POND OPEN SPACE TRACTS

FAIRFIELD, CONNECTICUT

Environmental Review Team Report

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

Wallingford, Connecticut

for the

Fairfield Conservation Commission

JANUARY 1987

ACKNOWLEDGEMENTS

The King's Mark Environmental Review Team Coordinator, Keane Callahan, would like to thank and gratefully acknowledge the following Team Members whose professionalism and expertise were invaluable to the completion of this study:

* William Warzecha, Geohydrologist
  Department of Environmental Protection

* Paul Rothbart, Wildlife Biologist
  Department of Environmental Protection

* Timothy Barry, Fishery Biologist
  Department of Environmental Protection

* Don Smith, Forester
  Department of Environmental Protection

* Kenneth Metzler, Wetland Specialist
  Department of Environmental Protection

* Joe Nestico, Senior Environmental Analyst
  Department of Environmental Protection

* Robert Souza, Recreational Planner
  Department of Environmental Protection

I would also like to thank Laverne Mendela, Secretary and Janet Jerolman, Cartographer of the King's Mark Environmental Review Team for assisting in the completion of this report.

Finally, special thanks to Thomas Steinke, Director, Conservation Department, Town of Fairfield, and Kenneth Placko, Open Space Manager, Town of Fairfield for their cooperation and assistance during this environmental review.

EXECUTIVE SUMMARY

The Fairfield Conservation Commission requested an environmental review on Perry's Mill Pond, an approximately 70-acre open space area owned and managed by the town. Due to their proximity to the Perry's Mill Pond open space tracts, Sturges Pond and Mill Hollow Park were also reviewed as part of this study.

The Perry's Mill Pond open space tracts, bisected by the Mill River, contains a broad spectrum of land forms, waterbodies, vegetative associations, and cultural resources. The site is characterized by a floodplain hardwood forest, wooded uplands, remnant orchards, thickets, terraces, the Mill River, the historic Perry's Mill Dam, Laurel Brook, north and south Perry's Mill Ponds, gravel piles, and a scrub/shrub wetland ("bog").

The open space tract is crisscrossed by opportunistic motorbike and walking trails. The borders of the site are frequently encroached upon for waste disposal, material storage, garden and private yard expansion. Local roads and rights-of-ways are used for parking since no formal parking areas are provided on the site.

The site presently supports passive, single participant, and unorganized recreational activity. This includes ice skating, camping, motor biking, fishing, trapping, swimming, birdwatching, canoeing, picnicing, tubing, and occassional hunting. No formal trail plan is established for the open space tract.

* *

Conflicts exist between the historic, recreational, educational, conservation, and floodplain management priorities for the site. Recognizing that a balance must be struck between competing uses is key to achieving long term management goals. Effective planning of existing resources will thus preserve site integrity while providing for its use and enjoyment by the public.

Therefore, the primary concern of the Conservation Commission is the increased development pressures surrounding the study area and competing uses of the site. Since natural resource information was already available for most of the site, the primary goal of the ERT was to interpret this information, and if necessary, generate any new information in order to provide natural resource management guidelines or alternatives to improve the overall environmental quality, stability, and diversity of the resources occupying the site. Thus, how best to manage the resources and uses of the site was the primary focus of this environmental review.

Through the inventory and assesment process, specific resources, areas of special concern, and managment and planning guidelines were identified. They fall into three general categories: (1) physical characteristics; (2) biological attributes; and (3) recreational planning considerations.

* *

PHYSICAL CHARACTERISTICS

Bedrock Geology

The bedrock underlying the study area is classified into two rock formations: (1) Golden Hill Schist; and (2) Beardsley Member of Harrison Gneiss. Both of these rock types consist of crystalline rocks which have been deformed by great heat and pressure in the earth's crust. The geologic name given to rocks formed under these conditions are metamorphic rocks.

Depth to bedrock in the study area ranges between less than 10 feet in the western parts near Sturges Pond and 119 feet below ground surface along the river in the central parts. Because the bedrock is deep seated, it should pose no major problems in terms of managing the open space tracts.

Surficial Geology

The surficial geology of an area consist of those unconsolidated mineral and organic material overlying bedrock. The two major surficial geologic deposits in the study area includes: (1) stratified drift and (2) alluvial deposits.

Soils

The scrub/shrub wetland south of Doreen Drive contains a high percentage of organic material which is relatively thick. These are Carlisle muck soils. They are poorly-drained and are saturated most of the year with standing water during the winter and spring. These areas are unsuitable for developmental purposes.

Areas comprised of inland wetland and floodplain soils are very important because of the hydrologic and ecologic functions they perform such as forming natural flood ways, reducing runoff, maintaining water quality, and providing wildlife habitat.

Hydrology

The Mill River has a watershed area of about 34.6 square miles or 22,144 acres. The watershed originates in the Town of Easton but encompasses portions of six towns including Monroe, Redding, Trumbull, Bridgeport, and Fairfield. Surface and groundwater flows in the study area are generally towards Mill River.

It is imperative that every effort be made to protect the good water quality characteristics of the Mill River. Additional development within the Mill River watershed that does not employ the best management practices will serve to worsen existing water quality. Local officials and agencies should consider implementing watershed management practices to mitigate the effects of land use changes in the Mill River watershed.

* *

BIOLOGICAL RESOURCES

Forest Resources

A forest management plan should be developed for the forest resources of the study area as well as for the rest of the Town of Fairfield. Such a plan would not only identify and describe the forest types, but for each type, present detailed forest management activities to be completed within the 10-year life span of the plan. The plan would contain a summary of management activities, with a rough schedule for accomplishment as well.

Wetland Habitats

The study area has a good diversity of wetland habitats, most of which are in reasonable shape to provide good educational and recreational potential to town residents. A proposed wetlands vegetation classification for the study area is as follows: (1) Floodplain forest; (2) Alluvial marsh; (3) Alluvial swamp; (4) Basin swamp or scrub/shrub wetland, semi-permanently flooded (Perry Bog); and (5) Riverine aquatic beds.

"Perry Bog" is classified as a Palustrine, scrub/shrub wetland, semi-permanently flooded. At present time, this wetland is characterized by substantial open water with an open growth of buttonbush and dead trees. This kettlehole wetland provides an important breeding area for waterfowl and is aesthetically valuable for photography, nature study or birdwatching especially in a populated community such as Fairfield. Therefore, an accurate classification only expresses what is present in this site at this time.

At present, the wetlands within the Perry's Mill Pond open space tracts have two major functions: (1) Flood control and (2) Wildlife habitat. Other functions include finfish habitat, educational potential, visual/aesthetic quality, and water-based recreation.

Wildlife Resources

The study area has a well diversified mixture of wildlife habitat types including red maple floodplain, mixed hardwood forest, riparian areas, scrub/shrub wetland, open water, and early successional stage habitats (i.e., shrubs, native fields).

Management of wildlife resources is in large part dependent upon habitat management. The manipulation of vegetation is a major part of wildlife management. Sustaining wildlife populations means regulating on a continual basis the kind, the amount, and the spatial arrangement of food and cover plants to provide the needs of wildlife.

Wildlife management and protection goals for the site should include production of optimum habitat diversity to maximize production of wildlife species. This can be done by creating and/or maintaining a diversity of food and cover with a mosaic of nesting, resting, and loafing sites scattered throughout the area.

Fishery Resources

The diversity of fish species found in the north and south ponds, the scrub/shrub wetland, and Mill River indicate a healthy and reasonably, balanced fishery.

Fishing access to the north and south ponds is good for both shore and cartop boat fishermen. A good ratio of shallow to deep water areas exist and some small patches of aquatic weeds were also observed.

There presently is a scarcity of fish-attracting cover in the north pond. For this reason it is suggested that some sort of fish-attracting devices be added to this pond.

The water quality is good and indicates there is potential for a possible put-and-take trout fisheries in both ponds during the spring season. However, the stocking of trout tends to attract larger numbers of anglers to an area. This can potentially lead to over-utilization of a small area, causing potential environmental impact and user conflicts. A possible "trade-off" to trout stocking which the Conservation Commission might wish to consider would be to enhance the white perch population (their spawning and migration takes place in early spring) and increase public knowledge of this resource.

Mill River and Water Quality Issues

Dissolved oxygen (DO) and temperature profiles suggest that both ponds should not stratify and have sufficient DO to support fish life. It is suggested that additional profile studies be conducted during the summer to verify if stratification occurs and if there are any DO depletions.

Biologically, the north and south ponds appear to be experiencing some eutrophic conditions in the form of aquatic weed growth. Although the weed growth appears to be natural, it does not appear to be aesthetically unpleasing or undesireable since the ponds support recreational activities such as swimming and fishing.

It is suggested that efforts be continued to develop the natural settings along the Mill River corridor with educational "tools" (i.e., taxonomy), directed trails, and regulated access points.

The field review indicated the need for erosion control on Mill River south of the breached dam because of scour and deposition into the south pond as well as the outflow area of this pond. It is important to implement a stabilization and sediment control program in order to keep both ponds from filling in or eutrophying unnaturally.

* *

RECREATIONAL PLANNING CONSIDERATIONS

Recreational Resource Base

The Perry's Mill Pond open space tract at the present time supports many forms of recreational activities such as ice skating, camping, motorbiking,

fishing, trapping, swimming, birdwatching, canoeing, picnicing, tubing, and occasional hunting. Several of the activities are not sanctioned by the town nor are they compatible with each other.

Most of the aforementioned active-type recreational activities occur in the area north of Mill Hill Road. The area south of the road (i.e., Mill Hollow Park) is used for hiking and other passive forms of recreation.

The ERT identified the following recreational resource problem areas: (1) Lack of adequate parking; (2) Poor trail system and lack of adequate trail markings; (3) Misuse of established trails by motorbikes; and (4) Litter in some sections of the study area.

Parking and Trails Considerations

Additional parking and trail system improvements are the most important features needing management. For example, althouth existing woodlands provides a good buffer for trail systems along the roads, the trail system lacks definition and direction for visitors unfamiliar with the study area. It is encouraged that the trails not be paved since it would decrease the aesthetic value of the study area.

It is encouraged that access to the study area be developed for physically challenged people. The topography is such that this could be accomplished with little changes to trail direction, construction, or impact on other users.

Due to the fragility of existing resources and the limited geographic extent of the site, it is advised that all motorized recreation be restricted from the study area. These forms of recreation are incompatible with existing nature trails and other passive uses as well as the River-Lab environmental education program conducted by the Mill River Wetlands Committee.

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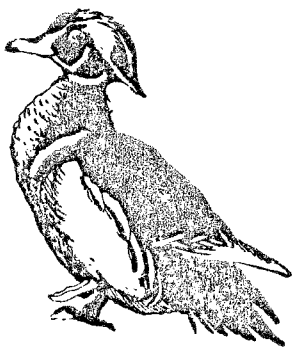


INTRODUCTION

The Fairfield Conservation Commission requested that an environmental review be conducted on Perry's Mill Pond, an approximately 70-acre open space area owned and managed by the town. The study area is approximately in the geographic center of Fairfield between Mill Plain Road, Bronson Road, and Lakeside Drive and Sturges Bridge (Figure 1). Due to their proximity to the Perry's Mill Pond open space tracts, Sturges Pond and Mill Hollow Park were also reviewed as part of this study (Figure 2). For clarity and brevity, these three areas, Perry's Mill Pond, Sturges Pond, and Mill Hollow Park, will be referred to throughout the report as either the "open space tracts," "site," or "study area."

The Perry's Mill Pond open space tracts, bisected by the Mill River, contains a broad spectrum of land forms, waterbodies, and vegetative associations. The site is characterized by a floodplain hardwood forest, wooded uplands, thickets, terraces, the Mill River, Laurel Brook, Upper and Lower Perry's Mill Pond, and a scrub/shrub wetland ("bog").

HISTORICAL LAND USE OF THE AREA

Prior to white settlement, Mill River flowed through the study area in a meandering configuration, bracketed by floodplains and bogs to the east, and sand and gravel bluffs and river terraces to the west. Tides often pushed salt water in from Long Island Sound as far as the Perry's Mill Dam.

The first mill at this point on Mill River was set on a dam at the head of Laurel Brook, a meander encircling a kame (i.e., gravel hill). This meander was deepened to create a sufficient flow for hydropower to handle increased

commerce in the 17th and 18th centuries. The present (breached) Perry's Mill Dam was undertaken only when the growth in population and commerce merited a larger structure.

The west wall of Perry's Mill Dam was breached in January 1958 to relieve upstream flooding conditions caused by an extreme "January thaw." Flooding had also disabled the bridge over Laurel Brook and marooned residents living in the Mill building. The Mill building was converted into a residence in 1949.

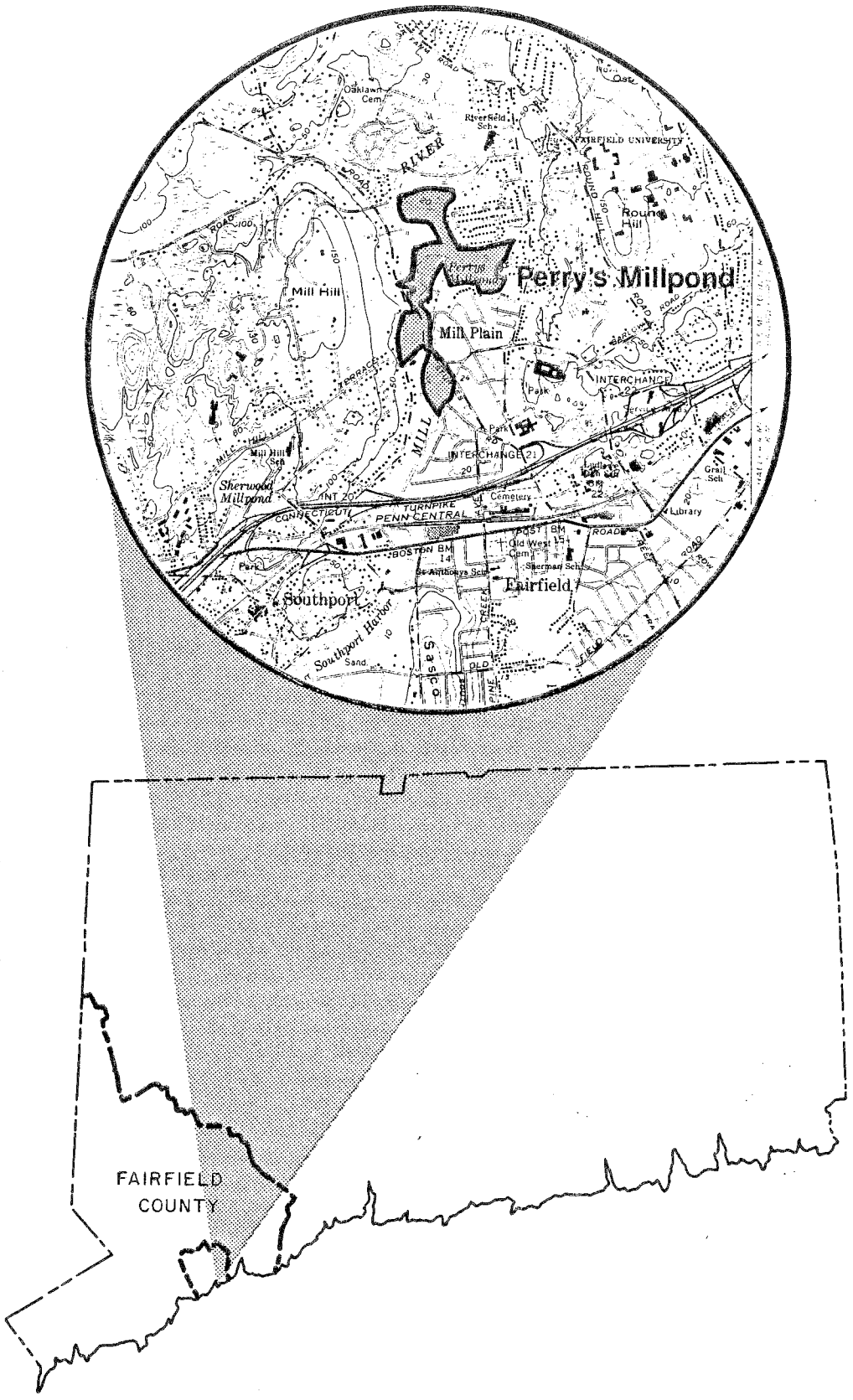
In the 1950s and 1960s, commercial gravel operators dredged the Mill River channel. Excavation activities expanded into the floodplain, creating the north and south ponds found on the site. A 400-foot wide floodplain forest remains, separating the ponds. During and after gravel mining, the operator diverted the river out of its original channel, stockpiled topsoil, sand, and gravel at the Sturges Road entrance to the site.

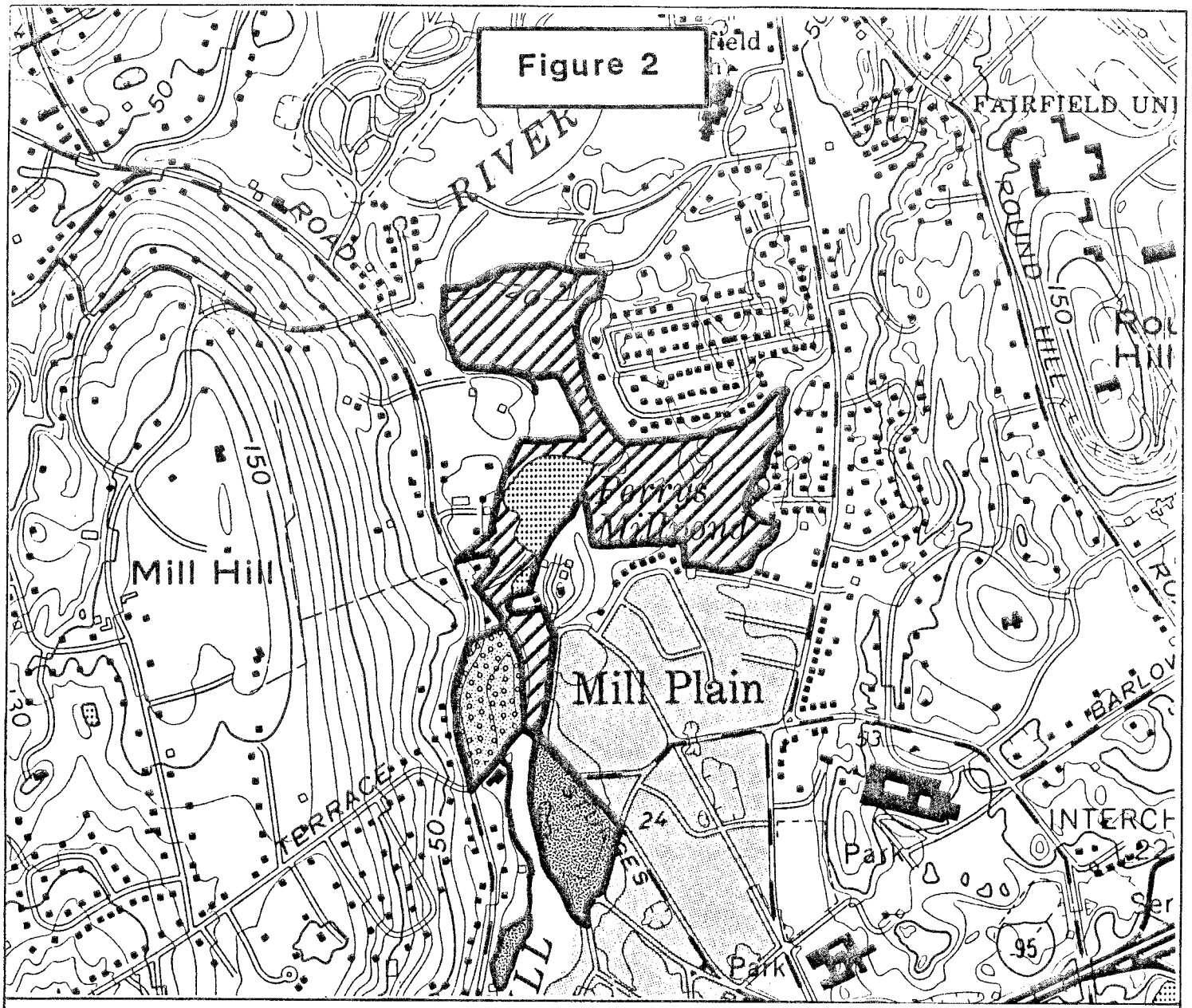
Most of the open space tracts were purchased by the town during the late 1960s. However, during the period of 1950 through 1980, undeveloped land surrounding the open space tracts was subdivided for residential purposes. Several homes are in relatively low lying areas subject to flooding during intense storms. These homes include those on Doreen Drive, Partridge Lane, and Bronson Road.

These open space tracts thus have a rich historical and cultural base such as the historic Perry's Mill Dam, colonial river fords, remnant orchards, excavated gravel ponds, and gravel storage piles. The open space tracts are crisscrossed by opportunistic motorbike and walking trails. The borders of the site are also frequently encroached upon for waste disposal, material storage, garden and private yard expansion. Local roads and rights-of-ways are used for parking since no formal parking areas are provided on the site.

Figure 1

LOCATION OF STUDY SITE





PERRY'S MILLPOND OPEN SPACE TRACTS

STURGES POND

MILL HOLLOW PARK

PERRY'S MILLPOND

FAIRFIELD, CONNECTICUT

LOCATION OF OPEN SPACE TRACTS

King's Mark Environmental Review Team

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ENVIRONMENTAL CHARACTERISTICS

Existing Natural Habitats

Perry's Mill Pond open space tracts provides ample opportunity to manage water, wood, and wildlife. Its upland and floodplain forests are capable of producing fuelwood and timber as well as providing habitat for dozens of plant and animal species.

As previously mentioned, the site contains a diversity of natural habitats such as mature forests, an abandoned orchard, wooded and shrub swamp, open meadow, old river meanders, floodplains, deltas, rapids, and open water all of which produce one of the most diverse and productive ecosystems in Fairfield.

Every conceivable niche is filled with amphibians, fish, reptiles, birds, and mammals. Wood ducks, canvasbacks, great blue herons, ruffed grouse, northern orioles, osprey, white-tailed deer, mink, otter, chain pickeral, largemouth bass, alewives, black snakes, snapping turtles, and leopard frogs are but a few of the wildlife species found on the site.

Water Resources

The open space tracts are located within the Mill River aquifer which serves to supply drinking water through private domestic wells and Bridgeport Hydraulic Company well fields. The aquifer and surrounding wetlands also serve to maintain river and streamflow during drought periods thereby enhancing wildlife and fishery habitat as well as the aesthetic quality of the site.

Flood Dynamics

The river, ponds, wetlands, and floodplains are important factors in the site's ability to store water and reduce peak flood flows in downstream areas. However, subdivision development on the edge of the floodplain combined with

increased runoff from watershed development coincident with high tides, cause flooding of private properties upstream from the gravel piles northwest of Perry's Mill Dam. On the west bank, large gravel and topsoil piles effectively block flood flows of Mill River at this point and, secondarily, so too does the Perry Mill Dam downstream.

The existing breach in the west wall of the dam is improperly located to significantly relieve flooding. This breach is also the source of floodplain scour and erosion of the west bank of the Mill River where if now threatens to wash out Sturges Road.

Engineering plans to reduce upstream flooding potential call for channelization, removal of gravel piles, and most of the dam. Such action would greatly reduce the flood hazard, but it would also eliminate much of the historic significance of the mill, disrupt established educational activities, and diminish habitat for fish and other aquatic life.

RECREATIONAL AND ENVIRONMENTAL EDUCATION OPPORTUNITIES

Recreational Assets

The site presently supports passive, single participant, and unorganized recreational activity. This includes ice skating, camping, motorbiking, fishing, trapping, swimming, birdwatching, canoeing, picnicing, river tubing, and occassional hunting.

No formal trail plan is established for the open space tracts. Instead, motorbike trails crisscross the area through all degrees of wet soils and wildlife habitat. Although the River-Lab (see discussion below) trails between Kingfisher Bend (south of Doreen Drive) and Sturges Road Bridge direct visitors to natural and historic points of interest, many existing trails are poorly laid out or are intrusive in the backyards of adjacent properties. Since few

foot bridges cross the river, the trail system is essentially discontinuous, thus limiting visitor appreciation of the natural or historical significance of the site.

Environmental Education Opportunities

The Mill River Wetland Committee (MRWC) initiated the River Laboratory or River-Lab program in 1967 to utilize the extraodinary concentration of significant land use and historical features of the Perry's Mill Pond open space tracts. Students involved in the River-Lab program use the site in conjunction with classroom units of study designed by MRWC and the Fairfield Schools Science Department. The outdoor laboratory part of this program, conducted in the floodplain area, utilizes land use and historical features to promote better understanding of the natural environment and its interaction with watershed development. The outdoor laboratory study-trips makes optimum use of the sites's plant and animal species diversity and all other features reflecting geological history and use. Mill River Wetland Study Group guides use selected trail points to reinforce specific concepts on each level. Environmental education exhibits and demonstrations change seasonally with changes in the river, but the exhibits and activities are generally located on the west bank above and below the dam as well as in Mill Hollow Park.

GOALS AND OBJECTIVES OF ENVIRONMENTAL REVIEW

Conflict exists between the historic, recreational, educational, conservation, and floodplain management priorities for the site. Recognizing that a balance must be struck between competing uses is key to achieving long term management goals. Effective planning of existing resources will thus preserve site integrity while providing for its use and enjoyment by the public.

Therefore, the primary concern of the Conservation Commission is the increased development pressures surrounding the study area and competing uses of the site. Since natural resource information was already available for most of the site, the primary goal of the ERT was to interpret this information, and if necessary, generate any new information in order to provide natural resource management guidelines to improve the overall environmental quality, stability, and diversity of the resources occupying the site. Thus, how best to manage the resources and uses of the site was the primary focus of this environmental review. Specific objectives included:

(1) Provide fish and wildlife management guidelines to enhance fish and wildlife habitat and populations.

(2) Assess existing wetland conditions and provide alternatives on how best to manage wetland resources.

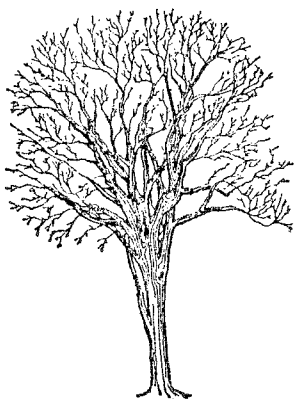
(3) Provide forest management guidelines to enhance the diversity of the forest resource.

(4) Determine recreational opportunities of the site, including trail circulation and potential recreational impacts.

(5) Assess the environmental condition of Mill River, the north and south ponds, and the riverbank community, and provide river management guidelines.

(6) Provide watershed management guidelines for the site.

PHYSICAL CHARACTERISTICS



Geologist referenced John Rodgers' Bedrock Geological Map of Connecticut (1985). It should be pointed out that the bedrock geologic map for the quadrangle has not been published to date. There is, however preliminary information available at the Department of Environmental Protection's (DEP) Natural Resources Center in Hartford.

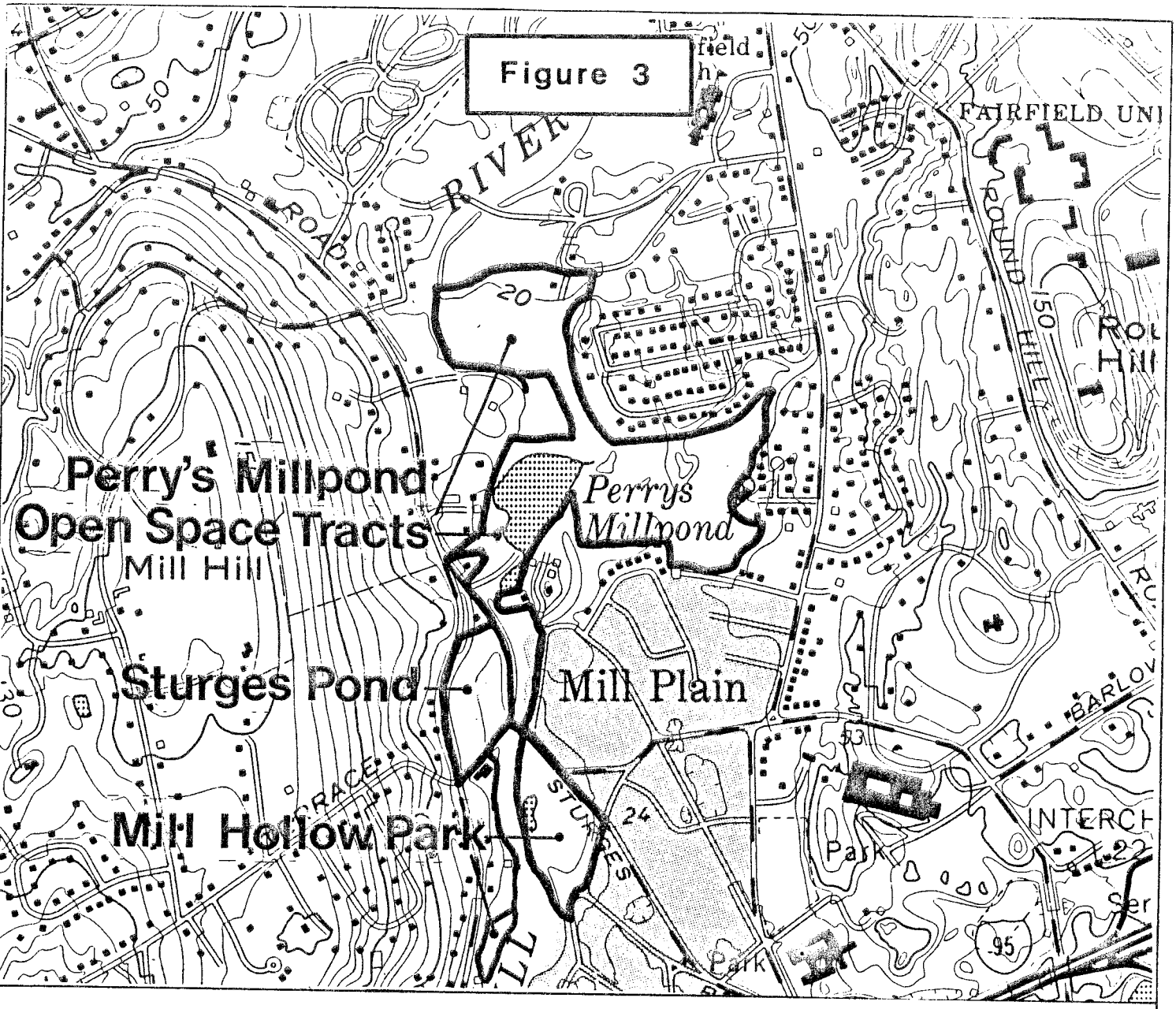
A surficial geologic map (MF-1295) for the quadrangle by J.R. Stone and E.H. London (1981) has been published by the U.S. Geological Survey.

Bedrock Geology

Rodgers has classified the bedrock underlying the study area into two rock formations: (1) Golden Hill Schist, and; (2) Beardsley Member of Harrison Gneiss (Figure 4). Both of these rock types consist of crystalline rocks which have been deformed by great heat and pressure in the earth's crust. The geologic name given to rocks formed under these conditions are metamorphic rocks. The rocks underlying the site are very old, ranging in age from 438 to 505 million years old (Ordivician Geologic Period). They have been geologically altered in composition, and folded and fractured over this very long time period.

Though bedrock outcroppings were not observed during the field review, Dr. John Nicholas of the University of Bridgeport has identified two bedrock outcropping areas: (1) the three spines or keels protruding from the water in the old riverbed just south of the site's entrance road and (2) the very dense granitic rock outcrop exposed by erosion of the bank just above Cobble Island.

Rodgers describes the Golden Hill schist as a gray to silvery, medium- to coarse-grained schist and granofels. This rock formation underlies the southern, central, and parts of the northern half of the study area. He described the Beardsley Member of Harrison gneiss, which underlies the eastern



PERRY'S MILLPOND

FAIRFIELD, CONNECTICUT

TOPOGRAPHY

King's Mark Environmental Review Team

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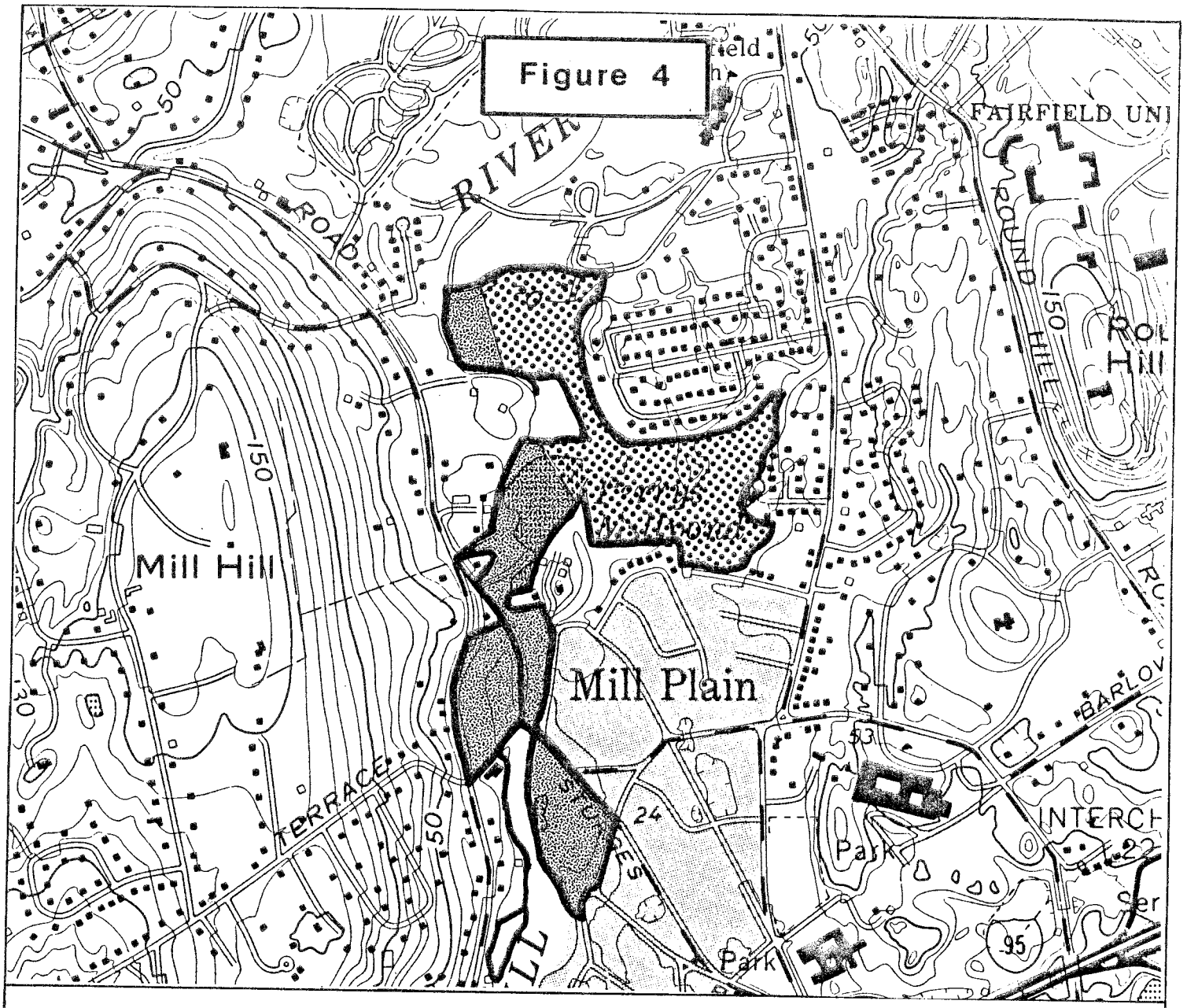

BEARDSLEY MEMBER OF HARRISON GNEISS

GOLDEN HILL SCHIST

Adapted from Bedrock Geological Map of Connecticut, John Rodgers

PERRY'S MILLPOND

FAIRFIELD, CONNECTICUT

BEDROCK GEOLOGY

King's Mark Environmental Review Team

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parts of the study area, as gray to dark, medium-grained lineated gneiss.

Gneisses, schists, and granofels are all textural terms given to the metamorphic rocks found on the site. Gneisses are crystalline, metamorphic rocks that have been altered by great heat and pressure within the earth's crust. Gneisses are distinguished by compositional banding of light and dark minerals. Typically, the light-colored minerals in the rock are quartz and feldspar, while biotite composes the darker mineral. A granofel is a metamorphic rock which may be light to dark, medium to coarse grained and massive to poorly layered. Its major minerals are primarily quartz and feldspar whose grain sizes are generally equal. Granofels differ from the gneisses in that it lacks the compositional banding. Schists refer to a crystalline, metamorphic rocks identified by the layering in the rock. Schists are typically defined by a parallel alignment of platy, flaky or elongated minerals, such as biotite and muscovite. They are primarily composed of mica, quartz, and feldspar, and occasionally spotted with garnets. Depth to bedrock in the study area ranges between less than 10 feet in the western parts near Sturges Pond and 119 feet below ground surface along the river in the central parts. A log of borings drilled at the Sturges Road Bridge revealed a depth of 68 feet without encountering bedrock (Source: Hydrogeologic Data Southwestern Coastal River Basins, Water Resources Bulletin #18). Because bedrock is deep-seated, it should pose no major problems in terms of managing the open space tracts.

Surficial Geology

The surficial geology of an area consists of those unconsolidated mineral and organic materials overlying bedrock. The two major surficial geologic deposits in the study area included: (1) stratified drift and (2) alluvial

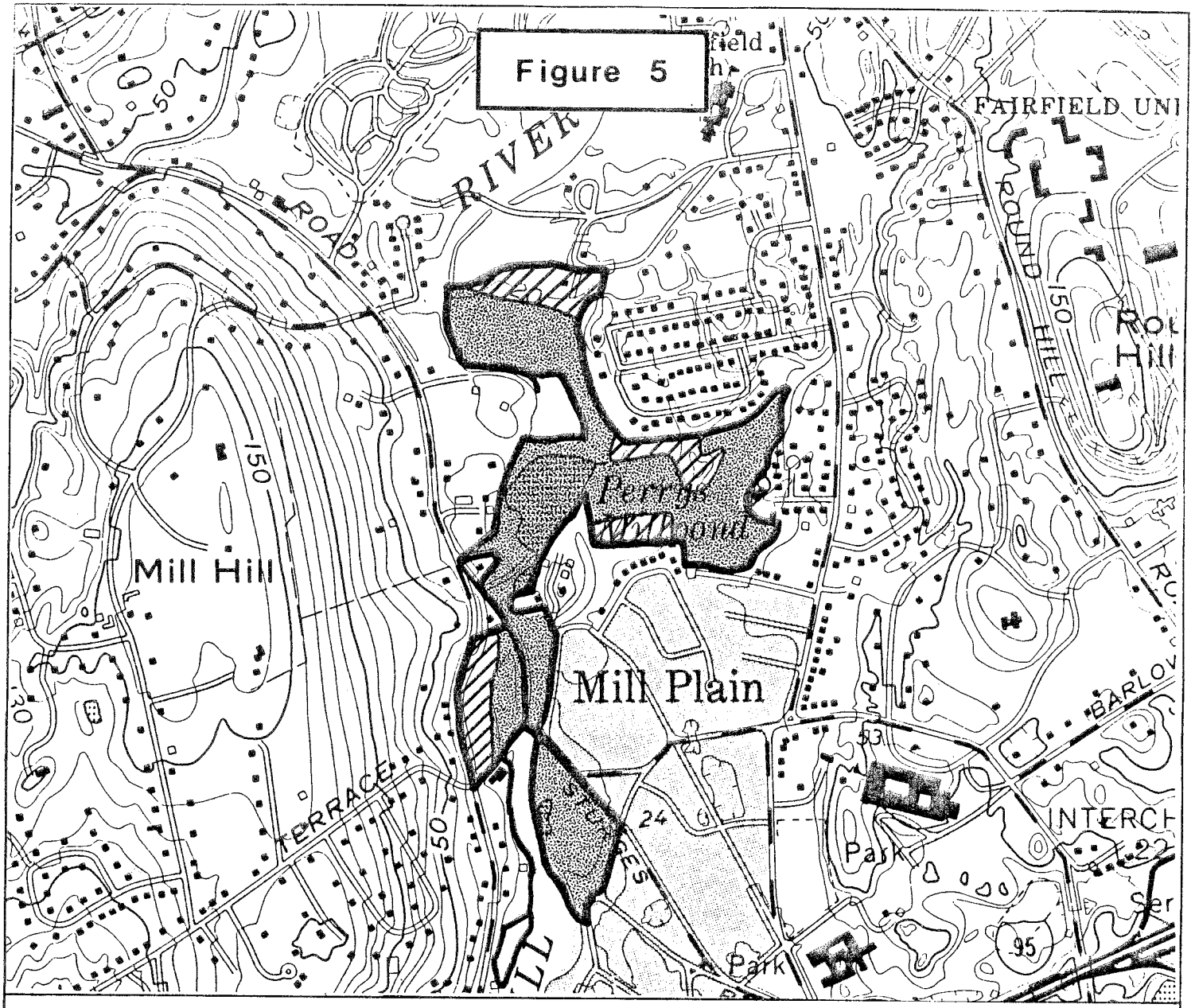
deposits (Figure 5). Stratified drift is composed of rock materials that were washed by meltwater streams emanating from glacier ice which once occupied the Mill River Valley 10,000 to 12,000 years ago. Sand and gravel are the major components of the stratified drift. Because stratified drift was reworked by the meltwater streams, they are commonly well-sorted and are bedded according to particle or grain size. Based on test hole information at Mill Plain near the Sturges Road Bridge, less than 20 feet of fine gravel and sand overlies as much as 50 feet of sand and silt.

Water moves rapidly through these permeable soils. As a result, they are good soils for both active and passive recreational uses, particularly where groundwater is deep.

Overlying the stratified drift deposits along Mill River are postglacial sediments called alluvium. Alluvial deposits consist of gravel, sand, and silt containing variable amounts of organic matter. Most deposits are less than 10 feet thick and are underlain by the adjacent deposits discussed above. The areas shown in Figure 5 as alluvial deposits are subject to flooding.

The alluvial deposits found in the study area are poorly-drained with the water table lying a few inches below the surface during winter and spring. For these reasons, alluvial soils hold little potential for any type of development. It seems likely that these areas would be most suitable for passive recreational uses, mainly during the dry time of year. The alluvial soils in the study area have been identified as Raypol.

The moderately sized scrub/shrub wetland south of Doreen Drive contains a high percentage of organic material which is relatively thick. These soils are identified as Carlisle muck soils (Ce). These soils are poorly-drained and are saturated most of the year with standing water during the winter and spring. These areas are unsuitable for developmental purposes.



ALLUVIAL DEPOSITS

STRATIFIED DRIFT

PERRY'S MILLPOND

FAIRFIELD, CONNECTICUT

SURFICIAL GEOLOGY

King's Mark Environmental Review Team

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Areas comprised of inland wetland and floodplain soils are very important because of the hydrologic and ecologic functions performed there. Some important functions include:

(1) Forming natural flood ways to convey flood waters from upstream to downstream points.

(2) Reducing runoff by storing water during times of flooding, and slowly releasing it to the downstream areas, thereby restricting flood peaks.

(3) Maintaining water quality.

(4) Providing wildlife habitat.

HYDROLOGY

The Mill River, which bisects the study area has a watershed area of about 34.6 square miles or 22,144 acres. It originates in the Town of Easton to the north but the watershed includes portions of six towns including Monroe, Redding, Easton, Trumbull, Bridgeport, and Fairfield. Surface and groundwater flows in the study area are generally towards Mill River.

Precipitation resulting in surface runoff flows across the surface of land until it reaches a brook or other body of water. Precipitation may also be absorbed into the ground, especially in the areas covered by permeable sands and gravels. Once it is absorbed, these waters may either be returned to the atmosphere through evaporation and plant transpiration, or percolate downward to the groundwater table. Once water reaches the groundwater table, it moves slowly downslope by the force of gravity, ultimately discharging to the surface in the form of a spring, wetland, stream or directly into the river. Generally speaking, groundwater flow in the watershed parallels the surface flow pattern. Based on available natural resource data and mapping information, the

study area appears to contain some thick, coarse-grained stratified drift deposits that may be capable of providing high yields of groundwater for wells. According to a map entitled, Groundwater Availability in Connecticut (Meade, 1978), the open space areas north of the south pond are believed to be underlain by coarse-grained stratified drift material. Where stratified drift deposits are generally thick, coarse-grained, have a saturated thickness of 10 feet or greater, and are close to a major streamcourse, it may be possible to obtain relatively large volumes of groundwater of approximately 50 to 2,000 gallons per minute.

The Mill Hollow Park area appears to be covered by coarse-grained stratified drift which is overlying fine-grained stratified drift. In terms of aquifer potential, this geologic setting would not typically be as prolific as the setting described above. According to Meade's map, a geologic setting with this type of setting is capable of yielding moderate to large amounts of water (50 to 500 gallons per minute) to individual wells.

The crystalline metamorphic rocks (i.e., schists, gneisses, and granofels), underlying the study area are also capable of providing water for individual wells. Bedrock transmits water by means of an interconnected system of fractures or seams. The amount of natural quality of water withdrawn from a bedrock well depends upon the numbers of water bearing fractures or seams it intersects and on the mineralogy of the rock formation through which the fractures pass.

The schist, gneisses, and granofels underlying most of the study area are usually capable of yielding three gallons per minute (gpm) or more without penetrating much more than 300 feet of bedrock. A yield of three gpm should be adequate to meet the needs of most active and passive recreational uses.

The natural quality of the groundwater supply should be good. However, there is a chance the underlying bedrock, particularly the schists and gneisses, may be mineralized with iron and/or manganese. If the concentrations of these minerals are high, the well water may need to be treated with a suitable method of filtration.

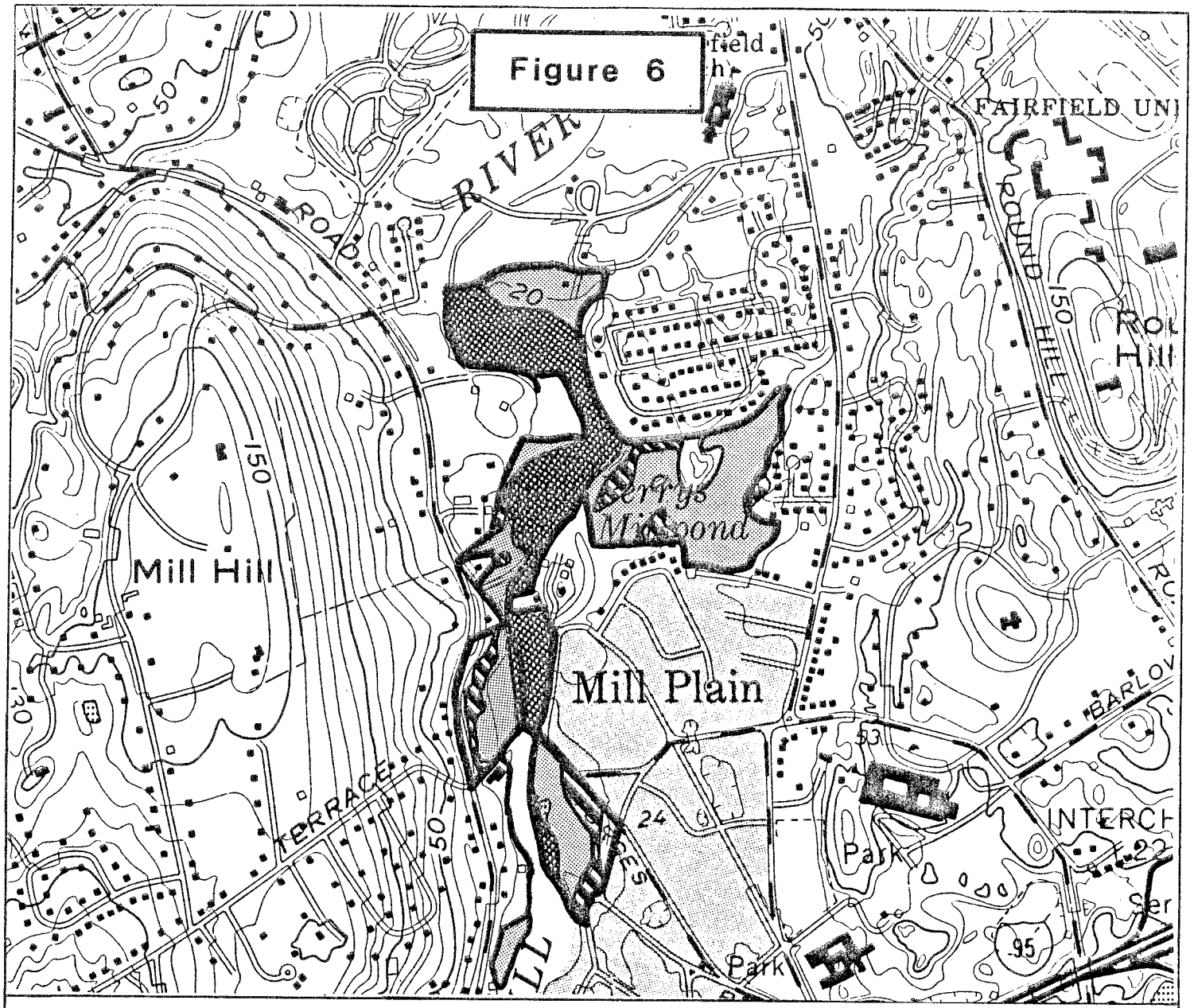
According to Connecticut's Water Quality Standards and Criteria for the Southwest Coast River Basin published by the DEP - Water Compliance Unit, the portion of the Mill River passing through the study area is classified as "A." A surface waterbody with an "A" classification may be suitable for drinking water supply and/or bathing; suitable for all other water uses; character uniformly excellent; or may be subject to absolute restrictions on the discharge of pollutants.

In view of the generally good water quality characterizing the surface water quality of Mill River, it is imperative that every effort be made to continue to protect the existing water quality conditions. Additional residential, commercial or industrial development or other types of activities such as, agricultural or lawn and garden fertilizing within the Mill River watershed that does not employ the best management practices will serve to worsen existing water quality. Local officials and agencies should consider implementing watershed management practices to mitigate the effects of land use changes in the Mill River watershed.

FLOODPRONE AREAS

A flood boundary and floodway map for Fairfield has been published by the Federal Emergency Management Agency (FEMA), Federal Insurance Administration. Based on the flood boundary map, most of the study area lies either within the

100-year flood boundary or the 500-year flood boundary or floodway fringe. The 100-year flood boundary covers most of the study area. (Figure 6 adapted from the FEMA map). A 100-year flood is a flood with a one chance in 100, or one percent chance of occurring in any given year. A 500-year flood is a flood with a one chance in 500, or 0.2 percent chance of occurring in any given year. It should be pointed out that this does not mean floods of the magnitudes mentioned above will occur only once in a 100 or 500 year period. The probability of occurrence remains the same each year regardless of what happened the year before. The 500-year flood boundary lies outside the 100-year flood boundary. There may also be wooded swamps, inland wetlands, or drainage channels subject to wetness and perhaps some flooding during periods of heavy rain.



FLOODWAY FRINGE

100 YEAR FLOOD BOUNDARY

500 YEAR FLOOD BOUNDARY

PERRY'S MILLPOND

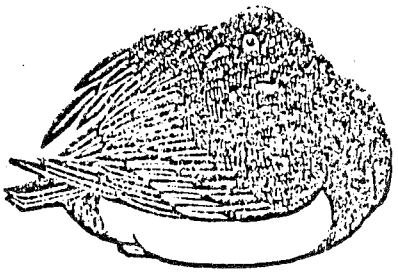
FAIRFIELD, CONNECTICUT

FLOODWAY AND FLOOD BOUNDARY

King's Mark Environmental Review Team

0 1000'

BIOLOGICAL RESOURCES



FORESTRY CONSIDERATIONS

Introduction

The forestry and vegetative characteristics of the Perry's Mill Pond open space tracts has not changed significantly since it was last surveyed in 1971 by Beals and Westover (1971). While the Beals and Westover report is 15 years old, the basic forest types identified and described have barely changed. The principles and ecological relationships remained constant and the recommendations presented still apply. Therefore, only a brief discussion of the vegetative characteristics of the study area is included in this ERT report. The following discussion is based on visual observations of the study area during the field review and from Beals and Westover (1971).

Forest and Vegetative Cover Characteristics

Late successional oak-beech-hickory forest community occupies the northern reaches of the study area. Other mixed hardwood species as well as early-successional shrubs also inhabit this area. Understory shrubs and herbaceous species include poison ivy, greenbrier, maple-leaved viburnum, spicebush, fern, wild grape, aster, and blue cohosh.

Moving south along Mill River, oak-beech-hickory forest grades into a red maple-ash forest cover type. Though oak and other hardwoods are present, the red maple is the dominant tree species.

The area east of the south pond and a red maple forest is dominated by a scrub/shrub wetland. Upland vegetation including sumac, dogwood shrubs, rose, and raspberry cover much of the transition area around the edge of the scrub/shrub wetland. (See Wetland Resources section of report for further discussion).

Continuing south along Mill River, oak, red maple and various shrub and herbaceous species dominate the western shore of Mill River and the shoreline of the south pond. Emergent aquatic vegetation was observed during the field review along the former channel of the Mill River. The most significant landform in this section of the study area is the earth and gravel piles left behind by the dredging of the south pond. While portions of the mounds are devoid of forest vegetation, some areas are covered by pioneer and early-successional plant species such as catalpa, elderberry, alder, grey birch, box alder, willow, dogwood shrubs, red maple, and smooth sumac. The ground cover beneath these small trees and shrubs consist primarily of rose, goldenrod, joe-pye weed, and associated herbs.

The area south of the breached Perry's Mill Dam and the south pond is characterized by red maple-ash cover type, oak and other hardwoods, and various understory species.

Crossing Sturges Road Bridge into Mill Hollow Park, the forest cover and vegetative characteristics does not change dramatically. Though maintained lawns with shade trees and ornamentals welcome the visitor from the entrance on Sturges Road, the site is primarily characterized by a red maple-black cherry forest community, shrubs, tall herbs, and cattail marshes. Other vegetative species found in this area include ash, hickory, and planted spruce and pine. There are also numerous pockets of Phragmites spp. and emergent aquatic vegetation. Refer to Appendix A for listing of plant species in the study area.

Forest Management Considerations

While the Beals and Westover (1971) report is detailed and complete, it cannot be regarded as a true "forest management plan." Such a plan would go

further, not only identifying and describing the forest types, but for each type, presenting detailed forest management activities to be completed within the 10-year life span of the plan. The plan would contain a summary of these management activities, with a rough schedule for accomplishment as well. Such a plan is the logical next step for the forest resources of the Town of Fairfield.

The gathering of the additional data required to support recommendations within such a plan and the drafting and compilation of a plan for an area of this size and complexity will require an investment of time and manpower in excess of the ERT program capabilities. For this reason, the following three options for town action are presented:

(1) The town may contact the DEP - Bureau of Forestry and request such assistance as they may be able to render towards formulation of a management plan. The appropriate field office is located at 627 Amity Road, Bethany, CT 06525. Telephone: 393-0723.

(2) The town may contract with a private professional forester to gather data and formulate the comprehensive forest management plan. The forester certainly would be expected to utilize the findings of the other disciplines found in this report in anticipating future demands on the forest resource. Of prime importance to the forester will be the goals of ownership the town has for its forestlands. The town may seek the advice of DEP - Bureau of Forestry in locating professional foresters and in setting plan standards.

(3) Given the large quantity of town-owned forestland, the town should consider the option of employing a Municipal Forester. The forester would be responsible for formulating and implementing forest management plans for all Town-owned forestlands. Additionally, if an individual with the right background can be found, the more urban resources can be addressed as well. For example, designing and implementing a state-of-the-art, town-wide Shade Tree Inventory and Management System can greatly improve the aesthetic values of town streets. DEP - Bureau of Forestry is available for advice in this area.

WETLAND RESOURCES

Analysis of Existing Wetlands Information

Wetlands information on the Perry's Mill Pond open space tracts is limited to a general description of the watershed, with maps providing information on vegetative cover based upon successional relationships and poorly-drained soils versus well-drained soils (Beals and Westover, 1971). This should be supplemented by a detailed floristic analysis of the vegetation with reference to habitats, such as floodplain forest, alluvial swamp, and scrub/shrub wetland (button bush "bog"). This can be accomplished through the aid of a summer intern at a nominal cost to the town. Detailed information is necessary in order to provide an adequate reference base to establish a "best use" policy prior to any management plans.

Existing Wetland Habitats

At present, the study area has a good diversity of wetland habitats, most of which are in reasonable shape to provide good educational and recreational potential to town residents. A proposed wetlands vegetation classification for the area is as follows:

(1) Floodplain forest (bordering much of the Mill River, including areas of "shrubby" vegetaton).

(2) Alluvial marsh (abandoned channels of the Mill River) with herbaceous, marshy vegetation.

(3) Alluvial swamp (much of Mill Hollow Park).

(4) Basin swamp or scrub/shrub wetland, semi-permanently flooded (Perry Bog).

(5) Riverine aquatic beds (floating and submerged vegetation within the river channel).

Discussion on the Classification of "Perry Bog"

"Perry Bog" appears to have been carefully surveyed with information available in Beals and Westover (1971) and Steinke (1980). However, there appears to be a misconception of the term "bog." If this area is viewed as a bog, it has to be understood that this wetland is in the early stages of bog development (or redevelopment) as outlined in Dansereau and Segadas-Vianna (1952). Bogs in the true sense would have peat accumulation well above the watertable with minimal influence of groundwater on the vegetation. Characteristic bog species found in Connecticut include leatherleaf (Cassandra calyculata), sheep laurel (Kalmia angustifolia), bog laurel (Andromeda glaucophylla), beak rush (Rhynchospora alba), cotton grasses (Eriophorum spp.), and a dominance of sphagnum mosses.

Regardless of the historic vegetation, and it appears that some type of mat vegetation (i.e., bog vegetation) was present on "Perry Bog" as per the 1965 DEP aerial photographs, in the opinion of the ERT Wetland Specialist, this area cannot at present time be classified as a bog. The term "bog" refers to the nutrient-poor, acid peatlands with a vegetation in which peat mosses (Sphagnum spp.), ericaceous shrubs, and sedges play a prominant role. In addition, conifers such as black spruce, larch, white pine, and in some cases Atlantic white cedar are often present along the nutrient-rich edges of some peatlands, are not considered bog species; and their presence does not make "Perry Bog" a bog.

The U. S. Fish and Wildlife Service, in its attempt to develop a national classification of wetlands has recognized the problems and confusion with the use of common terms such as bog, and has developed a classification based on the structure of the vegetation and the hydrology of the underlying substrate (Appendix B). In the case of "Perry Bog," the U. S. Fish and Wildlife Service

would classify this area as a Palustrine, scrub/shrub wetland, semi-permanently flooded (see Cowardin et. al. for classification). Utilizing this classification system is not an attempt to downgrade the ecological significance of this wetland. At present time, this wetland is characterized by substantial open water with an open growth of buttonbush and dead trees. This kettlehole wetland provides an important breeding area for waterfowl and is aesthetically valuable for photography, nature study or birdwatching especially in a populated community such as Fairfield. Therefore, an accurate classification only expresses what is present in this site at this time.

Ecological Value and Functional Role of the Wetlands

At present, the wetlands within the Perry's Mill Pond open space tracts have two major functions: (1) flood control and (2) wildlife habitat. Other functions include finfish habitat, educational potential, visual/aesthetic quality, and water-based recreation.

Rare and Endangered Species

According to the Connecticut Natural Diversity Data Base, there are two species of special concern listed in the vicinity of the study area. One, the riverweed (Podostemum ceratophyllum Michx.), is historic and has not been relocated since 1905. Riverweed grows submerged in clear, flowing water and is greatly impacted by siltation. Since the water quality in the Mill River is presently good, the potential for relocation of this species exists, especially above the area of south and north ponds.

The second species, the four-spined stickleback (Apeltes gradracus Mitchill), has not been confirmed within the Mill River since 1966. The record of the four-spined stickleback is of a freshwater, non-tidal population

documented by Dr. Walter Whitworth of the Univeristy of Connecticut. This fish was also located in other rivers in Fairfield County. This information is recorded in the Connecticut Natural Diversity Data Base in Hartford and was verified by a voucher specimen collected in 1966. The Data Base has no more current information at this time, and if necessary, Dr. Whitworth can be contacted at 486-2840.

Wetland Management Alternatives

The status of the wetlands in the study area should be maintained in their present state. There are sufficient trails throughout the study area to allow access to the wide diversity of habitats within the site. These open space tracts has potential for people of many different interests to enjoy.

Specific alterations may include:

(1) More clearly marking the trails and the types of habitats that they explore. A small map or brochure available to visitors will assist in pointing out hiking trails, vegetation types, birdwatching potential or fishing areas.

(2) Maintaining the existing level of the water in scrub/shrub wetland. This area provides excellent wood duck habitat with the vegetation apparently stablized since the water level was raised. The area of open water will probably maintain itself for quite some time before it is overgrown with vegetation.

(3) Constructing wood duck nesting boxes within the scrub/shrub wetland. As the dead trees are removed or fall, suitable nest sites will be eliminated.

WILDLIFE RESOURCES

Introduction

The wildlife resources of Perry's Mill Pond open space tract have been well described in Beals and Westover (1971). The site has a well diversified mixture of wildlife habitat types including red maple floodplain, mixed hardwood forest, riparian areas, scrub/shrub wetland, open water, and early successional stage habitats (i.e., shrubs, native fields). Comments will be directed towards management guidelines to enchance willife populations, since inventory data already exists (Appendix C).

Management of wildlife resources is in large part dependent upon habitat management. The manipulation of vegetation is a major part of wildlife management. Sustaining wildlife populations means regulating on a continual basis the kind, the amount, and the spatial arrangement of food and cover plants to provide the needs of wildlife.

Wildlife management and protection goals for the site should include production of optimum habitat diversity to maximize production of wildlife species. This can be done by creating and/or maintaining a diversity of food and cover with a mosaic of nesting, resting, and loafing sites scattered throughout the area.

Due to the diversity of wildlife species and habitat types within the study area, management guidelines will be directed towards overall species richness and diversity.

Wildlife Management Considerations

Ideal upland/forestland habitats for general wildlife considerations are composed of:

(1) Two to three percent of the land mass in permanent grass-legume plots.

(2) Five to seven percent of the land mass in permanent openings maintained to encourage early successional stage native vegetation.

(3) Ten percent of the land mass in cover species such as young growth conifer patches (1/8 to 2 acres).

(4) Managing the forestland by a combination of two systems: (1) roughly 75 percent of the forestland in even-aged and (2) 25 percent in uneven-aged stands. Eventually the management unit would consist of 25 percent seedling/sapling, 25 percent poles, and 50 percent saw timber. If these stands are well-mixed, optimum wildlife habitat will result.

Specific Upland Forest Guidelines

(1) Increase forestland diversity by making small (1/4 to 1 acre) openings in an east to west direction to maximize sunlight. This will encourage fruit-producing shrubs valuable to many wildlife species. The edges of the openings should gradually blend into the forested habitat (i.e., feathered edges).

(2) Pile brush (6 feet by 8 feet high by 10 feet in diameter) along edges of openings to create cover for birds and small mammals.

(3) Encourage mast producing trees (i.e., oak, hickory, beech).

(4) Leave 5 to 7 snags per acre for their food and nesting values.

(5) Trees with vines (i.e., berry producers) should be encouraged.

To illustrate this, poison ivy and bittersweet are good wildlife foods. Poison ivy is consumed by many species of wildlife, particularly a great variety of birds during the winter when other food sources are scarce. Although poison ivy can be a nuisance to man because it causes skin irritations, it is a valuable wildlife food source. Designated and regularly used trails should be kept clear of this plant to minimize contact, but should be left undisturbed in less traveled areas.

Bittersweet produces brightly colored fruit capsules that are eaten by several species of wildlife. This species is not considered a nuisance plant,

but an importnat wildlife food. Table 1 lists wildlife species utilizing poison ivy and bittersweet.

TABLE 1.

WILDLIFE SPECIES UTILIZING POISON IVY AND BITTERSWEET

POISON IVY

Upland Gamebirds

Ruffed Grouse
Turkey
Quail
Ring-necked Pheasant

Songbirds

Yellow-bellied Sapsucker
Fox Sparrow
White-throated Sparrow
Brown Trasher
Tufted Titmouse
White-eyed Vireo
Mrytle Warbler
Carolina Wren
Downy Woodpecker

Songbirds (cont)

Red-bellied Woodpecker
Hairy Woodpecker
Pileated Woodpecker

Mammals

Black Bear
Muskrat
White-tailed Deer
Cottontail Rabbit
Mice (various species')
Gray Squirrel

BITTERSWEET

Upland Gamebirds	Songbirds	Mammals
Ruffed Grouse	Eastern Bluebird	Cottontail Rabbit
Ring-necked Pheasant	Robin	Gray Squirrel
Quail		White-tailed Deer
Turkey		

Specific Upland Forest Guidelines (continued)

(6) Exceptionally tall trees, utilized by raptors as perching and nesting sites, should be encouraged.

(7) Aspen clumps and apple trees should be released from overcrowding competition.

(8) Planting of white pine seedlings within openings and as underplantings to increase the amount and distribution of conifer cover.

(9) Early successional stage vegetation which is essential to many species of wildlife is limited in Connecticut. Where possible, this habitat type (i.e., agricultural fields, pasture, grass-legume plots, native reverting fields) should be encouraged.

(10) Fields should be cut every one to three years to maintain early successional stage vegetation. Cutting should be scheduled on a staggered basis and not prior to July 1st to avoid disturbing nesting birds. A 15-foot wide border between fields and forestland should be established and maintained on a staggered basis every three to five years after July 1st. This 15-foot zone provides an additional edge component to the site.

(11) Placement of bluebird boxes along field edges.

It should be recognized that for optimum wildlife habitat potential, a variety of successional stage vegetation must be encouraged. Proper maintenance of openings and field borders must be conducted. If neglected, native vegetation will progress to less desirable stages, lowering the wildlife potential on the area.

Wetland Wildlife Management Guidelines

(1) Leave buffer strips (i.e., 100 feet) of natural vegetation along wetland areas to help filter and trap silt and sediments.

(2) Placement of three wood duck boxes on the scrub/shrub wetland. Although broods were observed and brood-rearing habitat is excellent, nest boxes probably would increase production. The other waterbodies do not provide excellent brood habitat; however, they could serve as nesting sites if boxes were installed. Broods could later travel to desirable habitat.

(3) Although Canada geese are usually aesthetically pleasing, they have become a serious nuisance problem in Fairfield County. If problems exist or develop, consider these suggestions:

a. Create undesirable edge habitat around ponds (i.e., abrupt drop off, no grass zone, gravel or chips).

b. Fencing of ponds.

c. Educate local residents on nuisance problems to discourage feeding.

d. Do not create and/or maintain islands within ponds. These often serve as nesting sites.

e. Plant vegetation other than grass which will be aesthetically and environmentally acceptable (i.e., shrubs, pachysandra, honeysuckle, ground juniper, Virginia creeper).

This wildlife management guideline is specific to nuisance Canada geese problems if they presently exist or ever develop. They are several alternative ground cover types undesireable to geese. This is not intended to be a comprehensive listing of ground cover species. Japanese honeysuckle and Virginia creeper have excellent wildlife management values, and in most cases, do not present a real threat to the health of forest trees. Honeysuckle is an excellent cover and food for birds and cottontail rabbits, especially during critical winter months. It also helps in controlling soil erosion and is aesthetically pleasing. The fruits of the Virginia creeper are important fall and winter food for wildlife. The berries ripen in the fall, but many cling onto the vines until late winter.

Table 2 lists wildlife species utilizing Japanese honeysuckle and Virginia creeper.

TABLE 2.

WILDLIFE SPECIES UTILIZING JAPANESE HONEYSUCKLE
AND VIRGINIA CREEPER

JAPANESE HONEYSUCKLE

Upland Gamebirds	Songbirds	Mammals
Quail	Eastern Bluebird	Cottontail Rabbit
Turkey	Purple Finch	White-tailed Deer
	American Goldfinch	
	Hummingbirds (various)	
	Dark-eyed Junco	
	Robin	
	White-throated Sparrow	
	Hermit Thrush	

VIRGINIA CREEPER

Songbirds	Songbirds (continued)	Mammals
Eastern Bluebird	Yellow-bellied Sapsucker	Red Fox
Fox Sparrow	Tufted Titmouse	Cottontail Rabbit
Starling	Red-eyed Vireo	White-tailed Deer
Tree Swallow	Robin	
Hermit Thrush	Black-capped Chickadee	
Olive-backed Thrush	Crow	
Wood Thrush	Common Flicker	
Veery	Mockingbird	
White-breasted Nuthatch	Downy Woodpecker	
Pileated Woodpecker	Red-bellied Woodpecker	
Gray Catbird		

Wetland Wildlife Management Guidelines (continued)

(4) Wetland forests should be managed as per forestland guidelines.

(5) The mixture of well-vegetated pond edges along withareas void of vegetation should be maintained. Sandy, rocky areas are valuable to shorebirds such as killdeer, sanderlings, and sandpipers while thickly vegetated areas are utilized by red-winged blackbirds, flycatchers, warblers, and numerous other passerines.

(6) Encourage landscaping with natural concepts. Avoiding lawns and chemical applications will lessen acreage of lossed habitat and possible oper water weed problems.

ENVIRONMENTAL EDUCATION CONSIDERATIONS

As previously mentioned, the study area exhibits characteristics ideal for environmental education opportunities. The following describes environmental education activities as related to wildlife resources utilizing the study area.

(1) A well-marked trail system should be established along with an accompanying informational pamphlet. This will allow interested individuals, not just organized groups to have an educational opportunity. If wildlife management practices are conducted (i.e., openings, plantings, bluebird boxes) they should be discussed. The major wildlife topic to emphasize should be vegetation types/succession and its value to wildlife.

(2) Expand the trail system to include the scrub/shrub wetland, open fields, and other sites representative of all the wildlife habitat types within the study area.

(3) Habitat development projects could be used to provide excellent hands on experience:

   a. Construct and install wood duck and bluebird boxes along with cataloging yearly nest box results.

   b. Conduct various studies to document wildlife diversity and abundance by habitat types (i.e., bird transects, small mammal live trapping, amphibian and reptile live trapping, vegetation transects, and photographic plots).

   c. Have youth groups do some aspen/apple releases, conifer plantings, brush piles, etc.

Since Connecticut is a densely developed and growing state available wildlife habitat continues to decline. It is therefore critical to maintain and/or enhance existing wildlife habitat in order to protect indigenous wildlife species. The guidelines discussed above will help maintain a well diversified wildlife resource within the study area.

For any further assistance regarding overall guidelines or species specific management considerations, please contact the DEP - Western District Office at 485-0226.

FISHERY RESOURCES

The diversity of fish species found in the north and south ponds, the scrub/shrub wetland, and Mill River indicate a healthy and reasonably, balanced fishery. The aquatic resource is dominated by warm-water species. It appears from the finfish survey data that a healthy population of "panfish" (i.e., bluegill sunfish, pumkinseed sunfish, crapple, yellow perch, white perch, and brown bullhead) exists in the north and south ponds. Fortunately, there also appears to be a good population of predatory fish namely, largemouth bass and chain pickerel. Golden shiners, young-of-the-year alewife and panfish should provide a stable forage base for the fishery. The fact that several different age classes of each species of fish were observed during the fisheries survey indicates that the fish are successfully reproducing (Appendix D). Presently, no "stunting" of panfish is occurring based on the size range of the sampled species. "Stunting" is a phenomenon that usually occurs in panfish populations in small ponds. It is an indicator of an unbalanced fish population, most often associated with a low ratio of predator to prey species. The lack of stunting of the panfish populations may be attributed to the consistant taking or harvesting of fish species such as largemouth bass, perch, and chain pickerel.

The westward swing in Mill River caused by the breached Perry's Mill Dam provides important shallow riffle fish habitat. The small fish, clam, crayfish, and other aquatic populations supported here may be a significant

factor in the larger fish populations utilizing the study area. The clay-bar or reef near the lower pond also provides habitat and cover. Members of the Mill River Wetlands Committee have observed fish nests on top of this reef, presumably largemouth bass nests because of the presence of large stones. This feature also serves to protect overwintering species from bottom scour in winter and spring thaw floods.

Fishing access to the north and south ponds is good for both shore and cartop boat fishermen. A good ratio of shallow to deep water areas exists and some small patches of aquatic weeds were also observed.

It is the opinion of the Team's Fishery Biologist that there presently is a scarcity of fish attracting cover (i.e., large boulders, weed beds, stumps, brush piles) in the north pond. For this reason it is suggested that some sort of fish-attracting devices be added to this pond. Fish attracting devices or artificial reefs have proved to be very effective for enhancing small pond fisheries by increasing the amount of suitable habitat for such species as largemouth bass, sunfish, and yellow perch. These devices can be easily and inexpensively made from a variety of materials such as old brush, Christmas trees, or tires. The materials are tied together, cemented at the base, and sunk at various locations (both deep and shallow) by either placing them on the ice shortly before ice-out or with the aid of a boat. They can be marked with small floats to enable fishermen to more easily find them or simply left unmarked. The devices have been shown to work quite well by congregating both fish and fishermen to a specific site. Labor to build the artificial reefs could possibly be supplied from youth groups such as the Boy Scouts, Girl Scouts or other organizations. The DEP Western District Fisheries staff could provide some technical assistance in the form of helping with material selection, size and placement of devices, and best time of year to install them.

A potential drawback to fish-attracting devices is that fast flowing flood waters may move them to undesireable areas. Cement-anchored brush and the like would be redeposited as easily as some of the naturally-occurring sunken debris and boulders. More expensive and heavier fish-attracting materials can be used, however to minimize this potential problem.

A rather large, aquatic weed patch (i.e., coontail) was observed along the southwestern edge of the south pond. Weed beds provide diversity of habitat and are desirable in a warm-water fishery. However, when extensive areas of a pond become heavily infested with aquatic weeds, a less than optimum balance of the fish populations can develop. Maintaining open patches in large weed beds such as these enables predatory species to prey more efficiently on forage fish and thus exert some control over their populations. Controlling weed growth can also help influence the fish populations by enhancing angling opportunities. Open patches can be maintained by installing materials which prohibit weed growth. Two such products are Dartex and Aquascreen. These materials can be laid over the desired area during any time of year and prohibit weed growth by preventing sunlight from reaching bottom pond sediments.

The Mill Hollow Park section of the study area provides very good public access to the stretch of the Mill River. The river in this area consists primarily of short, shallow riffles and pools. The major source of habitat providing cover for fish is comprised of undercut banks and root systems, and large boulders or stones in the water. The existing overstory of hardwoods provides shade during times of year when solar heating could be detrimental to stream-dwelling fishes. This area of the river is a good fisheries resource during the spring run of white perch, and it presently provides good habitat diversity in the study area. The river also oxygenates the water as it flows from the north to the south pond.

The water quality is good and indicates there is potential for a possible put-and-take trout fisheries in both ponds during the spring season. However, the data was apparently collected during the spring (May 1984) when water quality is usually at its best. If trout would be able to survive during the summer is questionable due to the usually lower water quality at that time. However, the stocking of trout tends to attract larger numbers of anglers to an area. This can potentially lead to over-utilization of a small area, causing potential environmental impact and user conflicts. A possible "trade-off" to trout stocking which the Conservation Commission might wish to consider would be to enhance the white perch population (their spawning and migration takes place in early spring) and increase public knowledge of this resource.

Lastly, opening access to the scrub/shrub wetland to the north and south ponds might enhance the fishery of the site. The scrub/shrub wetland appears to have an abundance of woody debris and suitable spawning sites which are presently not being fully utilized. Since the only apparent limiting factor in both ponds is the amount of suitable spawning habitat, allowing fish free access between the ponds and scrub/shrub wetland should increase the overall fishery. Connecting the two systems may impact the water level of the scrub/shrub wetland. This is not to suggest that there is a need to connect these two ecosystems. Rather, it is yet another management option available to the town to improve the fishery resource. It is up to town officials to determine what resources will receive management priority or preference.

WATER QUALITY CONSIDERATIONS

Existing Water Quality

Based on the water quality information provided to the ERT by the town, it is apparent that the north and south ponds are moderately shallow waterbodies that support warm-water fisheries (finfish information verifies this). Dissolved oxygen (DO) and temperature profiles suggest that both ponds should not stratify and have sufficient DO to support fish life (Appendix E). It is suggested that additional profile studies be conducted during the summer to verify if stratification occurs and if there are any DO depletions.

Biologically, the north and south ponds appear to be experiencing some eutrophic conditions in the form of aquatic weed growth. Although the weed growth appears to be natural, it does not appear to be aesthetically unpleasing or undesireable since the ponds support recreational activities such as swimming and fishing. Phytoplankton data and additional phosphorus data (i.e., more sensitive testing) should help define the overall trophic condition of the ponds. It may also indicate what impact the drainage basin is having on the ponds as related to nutrient input.

The Environmental Value of the Mill River Corridor

The field review of the study area indicated that its present state has a myriad of environmental settings in an area that is surrounded by a large amount of development. Existing trails adjacent to Mill River provide access to view and appreciate the river corridor and other natural settings. It is suggested that efforts be continued to develop these natural settings along the river corridor with educational "tools" (i.e., taxonomy), directed trails, and regulated access points.

Streamflow Characteristics of Mill River

It is suggested that the USGS-Hartford office be contacted for this assessment. It is also suggested that the DEP-Water Resources Unit that handles dams be contacted for their input concerning the dam repair and flooding. The field review indicated the need for streamflow modification because of the flooding and scour conditions. It should be acknowledged that, in general, the riffle habitat of the Mill River does support a diverse community of organisms worthy of environmental educational purposes.

Guidelines to Stabilize Riverbank Erosion and Sedimentation

It is suggested that the USDA-Soil Conservation Service be contacted for this assessment. The field review indicated the need for erosion control on Mill River south of the breached dam because of scour and deposition into the south pond as well as the outflow area of this pond. It is important to implement a stabilization and sediment control program in order to keep both ponds from filling in or eutrophying unnaturally (See Appendix F for Streambank Stabilization Techniques).

River Management Alternatives

The following river management alternatives are suggested:

(1) The site could continue to be maintained as a natural open space area with limited or passive use for fishing and swimming (i.e., if the insurance liability permits this usage). An expansion into an active program would require a tremendous financial output to develop access to the ponds, fish stocking programs, aquatic weed control, and most importantly, police supervision.

(2) Erosion and flood control procedures should be implemented to stabilize the outflow of the north and south ponds. Care should be taken when re-establishing the outflow channel to prevent creating a flooding problem for the converted Mill building, a private residence.

(3) Emphasis on educational programs with nature walks should continue to be promoted and developed for a wide range of usage such as laymen to higher learning. The ponds and Mill River appear to offer a wide range of ecological information.

(4) As a start, expansion of the parking area at Bronson Road should help promote the educational aspects of the site.

(5) The scrub/shrub wetland may be developed in the same educational ways as the other wetlands in the study area.

RECREATIONAL PLANNING CONSIDERATIONS

RECREATIONAL PLANNING CONSIDERATIONS

Introduction

The Perry's Mill Pond open space tract at the present time supports many forms of recreational activities. According to a Fairfield Conservation Commission report entitled, Open Space: Planning Inventory Report: Management Goals, Objectives, Uses and Support Activities, these recreational activities include ice skating, camping, motorbiking, fishing, trapping, swimming, birdwatching, canoeing, picnicing, tubing, and occasional hunting. Several of the activities are not sanctioned by the town nor are they compatible with each other.

Most of the aforementioned active-type recreational activities occur in the area north of Mill Hill Road. The area south of the road (i.e., Mill Hollow Park) is used for hiking and other passive forms of recreation.

A portion of the study area serves as an outdoor laboratory for the Fairfield Elementary School system. The environmental education activities are sponsored by the Mill River Wetlands Committee. Students in both public and parochial schools are afforded the opportunity to use the area for outdoor environmental programs.

Description of Recreational Resource Base

The study area contains a wide variety of physical features such as floodplain forest, scrub/shrub wetlands, open meadows, Mill River, ponds, and deltas. Observations made during the field review indicated the following problem areas:

(1) Lack of adequate parking.

(2) Poor trail system and lack of adequate trail markings.

(3) Misuse of established trails by motorbikes.

(4) Litter in some sections of the study area.

Some of positive features of the study area are the north and south ponds. From a visual inspection and existing water quality data, the quality of the water seems to be good. This, of course should be further qualified by a water sampling program. In this way, any future recreational uses of the pond(s) can be regulated as to the water quality.

The configurations of Mill River also provides additional recreational opportunities. The river just south from the south pond winds through the woods providing exceptional recreational amenities.

Finally, there is an adequate parking facility off Sturges Road Bridge for parking and access to the area without adversely impacting the surrounding environment.

Recreational Management Considerations

Parking Considerations

Additional parking and trail system improvements are the most important features needing management. As discussed during the field review, it may be possible to close Sturges Road Bridge from the intersection of Sturges and Bronson Road at the north down to the intersection of Sturges and Terrace Road before you turn to the east and go over the Mill River. This would provide all

of the parking necessary for automobiles, buses, and bicycles. Access should be provided for emergency vehicles if they have to pass through the study area. Traffic can be eliminated from the road with the use of either bollards, collapsible bollards, or a gate. The elimination of this road should have little to no impact on traffic at all. If by chance this road cannot be utilized for parking, then the town would have to construct a parking lot for at least 12 cars and three buses on the interior of the site. There is more than adequate space for such a lot.

Trails

Althouth existing woodlands provides a good buffer for trail systems along the roads, the trail system lacks definition and direction for visitors unfamiliar with the study area. A defined trail system could be established through the woods, marsh, around the ponds, and along the river. The trails should have a minimum width of eight feet, and constructed of stonedust or compacted gravel. It is encouraged that the trails not be paved since it would decrease the aesthetic value of the study area. A very important factor not to omit is trail markings with a corresponding key map. Several areas along the trail, a foot bridge will be required. It is advised that the bridges be constructed of wood, and built according to standards of the Appalachian Trail Councils trail book.

Handicap Access

Handicap access is presently not provided on site. It is encouraged that access to the study area be developed for physically challenged people. The topography is such that this could be accomplished with little changes to trail direction, construction, or impact on other users. The stonedust trail makes

for a good handicap trail. In wet areas, a wooden catwalk can be utilized. Wooden catwalks should be at least 48 inches wide.

Other Management Considerations

Due to the fragility of existing resources and the limited geographic extent of the site, it is advised that all motorized recreation be restricted from the study area. These forms of recreation are incompatible with existing nature trails and other passive uses as well as the River Lab environmental education program conducted by the Mill River Wetlands Committee.

Since picnic tables and fireplaces would disrupt the natural setting of existing forest or wetland communities, it is suggested that they be minimized or restricted from the Perry's Mill Pond open space tracts. The introduction of either picnic tables and especially fireplaces will only invite people to use the site after it is officially closed to public use. This could potentially lead to increased vandalism, public disturbance, and litter.

Mill Hollow Park shares similar natural characteristics with the Perry's Mill Pond open space tract, although the forest is not as dense or extensive. Additionally, a wooden catwalk trail encircles the wetland area found in the park. All management considerations for the Perry's Mill Pond open space tract stand true for Mill Hollow Park as well. Although the existing catwalk is 24 inches at the maximum, it is suggested that it be widened to a minimum of 48 inches.

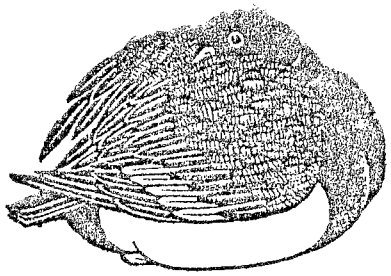
LITERATURE CITED

Beals, W. and P. Westover. 1971. The Pine Creek and Mill River Watersheds, Fairfield, Connecticut. Fairfield Conservation Commission. 55 pp.

Dansera, P. and F. Segadas-Vianna. 1952. Ecological Study of the Peat Bogs of North America. Canadian Journal of Botany 30:490-520.

Steinke, T.J. 1980. Perry Bog Restoration, Fairfield, Connecticut. Fairfield Conservation Commission. 28 pp.

APPENDICES



APPENDIX A

LIST OF PLANT SPECIES

TREES OF PERRY'S MILL POND TRACTS

Hemlock	Tsuga canadensis
Red Cedar	Juniperus virginiana
Weeping Willow	Salix babylonica
Cottonwood	Populus deltoides
Shagbark Hickory	Carya ovaha
American Elm	Ulmus americana
Gray Birch	Betula populifolia
Black Birch	Betula lenta
American Beech	Fagus grandifolia
White Oak	Quercus alba
Red Oak	Quercus borealis
Black Oak	Quercus velutina
Chestnut Oak	Quercus montana
Pin Oak	Quercus palustris
Tulip Poplar	Liriodendron tulipifera
Sassafras	Sassafras albidum
Sycamore	Platanus Occidentalis
Black Cherry	Prunis serotina
Chokecherry	Prunis virginiana
Black Locust	Robinia pseudoacacia
Honey Locust	Gleditsia triacanthus
Red Maple	Acer rubram
Sugar Maple	Acer saccharum
Norway Maple	Acer platanoides
Flowering Dogwwod	Cornus florida
White Ash	Fraximus americana
American Hornbeam	Carpinus carolinana
Tree-of-Heaven	Ailanthus altissima
Smooth Sumac	Rhus glabea
Staghorn Sumac	Rhus typhina

SHRUBS OF PERRY'S MILL POND TRACTS

Red-Osier Dogwood	Cornus stolonifera
Red Raspberry	Rubus idacus strigosus
Black Raspberry	Rubus occidentalis
Poison Ivy	Rhus radicans
Mountain Laurel	Kalmia latifolia
High Bush Blueberry	Vaccinium corymbosum
Arrow Wood	Viburnum dentatum
Maple-leaved Viburnum	Viburnum acerifolium
Button Bush	Cephalanthus occidentalis
Honeysuckle	Lonicera canadensis
American Yew	Taxus canadensis
Tree Club Moss	Hycopodium obscurum
Ground Cedar	Lycopodium complanatum
Partridge Berry	Mitchella repens
Grape	Vitis aestivalis
Bittersweet	Celastrus scandens

Nightshade	Solanum dulcamara
Multiflora Rose	Rosa multiflora
Witch Hazel	Hamamelis virginiana
Spicebush	Lendera benzoin
Scrub Oak	Quercus ilicifolia
Alder	Alnus crispa

HERBACEAOUS VEGETATION

Aster	Aster spp.
Cinquefoil	Potentilla spp.
Christmas Fern	Polystichum spp.
Sensitive Fern	Onoclea sensibilis
Goldenrod	Solidago spp.
Foxtail (Grass)	Alopecurus spp.
Cordgrass	Spartina spp.
Common Reed	Phragmites communis
Iris	Iris spp.
Jack-in-the-Pulpit	Arisaema atrorubens
Lady's Slipper	Cyperidium acaule
Milkweed	Ascepias spp.
Mullien	Verbascum thapsus
Queen Anne's Lace	Daucus caroba
Sedge	Carex spp.
Skunk Cabbage	Symplocarpus foetidus
Thistle	Cirsium spp.
Touch-me-not	Impatiens spp.
Vetch	Vieia spp.
Virginia Creeper	Parthenocissus quinauefolia

AQUATIC VEGETATION

Arrow Arum	Peltandra virginica
Water Weed	Elodea canadensis
Broad-leaved Cattail	Typha latifolia
Narrow-leaved Cattail	Typha angustifolia
Lesser Duckweed	Lemna minor
Pickerel Weed	Pontederia spp.
Bulrush	Scirpus spp.
Waterlilly	Nymphaea spp.
Water Milfoil	Myriophyllum spp.

APPENDIX B

NATIONAL WETLANDS INVENTORY INFORMATION

National Wetlands Inventory
U.S. Fish & Wildlife Service
1:100,000 Map Narrative Report
- Hartford SW -

Introduction

In 1974, the U.S. Fish & Wildlife Service directed its Office of Biological Sciences to conduct an inventory of the Nation's wetlands. As part of this overall objective, an effort began in October 1980 to delineate and classify wetlands within the boundaries of the State of Connecticut. The classification system used was based upon "Classification of Wetlands and Deepwater Habitats of the United States" (Cowardin et al. 1979).

Wetland maps (1:100,000) and wetland overlay maps (1:24,000) are produced at the National Wetland Inventory Headquarters in St. Petersburg, Florida. Final maps of Connecticut's wetlands are available at the Natural Resources Center, Department of Environmental Protection, 165 Capitol Avenue, Hartford, CT 06115. An integral part of the wetlands inventory is a narrative report for each 1:100,000 map. The following report provides both basic and specific information to aid the user in understanding the general area contained within the Hartford SW quadrangle. Included in this report are representative descriptions of wetland habitats arranged according to mapping units.

Map Preparation

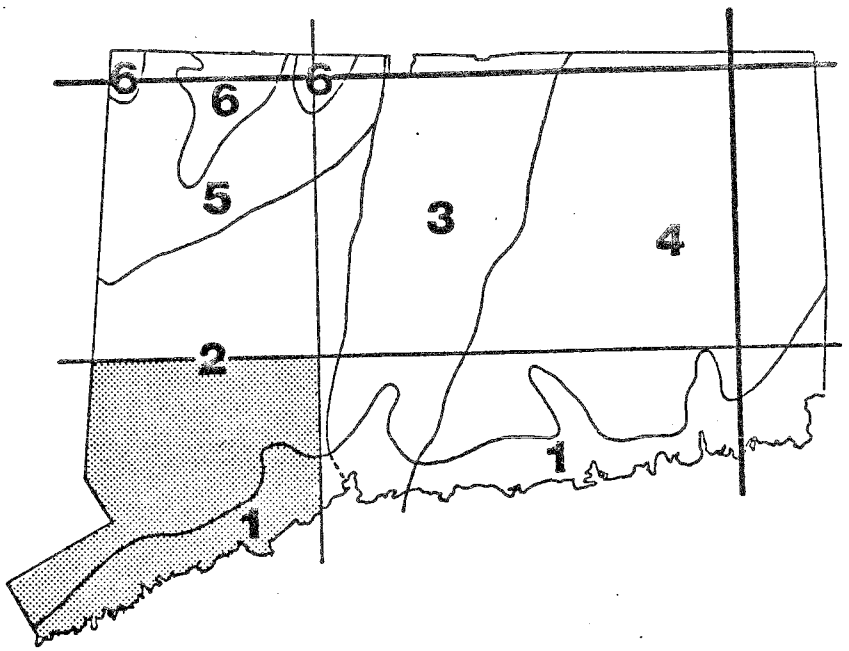
Contractor for this project was the Natural Resources Center, Department of Environmental Protection, 165 Capitol Avenue, Hartford, CT 06115. Aerial photographic interpretation and preparation of this report were by Nels E. Barrett and Kenneth J. Metzler. NWI coordinators for this project were Ralph E. Tiner, Jr. and John Organ, National Wetlands Inventory, U.S. Fish & Wildlife Service, One Gateway Center, Suite 700, Newton Corner, MA 02158.

Wetland delineation and classification for Hartford SW was done upon black and white panchromatic aerial diapositive transparencies. The imagery used was U.S.G.S. high altitude quad-centered aerial photography flown on April 3, 1980 and April 7, 1981 at the scale of 1:80,000. Ground-truthing selected sites was conducted during the autumn of 1980 and 1981 and during the spring of 1982.

User Caution

Map users are cautioned that mapping with aerial photographs has limitations. Through stereoscopic examination of the high altitude photographs, wetlands are identified and classified on the basis of tone, texture, pattern, size, local ecology, and cultural patterns. Aerial photographs reflect conditions during the year and season when they were taken. In addition, resolution limitations inherent in high altitude imagery can cause problems in accurately recognizing ground conditions. For these reasons, wetlands smaller than three acres were not consistently mapped and many areas with non-persistent emergent or aquatic vegetation were classified as open water.

Figure 1. Major physiographic regions of Connecticut (Modified from Dowhan and Craig, 1976). The shaded area indicates the location of Hartford SW. An index map to the 7.5' quadrangles in Connecticut is in Appendix A.

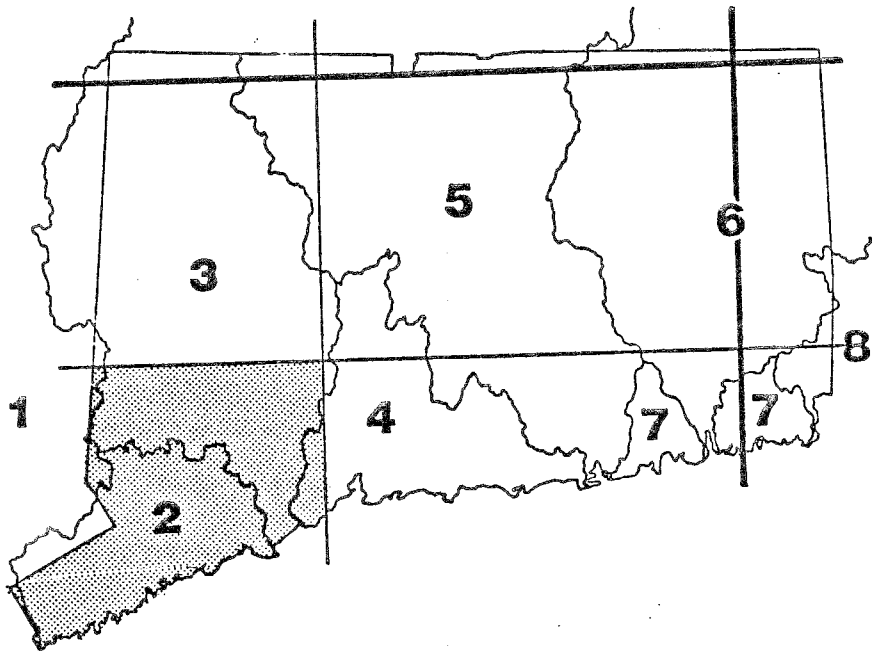


1. Coastal Region
2. Western Hills
3. Central Valley
4. Eastern Hills
5. Western Uplands
6. Western Highlands

Hydrologic Mapping Units

Hydrologic mapping units are part of an effort by the U.S. Geological Survey to provide a series of uniform, nationally consistent maps which accurately delineate hydrographic boundaries for Federal and State water agencies. Units are designated by an eight digit number linked to a computer file (Catalogue of Information on Water Data) which contains information on water data activities (U.S.G.S. 1979). All hydrologic mapping units in Hartford SW, except a small area on the western border, are in the New England Region (01). The northern and central portion of Hartford SW is drained by 01100005 or the Housatonic Major Basin (McElroy 1981), the southeastern portion is drained by 01100004, or the South Central Coast Major Basin, and the southwest portion is drained by 01100006 or the Southwest Coast Major Basin. A small area on the western border of Connecticut is in the Mid-Atlantic Region and is drained by 02030101 or the Hudson Major Basin.

Figure 2. Major drainage basins of Connecticut (McElroy, 1981). The shaded and heavy ruled areas refer to Appendix A.



1. Hudson
2. Southwest Coast
3. Housatonic
4. South Central Coast
5. Connecticut
6. Thames
7. Southeast Coast
8. Pawcatuck

Geology & Topography

The geology and topography of Hartford SW (Flint 1930) shows considerable variability throughout its area. Forces of many kind have contributed to its present structure. During the Pleistocene Epoch, the Wisconsin glacier covered all of Hartford SW. When the glacier melted, part of the debris was left in place to form the glacial till soils on the uplands and part was carried by glacial meltwater and deposited in stratified beds in the valleys and lowlands. Although changes in the topography of the upland areas were relatively small, the vast amounts of materials deposited by the meltwaters made the valleys much flatter than they were before. Along the coast, sea level has gradually risen since the last glaciation, with the recent rate of submergence for the Connecticut coast approximately 2.6 mm/yr. from 1940-1972 (Hicks and Crosby 1974). In general, the depth of unconsolidated materials in the uplands is much less than 10 feet, whereas the depth of terrace deposits may exceed 100 feet.

Hartford SW can be divided into two general physiographic provinces. Each province has a distinct bedrock geology with the resulting topography affecting not only the nature and development of soils, but the types and distribution of wetlands, their vegetation, and their current land use.

The bedrock of the Western Hills is primarily metamorphic; composed of Paleozoic gneisses and schists, complexly folded into north trending belts. Metamorphosed limestone (marble) valleys, in north trending belts, occur in the northwestern portion of Hartford SW along the Still River and in the general vicinity of Ridgefield. In addition, Triassic sedimentary and igneous rocks (similar to those in the Central Valley Region), underlie the Pomperaug Valley. The topography of the Western Hills is generally between 250 feet to 750 feet; the maximum elevation is almost 1,000 feet. The greatest topographic relief 400-500 feet is adjacent to the marble valleys and along the Housatonic and Naugatuck River Valleys. Wetlands in the Western Hills occur primarily on glacial till and in depressions filled with peats and mucks. Wetlands on terrace soils and on floodplains are restricted to the larger rivers in Hartford SW.

Contiguous with the Western Hills are the Coastlands. This seaboard region is generally lying within five to seven miles of Long Island Sound and is characterized by nearly level to rolling nearshore lands, and by protrusions of rugged and rocky upland extending to the coastline. Wetlands in this province, in addition to those described for the Western Hills, include extensive tidal marshes and flats, estuaries, wet sandy beaches, and rocky shores.

Soils

Soils are an important component of wetlands. The single feature that most wetlands share is soil or substrate that is at least periodically saturated with or covered by water (Cowardin et al. 1979). The National Wetland Inventory recognizes the relationships between soils, vegetation, and wetlands and in cooperation with the Soil Conservation Service is preparing a list of hydric soils to accompany the NWI classification system.

Soils in Connecticut have formed in a humid, temperate climate on a variety of parent materials. Soils are of the Wisconsin age or more recent and can be organized into four natural groups; soils formed on glacial till, soils formed on terraces, soils formed on floodplains, and organic soils in basins and depressions.

Wetland soils derived from glacial till occur on lower slopes and in valleys on bedrock controlled hills or in concavities on slopes and along the base of streamlined hills with compact basal till. Soils are generally stony, have little organic matter accumulation and are saturated or have surface water for part of the growing season. In most cases, these soils have formed under a hardwood forest composed primarily of Red Maple, American Elm, Yellow Birch, and a variety of oaks. Often the water table varies considerably during the growing season. In most of Hartford SW, these soils are derived primarily from crystalline rocks (schists, granite, gneiss), whereas in the Pomperaug Valley, the tills are derived from red sandstones, shales, and basalts. In the marble valleys, the tills are derived from the underlying limestone, with a pH often higher than any other soil in the state.

Terrace soils occur primarily in the lower portions of large river and stream valleys. They are underlain by stratified sand and gravel deposited during glacial times. In most places a few inches to three feet of loamy or fine sandy material covers the older, coarser water deposited material. These soils generally have little organic matter development, and can have a highly fluctuating water table. Terrace wetland soils have formed primarily under hardwood forest, but since these soils can often be quite acid, they can support various concentrations of White Pine and Hemlock.

Floodplain soils occur on lowlying, nearly level areas in stream and river valleys. They are formed in loamy deposits several inches to a few feet thick overlying layers of sand and gravel. These soils are subject to seasonal inundation with the lower, more poorly drained soils flooded most frequently. Ponding occurs in some areas and surface water remains well into the growing season. Poorly drained floodplain soils have developed under hardwood forest, primarily ash, maple, and elm in most areas. However, sloughs and depressions that have surface water throughout much of the growing season support marsh vegetation. Floodplain wetlands exhibits a wide range in moisture regimes that reflect changes in topographic position and drainage. Most floodplain soils were mapped as upland in this classification.

Inland organic soils occur in depressions and basins where surface organic deposits are five or more feet thick. These soils are saturated most of the time and often have surface water throughout the winter and spring. Inland trees. Windthrows commonly occur, and result in the irregular microtopography found in these wetlands.

Coastal organic soil or coastal peat occurs in tidal marshes in protected areas such as coves, embayments, or behind barrier beaches where deposition of marine sediments can occur. Coastal peat marshes have developed since the last glaciation, along with the gradual rise in sea level. Peat marshes develop under salt tolerant persistant emergent vegetation. The low marsh is regularly inundated twice daily by the tides whereas the high marsh is irregularly flooded during spring or storm tides.

All organic soils are wetlands in Hartford SW.

Climate

The climate of Hartford SW is characterized by its changeableness. Although close to Long Island Sound, the prevailing westerly winds give this region a climate that is influenced by air from the interior of the North American continent. Precipitation, however, comes from warm, moist maritime air swept up from the Caribbean Sea and therefore, Hartford SW is always close to the tracks of storms set off by the interplay of these two air systems. The resulting "weather" is highly unpredictable with great variations from day to day, season to season, and year to year.

In general, the climate of Hartford SW (Brumbach 1965) has large ranges in both diurnal and annual temperature, ample precipitation usually uniformly distributed throughout the year, great variation between the same season in different years, and considerable diversity from place to place. Climatic hazards infrequently occur and include hurricanes, excessive precipitation as rain or snow, droughts of one or more years duration, severe ice storms, and tornadoes.

As in other physical features, the climate of Hartford SW has regional variation and is summarized below (Dowhan & Craig 1976):

	(Western) Coast-lands	(South) Western Hills
Mean average temperature	50.5°F	49.5°F
Average winter temperature	31°F	29.5°F
Monthly mean minimum	23°F	19°F
Mean annual minimum	5°F	-5°F
Snowfall (inches)	30"	40"
Length of frost for season	180 days	160 days
Average summer temperature	71°F	70°F
Monthly mean maximum	83°F	85°F
Average precipitation	43"	45"

Description of the Wetlands

Hartford SW exhibits a variety of wetland types reflective of the irregular topography of the glaciated northeast. Forested swamps are by far the predominant wetland type, with areas of shrubs and emergent vegetation most commonly occurring in transitional situations such as pond borders or as the result of natural or manmade impoundments. In addition, tidal rivers, tidal marshes, tidal flats, and other estuarine features are common. Deep water habitats include the open body of Long Island Sound, bays, river estuaries, and scattered brackish water ponds as well as ponds, lakes, and reservoirs on the upland. Most inland bodies of open water in Hartford SE have been either impounded and/or excavated and have been mapped as such.

In defining our mapping units, we have tried to be as consistant as possible within the limits of the imagery used. However, for all areas mapped, we referred to 1980 1:12,000 black and white aerial photographs to confirm vegetation cover and to determine some wetland bounderies. In addition, considerable field time, both within the framework of this project and that of previous studies, was used in the final determinations. In this respect, we feel that the plant communities and ecological relationships represented by each mapping unit are as accurate as possible without undertaking a detailed field survey. All taxonomy used in this section follows Fernald (1950) for vascular plants and Schneider et al. (1979) for the algae.

The Palustrine System

The majority of wetlands in Hartford SW are in the Palustrine System. The Palustrine System includes all nontidal wetlands dominated by trees, shrubs, persistant emergents, and all such wetlands that occur in tidal areas where salinity is less than 0.5%. It also includes all bodies of open water less than 20 acres. The units are described below:

PFOIA

A forested wetland on river floodplains characterized by brief flooding during the spring but with the water table well below the soil surface during most of the growing season. Red Maple (Acer rubrum) is often the dominant tree, with Green Ash (Fraxinus pensylvanica) and American Elm (Ulmus americana) and Sycamore (Platanus occidentalis) common associates. The shrub layer in these forests is often well developed with Spicebush (Lindera benzoin), Silky Dogwood (Cornus amomum), Elderberry (Sambucus canadensis), and many small trees predominating. The ground cover is often lush with Sensitive Fern (Onoclea sensibilis), Ostrich Fern (Pteretis pensylvanica), Jewelweed (Impatiens capensis), and many grasses and sedges.

PFOIC

A forested wetland on river floodplains characterized by extended periods of flooding early in the vegetative season with surface water absent by the end of the season in most years. Red Maple, Pin Oak (Quercus bicolor), American Elm, and Green Ash predominate, the shrub layer is often well developed, and the ground cover is diverse with Sensitive Fern, False Hellebore (Veratrum viride) White Avens (Geum canadense), Jack-in-the-Pulpit (Arisaema atrorubens), and many others common.

PFOIE

This common wetland type is characterized by a forest canopy often dominated by Red Maple with the soil saturated or with standing water during part of the growing season. This mapping unit can be separated into three general community types not distinguished or separated on the accompanying maps.

The Red Maple - ericaceous shrub forest is characterized by the often dense shrub layer of species such as Highbush blueberry (Vaccinium corymbosum), Swamp Azalia (Rhododendron viscosum), Sweet Pepperbush (Clethra alnifolia), Winterberry (Ilex verticillata), Arrowwood (Viburnum recognitum), and Spicebush (Lindera benzoin). The microtopography is hummocky due to sporadic windthrows, with numerous herbs on the hummocks and an abundance of bryophytes in the depressions. This community is found on both organic soils and wet mineral soils.

The Red Maple - Spicebush forest differs with a dominant shrub cover of Spicebush. This Red Maple forest type occurs primarily along brooks and in swamps with seepage water. Often, Pin Oak (Quercus palustris), Swamp White Oak (Quercus bicolor) and American Elm are common associates. This forest type occurs primarily along brooks and in swamps that receive telluric water from the adjoining upland.

The Red Maple - Tussock Sedge forest is distinguished by a relatively open tree layer of Red Maple and a dominant ground cover of Tussock Sedge (Carex stricta). This wetland type typically occurs on the edges of ponds or lakes with fluctuating water levels, on spring fed slopes with spring flooding, or in areas where the water level has changed through impoundments.

PFO1Et

A wetland forest often dominated by Red Maple with various admixtures of Black Ash (Fraxinus nigra). This wetland type is restricted to the marble valleys of western Connecticut where the soil pH is often close to neutral (pH 6-7). This wetland differs from other deciduous forested swamps in Hartford SW by the abundance of characteristic species such as Sensitive Fern, Northern Buttercup (Ranunculus septentrionalis) and Miterwort (Mitella diphylla).

PFO4E

Coniferous forested wetlands are sporadically distributed in Hartford SW. These forests are distinguished primarily by a dense forest canopy of evergreen trees, a variable shrub layer, a sparse ground cover of few herbaceous species, and often a carpet of numerous bryophytes. As in other seasonally saturated wetlands, standing water can be present during part of the year, although the water table is generally below the soil surface during the summer months.

Atlantic White Cedar swamps are the predominant coniferous wetland in Hartford SW and are distinguished by a forest canopy dominated by Atlantic White Cedar (Chamaecyparis thyoides) with various amounts of Red Maple. Often, White Pine (Pinus strobus) and Black Gum (Nyssa sylvatica) are common associates. The shrub layer is variable, consisting of Winterberry, Highbush Blueberry, Sweet Pepperbush and often dense thickets of Mountain Laurel (Kalmia latifolia) and/or Great Laurel (Rhododendron maximum). Herbaceous vegetation is generally sparse

with Massachusetts Fern (Dryopteris simulata), Cinnamon Fern (Osmunda cinnamonmea), Carex folliculata, Sundew (Drosera rotundifolia), Star Flower (Trientalis borealis) and Partridgeberry (Mitchella repens) characteristic. Hummocks around the bases of the trees and much of the surface between the trees are often blanketed with numerous mosses.

PFO1/4E

A wetland forest with at least a 30% mixture of evergreen and/or deciduous trees. This mixed wetland forest includes Red Maple mixed with White Pine, Hemlock (Tsuga canadensis), or Atlantic White Cedar. As in other seasonally saturated wetlands, the soil is either saturated or has standing water for part of the growing season.

PFO1/SS1E

An open forested wetland with at least 30% canopy coverage of shrubs. This mapping unit was used primarily for shrub thickets with an open tree layer of Red Maple. These areas have a dominant shrub cover of Sweet Pepperbush, Swamp Azalea, and Highbush Blueberry, although Alders (Alnus spp.) and Willows (Salix spp.) occur in some areas. The soil surface in these wetlands is generally very hummocky with standing water in the depressions during the early portion of the growing season.

PFO4/SS1E

A wetland similar to the one previously described but with an open forest canopy of coniferous species such as Atlantic White Cedar or White Pine.

PFO5/SS1E

A seasonally saturated deciduous shrub wetland with a canopy of dead trees. In general, the presence of dead trees indicates a recent change in the water level.

PFO5/SS1F

A semi-permanently flooded shrub wetland dominated by Buttonbush (Cephalanthus occidentalis) with a canopy of dead trees. This wetland type is characterized by standing water present well into the growing season, with the soil surface exposed only for short periods during drought.

PFO1/EME

A seasonally saturated wetland with at least a 30% mixture of deciduous trees and emergent vegetation. Primarily this wetland is distinguished by scattered Red Maple, Ash, or Elm with a ground cover of numerous grasses, sedges, and other herbaceous plants. Tussock sedge (Carex stricta), Reed Canary Grass (Phalaris arundinacea), and Bluejoint Grass (Calamogrostis canadensis) are common associates.

PFO5/EME

A seasonally saturated emergent wetland with a canopy of dead trees. This wetland type occurs primarily in wetlands that have previously been impounded. The vegetation is very variable with numberous grasses, sedges, forbs, and scattered shrubs.

PFO5/EMF

A semi-permanently flooded emergent wetland with a canopy of dead trees. The vegetation can be variable, dominated by sedges (Carex stricta, C. spp.), Bur-reeds (Sparganium spp.), Cattail (Typha latifolia), Grasses (Phalaris arundinacea, Calamagrostis canadensis), or with a mosaic of several dominant species. Associated plants in this habitat include Marsh Fern (Dryopteris thelypteris), Arrowhead (Sagittaria latifolia), Rattlesnake Grass (Glyceria candensis), Wool-Grass (Scirpus cyperinus), Marsh Rush (Juncus canadensis) and many others. In this wetland type, surface water persists for most of the growing season.

PSS1A

A shrub wetland found primarily on river floodplains. This wetland type is characterized by brief flooding during the spring with the water table well below the soil surface for the rest of the growing season. This wetland is dominated primarily by Alder (Alnus rugosa, A. serrulata), Silky Dogwood (Cornus amomum), Red Maple (Acer rubrum) and a variety of other woody and herbaceous plants.

PSS1/3Ba

A saturated shrub swamp dominated by Highbush Blueberry with admixtures of Leatherleaf (Chamaedaphne calyculata) and Sweet Pepperbush. The substrate is a floating mat of Sphagnum moss that rises and falls with changes in the water table. This wetland type occurs infrequently on the margins of ponds and lakes in Hartford SW.

PSS1E

A seasonally saturated shrub wetland that can be separated into two vegetative types:

Ericaceous shrub thickets occur in undrained basins, on the edge of ponds and lakes, and on wet sand plains. The shrub layer is dominated by Sweet Pepperbush, Swamp Azalea, Highbush Blueberry, Winterberry, or Red Maple. Generally, these thickets are very dense and have an irregular surface of mounds and depressions. On the mounds grow numerous herbaceous plants and in the depressions are many mosses.

The second seasonally saturated shrub wetland has a variable vegetative cover of Alders, Dogwoods (Cornus amomum, C. stolonifera), and/or Willows. This wetland type occurs primarily on the edges of slow moving streams.

PSS1/4E

A seasonally saturated shrub swamp with at least a 30% mixture of evergreen and deciduous shrubs. This mixed shrub swamp includes ericaceous shrubs mixed with Red Maple, White Pine, Atlantic White Cedar or Black Spruce (Picea mariana) less than 20 feet in height. These two types were not separated in this survey.

PSS1F

A semi-permanently flooded shrub wetland dominated by Buttonbush. This wetland is characterized by the presence of standing water well into the growing season with the soil surface exposed only during periods of drought. Associated species include Bur-Reeds, Tussock Sedge, Willows, and numerous aquatic herbs and mosses.

PSS1T

A freshwater tidal shrub wetland dominated primarily by Alder, Swamp Rose (Rosa palustris), Green Ash, False Indigo (Amorpha fruticosa), Arrowwood (Viburnum recognitum), and Red Maple. This wetland is characterized by standing water during high tide with the soil permanently saturated during low tides. This wetland type was mapped primarily along the lower Connecticut River.

PSS3Ba

A saturated dwarf shrub bog dominated by Leatherleaf (Chamaedaphne calyculata) or Cranberry (Vaccinium macrocarpon) with admixtures of Sheep Laurel (Kalmia angustifolia), Huckleberry (Gaylussacia baccata), and Highbush Blueberry. The substrate is a floating mat of Sphagnum moss that rises and falls with changes in the water level. The water table is nearly always constant in this wetland type with surface flooding occurring only in deep depressions and pools. Associate species include small Cranberry (Vaccinium oxycoccus), Pitcher Plant (Sarracenia purpurea), Bog Cotton (Eriophorum virginicum), Beak Rush (Rhynchospora alba), and Sundew (Drosera rotundifolia, D. intermedia).

PSS3/EMBa

A saturated mixed shrub/emergent bog. The dominant vegetation includes Leatherleaf and/or large Cranberry mixed with sedges, shrubs, and numerous emergent plants. In general, these wetlands are primarily abandoned cranberry bogs. Associated species include Three-Way Sedge, Wool-Grass, and Sphagnum mosses.

PSS1/EME

A seasonally saturated wetland with at least a 30% mixture of shrubs and/or emergent plants. This wetland is characterized by surface water present during the spring and a variable vegetative cover. Common vegetation types include Red Maple and/or ericaceous shrubs mixed with sedges, grasses, and numerous herbaceous plants. Associated species include Marsh Fern (Dryopteris thelypteris), Sensitive Fern, Jewelweed, Smartweeds (Polygonum spp.), sedges (Carex spp., Scirpus spp.), Marsh St. Johnswort (Hypericum virginicum) and many others.

PSS1/EMF

A semi-permanently flooded wetland with at least a 30% mixture of shrubs and/or emergent plants. This wetland is characterized by the presence of standing water well into the vegetative season with the soil surface exposed only during periods of drought. Dominant species include Buttonbush, Water Willow, Three-Way Sedge (Dulichium arundinaceum), Wool-Grass, sedges, Arrow Arum (Peltandra virginica), Bullhead Lily (Nuphar variegatum), Pickerel Weed (Pontedaria cordata) and others.

PEMA

An emergent wetland found on floodplains as well as on temporarily flooded mineral soils. This wetland type is distinguished by brief surface flooding during the spring with the water table well below the soil surface for the rest of the growing season. These wetlands have a variable vegetation with grasses, sedges, and herbaceous species such as Joe Pye Weed (Eupatorium spp.) most prevalent.

PEMC

An emergent wetland found on river floodplains characterized by grass species such as Reed Canary Grass, sedges (Carex crinita, Carex spp.), Sensitive Fern, and many others.

PEME

A seasonally saturated emergent wetland with a variable ground cover. This wetland type includes pastures as well as wet grasslands. Common emergents include numerous sedges, grasses, rushes and other forbs.

PEMF

A semi-permanently flooded emergent wetland with a variety of herbaceous species. Primarily, this wetland is characterized by the presence of standing water for most of the growing season. Dominant herbaceous species include Tussock Sedge, Sweet Flag (Acorus calamus), Arrowroot, Arrow Arum (Peltandra virginica), Three-Way Sedge, Rice Cut Grass (Leersia oryzoides), Bur-Reeds (Sparganium spp.), and Smartweeds (Polygonum hydropiperoides, P. punctatum). Wetlands dominated by Water Willow were also assigned this signature.

PEMT

A freshwater emergent tidal wetland characterized by the presence of surface water during high tides with the soil saturated during low tide. The vegetation of these marshes is quite diverse and include River Bulrush (Scirpus fluviatalis), Sweet Flag, Bluejoint Grass, Cattail, Sensitive Fern, Arrowroot, and an endless list of grasses, sedges, and other herbaceous plants.

PEM/ABF

A semi-permanently flooded emergent wetland with at least a 30% mixture of pools with standing water. The vegetation of this wetland is similar to that described as PEMF with floating aquatics such as Water Lily (Nymphaea odorata), Bullhead Lily (Nuphar variegatum), Water-shield (Brasenia schreberi)submerged aquatics (Ceratophyllum demersum, Potamogeton spp. Elodea spp.) and floating aquatics such as Watermeal (Wolffia sp.) or Duckweed (Lemna minor) in the pools. Aquatic beds were not visible on the imagery and mapped only after field checking.

PEM/OWH

Shallow ponds with at least a 30% mixture of Cattail.

PABH

Shallow ponds with floating or submerged aquatic vegetation as described above.

PAB/OWH

A shallow pond with at least a 30% mixture of floating aquatic vegetation and open water.

POWH

A permanent pond that is less than 20 acres in areal extent.

POWHh

An impounded pond less than 20 acres in areal extent.

POWHr

Artificial waste water treatment plant basins.

POWHx

An excavated pond less than 20 acres in areal extent. This unit was mapped only when berms were readily visible on the imagery or in gravel pits.

POWKHr

Artificial basins that receive water through active pumping.

PUBG

A permanent pond that has been temporarily drained down.

PUBGh

A permanent pond that has been temporarily drained down and impoundment was visible on imagery or otherwise known.

The Lacustrine System

Wetlands in the Lacustrine System include all bodies of water greater than 20 acres in areal extent or bodies of water less than 20 acres deeper than two meters or with a bedrock controlled shoreline. Most lacustrine wetlands in Hartford SW have been impounded.

L1OWH

A permanent lake with no visible evidence of impoundment.

L1OWHh

An impounded lake or reservoir.

L2ABH

A shallow portion of a lake with floating emergent vegetation as described in PABH.

L2AB/OWH

A shallow portion of a lake with greater than 30% mixture of floating aquatic vegetation in open water.

The Riverine System

The Riverine System includes all wetlands and deepwater habitats included within a channel that lacks persistent vegetation and have a salinity less than 0.5 parts per thousand (^{0}/oo). This system includes all major rivers and streams in Hartford SW.

R3OWH

Upper perennial rivers and streams that contain permanent fast flowing water. Usually indicated by presence of rapids and a gravelly or rocky bottom.

R2OWH

Lower perennial rivers that contain permanent slow flowing water, low gradient, and often a well-developed floodplain.

R1OWV

Permanent tidal rivers that have salinities less than 0.5^{o}/oo. Only the major tidal rivers were mapped with this signature in Hartford SE.

R1FLN

Regularly flooded tidal flats within the river channel. In general, these areas are very muddy and are devoid of vegetation.

R1EMN

Regularly flooded freshwater tidal flats with a dominant non-persistant vegetation of Wild Rice (Zizania aquatica), Three Square (Scirpus americanus), and Pickerel Weed (Pontederia cordata). Vegetated freshwater tidal flats occur along river margins and in embayments where water velocity and amplitude fluctuate with the tide and the salinity is less than 0.5^{o}/oo.

The Estuarine System

The Estuarine System consists of deepwater tidal habitats and adjacent tidal wetlands that are at least partially open to the ocean. Salinities are by convention greater than 0.5 ^{o}/oo and less than 30 ^{o}/oo. In general, the estuarine system is strongly influenced by its association with land and can be characterized as a low energy system.

E1OWL

Permanent deepwater habitats, noteably Long Island Sound, where seawater is measurably diluted by the freshwater discharge of large rivers. Although the salinity distribution within Long Island Sound at any particular time varies (with many factors such as evaporation, magnitude of river discharge, and tidal fluctuation), the surface salinity at its eastern end is typically 30 ^{o}/oo (Hardy 1971) decreasing westward with a surface salinity of 25 ^{o}/oo at its western terminus.

E1OWL3

Permanent tidal river estuaries and embayments where the salinity is substantiall less than that of Long Island Sound. Due to the variable salinity range of Long Island Sound, the distinction between the Sound and other contiguous brackish deepwater habitats is gradual and often indistinct. However, in order to preserve Long Island Sound as a large continuous body of open water, we have separated the smaller estuaries where more active fresh water mixing takes place.

E1OWKL

Salt ponds actively maintained by siphons.

E1OWLh

Salt ponds with tidal drainage impeded by gates or weirs.

E2EMN

Regularly flooded tidal marshes dominated by Saltwater Cordgrass (Spartina alternaflora). This wetland type occurs along tidal creeks and drainage ditches and on low vegetated flats. Since the tidal range of Long Island Sound increases westward, these low salt marshes are more extensive in Hartford SW.

E2EMP

Irregularly flooded tidal marshes dominated by Salt Meadow Hay (Spartina patens) in pure stands or mixed with Spike Grass (Distichlis spicata) and/or Black Grass (Juncus gerardi). Occasionally, the marsh surface may be punctuated with slight depressions or pannes where saline waters accumulate. Pannes are distinguished by a short form of Saltwater Cordgrass and/or patches of halophytes such as Glasswort (Salicornia spp.), Sea Lavender (Limonium nashii), and Arrow Grass (Triglochin maritima). Pannes were mapped as inclusions within this wetland type.

E2EMN5

Regularly flooded brackish tidal marshes dominated by Narrow Leaved Cattail (Typha angustifolia) with various admixtures of Reed (Phragmites communis), Water Hemp (Acnida cannabina), and various sedges (Scirpus spp.). This signature was used only if field investigation indicated a regularly flooded tidal regime.

E2EMN6

Regularly flooded, slightly brackish tidal marshes dominated by Wild Rice or Three-Square. This signature was used primarily on the upper reaches of Housatonic River estuary.

E2EMP5

Irregularly flooded brackish reed marshes dominated by Narrow Leaved Cattail or Common Reed with various amounts of Water Hemp, Rose Mallow (Hibiscus palustris), and Bullrushes (Scirpus robustus, S. validus). This marsh type can be quite extensive in the estuaries of large tidal rivers.

E2SS1P

Irregularly flooded brackish shrub borders found on the upland edge of salt marshes and/or along drainage ditches on the elevated spoils. Dominant shrubs include Marsh Elder (Iva frutescens) and Groundsel Tree (Baccharis hamifolia) with various amounts of Switchgrass (Panicum virgatum), Common Reed, Seaside Goldenrod (Solidago sempervirens), and Sweet Grass (Hierochloe odorata).

E2SS1/EMP

A salt marsh border vegetation dominated by Marsh Elder, Groundsel Tree with at least a 30% mixture of Salt Meadow Hay, Blackgrass, or Saltwater Cordgrass.

E2BBN

Regularly flooded intertidal beach/bars characterized by unconsolidated sands, sorted and deposited by waves and currents. Intertidal beach/bars extend from mean low to mean high tide.

E2BBP

Irregularly flooded beach/bars that extend from mean high water to the extreme extent of spring tides. Associated features include sand spits, tombolos, barrier beaches, and pocket beaches.

E2RSN

Regularly flooded intertidal rocky shores characterized by bedrock and/or stones and boulders that have areal coverage greater than 75% and less than 30% vegetative coverage. As in all regularly flooded tidal wetlands, this wetland type extends from mean low to mean high tide along the coast.

E2RSP

Irregularly flooded rocky shores that extend from mean high water, including a splash zone characterized by blue-green algae, up to the extent of spring high tides.

E2AB/RSN

Regularly flooded rocky shores with at least 30% coverage of algae. In this intertidal zone, the substrate is stable enough to permit attachment and growth of sessile and/or sedentary invertebrates and algae. Typically, a very distinct vertical zoneation of diverse algal communities are observed. Common species include Rockweed (Fucus spp.), Irish Moss (Chondrus crispus), Sea Lettuce (Ulva latuca), and Porphyra spp.

E2FLN

Regularly flooded nonvegetated tidal flats characterized by a substrate of fine textured silts and clays.

E2SBN

Regularly flooded and exposed tidal creeks.

Special Modifiers

d - Wetlands that have been artificially ditched or drained.

r - Deep water habitats with an artificial manmade substrate.

t - Wetlands with a circumneutral pH formed in soils derived from limestone and marble.

x - Wetlands that have been excavated.

Linear wetlands

Linear wetlands have been delineated in this inventory with a dashed line. In general, these wetlands were smaller on the imagery than the width of a pen line (approximately 20-60 feet on the ground). Linear wetlands by convention have been classified by their surrounding vegetation.

REFERENCES

Bailey, R.G. 1978. Ecoregions of the United States. U.S. Forest Service, Intermountain Region. Ogden, Utah.

Cowardin, L.M., V. Carter, F.C. Golet, & E.T. LaRoe. 1979. Classification of Wetlands and Deep-Water Habitats of the United States. Office of Biological Services, Fish & Wildlife Service, U.S. Department of the Interior. Washington, D.C.

Dowhan, J.J. & R.J. Craig. 1976. Rare & Endangered Species of Connecticut and Their Habitats. State Geological & Natural History Survey. Report of Investigations #6. Hartford, Connecticut.

Fernald, R.F. 1950. Gray's Manual of Botany. Eighth edition. D. Van Nostrand Company, New York.

Flint, R.F. 1930. The Glacial Geology of Connecticut. State Geological & Natural History Survey. Bulletin #47. Hartford, Connecticut.

Hammond, E.H. 1964. Classes of land-surface form in the forty-eight states, U.S.A. Annals Assoc. Amer. Geog., Volume 54, Map Supp. #4, Scale 1:5,000,000.

Hicks, S.D., & J.E. Crosby. 1974. Trends and variability in mean sea level, 1893-1972. N.O.A.A. Technical Memorandum 13. National Ocean Survey. Rockville, Maryland.

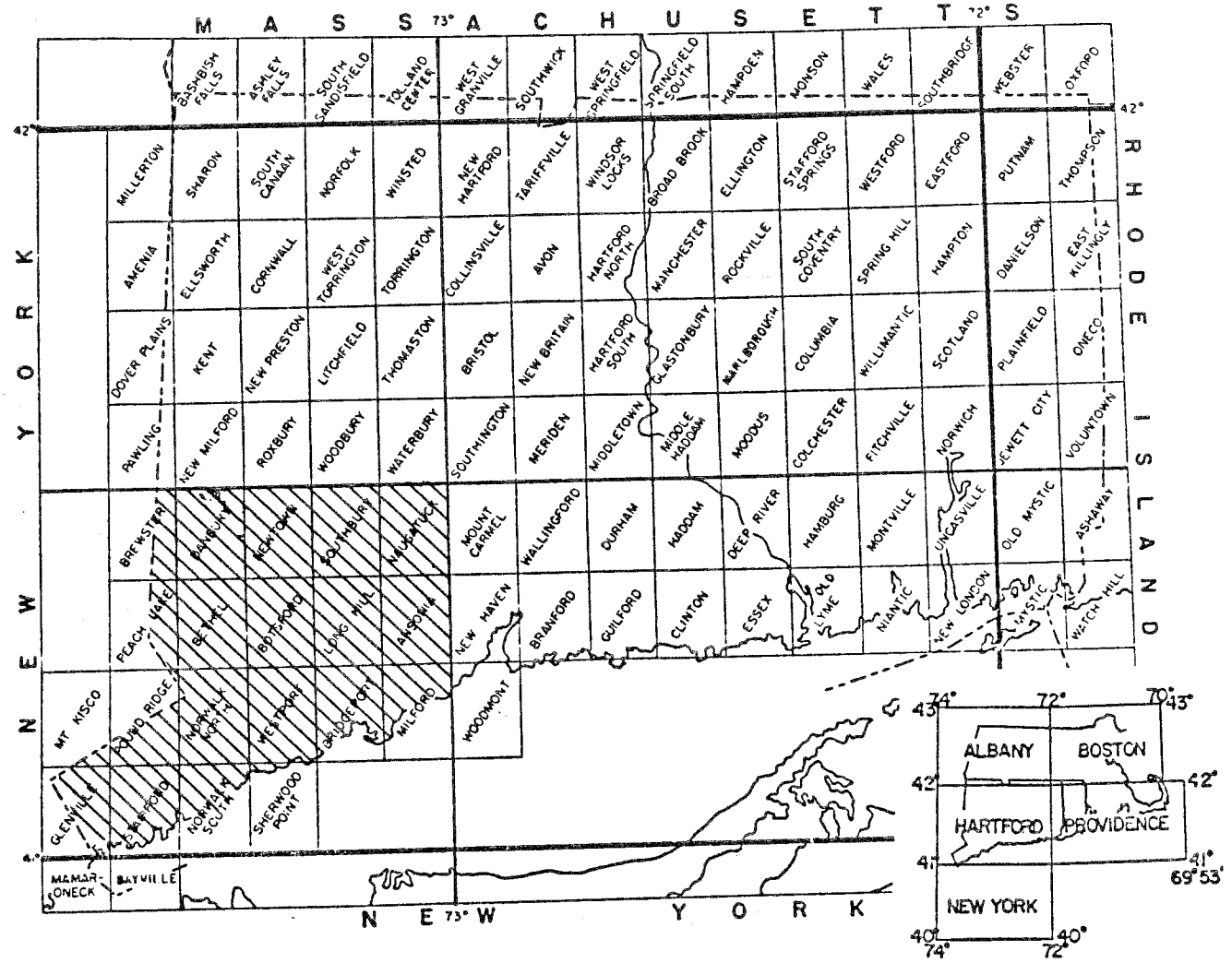
McElroy, M. 1981. Natural Drainage Basins in Connecticut (map). Connecticut Natural Resources Atlas Map: Drainage Basins Map. Dept. of Environmental Protection. Hartford, Connecticut.

Schneider, C.W., M.M. Suyemoto & C. Yarish. 1979. An Annotated Checklist of Connecticut Seaweeds. State Geological & Natural History Survey Bulletin #108, Hartford, Connecticut.

U.S.G.S., 1979. Catalog of Information on Water Data. Water Resources Region 01 (New England). U.S. Dept. of the Interior, Geological Survey, Office of Water Data Coordination. National Center. Reston, Virginia.

APPENDIX A

Connecticut quadrangle index map (1:24,000 series). The heavy ruled lines indicate the boundaries of the Hartford 1:250,000 National Topographic map (insert) with the hatched quadrangle indicating the area of this report.



APPENDIX C

WILDLIFE INVENTORY OF PERRY'S MILL POND TRACTS

MAMMAL SURVEY

Eastern Chipmunk	Tamias striatus
Eastern Mole	Scalopus aquaticus
Star-nosed Mole	Condylura cristuta
Woodland Vole	Microtus pinetorun
White-footed Mouse	Peromyscus leucopus
Gray Squirrel	Sciurus carolinensis
Red Squirrel	Tamiascuirus hudsonicus
Striped Skunk	Mephitis mephitis
Raccoon	Procyon lotor
Virginia Opossum	Didelphis virginiana
Muskrat	Ondatra zibethicus
Eastern Cottontail	Sylvilagus floridanus
White-tailed Deer	Odocoileus virginianus
Woodchuck	Marmota monax

NOTE: Bats were seen but it was too dark to identify them.

AMPHIBIANS AND REPTILES

Snapping Turtle	Chelydra serpentina
Painted Turtle	Chrysemys picta
Spotted Turtle	Clemmys guttata
Black Snake	Seminatrix pygaea
Garter Snake	Thamnophis sirtalis
Dekay Snake	Storeria dekayi
Leopard Snake	Rava pipiens
Common Tree Frog	Hyla versicolor
Green Frog	Rana clauitaus
Pickerel Frog	Rana palutris
Bull Frog	Rana catasbeiana
Newt (Red Eft)	Notophthalmus viridescens
Red-backed Salamander	Plethodou cinereus

BIRD SURVEY

Perry's Mill Pond (North) - April 30, 1984

Mockingbird	Yellow-rumped Warbler
Carbird	House Sparrow
Brown Thrasher	Red-winged Blackbird
Robin	Commom Grackle
Ruby-crowned Kinglet	Brown-headed Cowbird
Starling	Cardinal
Black and White Warbler	American Goldfinch
Yellow Warbler	Rufous-sided Towhee

Savannah Sparrow
Fox Sparrow
Song Sparrow
Great Blue Heron
Snowy Egret
Black-crowned Night Heron
Canada Geese
Mallard
Black Duck
Wood Duck
Common Merganser
Ring-necked Pheasant
Sanderling
Greater Black-backed Gull
Herring Gull
Ring-billed Gull
Laughing Gull
Rock Dove
Mourning Dove
Belted Kingfisher
Common Flicker
Downy Woodpecker
Tree Swallow
Barn Swallow
Blue Jay
Common Crow
Black-capped Chickadee

Perry' Mill Pond (South) - May 1, 1984

House Sparrow
Red-winged Blackbird
Robin
Commom Grackle
Brown-headed Cowbird
Starling
Savannah Sparrow
White-throated Sparrow
Fox Sparrow
Canada Geese
Mallard
Tree Swallow
Barn Swallow
Blue Jay
Common Crow
Sanderling
Cardinal
American Goldfinch
Black and White Warbler
Yellow-rumped Warbler
Yellow Warbler
Rufous-sided Towhee
Herring Gull
Laughing Gull
Mourning Dove
Common Flicker
Downy Woodpecker
Black-capped Chickadee

Scrub/Shrub Wetland ("Perry's Bog") - May 2, 1984

Mockingbird
Evening Grosbeak
American Goldfinch
Robin
Savannah Sparrow
Fox Sparrow
Green Heron
Canada Geese
Mallard
Tree Swallow
Belted Kingfisher
Blue Jay
Common Crow
Red-winged Blackbird
Starling
Wood Duck
Rufous-sided Towhee
Herring Gull
Mourning Dove
Black-crowned Night Heron
Common Flicker
Downy Woodpecker
Black-capped Chickadee

Sturges Pond - May 2, 1984

Black and White Warbler
Yellow Warbler
Red-winged Blackbird
Starling
Evening Grosbeak
Purple Finch
Robin
Rufous-sided Towhee
Savannah Sparrow
Fox Sparrow
Song Sparrow
Canada Geese
Blue Jay
Common Crow

Mill Hollow Park - May 3, 1986

Mockingbird
Catbird
Ovenbird
Robin
Cardinal
Black and White Warbler
Yellow Warbler
Savannah Sparrow
Fox Sparrow
Swamp Sparrow
Rock Dove
Snowy Egret
Canada Geese
Mallard
Black Duck
Barn Swallow
Blue Jay

Yellow-rumped Warbler
House Sparrow
Red-winged Blackbird
Commom Grackle
Evening Grosbeak
American Goldfinch
Rufous-sided Towhee
Herring Gull
Ring-billed Gull
Laughing Gull
Mourning Dove
Black-crowned Night Heron
Common Flicker
Downy Woodpecker
Tree Swallow
Black-capped Chickadee
Common Crow

APPENDIX D

FISH SURVEY

May 9th through May 23rd.

Perry's North

Fin Fish Survey

Species	Total Length	Standard Length	Age
Pumpkin Seed	6-3/4"	6"	4
B. Gill	5-3/8"	4-7/8"	4
B.Gill	5-7/8"	5-1/8"	5
P. Seed	5½"	5"	5
P. Seed	7"	6¼"	4
B. Gill	6"	5¼"	4
Yellow Perch	6-3/4"	6-1/8"	2
White Perch	10"	9-1/8"	3
R. B. Sunfish	7"	6¼"	4
B. Gill	6½"	6-1/8"	3
B. Gill	6½"	6-1/8"	3
B. Gill	5½"	5-1/8"	3
B. Crappy	9¼"	8-1/16"	4
Chain Pickerel	15-1/8"	14¼"	3
C. Pickerel	11-3/4"	11-1/8"	2+
L.M. Bass	10-3/4"	10"	3
P. Seed	5½"	5"	4
B. Gill	5½"	5-1/8"	3
B. Gill	6-3/4"	6-1/8"	4
B. Gill	7"	6-1/8"	5

Fin Fish Survey (cont'd)

Species	Total Length	Standard Length	Age
B. Gill	5-3/4"	5½"	4
B. Gill	6¼"	5-1/16"	4
Crappy	8-3/4"	8½"	4
Crappy	9¼"	8-3/4"	4
LM. Bass	11-3/4"	11"	3
LM. Bass	11½"	10-3/4"	3
LM. Bass	13"	12"	4
C. Pickerel	12½"	11½"	3
B. Gill	6-5/8"	5¼"	5
P. Seed	6"	5-1/8"	4

May 9th through May 23rd

Perry's South

Fin Fish Survey

Species	Total Length	Standard Length	Age
B. Gill	6¼	5-1/8	3
B. Gill	6-3/8	5-7/16	3
B. Gill	6½	5½	4
B. Gill	6-9/16	5½	4
B. Gill	6-5/8	5¼	4
P. Seed	4	3	2+
Perch	8½	7-3/16	3

Species	Total length	Standard Length	Age
B. Gill	7¼	6	3
B. Gill	7-5/8	6½	4
Crappy	8¼	7-1/8	3
C. Pickerel	12	10¼	3
C. Pickerel	12½	11	3
C. Pickerel	15	13-3/4	4
L.M. Bass	15-1/8	14	5
C. Pickerel	13-3/8	12½	4
B. Gill	5½	4½	5
B. Gill	6	5	5
C. Pickerel	14	12-5/8	4

May 9th through May 23rd

Fin Fish Survey

The Bog

Species	Total Length	Standard Length	Age
P. Seed	5½	4-5/8	3
P. Seed	5-1/8	4	4
P. Seed	4-9/16	3-5/8	4
P. Seed	3½	2-9/16	4
P. Seed	4-1/8	3¼	3
P. Seed	3-1/8	2-1/8	3

Fin Fish Survey- The Bog (cont'd)

Species	Total Length	Standard length	Age
P. Seed	3½	2-9/16	3
P. Seed	4-1/8	3¼	3
P. Seed	3¼	2½	2
L.M. Bass	12½	11	4

Note: Seining was done on May 22, 1984 and there were plenty of small P. Seeds & Golden Shiners that were captured. Also some Bull Heads were caught.

May 9th through May 23rd

Fin Fish Survey

Mill Hollow Park

Species	Total Length	Standard Length	Age
P. Seed	3½	3-1/8	2
Yellow Perch	6-1/8	5-3/4	3
P. Seed	4½	4	3
P. Seed	4	3-1/8	2
P. Seed	4½	4-1/8	3
P. Seed	5-1/8	4-3/4	4
Golden Shiner	9-1/8	8½	3
G. Shiner	8½	7-7/8	3
G. Shiner	7¼	6-1/8	3
Yellow Perch	7-1/8	6-3/8	4
C. Pickerel	11-3/8	10-1/8	3

May 9th through May 23rd

Fin Fish Survey

Sturges Pond

The only way this area was sampled was done by the seining method. As a result 3 brown Bullheads (Ietalurus-nebulosos) were captured.

Alewifes were caught in Mill River

Total Length	Standard Length	Age
10	9	4
10½	9-1/8	4
10¼	9	4

White Perch were also caught

Total Length	Standard Length	Age
9¼	8-3/8	4
8-5/8	7½	3
8½	7½	3
8	6-5/8	3

May 9th through May 23rd

List of Fish Captured During the Survey

	Common Name	Scientific Name
.	American Eel	Anguilla rostrata
*	Alewife	Alosa Pseudoharengus
*	Chain Pickerel	Esox Niger
*	Golden Shiner	Notemigonus Crysoleucas
*	White sucker	Catestomus Commersoni
*	Brown Bullhead	Ictalurus Nebulosus
-	White Perch	Monroe Americana
*	Red Breasted Sunfish	Kepomis Auritus
*	Pumpkin Seed	Kepomis Gobbosus
o	Blue Gill	Kepomis Macrochinus
o	Black Crappie	Pomoxis Nignomaculatus
*	Yellow Perch	Perch Flavescens
o	Large Mouth Bass	Micropterus Salmoides

- Amphidnomous

* Native to Connecticut

o Introduced

* Anadromous

. Catadromus

APPENDIX E

WATER QUALITY DATA

PERRY'S MILL NATURAL RESOURCE INVENTORY

Part III

WATER QUALITY

Introduction

Water quality was done by the LaMotte Limnological test kit. The various tests that were done are as follows: Dissolved O_2, CO_2, PH, Silica, Hardness, Nitrate and Phosphate. Also, temperature readings were taken at various locations as well as secchi disc readings. These chemical tests were done at Perry's North, Perry's South, the Bog, Sturges Pond and Mill Hollow Park.

DATA

Perry's North

Water Temp. At Various Depths

AREA	DEPTH	TEMP.
Surface	0 ft.	56° F
Middle	10 ft.	55° F
Bottom	19 ft.	55° F

CHEMICAL DETERMINATIONS AT INLET

Chemical Test	Reading
Dissolved O_2	9.4 ppm
Carbon Dioxide	6.0 ppm
PH	6.0
Silica	4.0 ppm
Hardness (Total)	45 ppm
Calcium Hardness	30 ppm
Nitrates	0.1 ppm NO_3 = 0.1 x 4.4 = 0.44 NO_3 ppm
Phosphates	NONE present

cont'd

NORTH EAST COVE

This area was chosen because it was the deepest part of the lake I could find.

Chemical Test	Surface	Middle	Bottom
Dissolved O_2	8.2 ppm	8.0 ppm	7.8 ppm
Carbon Dioxide	6.0 ppm	6.0 ppm	6.0 ppm
PH	7.0	6.8	6.5

MIDDLE OF THE POND

Chemical Test	Surface	Bottom
Dissolved O_2	6.6 ppm	5.6 ppm
Carbon Dioxide	6.0 ppm	7.0 ppm
PH	7.0 ppm	6.5 ppm
Silica	6.0 ppm	
Hardness	45.0 ppm	
Nitrates	0.1 ppm	
Phosphates	NONE present	

Secchi Disc: This simple instrument is used to measure turbidity of the water. This particular method is very simple and accurate means of determining effective light penetration. This was done by going out to the middle of the lake and taking readings in different locations of the pond. The final reading is an average of all readings, thus determining the turbidity of the water.

READINGS: 8', 9', 9.5', 8.5', 8.0', 9.0'

AVERAGE: 8.6'

OUTLET

Chemical Test	Reading
Dissolved O_2	7.8 ppm
Carbon Dioxide	6.0 ppm
PH	7.0

PERRY'S MILL NATURAL RESOURCE INVENTORY

CHEMICAL TEST PERRY'S BOG

*NOTE: All chemical tests for water quality were conducted at the outlet of the Bog.

Chemical Test	Depth	Reading
Dissolved O_2	Surface 0'	7.2 ppm
CO_2	"	6.5 ppm
PH	"	7.0
Silica	"	4.0 ppm
Hardness (Total)	"	48 ppm
Calcium Hardness	"	28 ppm
Nitrate	"	NONE present
Phosphates	"	NONE present
Temp.	"	57° F
Secchi Disc	"	Pond too shallow to conduct this test

CHEMICAL TEST STURGES POND

Chemical Test	Depth		Reading
Dissolved O_2	Surface 0'		8.2 ppm
CO_2	"		5.5 ppm
PH	"		6.0
Silica	"		10 ppm
Hardness (Total)	"		84 ppm
Calcium Hardness	"		40 ppm
Nitrate	"	NO_3 = 1.2 ppm	0.3 ppm
Phosphate	"		NONE present
Temp.	"		57° C
Secchi Disc	"		Too shallow to conduct this test

*NOTE: These tests were conducted at the south end of the pond.

COMMENT: This pond is too shallow to support fish life. With no fresh water supply to bring in cooling water and dissolved O_2 fish will die in the summer.

Average depth is around 3 ft.

5/16/84

PERRY'S MILL NATURAL RESOURCE INVENTORY

Chemical Test for Mill Hollow Park

Chemical Test	Depth	Reading
Dissolved O_2	Surface 0'	7.8 ppm
C O_2	"	5.0 ppm
P.H.	"	6.5
Silica	"	6.0 ppm
Hardness Total	"	52 ppm
Calcium Hardness	"	28 ppm
Nitrates	"	0.3 ppm
Phosphates	"	none present
Temp.	"	56°
Secchi Disc	"	Too shallow

NOTE: All chemical tests were conducted from the north shore of the pond.

PERRY'S MILL NATURAL RESOURCE INVENTORY

Chemical Analysis of the South Pond

Chemical Test	Reading	Location	Depth
Dissolved O_2	9.4ppm	Inlet	0'
	7.6ppm	Mid Lake	0'
	7.4ppm	Bottom of Mid Lake	15'
	8.0ppm	Outlet	0'
CO_2	6.5ppm	Inlet	0'
	6.0ppm	Mid Lake	0'
	6.0ppm	Bottom MidLake	15'
	6.0ppm	Outlet	0'
PH	7.0ppm	Inlet	0'
	6.5ppm	Mid Lake	0'
	6.5ppm	Bottom Mid Lake	15'
	6.5ppm	Outlet	0'

(cont'd)

Silica	6.0ppm	Inlet	0'
	6.0ppm	Mid Lake	0'
	6.0ppm	Bottom Mid Lake	15'
		Outlet	0'
Hardness Total	40ppm	Inlet	0'
	38ppm	Mid Lake	0'
	38ppm	Bottom Mid Lake	15'
	38ppm	Outlet	0'
Calcium Hardness	40ppm	Inlet	0'
	24ppm	Mid Lake	0'
	20ppm	Bottom of Mid Lake	15'
	24ppm	Outlet	0'

PERRY'S MILL NATURAL RESOURCE INVENTORY

Chemical Test of South Pond continued

Chemical Test	Reading	Location	Depth
Nitrates	0.4ppm	Inlet	0'
	0.4ppm	Mid Lake	0'
	0.6ppm	Mid Lake Bottom	15'
	0.4ppm	Outlet	0'

* Note: To get NO_3 you must multiply your Nitrate Reading by 4.4.

Phosphates - None were present in any of these tests.

Temperature	56^{o}	Inlet	0'
	55^{o}	Mid Lake Bottom	15'
	57^{o}	Mid Lake	0'
	56^{o}	Outlet	0'

Secchi Disc: 10,10.5, 9.5, 9.0, 10.0, 9.5, 10.0, 9.5,
Final Reading is 9.75ft.

APPENDIX F

STREAMBANK STABILIZATION TECHNIQUES

F. VEGETATIVE STREAMBANK STABILIZATION (VP)

1. DEFINITION

Stabilizing and protecting banks of streams or excavated channels against scour and erosion.

2. PURPOSE

To protect streambanks from erosion.

3. APPLICABILITY

This practice applies to natural or excavated channels where streambanks are subject to erosion from the action of water, ice, debris, or to damage from livestock or vehicular traffic.

4. PLANNING CONSIDERATIONS

All requirements of state law and permit requirements of local, state, and federal agencies must be met. Good planning normally requires staying away from streams. A primary cause of stream channel erosion is the increased frequency of bank-full flows which often results from upstream development. Most natural stream channels are formed with a bank-full capacity to pass the runoff from a storm with a 1.5 to 2-year recurrence interval. However, in a typical urbanizing watershed, stream channels are subject to a 3 to 5-fold increase in the frequency of bank-full flows. As a result, stream channels that were once parabolic in shape and covered with vegetation are often transformed into wide rectangular channels with barren banks. Many streambanks that need stabilization will require structural measures to make them stable.

Vegetation Zones Along Watercourses

Streambank vegetation for erosion control and bank stabilization is most important between the mean low water mark (MLW) and mean high water mark (MHW). Above mean high water, native vegetation often volunteers and maintains stable conditions. However, damage from vehicles and animals in this area often requires special plantings to provide adequate protection. Below mean low water vegetation will not grow.

5. DESIGN CRITERIA

Since each reach of channel is unique, measures for streambank protection must be installed according to a plan developed for the specific site. Designs shall be developed in accordance with the following principles:

a. Protective measures to be applied should be compatible with the planned improvements and site characteristics.

b. Streambank protection should start at a stabilized or controlled point and end at a stabilized or controlled point on the stream.

c. The first element of the work needed may be channel clearing and snagging to remove stumps, fallen trees, and debris which force the stream flow into the streambank.

d. The stream grade should be controlled, either by natural or artificial means, before any permanent type of bank protection can be considered.

e. Natural vegetation should be protected on the undisturbed portions of banks, especially those areas subject to flooding during construction.

6. INSTALLATION REQUIREMENTS

The first step in the vegetative stabilization process is to grade eroded or steep slopes to a maximum slope of 3 to 1 (3 horizontally to 1 vertically). Overhanging bank edges should be removed. Topsoil should be saved for reuse. Existing shrubs trees and other vegetation should be saved where possible.

a. Establishing Grass Vegetation

Since the area between the MLW and MHW is usually wet most of the year, water tolerant species should be grown. Suitable grass mixes are:

.4 lbs/1,000 sq. ft. Reed canarygrass, and
.1 lbs/1,000 sq. ft. Redtop
.5

or

.35 lbs/1,000 sq. ft. Reed canarygrass
.10 lbs/1,000 sq. ft. Redtop
.25 lbs/1,000 sq. ft. Bird's-foot trefoil with inoculant
.70

Reed canarygrass (Phalaris arundinaceae) seed can be sown on very damp bank soil, provided that the seeded surface is not covered by water for six months after sowing. See Permanent Vegetative Cover measure (page 6-5).

Seedings should be made April 1st through June 15th, or August 15th through September 15th. These mixes are not suitable for mid-summer seedings.

Reed canarygrass can be planted from slips taken from existing beds during the dormant season. Rhizomes and shoots are carefully removed from the earth without bruising the buds or the tips of the sprouts. They are placed in holes or narrow trenches, along the line of the average summer water level, so that only the stem sprouts are showing above the soil.

Streambank vegetation can be planted in conjunction with riprap or other stone facing by planting clumps, rhizomes or shoots in the crevices and gaps along the line of the average summer water level.

Mulch should be used with permanent seedings according to the measure for Temporary Mulching (page 7-1).

Sod should be selected and installed according to the Sodding measure (page 6-13). Turf should only be used where the grass will provide adequate protection, necessary maintenance can be provided, and establishment of other streambank vegetation is not practical or possible.

b. Establishing Shrub Vegetation

Stands of full-grown trees are of little use for protecting streambanks apart from the binding of soil with their roots. Shrubs provide much better protection and riverside stands of willow trees are often replaced naturally by colonies of shrub-like willows. These plants hold the soil with their root systems and reduce water velocities. They also protect tree trunks from damage caused by breaking ice and help to prevent the formation of strong eddies around large trees during flood flows. See Figure 6-18 for species to plant.

Shrub vegetation is particularly beneficial along the impact bank of a stream meander, where maximum scouring tends to occur. Infringement of shrub vegetation into the channel tends to reduce the channel width, increasing probability of floods. However, brief flooding of floodplain woods and undeveloped bottomlands does no significant damage, and the silt deposits in these wooded areas are less of a problem than eroded streambanks.

Evergreen ground covers are also useful. Plants should be used which are well adapted to the stream and site conditions.

Shrub willows, shrub dogwoods and other shrubs can be put into the soil as cuttings, slips or stems.

Willows can be planted as 1-year-old nursery-grown rooted cuttings or as fresh hardwood cuttings gathered from local mother-stock plantings. Silky dogwood and the alders should be nursery-grown seedlings 1 or 2 years old. Fresh cuttings should be 3/8- to 1/2-inch thick and 12 to 18 inches long. They should be kept moist. If not used at once, they should be stored in cool moist sand.

Streambanks are often difficult to plant, even when they are well-sloped. This is especially true in gravel or on steep banks. Where mattocks or shovels are unsatisfactory tools, a stiff steel bar, such as a crowbar, is better. The best tool for this purpose is a planting dibble, which is a heavy metal tool with a blade and a foot pedal. It is thrust into the ground to make a hole for the plant.

Rooted cuttings should be planted vertically in the bank with 1 or 2 inches of wood protruding above the ground surface. They should be planted in a hole large enough to accommodate the root system when well spread. The plant roots must be maneuvered into the bottom of the hole so they will grow down instead of up. The roots should not be twisted, nor should they be exposed above the ground surface. After the plant is placed, the dibble bar can be installed a few inches away from the plant to close the hole. Slow- release fertilizer should be applied on the surface, not in the hole. The soil should be tamped adequately to provide complete contact between the soil and the cutting. Cuttings should be planted six to eight feet on center in at least two rows, middle and bottom of the streambank. Plantings should be made early in the spring to ensure adequate moisture for growth.

Nursery grown plants should be planted for evergreen ground covers.

Since shrubs are generally not effective for the first two years, grasses should be seeded immediately following shrub planting to provide initial streambank protection. See the Permanent Vegetative Cover measure for streambank seedings (page 6-5).

7. MAINTENANCE

Streambanks are always vulnerable to new damage. Repairs are needed periodically. Banks should be checked after every high-water event is over. Gaps in the vegetative cover should be fixed at once with new plants, and mulched if necessary. Fresh cuttings from other plants on the bank can be used, or they can be taken from mother-stock plantings if they are available. Trees that become established on the bank should be removed at once.

Figure 6-18 - Shrubs for Streambank Protection

COMMON NAME (Botanical Name)	How to Plant	Years to Provide Cover	Mature Height(ft.)	Fertility Needs 1/	Acidity Needs 2/	Soil Texture 3/	Drought Tolerance 4/	Shade Tolerance5/
'STREAMCO' PURPLEOSIER WILLOW (Salix purpurea)	Rooted or unrooted cuttings	2-4	10-18	M	A	C,L,S	P	G
SHRUB DOGWOODS (Cornus racemosa) (Cornus amomum) (Cornus stolonifera)	Container grown or bareroot seedlings plant 2 ft. apart	3-5	8-12	M	SA	C,L,S	F	F
AMERICAN CRANBERRY (Viburnum trilobum)	2-year old seedlings plant 4 ft. apart	4-5	6-7	M	SA	C,L,S	P	F
'REM RED' AMUR HONEYSUCKLE (Lonicera maackii)	2-year old seedlings plant 6 ft. apart	3-5	8-12	M	SA	C,L,S	F	G
			EVERGREEN GROUND COVER FOR STREAMBANK					
LILY-TURF (Liriope muscari)	Divide clumps and plant 6-12 inches apart	2	1/2-1	L	A	C,L,S	G	G
HALL'S HONEYSUCKLE (Lonicera hallisiana)	Nursery grown plants. Plant 18 inches apart	2	1/2-1	L	A	C,L,S	G	G

1/ Fertility Needs: M = Moderate and L = Low
2/ Acid Needs: A = Acid and SA = Slight Acid
3/ Soil Texture: C = Clay, L = Loam and S = Sand
4/ Drought Tolerance: P = Poor, F = Fair, and G = Good
5/ Shade Tolerance: F = Fair and G = Good

Source: U.S. Department of Agriculture, Soil Conservation Service, Storrs, Connecticut.

I. RIPRAP (RR)

1. DEFINITION

A permanent, erosion-resistant ground cover of large, loose, angular stone.

2. PURPOSE

a. To protect the soil surface from the erosive forces of concentrated runoff.

b. To slow the velocity of concentrated runoff while enhancing the potential for infiltration.

c. To stabilize slopes with seepage problems and/or non-cohesive soils.

3. APPLICABILITY

To soil-water interfaces where the soil conditions, water turbulence and velocity, expected vegetative cover, etc., are such that the soil may erode under the design flow conditions. Riprap may be used, as appropriate, at storm drain outlets, on channel banks and/or bottoms, roadside ditches, drop structures, at the toe of slopes, or to stabilize streams, etc.

4. PLANNING CONSIDERATIONS

Since riprap is used where erosion potential is high, construction must be sequenced so that the riprap is put in place with the minimum possible delay. Disturbance of areas where riprap is to be placed should be undertaken only when final preparation and placement of the riprap can follow immediately behind the initial disturbance. Where riprap is used for outlet protection, the riprap should be placed before or in conjunction with the construction of the pipe or channel so that is is in place when the pipe or channel begins to operate.

All requirements of state laws and permit requirements of local, state and federal agencies must be met. Good planning normally requires staying away from streams. A primary cause of stream channel erosion is the increased frequency of bank-full flows which often result from upstream development. Most natural stream channels are formed with a bank-full capacity to pass the runoff from a storm with a 1.5 to 2-year recurrence interval. However, in a typical urbanizing watershed, stream channels are subject to a 3 to 5 fold increase in the frequency of bank-full flows. As a result, stream channels that were once parabolic in shape and covered with vegetation are often transformed into wide rectangular channels with barren banks. Consider preserving or developing viable aquatic habitat.

Riprap sizes can be designated by either the diameter or the weight of the stones. It is often misleading to think of riprap in terms of diameter, since the stones should be rectangular instead of

spherical. However, it is simpler to specify the diameter of an equivalent size of spherical stone. Figure 8-70 lists some typical stones by weight, spherical diameter and the corresponding rectangular dimensions. These stone sizes are based upon an assumed specific weight of 165 lbs./ft.

Figure 8-70 - Size of Riprap Stones

Weight (lbs.)	Mean Spherical Diameter (ft.)	Rectangular Shape	
		Length (ft.)	Width, Height (ft.)
50	0.8	1.4	0.5
100	1.1	1.75	0.6
150	1.3	2.0	0.67
300	1.6	2.6	0.9
500	1.9	3.0	1.0
1000	2.2	3.7	1.25
1500	2.6	4.7	1.5
2000	2.75	5.4	1.8
4000	3.6	6.0	2.0
6000	4.0	6.9	2.3
8000	4.5	7.6	2.5
20000	6.1	10.0	3.3

Source: U.S. Department of Agriculture, Soil Conservation Service, Storrs, Connecticut

Since graded riprap consists of a variety of stone sizes, a method is needed to specify the size range of the mixture of stone. This is done by specifying a diameter of stone in the mixture for which some percentage, by weight, will be smaller. For example, d-85 refers to a mixture of stones in which 85 percent of the stone by weight would be smaller than the diameter specified. Most designs are based on d-50. In other words, the design is based on the average size of stone in the mixture.

Figure 8-71 - List of Connecticut Department of Transportation Riprap Sizes

Standard Riprap: This material shall conform to the following requirements:

Not more than 15 percent of the riprap shall be scattered spalls and stones less than 6 inches in size.

No stone shall be larger than 30 inches in size, and at least 75 percent of the mass shall be stones at least 15 inches in size.

Intermediate Riprap: This material shall conform to the following gradation:

Stone Size	Percent of the Mass
12" or over	0
10" to 12"	30-50
6" to 10"	30-50
4" to 6"	20-30
2" to 4"	10-20
less than 2"	0-10

Modified Riprap: This material shall conform to the following gradation:

Stone Size	Percent of the Mass
8" or over	0
6" to 8"	20-50
4" to 6"	30-60
2" to 4"	30-40
1" to 2"	10-20
less than 1"	0-10

Source: U.S. Department of Agriculture, Soil Conservation Service, Storrs, Connecticut.

5. DESIGN CRITERIA

a. Gradation

The riprap shall be composed of a well-graded mixture down to the one-inch size particle such that 50 percent of the mixture by weight shall be larger than the d-50 size as determined from the design procedure. A well-graded mixture as used herein is defined as a mixture composed primarily of the larger stone sizes but with a sufficient mixture of other sizes to fill the progressively smaller voids between the stones. The diameter of the largest stone size in such a mixture shall be 1.5 times the d-50 size.

The designer, after determining the riprap size that will be stable under the flow conditions, shall consider that size to be a minimum size and then, based on riprap gradations actually available in the area, select the size or sizes that equal or exceed the minimum size. Consider the possibility of damage by children in selecting a riprap size, especially if there is nearby water to toss the stones into.

b. Thickness

The minimum thickness of the riprap layer shall be 1.5 times the maximum stone diameter but not less than 6 inches.

c. Quality of Stone

Stone for riprap shall consist of field stone or rough unhewn quarry stone of approximately rectangular shape. The stone shall be hard, angular, of such quality that it will not disintegrate on exposure to water or weathering, be chemically stable and it shall be suitable in all other respects for the purpose intended. The bulk specific gravity (saturated surface-dry basis) of the individual stones shall be at least 2.5.

Rubble concrete may be used, provided it has a density of at least 150 pounds per cubic foot, and otherwise meets the requirements.

d. Riprap at Outlets

Design criteria for sizing the stone and determining the dimensions of riprap pads used at the outlet of drainage structures are contained in Outlet Protection (page 8-103).

e. Riprap for Channel Stabilization

Riprap for channel stabilization shall be designed to be stable for the condition of bank-full flow in the reach of channel being stabilized. The design procedure, which is extracted from the Federal Highway Administration's Design of Stable Channels with Flexible Linings (4), shall be used.

Riprap shall extend up the banks of the channel to a height equal to the maximum depth of flow or to a point where vegetation can be established to adequately protect the channel.

The riprap size to be used in a channel bend shall extend upstream from the point of curvature and downstream from the point of tangency a distance of at least 5 times the channel bottom width. The riprap shall extend across the bottom and up both sides of the channel.

Where riprap is used only for bank protection and does not extend across the bottom the the channel, riprap shall be keyed into the bottom of the channel to a minimum depth equal to 1.5 x maximum size stone and shall extend across the bottom of the channel the same distance (Figure 8-72).

f. Riprap for Slope Stabilization

Riprap for slope stabilization shall be designed so that the natural angle of repose of the stone mixture is greater than the gradient of the slope being stabilized (Figure 8-72).

g. Filter Blankets

A filter blanket is a layer of material placed between the riprap and the underlying soil surface to prevent soil movement into or through the riprap.

A filter blanket can be either a gravel layer or a plastic filter cloth. A determination of the need for a filter blanket is made by comparing particle sizes of the overlying material and the base material in accordance with the criteria below.

(1) Gravel filter blanket: The following relationships must exist:

$$\frac{d_{15}\text{filter}}{d_{85}\text{ base}} < 5 < \frac{d_{15}\text{filter}}{d_{15}\text{ base}} < 40$$

and,

$$\frac{d_{50}\text{filter}}{d_{50}\text{ base}} < 40$$

In some cases, more than one layer of filter material may be needed. Each layer of filter material should be approximately 6 inches thick. In these cases, filter refers to the overlying material and base refers to the underlying material. The relationships must hold between the filter material and the base material and between the riprap and the filter material.

(2) Plastic filter cloth: Plastic filter cloth may be used in place of or in conjunction with gravel filters. The following particle size relationships must exist:

(a) For filter cloth adjacent to granular materials containing 50 percent or less (by weight), of fine particles (less than 0.075mm):

a) $$\frac{d_{85}\text{ base (mm)}}{\text{EOS* filter cloth (mm)}} > 1$$

b) Total open area** of filter cloth is less than 36 percent.

(b) For filter cloth adjacent to all other soils:

a) EOS less than U.S. Standard Sieve No. 70.

b) Total open area of filter is less than 10 percent.

No filter cloth should be used with an EOS smaller than U.S. Standard Sieve No. 100.

Filter blankets should always be provided where seepage from underground sources threatens the stability of the riprap.

* EOS - Equivalent Opening Size to a U.S. Standard Sieve Size.

** Consult manufacturer's specifications for fabric's total open area

6. INSTALLATION REQUIREMENTS

a. Subgrade Preparation

The subgrade for the riprap or filter shall be prepared to the required lines and grades. Any fill required in the subgrade shall be compacted to a density approximating that of the surrounding undisturbed material. Brush, trees, stumps and other objectionable material shall be removed.

b. Filter Blanket

Placement of the filter blanket should be done immediately after slope preparation. For granular filters the stone should be spread in a uniform layer to the specified depth. Where more than one layer of filter material is used, the layers should be spread so that there is minimal mixing of the layers.

For plastic filter cloths, the cloth should be placed directly on the prepared slope. The edges of the sheets should overlap by at least 12 inches. Either anchor pins or wire staples can be used. Anchor pins, 15 inches long, should be spaced every 3 feet along the overlap. Eleven gauge wire staples, 6 to 10 inches long with a 2 to 6 inch spread can also be used at 3 foot spacing. The upper end of the cloth should be buried a minimum of 12 inches deep. The lower end should be toed in (Figure 8-73). Care should be taken not to damage the cloth when placing the riprap. If damage occurs, that sheet should be removed and replaced. For large stone, 12 inches or greater, a 4-inch layer of gravel shall be used to prevent damage to the cloth, protection from ultraviolet rays and to provide interfacial contact.

c. Stone Placement

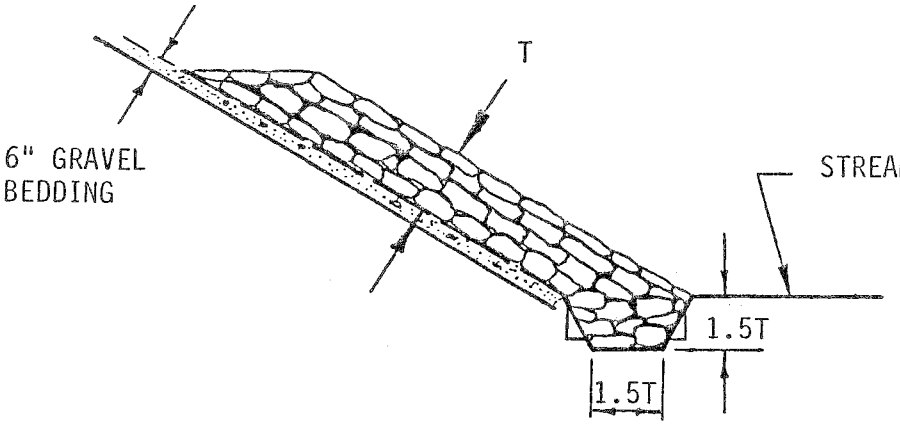
Placement of riprap should follow immediately after placement of the filter. The riprap should be placed so that it produces a dense well-graded mass of stone with a minimum of voids. The desired distribution of stones throughout the mass may be obtained by selective loading at the quarry, controlled dumping of successive loads during final placing, or by a combination of these methods. The riprap should be placed to its full thickness in one operation. The riprap should not be placed in layers. The riprap should not be placed by dumping into chutes or similar methods which are likely to cause segregation of the various stone sizes. Care should be taken not to dislodge the underlying material when placing the stones.

The finished slope should be free of pockets of small stone or clusters of large stones. Hand placing may be necessary to achieve the required grades and a good distribution of stone sizes. Final thickness of the riprap blanket should be within plus or minus 1/4 of the specified thickness.

7. MAINTENANCE

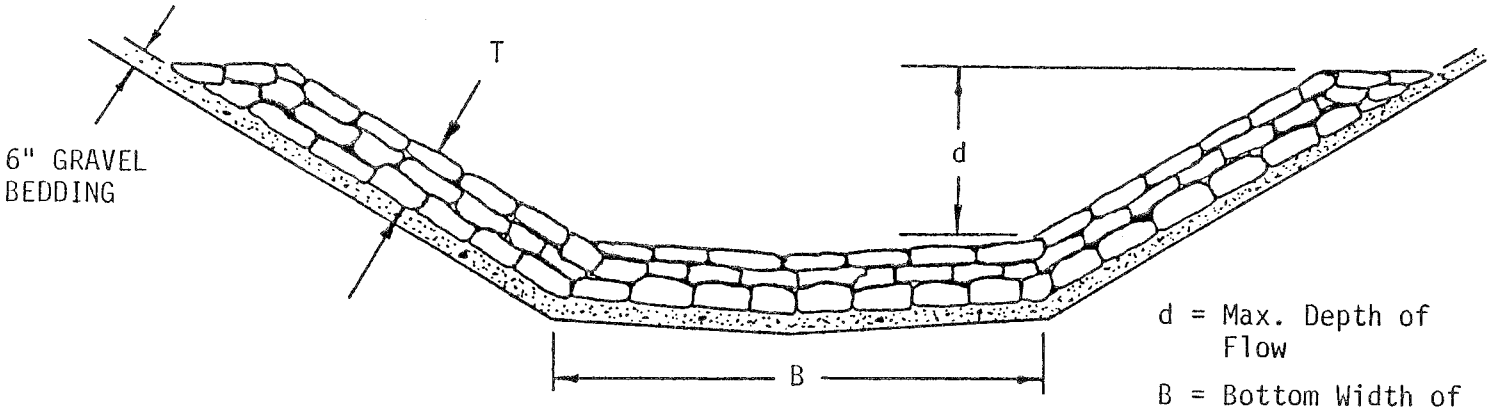
Once a riprap installation has been completed, it should require very little maintenance. It should, however, be inspected periodically to determine if high flows have caused scour beneath the riprap or dislodged any of the stone. If repairs are needed, they should be accomplished immediately.

Figure 8-72 - Typical Cross Sections



T = 1.5 Times the Maximum Stone Diameter, But No Less Than 6 Inches.

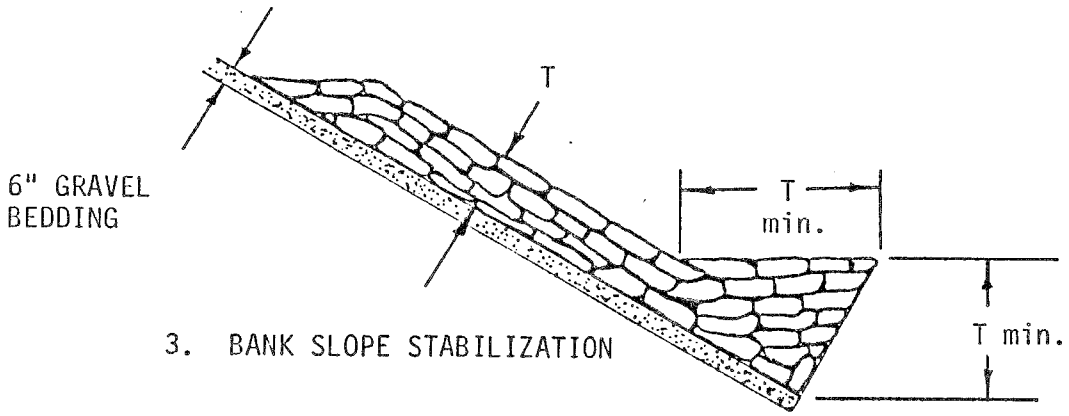
1. STREAM CHANNEL STABILIZATION



d = Max. Depth of Flow

B = Bottom Width of Channel

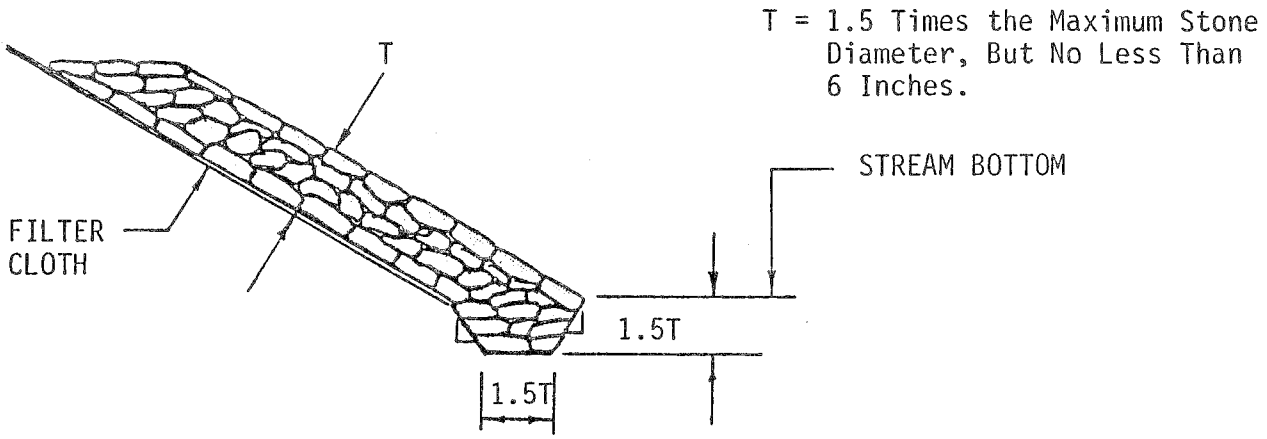
2. STREAM BANK STABILIZATION



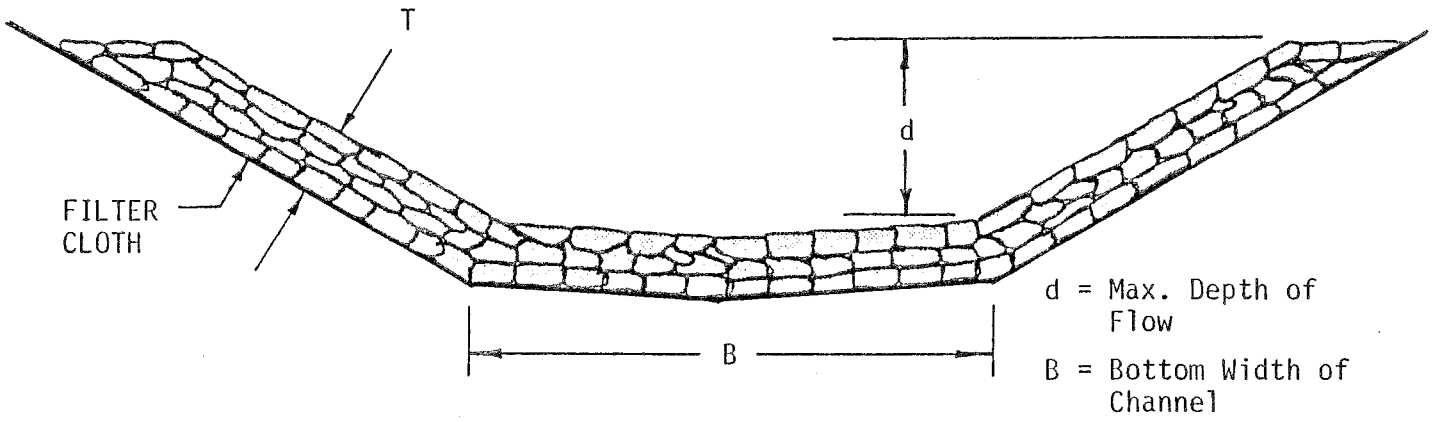
3. BANK SLOPE STABILIZATION

Source: U.S. Department of Agriculture, Soil Conservation Service, Storrs, Connecticut.

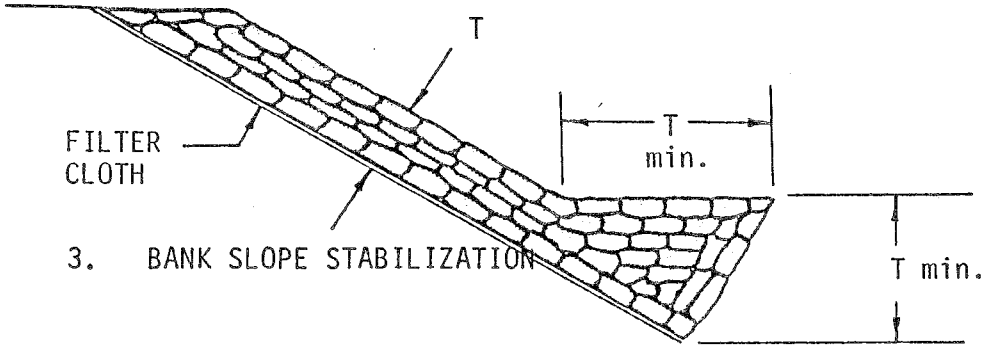
Figure 8-73 - Typical Cross Sections



1. STREAM BANK STABILIZATION



2. STREAM CHANNEL STABILIZATION



3. BANK SLOPE STABILIZATION

Source: U.S. Department of Agriculture, Soil Conservation Service, Storrs, Connecticut.

J. GABIONS (G)

1. DEFINITION

A flexible woven-wire basket composed of two to six rectangular cells filled with stones.

2. PURPOSE

a. To protect the soil surface from the erosive forces of concentrated runoff.

b. To slow the velocity of concentrated runoff while enhancing the potential for infiltration.

c. To stabilize slopes with seepage problems and/or non-cohesive soils.

3. APPLICABILITY

Channels, revetments, retaining walls, abutments, check dams, and similar installations.

4. PLANNING CONSIDERATIONS

Since gabions are used where erosion potential is high, construction must be sequenced so that the gabions are put in place with the minimum possible delay. Disturbance of areas where gabions are to be placed should be undertaken only when final preparation and placement of the gabions can follow immediately behind the initial disturbance.

All requirements of state law and permit requirements of local, state, and federal agencies must be met. Good planning normally requires staying away from streams. A primary cause of stream channel erosion is the increased frequency of bank-full flows which often results from upstream development. Most natural stream channels are formed with a bank-full capacity to pass the runoff from a storm with a 1.5 to 2-year recurrence interval. However, in a typical urbanizing watershed, stream channels are subject to a 3 to 5 fold increase in the frequency of bank-full flows. As a result, stream channels that were once parabolic in shape and covered with vegetation are often transformed into wide rectangular channels with barren banks. Consider preserving or developing viable aquatic habitat.

5. DESIGN CRITERIA

Gabions may be used when all the following conditions are met:

a. The design storm, riprap size and location, filter and quality criteria for riprap are met.

b. The design water velocity does not exceed that given in Figure 8-80.

Figure 8-80 - Design Water Velocity

GABION THICKNESS (ft.)	MAXIMUM VELOCITY (ft./sec)
1/2	6
3/4	11
1	14

Source: U.S. Department of Agriculture, Soil Conservation Service, Storrs, Connecticut.

c. The Manning's "n" value used for gabions shall be 0.025.

d. The gabions are not exposed to abrasion from sand or gravel transported by moving water.

e. The pH of the soil and water is above 5 and the soil and water resistivity is more than 4,000 ohms/cm or plastic coated gabions shall be used.

f. A filter is required unless the gabion has a thickness of at least three times the d_{50} size of the rock used to fill the gabions.

g. The rock used to fill the gabions shall be larger than the gabion mesh opening.

h. Manufacturer's specifications are followed.

6. INSTALLATION REQUIREMENTS

Each gabion shall be assembled by binding together all vertical edges with a continuous piece of connecting wire looped twice around the vertical edges with a coil approximately every four inches, except the mattress type where the coil shall be approximately every three inches. Empty gabion units shall be set to line and grade as shown on the plans. Connecting wire shall be used to join the units together in the same manner as described above for assemble. Internal tie wires shall be uniformly spaced and securely fastened in each outside cell of the structure. When gabions are being placed as slope protection or channel lining, the internal tie wires may be deleted.

Care shall be taken when placing aggregates to assure that the sheathing on PVC coated gabions will not be broken or damaged.

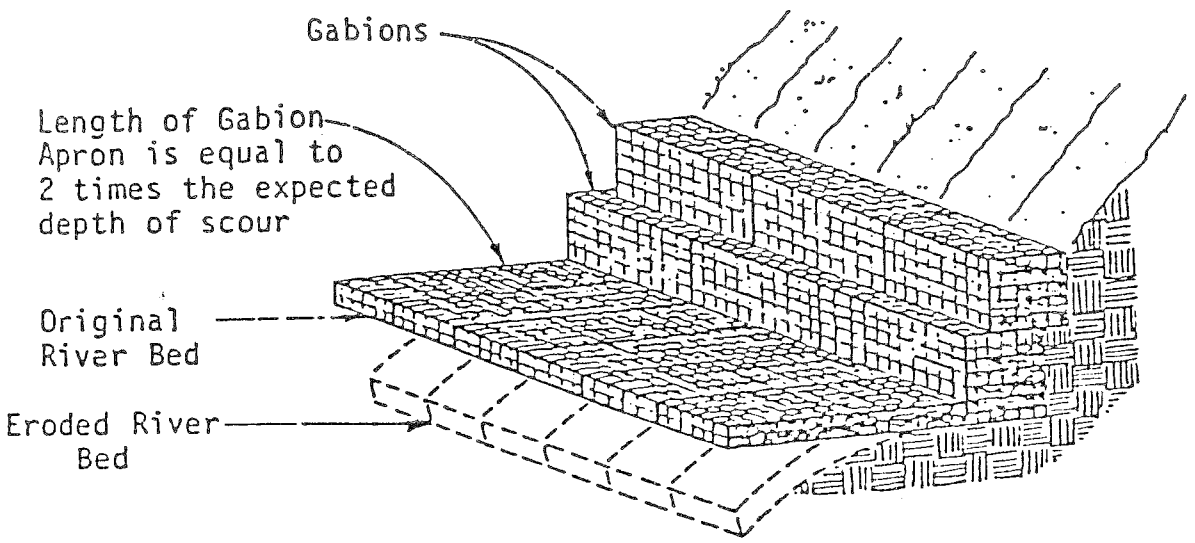
A standard fence stretcher, chain fall, or iron rod may be used to stretch the wire baskets and to maintain alignment. After a gabion has been filled, the lid shall be bent over until it meets the sides and edges. The lid shall then be secured to the sides, ends and diaphragms with the connecting wire in the manner described above for assembling.

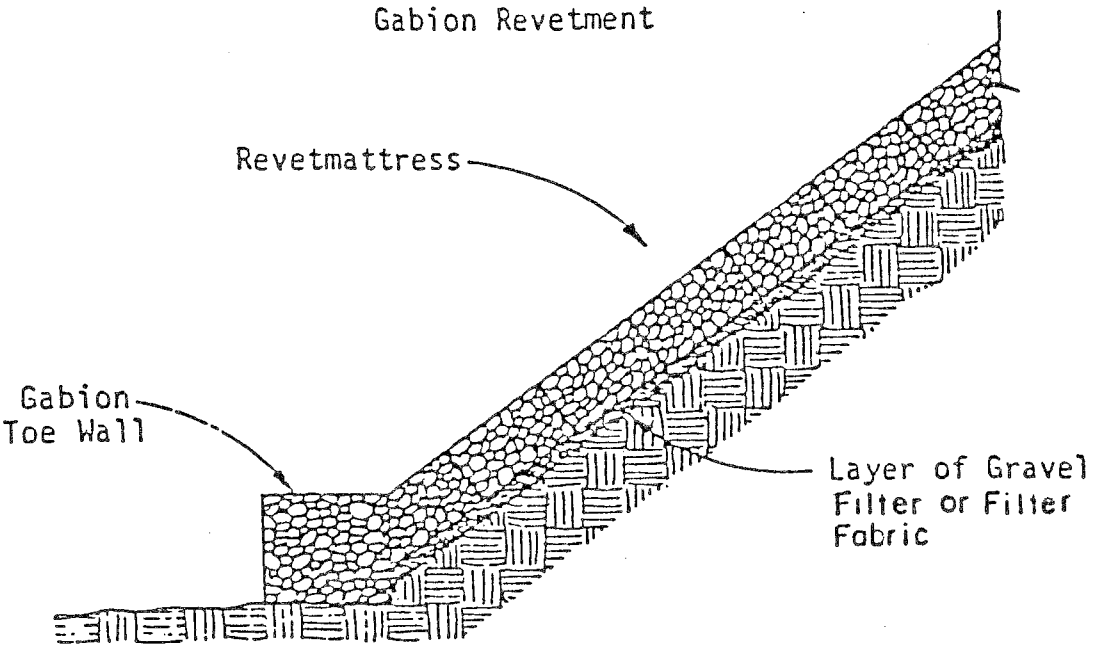
When the mattress type gabions are placed on 1½ to 1 (or steeper) slope, hardwood stakes shall be driven through the gabion along the top edge, as necessary, to hold the installation in place. Manufacturer's directions will be closely followed.

7. MAINTENANCE

Periodic inspection for signs of undercutting or excessive erosion at transition areas is essential and repair must be carried out promptly.

Figure 8-81 - Gabions





GABIONS

Source: Virginia Erosion and Sediment Control Handbook, 1980. Virginia Soil and Water Conservation Commission.

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, 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 - a 83 town area serving western Connecticut.

As a public service activity, the Team is available to serve towns and/or developers 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 and/or developers in the review of sites proposed for major land use activities. 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 recreational/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 indentifying 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 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 purposes of review, and a statement identifying the specific areas of concern the Team should investigate. When this request is approved by the local Soil and Water Conservation District and King's Mark RC & D Executive Committee, the Team will undertake the review. At present, the ERT can undertake two (2) reviews per month.

For additional information regarding the Environmental Review Team, please contact your local Soil and Water Conservation District or Keane Callahan, ERT Coordinator, King's Mark Environmental Review Team, King's Mark Resource Conservation and Development Area, 322 North Main Street, Wallingford, Connecticut 06492. King's Mark ERT phone number is 265-6695.