



**The Hoppers -
Birge Pond
Property**

Bristol, Connecticut

**King's Mark
Environmental
Review Team
Report**

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

The Hoppers - Birge Pond Property Bristol, 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.**

**for the
City Council and
Parks and Recreation Department
Bristol, Connecticut**

September 2003

Report No. 320

**CT Environmental Review Teams
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Acknowledgments

This report is an outgrowth of a request from the Bristol City Council and the Parks and Recreation Department to the North Central Conservation District and the King's Mark Resource Conservation and Development Area (RC&D) Executive Council for Environmental Review Team assistance. The request was approved and the project reviewed by the King's Mark Environmental Review Team (ERT).

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

The field review took place on Wednesday, May 14, 2003.

| | |
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I would also like to thank Ed Swicklas, superintendent, Bristol Parks and Recreation Department, Robyn Bugbee, City of Bristol, Cynthia Donovan, Bristol park commissioner, Mike Saman and Jean LeTourneau, Hoppers Birge Pond Committee, and other interested park commissioners and committee members for their cooperation and assistance during this environmental review.

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

This report represents the Team's findings. It is not meant to compete with private consultants by providing site plans or detailed solutions to development problems. The Team does not recommend what final action should be taken on a proposed project - all final decisions rest with the City. This report identifies the existing resource base and evaluates its significance to the proposed use, and also suggests considerations that should be of concern to the City. The results of this Team action are oriented toward the development of better environmental quality and the long term economics of land use.

The King's Mark RC&D Executive Council hopes you will find this report of value and assistance in the review of the Hoppers-Birge Pond Property.

If you require additional information please contact:

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Introduction

Introduction

Introduction

The Bristol City Council and the Parks and Recreation Department have requested assistance from the King's Mark Environmental Review Team in reviewing the city owned Hoppers-Birge Pond Property for recreational use.

The Hoppers-Birge Pond Property purchased in 1973, consists of ±207 acres of open space located approximately one half mile northwest of the downtown business district. Birge Pond, a man-made ±14 acre waterbody, is located in the northeastern portion of the property. A landlocked, privately owned inholding of ±25 acres with houses exists just west of Birge Pond. Both the city owned land and the private property are accessed via Ambler Road. An adjacent 19 acre parcel known as the Roberts Property was recently purchased by the City for use for possible active recreation.

The property is geologically unique because of the several huge kettles found on the site. Locally these large glacial depressions are called "hoppers." The site also includes Native American, colonial and early industrial history significance.

The City has made minimal improvements to the property since 1973. There has been some clearing and construction of walking trails, installation of siltation traps, and recently approvals have been granted for the dredging of Birge Pond.

As written in the ERT request application:

"over the years a number of studies have been conducted in order to attempt to determine appropriate outdoor recreational use of the property. All these studies were conducted with a specific land use in mind, thus calling objectivity of their conclusions and recommendations into question. One faction of residents are proponents of using the property for a golf course;

another faction wishes to see the property remain in its current natural state; and a third faction would like the property to be developed for passive and active public outdoor recreation including ballfields. All parties concur that the unique geologic features, i.e. the kettles/hoppers, should be preserved.”

Objectives of the ERT Study

The City has requested the ERT study so that they will have a current, unbiased assessment of the property in order to determine the types of recreational activities that are feasible and will provide the highest and best public outdoor recreational use of the Hoppers-Birge Pond Property. Areas of specific information requested include: geology, soils, hydrology, water supply, water quality, vegetation, wildlife habitat, aquatic resources, wetlands, land use, recreation planning, archaeological and historic significance, and management recommendations and guidelines.

The ERT Process

Through the efforts of the City Council and Parks and Recreation Department, this environmental review and report was prepared for the City of Bristol.

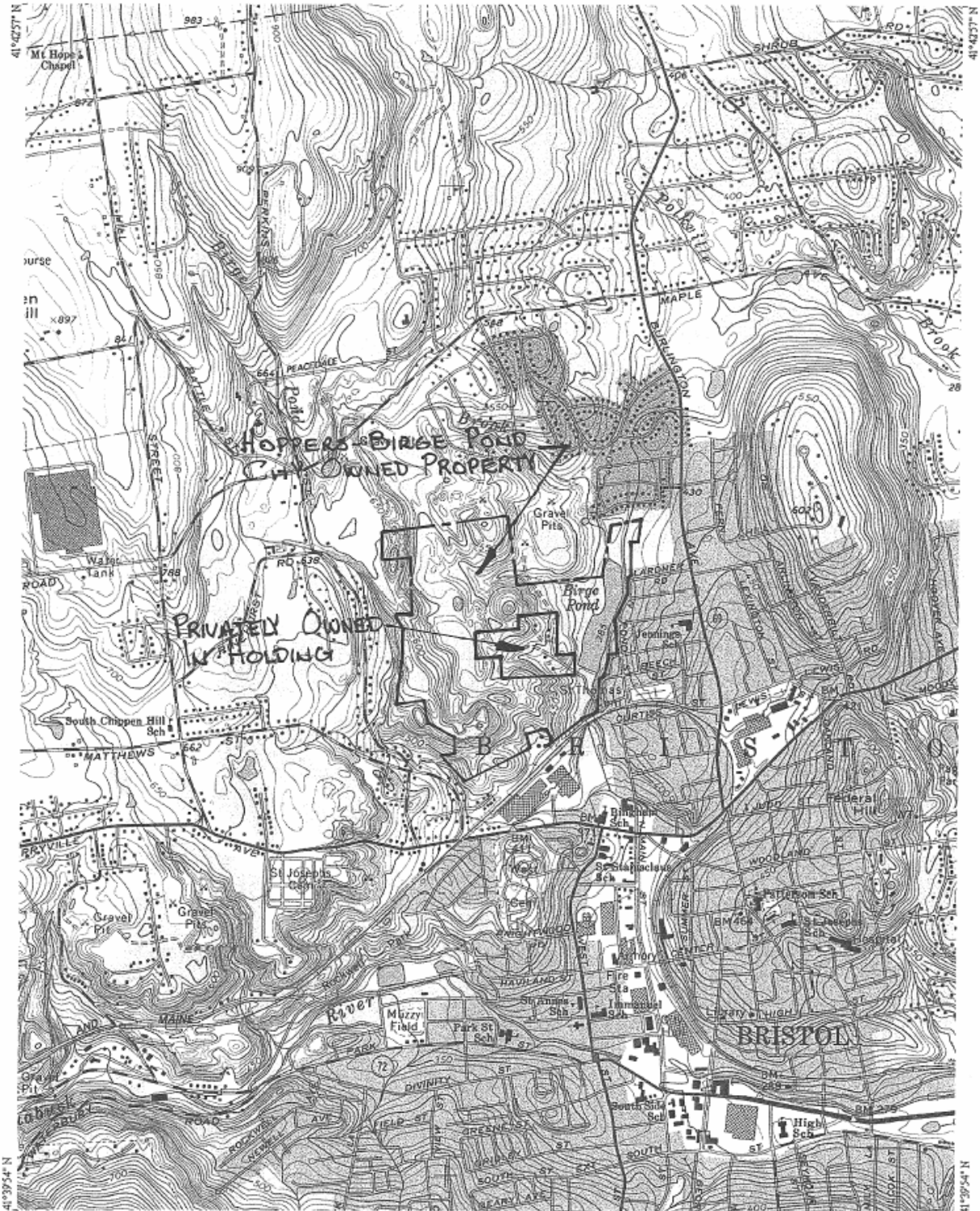
This report provides an information base and a series of recommendations and guidelines which cover the topics requested by the City. Team members were able to review maps, plans and supporting documentation provided by the applicant.

The review process consisted of four phases:

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

The data collection phase involved both literature and field research. The field review was conducted on Wednesday, May 14, 2003. The emphasis of the field review was on the exchange of ideas, concerns and recommendations. Being on site allowed Team members to verify information and to identify other resources.

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



41°42'57" N
72°38'38" W
MDN | TN
149°



NAD27 72°55'46" W
41°39'54" N

Land Use Analysis

Land Use Analysis

The purpose of this ERT study is to provide an objective determination of what public outdoor recreational activities can prudently be located throughout this ±200 acre site in order to increase public use of the Hoppers-Birge Pond property. Any decision on what to do with the Hoppers-Birge Pond property needs to understand options. This is to propose two overall parameters in searching for use solutions. One parameter is site specific, examining the assets of the Hoppers-Birge Pond site in order to understand its value: what parts of the property should be considered the building blocks for future use and development and then looking for activities and uses that are compatible and enhancing these building blocks. To accomplish this task, both the natural and man made assets of the Hoppers-Birge Pond site need to be identified: what these are, how many assets there are, are these unique or can these be provided in other places, how important are these assets to keep, and how do these assets relate to one another.

The other parameter takes a larger view of the situation. This requires determining the City's over all recreation and open space framework and understanding how Hoppers-Birge Pond site fits into the overall picture. In addition to knowing the assets of the Hoppers-Birge Pond site, it is important to know what the City of Bristol's open space and recreational park system is comprised of: how much land is there, how these facilities are used, the number and types of facilities provided? the uniqueness of these resources and how easily can a resource be provided or duplicated in other locations. This will establish the context for understanding where Hoppers-Birge Pond site fits into the picture and provide insights on developing its various assets.

Both parks and open space provide varying types of outdoor environments for enjoyment and recreation. Often the terms parks and open space are used interchangeably but differences of design, use and intent can be surmised. The

major characteristic of a park is its significant man-altered landscape and therefore has greater maintenance needs. In contrast, the term “open space” is often used to signify landscapes where there is minimal, man-made changes. The intent of open space is to have an outdoor experience in a setting, which has undergone minimal, man-altering changes to the landscape.

In terms of the types of activities, parks and open space need to be understood on a continuum of scales: active to passive, and game to exploratory. Park activities tend to be more active and have organized games while open space tends to be more passive and/or exploratory in character. Parks are places for active, organized activities and games that require specialized equipment or facilities, such as playgrounds for children, manicured fields for ball games, or courts for basketball and tennis. Parks can also be places for passive activities, such as the aesthetics of flower gardens and the quiet reflection of memorials, where the landscape has undergone significant, man-made changes.

Open space activities also vary, from the more passive, such as trail walking, to the very active, such as whitewater rafting and cross country skiing. For open space activities, the emphasis is that the experience take place in an outdoor setting characterized by minimal, man-altered changes to the landscape. Open space activities can be described as exploratory, more individually focused, and not game sports requiring a man-altered field for playing. These activities accept nature “as is” and do not require significant modifications to the existing landscape.

The Hoppers-Birge Pond Property within Bristol's Open Space & Park Network

Bristol has an extensive system of parks, recreational facilities and open space both public and private. The City of Bristol's Year 2000 Plan of Conservation & Development notes that there are almost 2,400 acres of public and private open space and recreational land. This represents 14.1 % of Bristol's total acreage of

17,361 acres. Close to two thirds, 1,530 acres (63%) of these 2,400 acres is publicly owned land and the remaining one third, 864.3 acres, is privately held. Some of this private land is active recreation, such as two golf courses and two sportsmen's clubs. Other private land is open space, from the educationally oriented lands of the Environmental Learning Centers of Connecticut to set-aside areas of private residential development.

Furthermore, accessibility of these resources vary, regardless whether public or private. While public parks are open to all, not all publicly owned open space is accessible, specifically municipally owned watershed land. Privately owned facilities vary in their accessibility, such as private clubs which are available only to members while the private amusement park is open to all (for a fee).

In terms of the 1,530 acres of publicly owned land in Bristol, a little more than half, (787.8 acres), is accessible to the public and is comprised of parks, playgrounds, public squares, greens and forested areas. The other open space is watershed land and there are 740 acres of these lands, owned by either the City of Bristol or the City of New Britain. Bristol's Water Department has 430 acres and City of New Britain has 308 acres. These watershed lands are not accessible.

The Hoppers-Birge Pond property is part of the 787.8 acres of public recreational land. Parks tend to be the active areas, having the man altered landscape and facilities: with playground equipment, tennis courts, basketball courts, and various ball-fields. All of these facilities are managed by the Parks & Recreation Department or the School Department. Areas classified as open space have a minimally altered landscape and are managed by the Parks & Recreation Department.

The majority of the public recreational land is in the park/active category. These park/active facilities comprise 492.8 acres or 62.6% of the 787.8 acres of public recreation land. 259.7 acres are formally listed as park or playground and

managed by the Parks & Recreation Department. In addition, there is one area of 54.6 acres listed as open space but because it has active uses, specifically two soccer fields and a rope challenge, it may be categorized as recreational and therefore a park. The School Department has 178.5 acres of recreation facilities, such as tennis courts, track, ball-fields, basketball courts, and playgrounds, and are all associated with a school building. All of these school facilities are active and can be categorized as parks.

Total public open space is 295 acres and includes City and State owned lands. Except for the State of Connecticut owned Nelson's Field of 49.0 acres, the publicly accessible open space is owned by the City of Bristol and managed by Parks & Recreation Department. The City's total open space acreage is 246 and the Hoppers-Birge Pond Property comprises the overwhelming portion of this acreage (82.6%). The remaining municipal sites are scattered and small. At 203.3 acres, Hoppers-Birge Pond property is the single largest municipally owned and publicly available open space resource in the City of Bristol. While the publicly owned watershed lands are the larger at 738 acres, these lands are not accessible to the public and the Hoppers-Birge Pond property is. Both the size and public accessibility of the Hoppers-Birge Pond property are two significant factors for wanting to maintain the property for open space purposes.

Resources of the Hoppers-Birge Pond Property

The Hoppers-Birge Pond property is listed as open space in the Plan of Conservation & Development. In terms of activities, the Plan notes trails for hiking, walking and bicycling, fishing and canoeing in Birge Pond, and areas for picnics. Except for picnics, all of these activities can be described as exploratory and appropriate to a woodland setting. Furthermore, all of these activities require a minimal alteration of the existing landscape in order to accommodate these activities.

Moreover, the importance of the Hoppers-Birge Pond property is not the ability to have these activities. Most of these activities can be accommodated at other parks in the City. It is the unique setting of the Hoppers-Birge Pond property for these activities, and possibly other activities, where lies the resource value of the Hoppers-Birge Pond property. The setting is important due to geological and historic features. These features are the buildings blocks and it is the impact of other activities on these building blocks that needs to be evaluated when proposing and examining future activities and plans for the Hoppers-Birge Pond property.

The most important building block of the Hoppers-Birge Pond property is geological: the kettles, also known as "hoppers." These kettles are geological formations of glacial origin and it is the presence of these kettles, within the property's rolling terrain and the mixed hardwoods, that gives this property its unique value as land resource. These kettles should be preserved for the future because of their geological significance and are a beginning point in any further development of the property. These kettles are living history of this area's glacial origins and an educational resource.

Related to the kettles themselves is the land adjacent to the kettles. This land establishes the context and setting for each kettle. The question is how this adjoining land should be utilized. Some type of buffer parameter around each of the kettles should be established in order to maintain the proper setting for each kettle. By having a buffer, a landscape context will be created and maintained for each kettle. These buffers will protect the kettles from new, adjoining uses.

Beyond these buffers, other uses can be developed on the adjoining land but any potential use must be analyzed in terms of its impact on the kettles and the buffer area. There are other factors to consider in the use of the land and a major question involves flora and fauna. Any proposed use must be analyzed for its impact on the health of the plant and animal habitat. That evaluation is beyond

the scope of this Team member's analysis and is deferred to the environmental specialists.

Birge Pond is the other major natural and man-made resource on this property. The Pond results from a man-made dam in the 1800's and is supplied by springs and the watershed to the east and north of the Pond. The pond provides water based recreational opportunities, specifically canoeing and fishing, and provides a historic context to these activities, formed because of the City's industrial past. Another building block is the historic aspect to the property. The Hoppers-Birge Pond Association Map identifies and references the Old Colonial Road. This road was apparently used by early inhabitants as a travel route between settlements and therefore gives a historic and educational dimensions to one particular trail. As trails are appropriate uses in open space areas, the Old Colonial Road should also be treated with reverence. The introduction of other potential uses need to be analyzed for their impact upon the continued viability of the Old Colonial Road trail.

The Comments of Bob Cless CCRPA, & ERT Team member:

"There were some small milling activities on Ambler Road in the form of two or more small dams on a small unnamed stream which flows into the channel exiting Birge Pond at its south end. Rutsch notes the organization of Birge Pond as a millpond with a raceway on the eastern side of it to supply waterpower to several mills south of the pond. The race is clearly drawn in the 1855 Woodford Hartford County map. In addition Ambler Road is noted as a possible remnant of a colonial road by Rutsch.

A walkover archaeological investigation of the Pond area was conducted by Edward Rutsch of Historic Conservation and Interpretation Inc. in 1987 for Maguire Group Inc. Rutsch notes that there has been no known prehistoric artifacts found in the vicinity of Birge Pond. However, the nearby Federal Hill

area was used prehistorically for soapstone mining, a soft stone used mostly for bowl making. Also the former high school, now a middle school, area on Memorial Drive was supposedly collected by a Robert T. Wood who donated his collection of prehistoric artifacts to the Bristol Library.

My own careful comparison of the existing roads and historic maps from the 18th century suggests that this is correct. It appears that a road from near the present day Route 89 and Route 6 junction went through the Birge Pond area to travel in a Northwesterly direction almost straight to the center of Harwinton. It is clearly depicted on the Bloget 1792 and the Soltzmann 1796 State of Connecticut maps. Our guides during the Birge Pond walkover suggested a narrow road or cart path further west was a colonial road but I saw no clear evidence for it to be more than a cart path possibly to service the charcoal mounds. I noticed no evidence of stone walls or agricultural activities. The cart path may be a secondary road joining the probable Colonial Road. Only research will clarify this question. There were a few large black oaks, some maples and a few eastern pines and some evidence for recent fires along trails. Some of the trails were probably cart paths for charcoal."

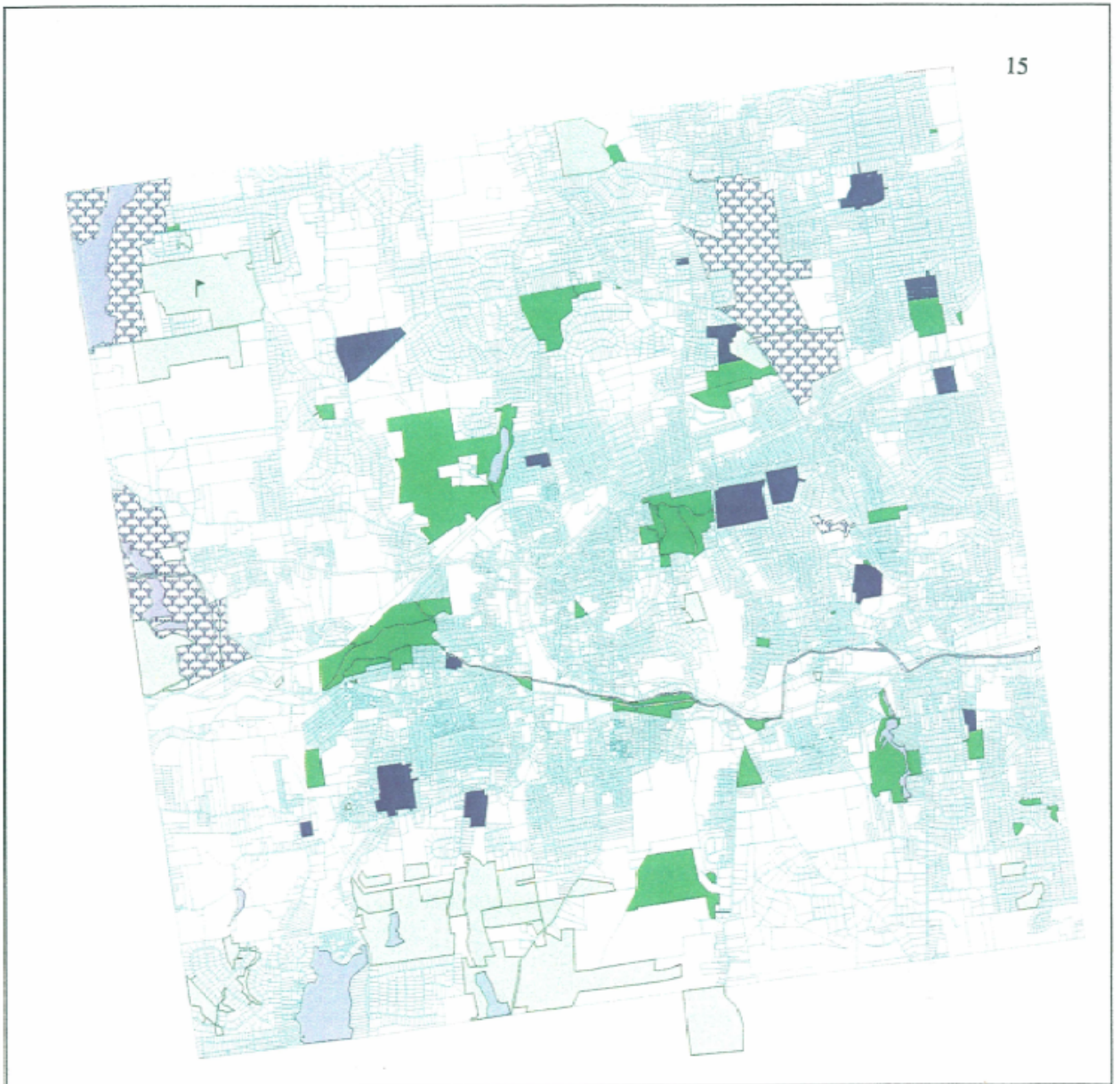
In addition to the property's geological and historic significance, the property can be seen as an archeological resource. Potential uses should be examined for impact on archeological areas. The archeological areas add to the context of the open space.

The Comments of Bob Cless, CCRPA, & ERT Team member:

"Two charcoal mounds were found and noted with GPS. A large black oak in one suggests that the age of both of them is at least 130 plus years because the tree was large and perhaps over 80 years old. It is my experience that trees generally only grow in a charcoal mounds after a long but undetermined period of time. The intense heat from the charcoal making may sterilize the soil in some way






reducing its natural fertility. Charcoal making was historically practiced by relatively marginalized people called colliers who sometimes belonged to ethnic or immigrant groups. Usually it was a single collier and his helper who burned as many as three or four charcoal mounds or pits down over a week or more to produce charcoal. The charcoal was used principally in industrial furnaces, for example iron smelting, during the 18th and 19th century. Sometimes, the collier for his own use near the mounds, built a small simple hut. The two mounds found could represent a single event or repeated use of one prepared area. I would recommend some investigation, initially just a walkover, to see if more evidence for this practice can be found.

Prehistoric sensitivity would generally be around known seeps and along streams, particularly on the terraces above the pond. The kettles are not perched, they are well drained and it seems unlikely that they ever held water long enough to be attractive to animal or human use. It might be good to test for organic layers below the existing pothole surface. The state archaeologist has stated an interest in testing the bottoms of some of the kettles. He suggests that the kettles may have been used as places to entrap large mammals such as deer and perhaps fauna from the earliest period of human occupation of the Connecticut landscape."



**Plan of Conservation and Development
City of Bristol, CT**

Existing Parks and Open Space

-  Public Park or Open Space
-  Private Recreation/Conservation Lands
-  Water Supply Watershed
-  Public School Facilities
-  Waterbodies



0 0.6 1.2 Miles

BFJ Buckhurst Fish & Jacquemart Inc.

*Sources: Central Connecticut Regional Planning Agency
Buckhurst, Fish & Jacquemart Inc.
Bristol Parks Department
1989 Bristol Plan of Development
Bristol Regional Environmental Center*

Inventory of Publicly Owned Parks, Recreational Facilities and Open Space, City of Bristol, CT

| Name and Location of Facility | Description of Facility | Size (in acres) |
|--|---|-----------------|
| Rockwell Park (Jacobs Street, Dutton Avenue and Terryville Road) | municipal park; contains swimming lagoon, picnic areas, pavilions, playground equipment, tennis courts (lighted), basketball courts, baseball fields, hiking trails, swimming pool | 96.2 |
| Page Park (King Street, Moody Street, Page Avenue and Woodland Street) | municipal park; contains outdoor swimming pool, playground equipment, fishing lagoon, picnic areas, six tennis courts (lighted), basketball court, softball field (lighted), baseball field, pavilion and lodge buildings | 80.6 |
| Boulevard Park (Memorial Boulevard) | municipal park; contains park benches, fishing lagoon, four tennis courts, memorial monuments, walking path with mile markers | 19.2 |
| Seymour Park/Riley Field (Shrub Road) | municipal playground; contains baseball field, basketball court, two tennis courts, playground equipment, picnic areas | 5.2 |
| Peck Park (behind Greene-Hills School) | municipal park; contains four tennis courts, playground equipment, softball field | 4.0 |
| Kern Park (behind Ivy Drive School) | municipal park; contains playground equipment | 3.1 |
| Brackett Park (North Main Street and School Street) | municipal park; contains basketball court, playground equipment, park benches | 2.3 |
| Wilson Park (King Street, Fifth Street and Sixth Street) | municipal playground; contains playground equipment, softball field, basketball court | 2.0 |
| Veterans Memorial Park (Central Street and Broad Street) | municipal park; contains memorial, park benches | 0.1 |
| H.C. Barnes Field (Mix Street) | municipal playfield; contains regulation softball field (lighted) | 25.6 |
| E.G. Stocks Playground/J.P. Casey Field (Middle Street and Lake Avenue) | municipal playground/playfields; contains playground equipment, volleyball courts, basketball court, softball field, "midget" football field | 10.5 |
| Muzzy Field (Muzzy Street) | lighted baseball, football and soccer stadium complex; seating capacity: baseball - 4,900; football/soccer - 5,800. | 8.4 |
| Federal Hill Green (Maple Street, Queen Street and Center Street) | municipal green; contains lighted walkway, playfield, park benches, playground equipment | 2.1 |
| Muzzy Triangle (Park Street/Divinity Street) | municipal open space | 0.4 |
| Birges Pond/Hoppers (North Pond Street) | municipal open space; contains pond, hiking, walking and bicycle trails, picnic areas; fishing and canoeing allowed on pond | 203.3 |
| Pine Lake Open Space (Pine Street, Birch Street and Emmett Street) | municipal open space; contains lake, Challenge ropes course and two soccer fields | 54.6 |
| Nelson's Field (Burlington Avenue and Maple Avenue) | state-owned open space | 49.0 |
| unnamed parcel (Mans Lane and Hopmeadow Road) | municipal open space | 1.2 |
| unnamed parcel (Cherry Hill Drive) | municipal open space | 0.5 |
| unnamed parcel (Marcia Drive) | municipal open space | 1.0 |
| unnamed parcel (Violet Drive) | municipal open space | 1.4 |
| unnamed parcel (Candlewood Drive) | municipal open space | 1.9 |
| unnamed parcel (Jamesdrew Lane) | municipal open space | 5.0 |
| unnamed parcels (Brandon Run, Cameron Dr., Corbin Ridge, Tiffany Lane, Tyler Way) | municipal open space | 31.7 |
| Bristol Indoor Swimming Pool (Mix Street) | municipal swimming facility | N/A |
| Total Acreage | | 609.3 |

Sources: 1989 Bristol Plan of Development, City of Bristol Parks Department

Inventory of Recreational Facilities at Public and Private Schools, City of Bristol, CT

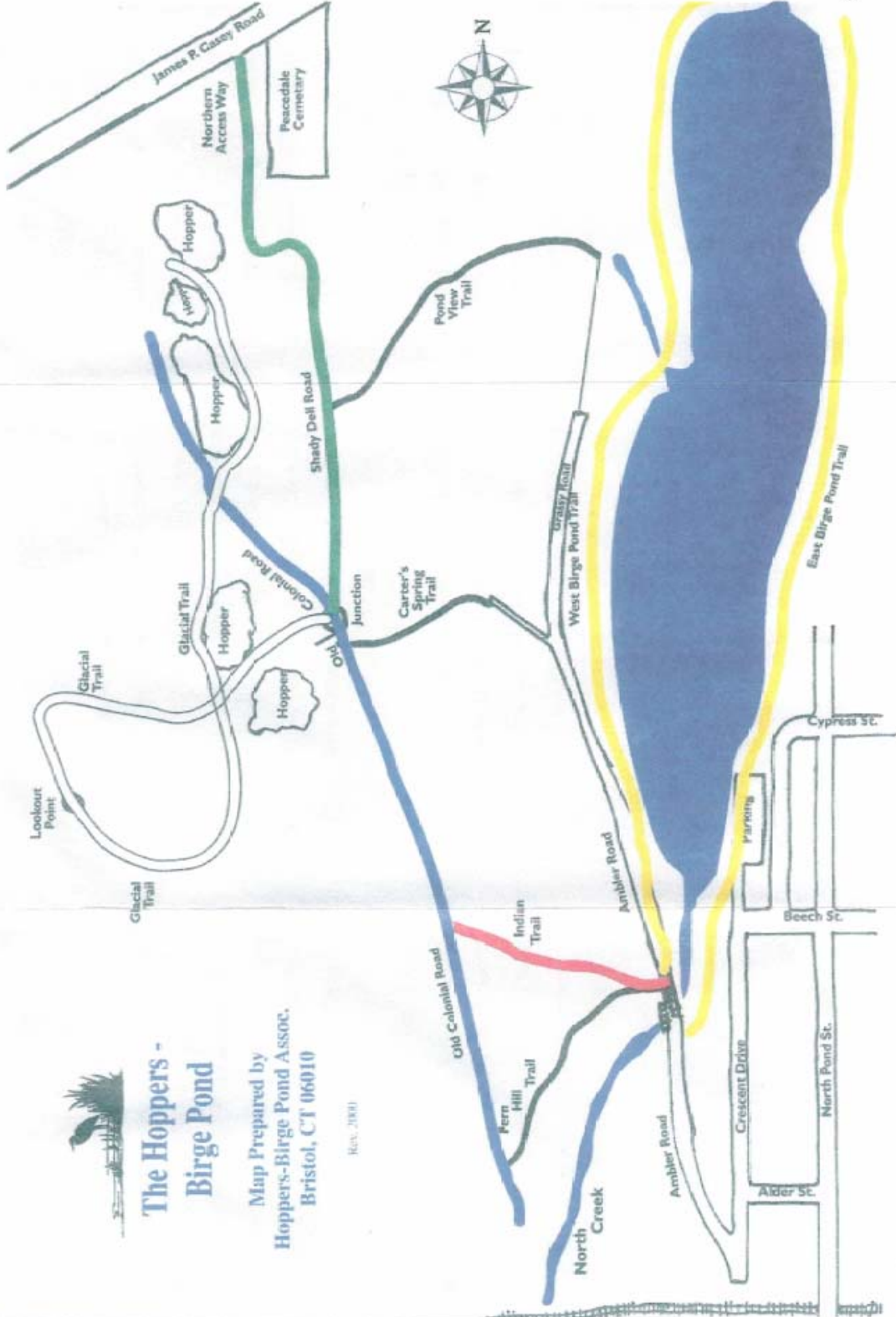
| Name and Location of School | Description of Facility | Area used for recreation (in acres) |
|---|--|-------------------------------------|
| Public Schools | | |
| Bristol Central High School (Wolcott Street) | five tennis courts, three baseball/softball fields, one football field, three soccer fields, one track | 27.0 |
| Bristol Eastern High School (King Street) | six tennis courts, three baseball/softball fields, one football field, three soccer fields, one track | 29.0 |
| Chippens Hill Middle School (Peacedale Street) | two baseball/softball fields, one soccer field | 10.0 |
| Memorial Boulevard Middle School (Memorial Boulevard) | two baseball/softball fields, one track | 4.0 |
| Northeast Middle School (Stevens Street) | two basketball courts, two baseball/softball fields, two soccer fields | 24.0 |
| C.A. Bingham School (North Street) | one basketball court, playground equipment | 1.5 |
| Edgewood School (Mix Street) | three basketball courts, playground equipment | 12.0 |
| Greene-Hills School (Pine Street) | playground equipment | 7.0 |
| E.P. Hubbell School (West Washington Street) | two basketball courts, playground equipment | 15.0 |
| Ivy Drive School (Ivy Drive) | one basketball court, one baseball /softball field, playground equipment | 15.0 |
| J.J. Jennings School (Burlington Avenue) | one baseball/softball field, playground equipment | 3.0 |
| Mountain View School (Vera Road) | two basketball courts, one baseball/softball field, playground equipment | 5.0 |
| C.T. O'Connell School (Park Street) | one basketball court, playground equipment | 2.0 |
| South Side School (Tuttle Road) | three basketball courts, one baseball/softball field, playground equipment | 9.0 |
| Stafford School (Louisiana Avenue) | one basketball court, one baseball/softball field, playground equipment | 15.0 |
| Total Acreage – Public Schools | | 178.5 |
| Private Schools | | |
| St. Paul Catholic High School (Stafford Avenue) | one baseball/softball field, two football/soccer fields, one track | 12.0 |
| St. Stanislaus Montessori School (West Street) | playground equipment | .5 |
| St. Joseph's School (Center Street) | playground equipment | .5 |
| St. Anthony's Grammar School (Pleasant Street) | one basketball court, playground equipment | .5 |
| St. Matthew's School (Welch Drive) | playground equipment | 1.0 |
| Total Acreage – Private Schools | | 14.5 |

Sources: 1989 Bristol Plan of Development; City of Bristol Board of Education

Inventory of Privately Owned Recreational Facilities and Open Space, City of Bristol, CT

| Owner, Type and Location of Property | Size (in acres) |
|--|------------------------|
| Bristol Regional Environmental Center Barnes Nature Center – Shrub Rd. | 53.2 |
| Indian Rock Preserve – Old Wolcott Rd., Wolcott Rd. | 222.0 |
| open space – Willis St. | 12.4 |
| open space – Northmont Rd., Southmont Rd., Beecher Rd. | 27.6 |
| open space – Marsh Rd. | 77.2 |
| open space – Brewster Rd. | 9.7 |
| Girl Scouts Connecticut Trails Council camp – Willis St. | 35.7 |
| Chippabee Golf Club golf course/country club – Marsh Rd. | 140.7 |
| Jacklin Rod and Gun Club rod and gun club – Willis St. | 68.8 |
| Pequabuck Golf Club of Bristol golf course – Terryville Ave. | 66.2 |
| Bristol Fish and Game Club fish and game club – Willis St. | 126.8 |
| Hickory Hill Estates Inc. open space – Julia Rd. | 9.2 |
| open space – Poitras Rd. | 6.7 |
| Lawrence Lane Community Association open space – Lawrence Lane | 4.4 |
| JWDC Development Corporation open space – Aldbourne Dr. (to be deeded to City of Bristol) | 3.7 |
| Total Acreage | 864.3 |

Sources: 1989 Bristol Plan of Development; City of Bristol Assessor's Office



The Hoppers - Birge Pond

Map Prepared by
Hoppers-Birge Pond Assoc.
Bristol, CT 06010

Rev. 2000

EARLY HISTORY OF THE HOPPERS

COLONIAL HISTORY AND TODAY AT THE HOPPE

On behalf of the Hoppers Birge Pond Association and the Hoppers Birge Pond Committee we welcome you to the Hoppers Birge Pond Nature Preserve. We are proud that the City of Bristol has protected this two hundred acre portion of land that abounds in wildlife, unique glacial features and local history of Bristol. It speaks highly of a community that is far sighted enough to realize that preservation of land and our environment is important for Bristol today and the Bristol of tomorrow.

The "Hoppers" is local terminology that refers to the huge "scotch holes" that were formed during the Ice Age 12,000 years ago. When the ice slowly melted and percolated through the gravelly soil, huge depressions we call "hoppers" were formed. Other notable glacial features are prominent in the 270 acre open space area. Eskers and drumlins were formed by rivers that rushed through the area carrying silt, sand, and gravel. An esker is a narrow mound of glacial drift and a drumlin is a low rounded hill composed of glacial drift.

Glacial features are not the only attractions to the Hoppers-Birge Pond. The area abounds in the history of Bristol's pioneer days. The Hoppers is crisscrossed by several old roads and historic Indian trails which were the main thoroughfares of days gone by.

We hope this will be the first of many visits to the Hoppers. Each season the Hoppers offers a variety of passive recreational activities. Ice fishing is popular in the winter, spring time bird watching and hiking, summer fishing, hiking and picnicking and perhaps autumn is the most spectacular season of all. It is then the hoppers bursts into radiant fall foliage.

Regardless of the season, the Hoppers is an asset to the City of Bristol. We hope you enjoy your visit to The Hoppers Birge Pond Nature Preserve and return several times.

The Indians in the Bristol-Farmington area were Wappany which had their headquarters near Poughkeepsie, New York. Perhaps the most famous tale of local folklore is that of Cochepianee who is said to have toiled for hours transporting a cifer null in Farmington through the Hoppers to a cifer null in Farmington. Stephen Graves, a Tory, is said to have escaped from his cell in the Sons of Liberty into an area of the Hoppers called Pine Hollow.

Today The Hoppers Birge Pond Association and Farmington Mayor's Hoppers Birge Pond Committee continue efforts to preserve and protect a unique natural resource. Together our long-term goal is the restoration of Birge Pond and the protection of the surrounding woodlands that provide a variety of wildlife with much needed habitat.

The Hoppers Birge Pond Association also offers a slide presentation free of charge to any interested groups. Video is also available at the Bristol Public Library and the Manross Library in Forestville. Feel free to call 589-2841 or 583-9572.

Conservation District Review

Recreational Alternatives Study

General Data

Owner: City of Bristol, Connecticut. Purchased by Bristol in 1973 with financial assistance from the U.S. Department of the Interior under the Land and Water Conservation Fund Act of 1965. As such the property must remain a public outdoor recreational area.

Location and Size: The 207-acre site is .5 miles northwest of downtown Bristol (see **Figure 1**). It is largely surrounded by private sand and gravel excavation properties (both abandoned and active) and by low and medium density residential areas (a significant portion of the latter built since town purchase of the H-BP recreation land). Birge Pond is 14.3 acres, and the forested “Hoppers” area is 150 acres. The remaining acreage is marsh. The elevations at the site range from +385 at pond level to +820 at the high point.

The 19-acre parcel called the “Roberts Property” has been added to the acreage of the H-BP recreation area. (In **Figure 1**, the northern quadrangle delineated separately and adjacent to the main body of the Hoppers.) It was recently both farmed and mined/partially-reclaimed.

Reason for Request: The City of Bristol wants to definitively determine the type(s) of passive and active recreational activities that are feasible, optimal, and that will provide the “highest and best” public recreational use of the Hoppers Birge Pond property.

Prior Studies:

- “Final Report of Findings; Dredging/Water Quality Improvement Study for the Birge Pond Restoration Project,” Normandeau Associates, Inc., 1993
- “Report from the Mayor's Hoppers/Birge Pond Study Committee,” City of Bristol, CT, 10-10-89
- “Feasibility Study, Hoppers-Birge Pond Recreation Area,” Maguire Group, Inc., 1988
- “Hoppers-Birge Pond Development Plan,” Hoppers-Birge Pond Committee, State of Connecticut, 1977

Site Description:**Geology**

The geology of this site has been much discussed in previous studies and reports. This is because the character of the site's geological formations defines its character and created its unusual and notable qualities.

To summarize from prior reports, the Hoppers portion of the property was formed during the last glacial retreat. Receding glacial meltwaters deposited stratified (layered) sands, silts, and gravel into an ice-dammed glacial lake that was bounded by the Chippens Hill drumlin to the northwest and a massive ice dam to the southwest. (See **Figure 2**) The glacial lake was not part of the much larger Glacial Lake Hitchcock, but was directly southwest of it, and formed under similar conditions. The ice dam that formed the lake melted to successively lower levels over time, leaving behind a “step-like, sloping, or irregular quality” to the kame terraces and knolls of the site. The site's kettles (colloquially known as “hoppers”) were formed by buried glacial ice that did not carry much debris. When the ice melted, large holes were left. “Sinuous elongate” esker ridge-forms

run adjacent to and between kettles, particularly in the northwest portion of the site.

The kettle holes have repeatedly been described as geologically unique and visually impressive because of their width and depth (several hundred feet for both), and their dryness. There are five major kettles, four of which are the Twin Hoppers, Shaffrick Hopper (portions of which are on private land), and Roberts Hopper, which is on the land recently acquired by Bristol. As can be seen in **Figure 3**, the kettles formed in the vicinity of a glacier's edge. The most striking portion of the kettles area is the quarter-mile walk on a very narrow esker ridge between the Shaffrick and Robert kettles, with dramatic views into each.

Two other major kettles, the Mother and Child, that had been in the same vicinity as the others but on privately owned land, were destroyed by sand and gravel excavations in 1988.

There are reportedly three scenic panoramic views from the Hoppers to all of Bristol and areas beyond. One of these views, which extends over Bristol to other more distant ridgelines that include Avon Mountain and the Heublein Tower, was viewed by the ERT study group. The panoramic views are said to be at their peak in fall and winter, when leaves have fallen.

The ERT study group was informed that all parties involved with the Hoppers, including the City of Bristol, concur that the unusual geologic features of the Hoppers should be preserved. Additionally, a 1988 referendum favoring preservation of the Hopper's natural/geologic features, and opposed to municipal excavation of the property's sand and gravel, passed overwhelmingly. The referendum was a response to a proposal by some members of city government that the City mine sand and gravel in the Hoppers to obtain funds to build a municipal golf course there.

Soils

About 90% of the property is made up of stratified sands and gravels of glacial origins. (See **Figure 4**) Bristol is laced with such “surficial” deposits, in places where there were glacial lakes and ponds. (See **Figure 5**, and compare to **Figure 2**) The sand and gravel are often less than 20” below the soil surface. As would be expected, soils associated with underlying sand and gravel have low moisture-holding capacity, rapid permeability, and low natural fertility. In the Hoppers these factors have led to the somewhat meager forest cover, which is also prone to summer fires because of droughty conditions.

The 2002 USDA State of Connecticut Soils Report indicates the presence of the following soils on the HBP property (See **Figure 6**):

The Hoppers Area Associated Soils:

- Hinckley Gravelly Sandy Loam Soils (previously called Terrace Escarpment soils in 1954 Soil Survey) Found on almost all of the Hoppers area. **Figure 7** shows the Hoppers containing the largest block of Hinckley terrace soils in Bristol.

Description:

Most soils in the Hoppers area are Hinckley Gravelly Sandy Loam, 3-15% slopes, or Hinckley Gravelly Sandy Loam, 15-45% slopes. Hinckley soils occur on glacial terraces, outwash plains, valleys, kames, and esker landforms. The soil is excessively drained. Both types developed on stratified glacial sandy and gravel deposits.

Recreational Use:

The 2002 USDA Soils Report rates both Hinckley soil types as having very limited capacity to sustain lawns, landscaped conditions, golf fairways, or playgrounds. While the Hinckley soils with 15-45% slopes are rated as very limited for paths and trails, Hinckley soils with 3-15% slopes are rated as

not limited for creation of paths and trails. Hinckley soils with 15-45% slopes are rated as very limited for picnic area usage, but as only somewhat limited at 3-15% slopes (picnic areas would generate somewhat more intense use and larger and less linear use areas, requiring a more intensive use in more level areas than trails).

Birge Pond Associated Soils:

- Saco Silt Loam

Small area found north of Birge Pond

Description:

These soils occur on drainage-ways, depressions, river valleys, floodplain landforms. The parent material is alluvium.

Recreational Use:

Being a wetland soil, Saco soil areas are very limited in all recreational uses, including paths and trails, grass and landscape uses, golf fairways, picnic areas, and playgrounds.

- Raypole Silt Loam

Found in two drainage ways west of Birge Pond that extend from the Hoppers area.

Description:

Raypole Silt Loams occur on drainage-ways, depressions, valleys, outwash plains, and terrace landforms. Slopes are 0-3%, and runoff is low. The soil is poorly drained. Minimum depth to seasonal water table, when present, is about 6 inches. The parent material consists of eolian (windblown) deposits over sandy and gravelly outwash.

Recreational Use:

Like Saco Silt Loam, Raypole soils are very limited in all recreational uses.

- Rippowam Fine Sandy Loam

Small area found at the southern border of Birge Pond

Description:

These soils occur on river valleys, drainageways, depressions, and flood plain landforms. The parent material consists of alluvium.

Recreational Use:

As with Saco and Raypole Soils, Rippowam soils are very limited in all recreational uses.

- Agawam Urban Land Complex

Found on the northeast bank of Birge Pond.

Description:

The Urban Land component is not rated, because of its variability in the modified cultural environment. Agawam soils consist of fine sandy loam over stratified very gravelly coarse sand to fine sand. They are well-drained to somewhat excessively drained soils on stream terraces, valleys, and outwash plain landforms. They also occur as eolian (windblown) deposits over glaciofluvial (glacial river) deposits. Rapidly permeable, they drain well in spring. The soils can be droughty, with nutrients leaching out. Runoff, flooding, and ponding is negligible, and there is low to medium erosion hazard.

Recreational Use:

Because of the Urban Land component, land use suitabilities need to be field checked. Agawam soils are not limited for paths and trails, somewhat limited for golf fairways, not limited or somewhat limited for picnic areas, dependent on slope, and somewhat limited or very limited for playgrounds, dependent on slope.

- Charlton Urban Land Complex

Found on the east bank of Birge Pond.

Description:

Urban Land is not rated, because of its variability in the cultural environment. Charlton soils are firm to very friable fine sandy loam to very stony fine sandy loam, well drained, with medium erosion hazard.

Recreational Use:

Because of the Urban Land component, land use suitabilities need to be field checked. Charlton soils are very limited for playgrounds. Steep slopes are somewhat limiting for paths and trails, but moderate and minimal slopes are not limiting. Steeper areas are very limiting for picnic areas, while moderate slopes are somewhat limiting.

Roberts Property Soils

The most recent USGS topographical mapping is out-of-date for this property. Sand and gravel mining have dramatically altered some of the terrain, which needs to be re-surveyed.

- Udorthents, smoothed

Found in a small area at the northeast of the newly acquired Roberts property.

Description:

These are very deep, somewhat excessively drained to moderately well drained soils that have been altered by cutting and filling. Udorthents occur in and adjacent to urban areas, industrial areas, school-yards, and borrow areas. Slopes are dominantly 0-8% but range from 8-25% on the sides of excavations. Fill material is greater than 20 inches over original soil and is dominantly sandy loam, although it ranges from silt loam to sand. Rock fragment content ranges from 0-60%. Included in this soil grouping are reclaimed gravel and sand pits, with the soil dominated by

gravel and sand in these areas. The characteristics of this unit are so variable that an on-site investigation is required to determine the suitability for proposed uses.

Recreational Use:

Rated as variably limited for different recreational uses, dependent on on-site investigation.

- Udorthents Pits Complex, gravelly

A large portion of the newly acquired Roberts property is of this soil type.

Description:

The parent material is gravelly outwash. Slopes range from 0-35%, with medium runoff. The soil is moderately well-drained. Gravelly coarse sand and silty clay loam start about 5" below grade. Pits are open excavations from which the soil and commonly underlying material have been removed, exposing either rock or other material. The slopes range from 0 to 80 percent, depending on the excavation, and the runoff class is high.

Recreational Use:

Rated as variably limited for different recreational uses, with development dependent on on-site investigation of reclamation conditions.

- Sudbury Sandy Loam. 0-3%

Found in a small area at the northwest of the Roberts property

Description:

Moderately well drained sandy terrace soils that developed on sand and gravel deposits. Gravel makes up from 2-20% of the soil. Rapidly permeable, but with a seasonal high water table interfering with internal drainage. Mottled at 10-18 inches.

Recreational Use:

Not limited for paths and trails, somewhat limited for picnicking, playgrounds, and golf fairways, due to the shallow depth to the saturation zone.

- Agawam Fine Sandy Loam. 0-3%

Found on the northeast of the Roberts property.

Description:

See above, under Agawam-Urban Land Complex.

Recreational Uses:

See above for Agawam description and recreational capabilities.

Erosion Conditions and Potential: Hoppers Area

The 1977 study noted that “if there is a natural hazard to the Hoppers-Birge Pond site, it is the potential for erosion. Because of the terrace escarpments of sand and gravel, steep slopes of 15% [*and over*], high permeability, and droughtiness, the land can only sustain minimum activity or lose its vegetative cover. The loss of the vegetative cover is a direct catalyst for erosion.” The kettle holes have been considered especially fragile.

Previous studies have noted that trails had been damaged by motor vehicles, as well as by wind and rain.

2003 observation shows that trails continue to erode and to be undercut, especially around curves, despite volunteer efforts to maintain them. Dirt bikes and all-terrain vehicles reportedly continue to make liberal use of the Hoppers.

By observation, the Hoppers is an unusual environment, an inland area that seems almost beach-like in its obvious and extreme sandiness and its rather stunted woody vegetation and its scarce herbaceous understory. There is an unusually dense concentration of small steep-sloped knolls, ridges, and cavities -

so many, in fact, that the USGS topographic map seems an inadequate guide to the terrain. (See Figure 8 for Slope Analysis of the USGS data currently available.) Sometimes it almost appears that precarious-looking piles of sandy material have been placed along ridges by mechanical means, when, in fact, the material was left by glacial activity and has somehow still persisted into the present. One or two trails on very narrow esker ridges between major kettles seem almost designed as viewing areas into the kettles, when in fact these ridges are thin walls of sandy material left by glacial meltwaters that flowed between the ice masses that molded the kettles.

Much of this sandy and complex terrain was long stabilized by pre-European pine forest. The pines having been completely logged during the 19th century, the many landforms of the kettles have undoubtedly been more susceptible to being eroded and undermined by such human activity as minor grading, wheeled traffic, and probably even pedestrian use.

Vegetation/Wildlife: Hoppers Area

A diarist of the early 19th century wrote that the Hoppers were a “thick” pine and chestnut forest. Studies since 1977 describe oak as the dominant species, with many trees being about 50 years old. The trees haven't reached expected height due to the natural excessive drainage of the soil, and because of frequent forest fires. Pines are especially vulnerable to fire, so have not flourished recently. Fires also have reduced the shrub and herbaceous layers of the forest, which in turn have reduced the presence of wildlife.

Besides oak, other trees in the Hoppers include birch, red maple, and beech. Mountain Laurel is an abundant understory shrub. Herbaceous plants include ferns, Trillium, Jack-in-the-Pulpit, Lady's Slippers, Hepatica, Arbutus, Terillium Coltsfoot, and Spring Beauty. A mycological organization reportedly counted 48

varieties of mushrooms and fungi. Wildlife includes woodpeckers, ruffed grouse, red fox, raccoon, skunk, rabbit, and opossum.

Hydrology and Water Quality: Birge Pond and Surrounding Areas

Birge Pond is at the southern downstream end of Birge Brook, the Pequabeck River's largest tributary. (The pond also receives water from two other smaller watercourses and from a number of small seasonal springs from within the Hoppers.) The Pequabeck River is part of the Farmington River watershed. (see **Figure 9** for Watershed Map). The 928 acre 1.4 mile watershed of Birge Brook is to the north and west of Birge Pond (see **Figure 10** for Birge Brook Watershed Map).

There is a large aquifer below the Hoppers. Being located at the base of the sand and gravel Hoppers area, Birge Pond likely receives a considerable amount of groundwater flowing from the Hoppers.

An 18th century map shows a much smaller pond surrounded by marsh. The first dam was constructed in 1831, expanding the size of the pond, which was over time increasingly used as a reservoir source for water power for downstream factories. Remnants of industrial raceways can be found on both sides of Ambler Road. In 1933 a concrete spillway was built to replace an earlier dam, and it is still in place.

Birge Pond is now 1900 feet long and 300 feet wide. Since initial study of Birge Pond's water quality in 1977, the pond has consistently been described as impaired and eutrophic. The most extensive study of water quality and hydrology was written in 1993 by Normandeau Associates.

To summarize from the latter report, sedimentation has made the pond shallower, smaller, and warmer. "The entire pond contains a soft upper sediment layer overlying sandy substrate." Increased nutrient levels, associated

with sedimentation, are indicated by high concentrations of algae and nuisance aquatic weed growth, especially in the shallower areas. "Very shallow warm water will limit many aquatics, and the soft, flocculent substrates will inhibit rooting of both aquatics and emergents." The above conditions, together with low dissolved oxygen, impair fish habitat. Recreation potential in the form of swimming has also been described as limited, at least until there is substantial improvement in water quality.

The Normandeau report stated that sediment testing showed low concentrations of most heavy metals and petroleum hydrocarbon, and non-detectable levels of mercury, pesticides, and PCB's, indicating "no major contaminant point sources to pond sediments."

The northern wetland associated with the pond, also filling with sediment, "provides a valuable urban habitat for terrestrial and aerial species because of its size, diversity of wetland cover type (alder swamp, red maple swamp, cattail marsh and rice cutgrass beds), and vegetative water interspersions with the serpentine stream channels." The wetland also acts as a pollutant-filtering buffer to continuing upstream residential development. (See **Figure 11** for Wetlands/Watercourses Map).

Among species associated with Birge Pond and its associated wetlands are heron, swans, mallards, sunfish, perch, shiner, bass, pickerel, crayfish, turtles, bullfrogs, blueberries, blackberries, and waterlilies.

The Birge Brook watershed land-uses include residential sub-development, undeveloped woods, and agriculture. (See **Figure 12**) The Normandeau study states that Birge Pond's small watershed area to pond area ratio almost dictates that the pond will be eutrophic, given any development at all in the watershed. The Pequabek River has long had compromised water quality, due in part to previous point-source pollution problems associated with

commercial/industrial uses. (See Figures 13 and 14 for most recent EPA water quality ratings). Since, as has been stated in all cited reports, water quality in the large tributary of Birge Brook has been consistently degraded by erosion and stormwater runoff from mining and from the 30+ years of subdivision development, it is likely that water quality of the Pequabeck River is affected.

All studies since 1977 have recommended specific measures to improve water quality in the Birge Brook watershed. The following responds to some of these recommendations:

- Historically, several sand and gravel operations discharged large quantities of sand and silt downstream into the pond. There is now just one quarry in operation, and the City of Bristol has reportedly been working with this operator to reduce activities that impact water quality. Sandbanks adjacent to the pond and watercourses require ongoing monitoring and maintenance.
- The City also is aware of potential impacts of ongoing residential construction on water quality. It will be important to continue monitoring construction sites carefully, since potential impacts to water quality can be large and direct.
- The 1993 Normandeau study counted 17 direct stormwater outfalls in the Birge Pond watershed. Three discharged directly into Birge Pond from roads to the east of the pond. There is extensive use of sand in roadways during the winter. According to the all the studies done, a major cause of sedimentation and high nutrient loading in Birge Pond has been untreated stormwater runoff from roads.

In 1999, as a result of a lake restoration study undertaken years earlier by the City of Bristol and the DEP, three sedimentation chambers were installed at

the three outfalls from road to pond. (See **Figure 17**). The three outfall areas, which had eroded and destabilized over time, were re-graded and stabilized.

If another sedimentation chamber were to be installed at the convergence of a small tributary into the west side of the pond, water quality impacts would be further mitigated, since the tributary carries runoff from nearby medium density development.

- After decades of recommendations and planning, the City of Bristol and the DEP have secured funding for and are collaborating to dredge Birge Pond to reduce its sediment load. It is a costly endeavor, making it even more important that the original conditions that caused the sedimentation continue to be addressed, resolved, and ameliorated.

The 1993 Normandeau hydrology study described the north headwaters of the brook as “fairly well-buffered” from the environmental impacts of then existing development. At that point, the northern half of the brook was a mixture of wooded areas and of medium density residential development that was more or less set back from the brook. (It is possible that further development has modified conditions.)

The southern half of the brook was described as not well buffered, with The Hoppers the only substantial open space in the southern Birge Brook watershed. Studies of the area previous to 1993 noted unstable and eroding streambanks along the brook, particularly where development abutted the brook. Steep areas are generally more vulnerable to erosion. One study noted six discharge pipes from backyard swimming pools that probably emptied directly into the brook.

There is no indication that the 14 or more remaining outlet discharges of the Birge Brook watershed have been assessed. If not already started, the City of Bristol or a local watershed association could undertake an inventory of

stormwater outlets, noting erosion and sedimentation problems along the length of Birge Brook. With such an inventory, problems could be prioritized as to severity, and funding sought for fixing them one by one.

As with all development along watercourses, water quality can be negatively affected by property owners using excess lawn and garden fertilizers, and allowing leaves and lawn clippings, automotive fluids, soaps, and pet waste to enter the storm drainage systems. Ongoing public education targeted to homeowners in the watershed can help to reduce non point sources of water pollution.

Evaluation of Recreational Alternatives

Several proposals for various types of recreational activities in the Hoppers-Birge Pond area have been made over several decades. Suggested uses for the Birge Pond area have included hiking, boating, fishing, skating, hockey, and swimming. Proposals for the Hoppers have included trails for hiking, cross-country skiing, biking, dog walking, picnicking, environmental education, sledding, active sports, and golfing. With the recent acquisition of the Roberts property, there no doubt has been interest in some of the same recreational activities that have over time been proposed for the Hoppers.

The following comments are made in the context of what the Team was told was the goal of preserving the unique geology of the Hoppers. Alternative proposed recreational uses are also evaluated as to potential effects on and consumption of natural resources, i.e., the “match” of natural site features and resources to proposed uses. Reference can be made to **Figure 15**, which shows open space and recreation areas in Bristol. **Figure 16** is a Summary “Good-Bad” Map illustrating opportunities (in green) and limitations (in yellow for moderate and red for extreme) for recreational development, as determined by standard environmental planning criteria in relation to natural resources.

One overall recommendation for the entire site, but especially for the Hoppers, is to commission a licensed surveyor to map the area. As described above, this is an extremely intricate and variable property that was never adequately mapped. Without a good map, it's difficult to plan and design in an informed, conservative, and appropriate way.

Birge Pond Area:

- **Hiking.** The volunteer Mayor's Committee on the Hoppers-Birge Pond has recently constructed a boardwalk around Birge Pond. This seems an ideal amenity for public access to the pond, as it also protects the wetland soils from compaction or erosion.
- **Boating.** Canoeing, kayaking, and row-boating can provide pond access while not polluting.
- **Fishing.** Fishing is a recreational activity that has no negative impact on water quality.
- **Skating and Hockey.** These are winter sports dependent on an appropriately frozen lake. Neither activity would impair water quality.
- **Swimming.** While the recently placed sediment chambers and the imminent pond dredging will improve pond water quality, any decision to allow swimming depends on up-to-date water quality testing, to determine whether the water meets standards for human contact. Water quality is unlikely to improve to this standard in the foreseeable future, especially since development continues in the small Birge Brook watershed area.

Vehicular access and boat launches to Birge Pond are better placed on non-wetland soils that are relatively level, i.e., reasonably level areas east of the pond, and at the Ambler Road entry, by the dam.

Hoppers Area:

- *Trails and Hiking:* As detailed in the body of this report, the major soil of the Hoppers area, the Hinckley soil, is not limited for trails and hiking when the slopes are less than 15%, but is very limited when slopes are greater than 15%. Observation seems to support these standards: the soils are very sandy and erodable, and the edges of trails are eroding, especially in the steeper sections.

Some suggested parameters for trail design:

- All paths should be stabilized with gravel, and path edges stabilized with groundcover plantings, carefully nursed until established and monitored thereafter.
- Try to keep most trails in the least steep areas (areas in yellow on slope map), concentrated in the center of the property, and which do provide the opportunity to connect the Birge Pond, the Hoppers, and the Roberts property. A detailed map would be very helpful in locating more level areas within the steeper portion of the property, and in locating potential trail connections.
- When it is necessary to traverse steeper slopes, keep the length of the climb as small as feasible, and consider armoring that portion of the slope with stones and/or steps. Consider this also for areas where paths curve. If trail use increases, which is a goal for the city and park advocates, the wear and tear on the narrow ridges and on kettle sides in the actual kettles area in the northwest Hoppers will be considerable in this fragile landscape. Consider building boardwalks, bridges, and steps there. (A potential positive side effect of building steps and wooden walkways might be that uninterrupted dirt biking some of the steep trails might be made less attractive.)
- Place multiple signs that guide people to use designated paths, with accompanying explanations in relation to soils, geology, erosion, etc.
- Also place signs restricting dirt and mountain bike and motorized traffic; again, some of these signs should clearly and even diagrammatically show the

reasons for these restrictions and the impacts of such activities (i.e., this is not just to deprive people of fun). Consider designating a separate area for such vehicles in already mined areas where these activities would not hurt the land.

Cross-country skiing: This should be restricted to the most level and stable areas of the Hoppers.

Biking: The soil is too fragile to sustain wheeled traffic.

Sledding: The slopes/soil are too fragile.

Dog walking: This potential use depends on whether hikers can be counted on to keep their dogs on leashes and on designated trails. Digging around by dogs could be an erosion hazard in these sandy soils. If this activity is permitted on a trial basis, place signage addressed to dog owners similar to that described in "hiking and trails."

Picnicking: The predominant soil of the Hoppers is rated as somewhat limited for this use for slopes below 15%, but as very limited at slopes above 15%. It would be practical and make environmental sense to locate picnic areas in lower flatter areas of the property, relatively close to access roads/parking areas.

Golf course: A 1997 report released by the American Society of Golf Course Architects states that rolling hills and interesting landscapes are ideal for a golf course site. Simultaneously, the report states that a site that is suitable also requires only minimal earthmoving operations (resulting in reduced construction costs). The site must be "suited to allow an environmentally responsible approach to the development." Environmental parameters to be evaluated for site selection include presence of wetlands, drainage, and the soil conditions. "Drainage and quality topsoil are essential to growth of the fine turf."

The State of New Jersey DEP has published a manual entitled " Golf Course Design and Construction: Best Management Practices" (http://www.state.nj.us/dep/watershedmgt./DOC/pdfs/golf_chapter_1.PDF.) The following quotations are from that report:

"The first steps towards establishing an environmentally compatible golf course is site selection. A thorough analysis of all natural, social, and archaeological resources of potential golf course sites should be performed. The presence and extent of some types of ecosystems may render portions or entire sites unsuitable for development. Examples include: Sensitive aquatic regimes - Threatened and endangered plants or animals - Wetlands of high water table - Steep slopes...."

"This [considered] land in its existing state usually provides a great many natural resource benefits including wildlife habitat, stormwater infiltration, and scenic vistas. The concept of having the golf course "lay lightly on the land" is one that has been in use in Scotland and England for centuries. Simply put, the course designer finds a socially and environmentally suitable site and then fits the golf course to the existing terrain as much as possible. The course then is constructed in an efficient manner, and proper relationships with site resources are established. Extra sensitivity is afforded the zones associated with watercourses, wetlands, and steep terrain.... Much native vegetation is preserved in large sections of rough and out-of-play areas, with intensely managed turf kept to the minimum. In the United States, the contrary idea has been used for much of this century. That is, sculpting the golf course from the land through extensive earth moving, without sufficient regard for natural features and limitations. In this way, greater risk for environmental degradation can result, and greater management measures are necessary. This type of development can also increase costs for permitting, construction, and maintenance. Fortunately, the current school of thought in the U.S. is swinging back toward the more site-sensitive design."

"The site selected should lend itself to use of natural terrain and avoids location of golf course, clubhouse facilities, or parking lots in an area requiring substantial alteration of the existing terrain or vegetation (i.e. filling of ravines, flattening hills, etc.). Significant grading on steeper slopes (30% or greater) or highly erodible soils should be avoided."

"Design Components & Considerations. The following factors need to be identified and mapped as appropriate: Property boundaries - Topography with areas of steep slopes emphasized - Natural runoff patterns - Existing vegetation The existing ecosystems must be identified: Water resources, both surface and ground, including wetlands - Soil map units from USDA Cooperative Soil Survey.... Scenic views for preservation - Historical and archaeological resources."

"Terrain and Water Considerations. All of these stormwater management structures will need to be maintained on a regular basis in order to function properly. Accumulated debris in basins, erosion on shorelines or in swales must be addressed promptly or the structures can become offsite pollutant exporters. Care should be taken to not provide extensive habitat elements favored by Canada geese. Canada geese populations have become a source of reduced water quality in some areas, due to nutrient and bacteria rich fecal material and destruction of shoreline vegetation...."

"Irrigation Water Considerations. The issue of irrigation water is a critical one. The availability water, irrigation requirements of the golf course, and methods of application will influence the location and design of the golf course. Irrigation issues are addressed in the design phase. Research can be done to determine of the withdrawal of groundwater for irrigation will affect the water supply of an area...."

Buildings and Parking Considerations. The construction of clubhouses, pro shops, food and beverage facilities, parking lots, and maintenance areas causes water quality impacts similar to traditional commercial development. Runoff from these areas can contribute sediment, heavy metals, fecal bacteria, organic and inorganic debris, household chemicals, oils & greases, and floatables to the adjacent surface waters. Since most of these facilities require extensive impervious surfaces, stormwater runoff volumes are much heavier than pre-development conditions. The impacts of higher pollutant export are felt not only in adjacent water bodies, but also far downstream...."

"Sediment loading from large construction sites may be as much as 100 times greater per acre than farmed fields. Suspended solids represent not only an important pollutant, but are also a principal transport vector for other surface water pollutants such as phosphorous fertilizer, pesticides, and heavy metals. Golf course construction often involves the disturbance of an unusually large amount of land...."

A 1988 feasibility study by the Maguire Group included a concept plan for a golf course, unseen by ERT members, that developed most of the property for a golf course, but left the kettles themselves unaltered. The rest of the plan included "typical development components - selective clearing, excavation and grading, irrigation systems, cart paths, shelters, bridges, maintenance facilities/equipment, clubhouse and parking, access road...."

Even if such a plan avoided the five major kettles, it would still radically transform most of the Hoppers land and environment. The kettles occur in a specific geological context that is notable for its complex terrain, its almost dune-like environment, and its very obvious glacial origins. Part of the special nature of a visit to the Hoppers area is the trail approach through a natural sequence of landscape features that bit by bit foretell the ultimate drama of the kettles and kame terrace formations.

If walkers simply went from the openness of a golf course to the kettles area, there would be little opportunity in the present and future for structured/unstructured learning about the components of the Hoppers landscape that illustrate so well a very important and influential period of our pre-history. Were most of the Hoppers a golf course, one can readily imagine the remaining much-reduced kettles area as a recreational sideshow of big holes, largely devoid of connection to and clear derivation from its thousands year old past. Without that context and preparation, visitors are less likely to respect the phenomena that they are viewing, and are more likely to take the opportunity for more impulsive thrill-oriented recreation and vandalism that could lastingly harm the land.

We live in a time where technology has assured that almost anything anyone can imagine can be constructed, given enough financing. Rivers can be buried, wetlands filled (albeit "recreated" elsewhere as per regulation), hills made flat, deserts green. Unlike the 18th/19th centuries, development choices are increasingly made in cultural context, since virtually none are imposed by the natural world.

There is no easy fit between the environment of the Hoppers and the requirements of a golf course. Unlike the ideal "gently rolling" landscape, most of the slopes are very steep. The soils are rated by the USDA Natural Resource Conservation Service as "very limited" for lawn, landscaping, golf fairways, and

playgrounds, and are low in fertility and moisture retention, leading to stunted vegetation, and to drought and fire. The whole site is very erodible, the land is atop an aquifer, and runoff from development would enter the already degraded Birge Pond.

Generally, construction of a golf course involves earth moving and construction of a good deal of impervious surface. Lawn maintenance requires a high amount of water for irrigation and fertilizers. These all have potential environmental impacts that any developer needs to plan to mitigate.

Given the site conditions at the Hoppers, earth moving would need to take place over almost the whole site. Serious erosion would be a possibility once the site was graded. Huge amounts of topsoil would need to be imported. An unusual amount of water would be needed for irrigation, possibly affecting the water table and water reserves. Unusually heavy fertilization would be needed to generate and maintain vegetation, leading to likely nutrient leaching into both groundwater and the pond, which would decrease water quality - possibly significantly, possibly reducing the salutary effects of dredging the pond.

The City of Bristol already hosts two golf courses that are not far from The Hoppers (see Figure 16). If there is a consensus among decision-makers that resources, both natural and financial, should be conserved by fitting land use to site conditions, then perhaps the City might either search for a site better endowed for construction of a golf course, or decide not to build one.

Active sports: There is no area on the periphery of the Hoppers, which is all steep, that could sustain the grading, paving, and heavy usage involved with active sports and accompanying parking, unless there was radical alteration of the terrain. This would increase the potential for erosion and sedimentation. Financial investment would be much less on more suitable land. The 1977 study also concluded that the site was not suited for active recreation.

Environmental education: The 1977 DEP study stated that “geologically. . . a wide diversity of glacial processes were taking place in a relatively small area.... As part of the scientific and educational program, the town should consider interesting local schools teaching earth sciences, probably community college level, to begin a geologic inventory of the property and work out in much greater detail the glacial processes that were active in developing the Hoppers.” Other potential student group users include school groups, camp groups, earth science/nature education classes, and youth groups. There are a number of possibilities for adult education opportunities, based around geology, vegetation, wildlife, wetlands, water quality, etc.

Well-designed and researched and graffiti-proof signage throughout the Hoppers-Birge Pond could be educational for both youth and adults. The 1977 report also contains a creative list of very practical suggestions for education stations throughout the Hoppers-Birge Pond.

The Roberts Property:

The recent acquisition of the Roberts property by the City of Bristol balances conservation of natural resources with community needs for active recreation. There is a large section of the property that has been mined for sand and gravel, and satisfactorily reclaimed. This level area is probably ideal for higher impact recreational uses: construction of ball fields, parking, and a recreation facility with bathrooms (although more specific field studies should be undertaken, as per the soils section of this report.) The ability to create a core of active recreation on appropriate land adjacent to a main road diminishes the need to consider the Hoppers for such activities, and also creates a potential to introduce new users to the Hoppers-Birge Pond property.

Summary Recommendations

The Hoppers-Birge Pond is a special environment that requires relatively little alteration or enhancement to attract and interest people. Currently, the recreation area is hidden and inaccessible as far as the public is concerned (a recipe for the wrong kind of uses, such as ATV riding). There is no reason, with a fairly minimal investment, that the Hoppers could not become well known, not only to Bristol residents, but also to weekend walkers across Connecticut. If that happened, there would be an increase in the number of visitors who would contribute to Bristol's economy.

In the short term, a survey needs to be done and an accurate map created. Shortly thereafter, landscape design and natural resource professionals could be brought in to determine the optimal locations for trails/circulation system, parking, fencing and gates, as well as active recreation areas on the Roberts property. The team would also draw design details for trails and trail structures such as steps and boardwalks, and for signage, and they would make a maintenance manual. Construction could be contracted or done on a mostly volunteer basis, based on design/construction documents.

If the City of Bristol is unable to find the resources to implement the above or something similar, "doing less" would be less environmentally detrimental than "doing more." Doing more, i.e. wholesale reconstruction of the Hoppers for active recreation/golf course, would eliminate the potential for creating a geological/natural resource preserve in the future. A fallback position for "doing less" might include construction of entry/exit signage and gates. However, even doing nothing would be better than radical alteration of the terrain, even if balanced out by continued misuse by dirt bikers and ATV's.

Once outfitted, the Hoppers-Birge Pond needs to be managed by experienced people.

In the long term, essential management components would include maintenance, natural resource monitoring, park security and rule enforcement, and generation/coordination of public awareness, public programs and park volunteers.



Figure 1- Hoppers-Birge Pond Location

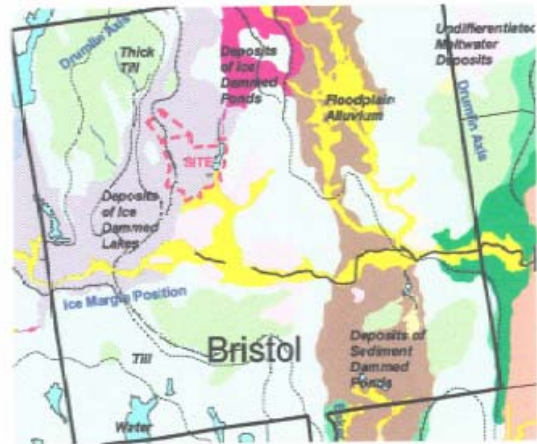


Figure 2- Glacial Geological History in Bristol



Figure 3- Kettles in Geologic Context

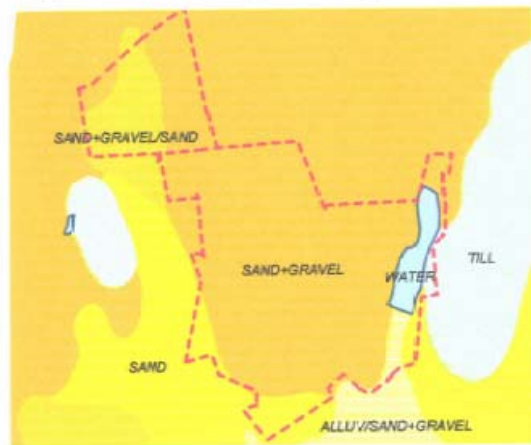


Figure 4- Surficial Materials Left by Glaciers at Site

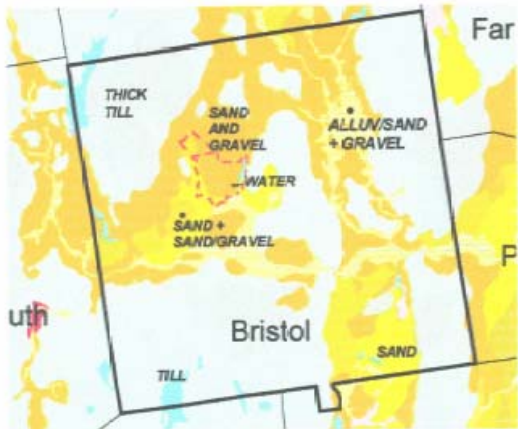


Figure 5- Surficial (Glacial) Materials in Bristol

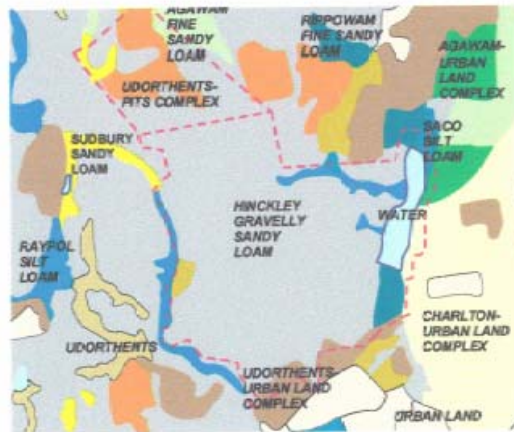


Figure 6- Soils at Hoppers-Birge Pond

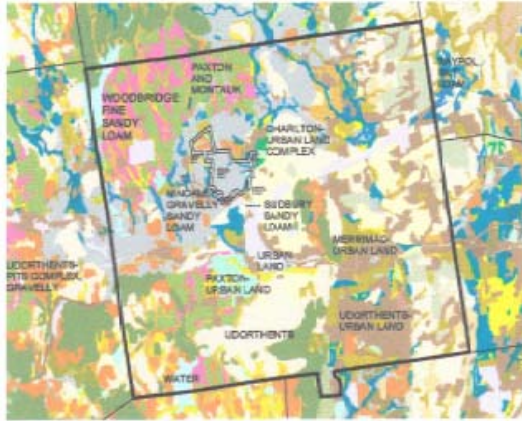


Figure 7- Soil Types in Bristol

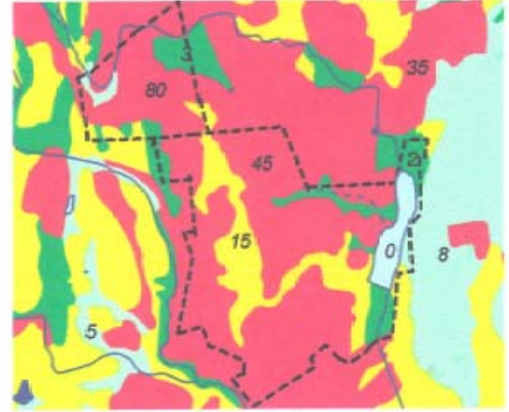


Figure 8- Maximum Slopes at Site (Percent Slope in Numbers; Flatter to Steeper: Green to Yellow to Red)

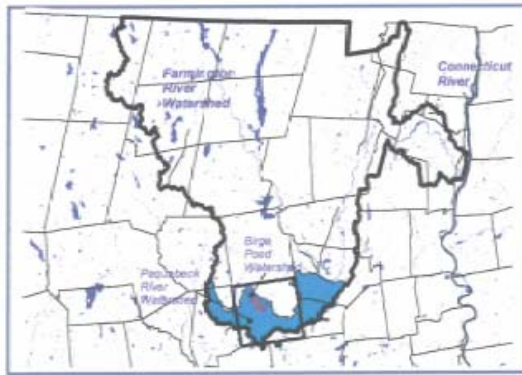


Figure 9- Birge Brook Watershed in Context



Figure 10- Birge Brook Watershed and Site



Figure 11- Land Uses in Birge Brook Watershed

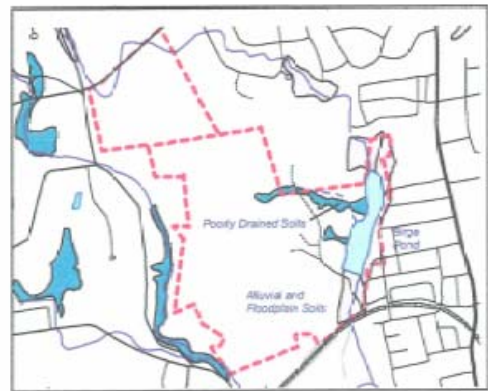


Figure 12- Site Wetlands

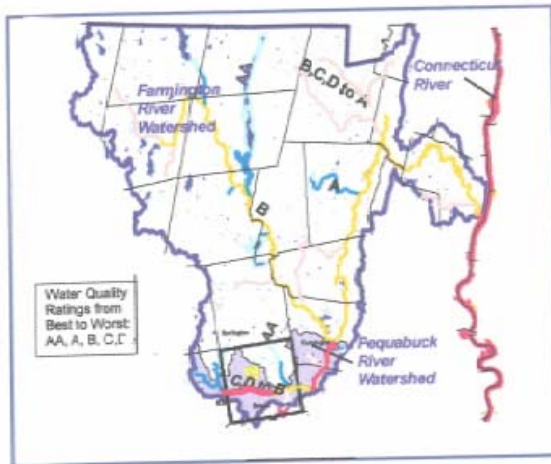


Figure 13- Water Quality in Farmington River Watershed

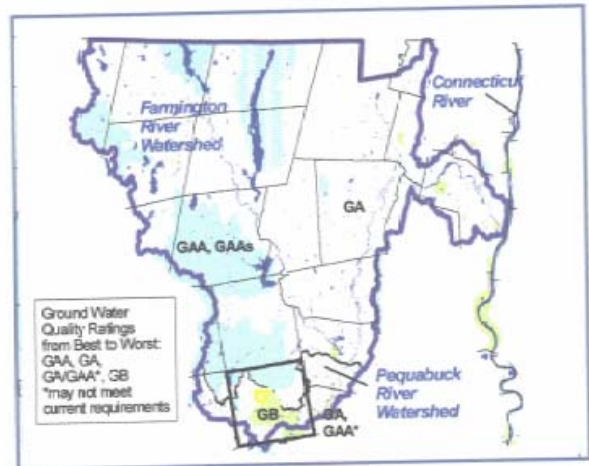


Figure 14- Ground Water Quality in Farmington River Watershed

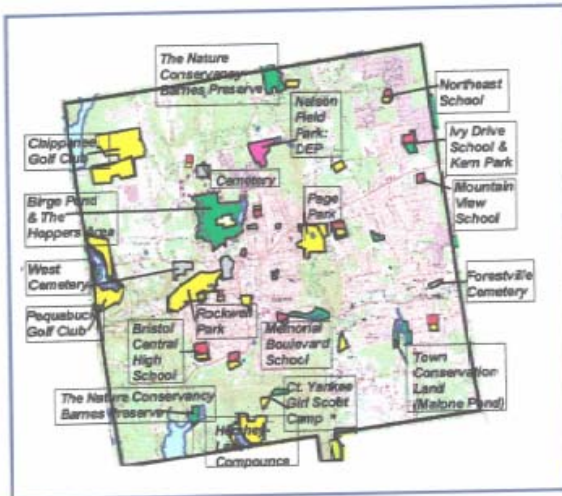
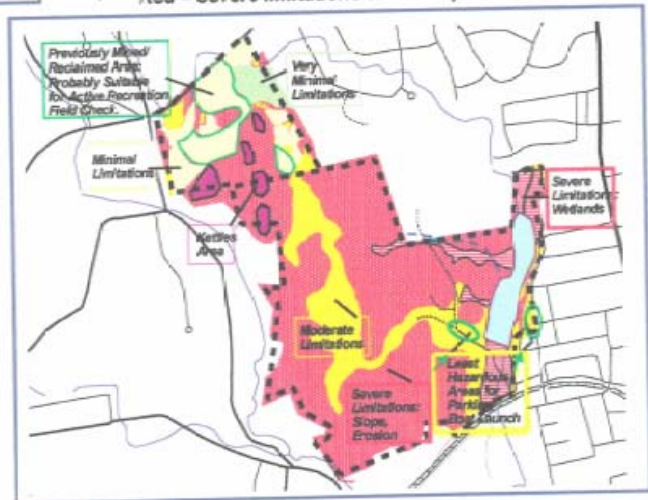


Figure 15- Recreation Sites in Bristol



Figure 16- "Good-Bad" Map for Recreational Development

Green = no limitations to development
 Moss Green = very few limitations to development
 Light Yellow = minimal limitations
 Yellow = moderate limitations
 Red = severe limitations to development



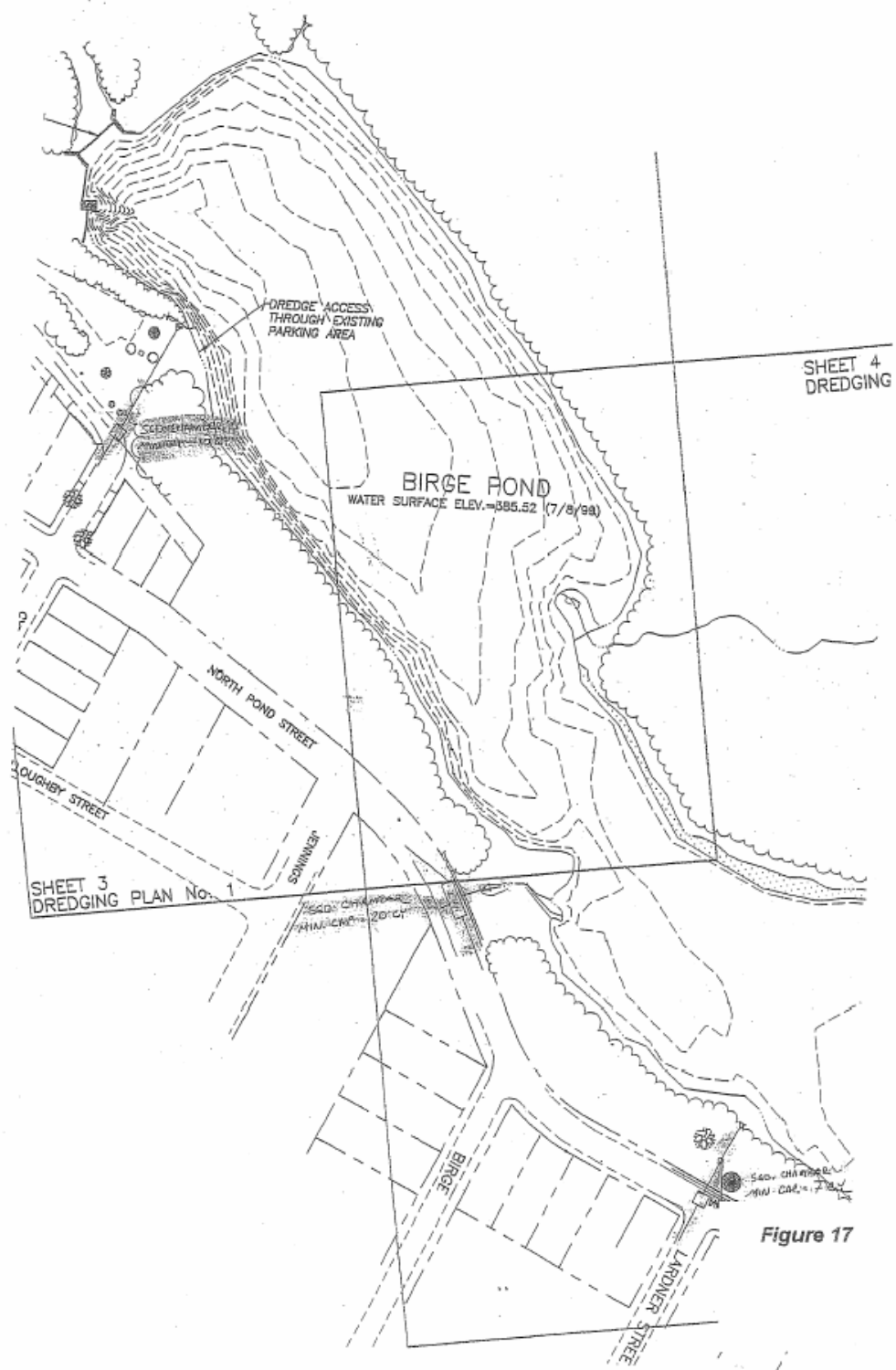


Figure 17

Physical and Biological Characteristics

Geology

The "Hoppers" in Bristol is an area of hummocky topography that contains numerous closed depressions (holes in the ground), isolated hills and steep slopes that approximate the angle of repose (30-35°) for loose sand and gravel. Numerous exposures, caused by localized erosion along trails and stream and gully banks, reveal sand, gravel, and brownish-colored windblown silt, suggesting the entire area is underlain by sand and gravel. Indeed, commercial gravel excavation has taken place in the immediate area.

Simpson (1961) mapped the area as "kame terrace" or "Ice-contact" deposits (see map and interpretative cross-section) which are land forms that are composed of stratified sand and gravel.¹ They were formed during the end of the last "Ice Age" when glacial ice, that covered the entire area and was a kilometer or more in thickness, stagnated and melted from south (~14,000 years ago) to north (~10,000 thousand years ago). The melt water, of course, collected into streams and flowed toward the sea in channels that initially were on top of the wasting ice or in melt-out tunnels beneath the ice. The streams transported an immense amount of glacially-eroded rock-debris (gravel, sand and mud). Where local conditions resulted in a loss of stream power, stratified sand and gravel was deposited in crevices and tunnels within the melting ice, in depressions on top of the melting ice, or up against stagnant ice that was left in the valleys. In some places, deposits of sand and gravel completely buried isolated remnants of ice. The stratified sand and gravel deposits formed relatively flat alluvial surfaces in a series of progressively lower terraces as the ice melted,. When buried ice melted and the melt water percolated downward, the alluvial terrace deposits collapsed into the resulting voids creating the closed depressions. These topographic depressions are called kettles (redundantly kettle holes) and locally are known

¹ Within the Hoppers-Birge Pond area terrace elevations are ~530' and ~620'.

as hoppers. Sand deposited on top of the ice produce isolated hills that help form the hummocky topography. Similar stratified sand and gravel deposits are found scattered throughout CT and all of New England in the form of kames, kame terraces, eskers, and other ice contact deposits. They are an important resource for construction-grade sand and gravel. Kettles, however, are not abundant and only a few stratified sand and gravel deposits contain them. The kettles at Bristol are among the better examples in Connecticut of this topographic feature. Thus, they may be considered as somewhat unique and worthy of the preservation that the town of Bristol provides.

Although glacial erosion produces a spectrum of grain sizes ranging from boulders to mud, the process of stream erosion leaves behind the larger boulders and the process of stream deposition produces an unconsolidated stratified-deposit in which most of the mud-sized particles are winnowed. The overall process is referred to as sorting and results, because of the absence of mud-sized particles, in weakly cohesive materials that when disturbed, easily move downslope under the influence of gravity. Sorting also produces materials with fairly high porosity (25-35%) and extremely high permeability (measured in terms of Darcys or tens of Darcys). These properties make a good aquifer but an exceedingly well-drained soil and subsoil and must be considered during planning for any potential use.

The materials that make up the Hoppers are an excellent shallow-aquifer that allows rapid transmission of large quantities of ground water and development of high-yield water wells. The water table is near the ground surface only at lower elevations and numerous springs are found in the wetlands surrounding Birge Pond.

Potential Uses and Geologic Considerations

Possible uses for the area depend upon town generated priorities. This review team cannot establish those priorities. Several suggested uses appear feasible.

Maintain property in its current state.

Some trails have been established and many of these could be enhanced as nature trails with relatively little cost and little effort. Geology and biology field trips for students in local K-12 schools could easily be developed and implemented. Maintenance of trailside signs would be minimal unless vandalism damages them. Depending on town goals and financial commitment, additional educational facilities could be built that would include a classroom and/or an auditorium, museum/exhibit area, and rest rooms. All of this could be done with only limited alteration of the property. The geologic properties of the site would not be a hindrance to this type of development.

All terrain vehicle (ATV) enthusiasts use the trails and some of the town population find the noise and potential danger posed by the speed of these vehicles offensive. In addition, the trails used by ATVs are subject to enhanced erosion in part because of the unconsolidated nature of the soils. Thus, some wish more active use of the area to discourage ATV use of the trails and encourage enactment and enforcement of regulation/ ordinance limiting, or indeed, prohibiting such use. Some special interest groups promote development that facilitates their interest, such as golf.

Develop for passive (trails) and active outdoor recreation, including ballfields and a golf course.

The above considerations regarding trails would also apply to this option. Active development might include construction of various playing fields (soccer, football, baseball, perhaps tennis courts), development of lake and

lakeside recreation, such as swimming in the summer and ice-skating in the winter, fishing all year long, or construction of a golf course. The hummocky topography of the area presents a challenge to construction of playing fields and/or a golf course because no level land is present in the site and extensive grading will be required. Undertaking development of large acreage² required by ball fields or a golf course will irreparably destroy the natural character of the site. This is only an issue if a town priority is to use the area as a nature preserve. A benefit of grading could be realized by selling some of the gravel to help finance the projects. The easily eroded nature of sand and gravel will require strict erosion and sedimentation controls, especially for steep slopes when grading is completed. Rill and gully formation were observed in several places on steep slopes of adjoining private property where gravel removal took place. Temporary siltation ponds may be needed until the graded surfaces are stabilized.

Grading, however, will destroy the thin soils that cover the sand and gravel. The thinness of the soil will make it difficult to salvage, requiring importing large amounts of new soil to cover the fields or course. The financial benefits of selling the gravel may be canceled by this need. For financial considerations, it is likely that the replaced soil will be thin also.

Because of the droughty nature (excessively well drained) of the area, it is unlikely that the replaced soils will retain moisture or nutrients well, requiring irrigation, fertilization and possibly application of pesticides, especially for a golf course. Although approved, biodegradable and perhaps even organic, fertilizers and pesticides may be used, they will leach through the soils rapidly and eventually percolate downward to recharge the ground water. Because of the high permeability of the aquifer, nutrients leached from

² It might be questioned whether sufficient acreage exists for a golf course and/or one or more ball fields. The golf course cited by the Maguire Group (1988, p.23) covers 144 acres. The total land owned by the town in the Hoppers-Birge Pond site is only ±207 acres. A golf course would require more than 50% of the available space and would need extensive, severe regrading.

fertilizer will rapidly be transmitted to the springs and streams that recharge Birge Pond. This poses a potential problem not to human health, but to the health of Birge Pond: introduction of nutrients may stimulate growth of unwanted algae and increase the risk of eutrophication.³

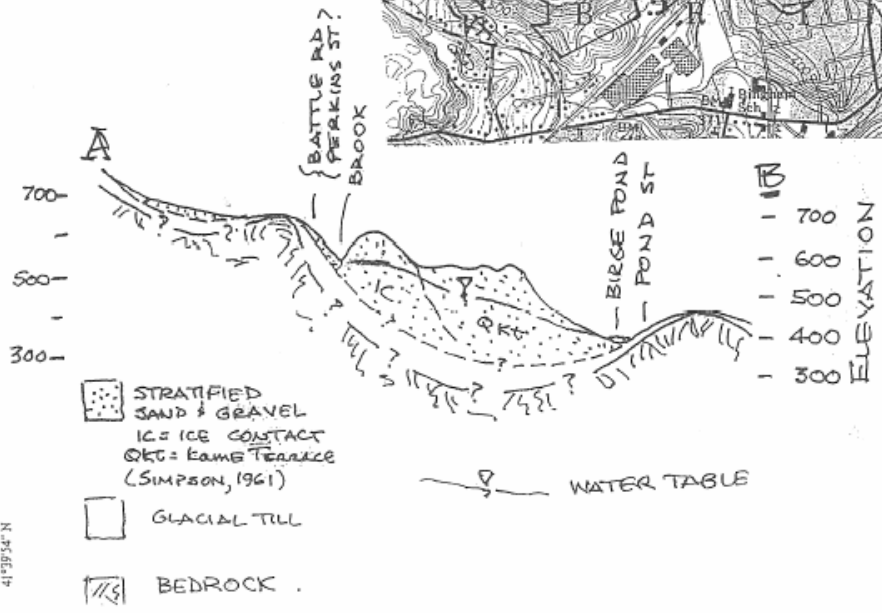
Active use of the pond may require dredging. Dredging will provide a deeper area for swimming and will likely improve habitats for aquatic life. The dredged material will likely be muddy, organic rich sand and sandy mud. In some locales, dredge spoils have been applied to the land as a soil substitute. If that is considered for development of ball fields or a golf course at the Hoppers-Birge Pond site, the spoils should be tested for possible contaminants such as heavy metals or non-aqueous liquids, especially if there is a history of any manufacturing or certain commercial uses within the watershed.

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Maguire Group, Inc., 1988, Feasibility Study, Hoppers-Birge Pond Recreation Area, Presented to The City of Bristol, March 2, 1988; 27p. + Appendices.

Simpson, H.E., 1961, Geologic Map of the Bristol Quadrangle, Connecticut: Surficial Geology. U.S. Geol. Survey Map series GQ 145.

³ For the same reason, use of septic tanks in the immediate area should be discouraged, especially if use of the lake for fishing or summer swimming is proposed. All town sanitary improvements should be connected to municipal sewage treatment facilities.



41°39'54" N
M 146°



CITY OF BRISTOL
 HOPPERS BIRGE POND PROPERTY
 ERT STUDY REQUEST

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A Watershed Perspective

Introduction

These comments are given from the perspective of improving and maintaining water quality and supporting designated uses of the State's waters in accordance with Connecticut's Water Quality Standards.¹ This information also reflects upon the Connecticut Department of Environmental Protection's (CTDEP) growing commitment to address water resource concerns from a watershed perspective, taking into account the cumulative impact that various land use policies and activities within a given watershed may have upon water resources.

The following remarks may overlap with those of other ERT members who are dealing with more specialized aspects of the review (i.e. fish and wildlife habitat, historic/archaeological significance, wetlands, stormwater erosion and sedimentation control, etc.). In such cases, these comments are meant to support not supplement their specialized reviews.

Meeting Background

After meeting at City Hall to discuss the history and previous proposals for recreational use of the site, a field walk was conducted beginning at Birge Pond. The Hoppers property exhibits steep topography that must be traversed to be appreciated. Passing local historic landmarks, the trails provide access through the site, ascending ridge tops that lead to outlook points and around kettle holes or "hoppers", as they are locally referred to. These natural geologic features are the chief resources of concern and are intended to be maintained. The question

¹ State of Connecticut, Department of Environmental Protection. Effective 1996 & 2002. Water Quality Standards. Bureau of Water Management, Planning and Standards Division. Hartford, CT.

is, how can recreation be incorporated into the site while protecting these natural features, and Birge Pond?

Brief Site Description

The site is located within the Pequabuck River Subregional Drainage Basin, which has a local watershed drainage area of 1.635 square miles, encompassing Birge Pond and Birge Pond Brook. The Pequabuck River drains to the Farmington Regional Drainage Basin, which then drains to the Connecticut River Major Basin, and ultimately to Long Island Sound. The site, over 200 acres, is mostly undeveloped with the exception of an in-holding that has a few residences. Access is through Ambler Road by Birge Pond Dam. A portion of the parcel that was recently purchased, is a former sand and gravel mining operation that has been reclaimed (i.e. the site has been appropriately stabilized). An adjacent parcel also previously mined, now contains houses although the cut slopes remain a source of sedimentation for a nearby stream. The rolling terrain, overall change in elevation, narrow ridges and footpaths make traversing the site challenging, but not insurmountable. Mixed hardwood forest and a sparse understory are the dominant vegetative cover over the large, glacial kame terrace deposits of sand and gravel. These upland soils are predominately excessively well drained, droughty, and highly erosive, which is characteristic of the setting for kettle holes.

Water Quality Classifications

The surface water quality designation for Birge Pond and Birge Pond Brook is Class A. Class A surface waters are known or presumed to meet the criteria which support the following designated uses: habitat for fish and other aquatic life and wildlife; potential drinking water supplies; recreation; navigation; and water supply for industry and agriculture.

The surface water quality designation for the Pequabuck River is Class C with a goal of Class B (C/B). Class C/B surface waters presently do not meet the criteria or are not supporting of one or more assigned designated uses due to pollution. Class B designated uses are identical to Class A designated uses, except that they do not include potential drinking water supplies.

The groundwater designation for the site is Class GA which has the following designated uses: existing private and potential public or private supplies of water suitable for drinking without treatment; baseflow for hydraulically connected surface water bodies.

To determine whether the State's surface water resources are meeting designated uses, CTDEP monitors or collects samples from selected water bodies throughout the state. Generally, water quality is assessed based on the following three uses: fish consumption, aquatic life support, and primary contact (i.e. direct exposure) for recreation. The degree to which the water body is suitable for that use is assigned one of the following use support descriptors: fully supporting, threatened (fully supporting but threatened by impairment), partially supporting, not supporting, not attainable or not assessed. The degree to which these different uses are supported by the water body determines the "overall use support".²

Birge Pond and the section of the Pequabuck River from the mouth at the Farmington River to the center of Bristol have been included in the CTDEP's Monitoring and Assessment program. This section of the Pequabuck River was found to be not supporting or only partially supporting of aquatic life; not supporting of primary contact recreation; and not supporting of overall use. Likely causes for impairment are pathogens, indicator bacteria, and pesticides.

² State of Connecticut, Department of Environmental Protection. October, 2002. 2002 Water Quality Report to Congress. Bureau of Water Management, Planning and Standards Division. Hartford, CT.

Suspected sources are municipal and industrial point sources, and urban runoff/storm sewers. Birge Pond was found to be only partially supporting of primary and secondary contact recreation; partially supporting of overall use; and threatened for cold-water fisheries (e.g. trout). Likely causes for impairment are excessive nutrients and siltation leading to noxious aquatic plants and algal growth. Suspected sources are erosion and sedimentation, and urban runoff/storm sewers.³

Issues of Concern

Erosion and Sedimentation

Birge Pond has long been identified as suffering from excessive sedimentation in large part due to the various sand and gravel operations within the area. Recent improvements made to the pond (e.g. construction of in-stream sedimentation basins) and the stormwater drainage management collection system, has significantly reduced the amount of sediments flowing into the pond. Future plans to dredge Birge Pond will complete its restoration. However, sediment continues to come off the Hoppers parcel from the access trails (both formal and informal) which have become unstable with overuse, especially from ATVs. Because of the sandy soils and steep terrain, stabilization of future site development work may be difficult, potentially causing serious sedimentation of the pond, streams and surrounding wetlands. After so much effort has been spent on restoring Birge Pond, it would seem to be counter-productive to undertake an activity that may increase sedimentation and thereby threaten the pond's new recreational opportunities (i.e. picnicking, canoeing, kayaking, fishing, and possibly swimming), besides being harmful to the environment.

³State of Connecticut, Department of Environmental Protection. 2002 List of Connecticut Water Bodies Not Meeting Water Standards. Bureau of Water Management, Planning and Standards Division. Hartford, CT.

Any proposal for developing the Hoppers parcel that requires extensive site work should be done in phases so one portion of the property can be stabilized before the next phase of work can begin. This will minimize the amount of soil exposed at any one time. Without such precautions, a large storm event could cause major sedimentation of the wetlands, Birge Pond or Birge Pond Brook. During construction, the City should have an agent inspect the site regularly to ensure proper installation and maintenance of the soil erosion and sedimentation control measures consistent with the 2002 Connecticut Guidelines for Soil Erosion and Sediment Control,⁴ revised. Additionally, site stabilization where materials have been removed for the purposes of re-sale may be extremely difficult. Re-establishing native vegetative plantings may require artificial watering or costly soil amendments. If alternatives to native plantings are deemed necessary, great care should be taken to select non-invasive species that will enhance wildlife habitat.

Decreased Groundwater Storage

Previous reports indicate that the sand and gravel deposits underlying the Hoppers parcel provide substantial groundwater support for Birge Pond and Birge Pond Brook. This groundwater discharge may support base flow when surface water runoff and precipitation is low. It may also moderate stream temperatures, thereby reducing thermal stress on fish. Removal of the sand and gravel deposits may diminish the quantity of water stored and the associated discharges to the wetlands, pond and streams, consequently affecting water quality and stream habitat. There is an even greater concern for the downstream section of the brook that discharges to the Pequabuck River. The Pequabuck River has been identified as not fully supporting its designated uses, in part due to the volume of effluent discharge from Water Pollution Control Facilities

⁴The Connecticut Council on Soil and Water Conservation. May, 2002. 2002 Connecticut Guidelines for Soil Erosion and Sediment Control. Connecticut Department of Environmental Protection, Bureau of Water Management, Inland Water Resources Division. Hartford, CT.

(sewage treatment plants). Decreases in stream flow to the river may exacerbate these conditions by reducing the amount of water available for dilution.

Golf Course Development

A previous suggested alternative use for the site is a municipal golf course. To help off-set the costs of development, it is anticipated that the sale of sand and gravel deposits would be necessary, and depending on the market value of the resource, even practicable, provided that this sale does not violate the terms and conditions of the National Park Service's Land and Water Conservation Fund grant used to purchase the property. Development of a golf course also raises other issues. The maintenance and operation will require an enormous quantity of water that would probably need to be obtained from groundwater wells and/or a surface water supply, such as Birge Pond. Besides the adverse affects of diminishing the flows of Birge Pond Brook as a result of decreased groundwater storage from the removal of sand and gravel as described above, and/or withdrawals from groundwater wells, there may be conflicts with neighboring residential water supply wells. Such competing uses should be investigated and evaluated as part of a state Water Diversion permit application which is required for withdrawals of water in excess of 50,000 gallons per day. Before undertaking the long-term commitment of the sale of sand and gravel, it would behoove the City to further investigate the hydrologic effects of such development.

Additionally, the golf course proposal should have a management plan which describes the best management practices proposed for the site. For more information, see the final draft of the "Report of the Advisory Committee On Potential Best Management Practices for Golf Course Water", October 4, 2001 (<http://www.ctiwr.uconn.edu/Projects/Golf/finalbmp.pdf>)

It is also important to note that the operation and maintenance of a golf course will most likely require the application of fertilizers and pesticides. Their use could potentially pose additional threats to water quality as a result of surface water runoff and groundwater infiltration. The addition of more nutrients to the

wetlands, Birge Pond and Birge Pond Brook may exacerbate present water quality conditions such as excessive growth of noxious aquatic plants and algae in Birge Pond. Note that nutrient and pollutant loadings to wetlands and watercourses that drain to the State's major rivers and Long Island Sound (LIS) is a major interstate concern.

Imperviousness

Any development proposals that will involve substantial impervious surfaces (e.g. paved roads, parking lots and community facilities, etc.) should be designed to promote groundwater infiltration. In addition to recharging groundwater supplies, on site recharge can help filter out minor pollutants and reduce the volume of flow discharging to surface waters as well as reduce the risk of erosion and sedimentation.

Buffers

It is also recommended that any new development leave a vegetated strip between the area of disturbance and surface water resources, including wetlands to help protect water quality, and fish and wildlife habitats from nonpoint source pollution. Vegetated buffers help trap road sands, contaminants and other pollutants contained in stormwater runoff generated from roadways, parking lots, roof tops, and other impervious surfaces, as well as eroded sediments occurring from natural scour or land moving activities such as site development and other soil disturbances. Vegetated buffers also help moderate the temperature of stormwater runoff, thereby reducing thermal impacts on aquatic wildlife. A 50-foot buffer is typical, but widths can vary immensely depending on such factors as topography, the erosivity of the soil, and the value or sensitivity of the water resource. The CTDEP Fisheries Division⁵ recommends a 100-foot

⁵Brian D. Murphy, Technical Assistance Biologist, Inland Fisheries Division. December 13, 1991. Position Statement - Utilization of 100 Foot Buffer Zones to Protect Riparian Areas in Connecticut. Connecticut Department of Environmental Protection, Bureau of Natural Resources, Inland Fisheries Division. Hartford, CT.

buffer along perennial streams and a 50-foot buffer along intermittent streams; measured from the upland boundary of the regulated area, including any riparian wetlands. CTDEP Fisheries further recommends that the buffer remain in a naturally vegetated and undisturbed condition.

Recommendations

Based on this Team member's review of information provided to the City in previous reports and prior evaluations for the use of this property, it appears that the City of Bristol is shy of the recommended number of parks for its size. In contrast, however, there are numerous golf courses, both municipal and private, located within a short travel distance from the site, leading to this reviewer's conclusion that the former represents the greatest need. Overlooking this statistical rationale, development concerns associated with a golf course far exceed those proposed by a recreational park, nearly regardless of the park amenities. The construction and operation of a golf course may pose significantly more serious impacts to water resources than would passive recreation or other park and community activities whose comparable development needs (e.g. roadways, community buildings, public water supply, septic system) would be at a much smaller scale. Erosion and sedimentation concerns and the need for appropriate site stabilization exist for each, but the area of disturbance would presumably be greater for a golf course. Best Management practices for controlling stormwater runoff and promoting groundwater infiltration equally apply. And the use of fertilizers and pesticides that may be applied to park ball fields should be carefully managed, as with the golf course. Although without a doubt, the water supply needs for a golf course would far exceed that of a park. Consequently, the potential for withdrawals for golf course irrigation to affect other residential supplies and possibly diminish stream flows may be greater than the effects caused by a nominal well(s) supplying park operations with drinking and sanitary water, and possibly irrigation.

Past propositions for the Hoppers parcel have included a nature preserve and multiple versions of a recreational park with a vast assortment of amenities, from passive interpretive trails to sport and beach facilities. Regardless of the City's choice, any site development should take into full consideration the concerns identified in this report. Additionally, any future trails should be designed to follow the natural terrain so as to minimize erosion and maintenance. Note that all proposed uses for the site should be evaluated for consistency with best management practices and possibly local, state and federal permitting requirements.

Wetlands Review

Bristol should have a recent, single page, common scale map of this area available to all. In some instances it was difficult for the Team to understand the layout of plans and individual parcel locations since only small-scale maps which covered large areas, and often left out details of importance, were provided.

The map should show the wetland boundaries and the wetland setback lines within the park.

All of the areas that concern wetlands center on or around Birge Pond, its tributaries, and its outflow. For the most part, any proposed actions of development leave these areas undisturbed.

The DEP has mapped both the groundwater and the surface quality here as "A." On a scale of D, C, B, A, AA we see that the water quality is quite good. It could be that since not every area of the state can have its water tested, and assumptions have to be made based on surrounding land use and known areas of pollutants, there could be locations with the park with water quality above the A level.

Description

The whole area of Birge Pond and the Hoppers is on a glacially deposited sandy base. Birge Pond today has a surface area of 11.8 acres as mapped by the CT DEP. Over the years it has been reported in different documents that it was larger. Given that the assessment of surface area can be tricky and most likely inconsistent of method, one thing the numbers do seem to show over time is a decrease in size.

The ponds' major tributary is Birge Pond Brook. This brook enters the pond from the north. It flows for $\pm 2 \frac{1}{4}$ miles before entering the pond. Over this span, it encounters at least seven road crossings, passes through a cemetery, and has lost much of its riparian area. The opportunity for the brook to take on road sands as sediments is great, as is the opportunity to take on lawn pesticides and fertilizers.

The second largest tributary is an unnamed stream that flows from the west-north-west for 1,200 feet before entering Birge Pond. Beginning as a seep, the stream drops almost exactly 50 feet on its way downslope for a 4.2% gradient. Along its run is found excellent riparian habitat consisting of tree cover and lush herb, and shrub level growth. With a buffered distance of more than 125 feet of woodland to the north, and several hundred feet of woodland to the south, this stream finds itself in a nearly untouched watershed.

The third major inflow enters the pond from the east. A pipe discharges the runoff from the neighboring subdivision into a collection of energy absorbing rip-rap, into a small detention basin and then downslope to the pond.

The watershed of Birge Pond and Birge Pond Brook is approximately 880 acres. Of this, a first cut analysis shows the drainage to be almost exactly a 50/50 split of residential subdivisions (49.7%) and woods and fields (50.3%). The main stem of Birge Pond Brook is approximately 8,866 feet in length, or about 1.7 miles. Of this run however, the last 1,554 feet, or $\frac{3}{10}$ of a mile, flows primarily through subdivisions and has seven road crossings. These 1,554 feet of stream offer great opportunity to collect road sands, oils, lawn pesticides and fertilizers and can transport all of it into the pond.

The watershed for the unnamed stream to the west-north-west is approximately 95 acres. Of this amount about 9.5 or 10% is in subdivision. Another roughly 6.5 acres, about 6.8%, is in reclaimed quarry. Thus, in total

only about 17% of the watershed has been impacted by some type of land use, but only 10% has development. Its rather undeveloped state for more than the past ~70 years provides an opportunity of wetland and watershed education not often encountered in the Connecticut River drainage.

The location of the Hoppers area that the Team visited is only one small part of the hydrologic system(s) and drainage basin(s) in which it lies. That is, many types of land uses outside of the park boundaries share the Birge Pond Brook watershed.

The inflow area of the Brook has the boardwalk and diverse plant communities. The wetland that exists here is all the more valuable because of the scarcity of wetlands remaining in the watershed.

Wetland Flora and Fauna

The Brook, Pond, and wetland complex provide a variety of functions in the Birge Pond drainage. Wildlife habitat is likely the most apparent function to the casual observer. On the macro scale, the swan nest at the inlet of Birge Pond Brook is easy to observe. Reports are that a variety of warm water fish inhabit the pond; and surprisingly, at the unnamed stream that enters from the west-north-west in the reach just in from the pond there is cold water habitat for trout. Other denizens of the deep are the painted and snapping turtles.

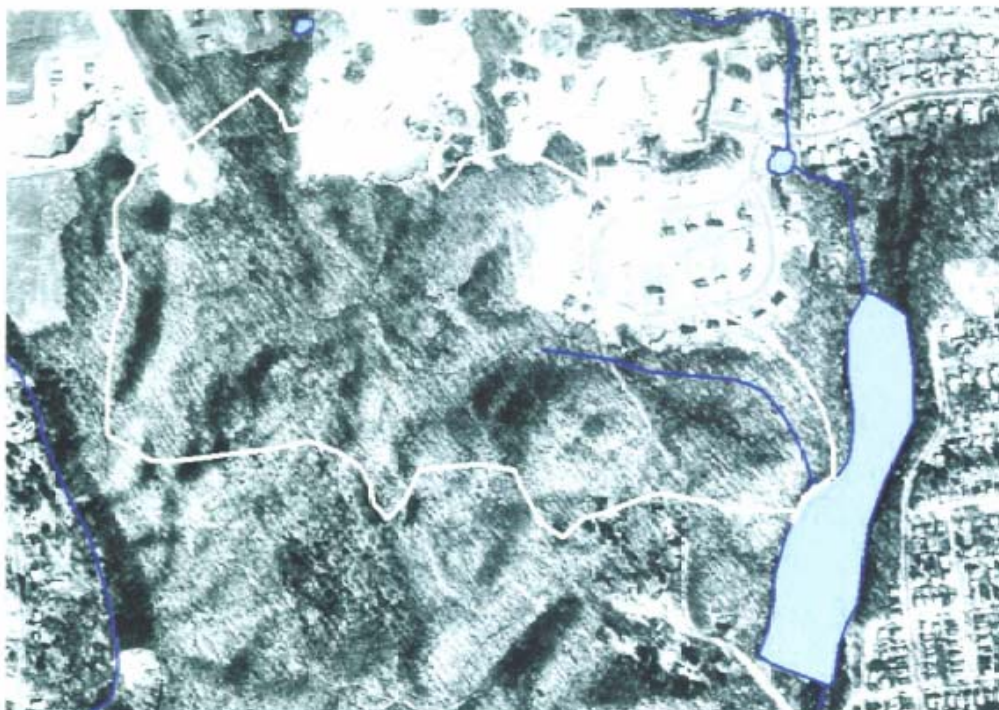
Add to this fauna the wide variety of wetland flora in the areas adjoining the lake: various emergents in the standing waters, shrubs associated with wet areas, lily pads on the water, and cattail communities. Individually, not any of these species is notable. But when taken together with the fauna, the richness of the wetland environment can be appreciated.

However, another part of this scenario is the algal blooms that effect the lake. The algal blooms are indicative of a nutrient rich water body. The question is what is the source of the nutrients enriching the pond. As mentioned above, the riparian area - or the buffer - along Birge Pond Brook is a critical factor to preserving water quality and much of it has been lost. It is/will be difficult to plan for the preservation of water quality in Birge Pond and not have a consciousness of the upstream, out-of-the-park inflow sources that are affecting it.

Comments and Recommendations

- Members of the Team followed the streamcourse that enters the pond from the west-north-west for its entire length, from its headwaters seep to its mouth. Here the City has a suburban, wetland treasure. Rarely in this part of the state, and often not at all, can you find a stream and its watershed that can be studied from its headwaters to its mouth nearly unimpacted. The riparian area along this stream is intact. The wetland soils are classic, the stream is a cold water fishery habitat as seen by the young trout near the mouth, water quality is likely to be excellent, and the stream controls its own sinuosity - it is not straightened or channelized by human hands. Additionally, the stream and its watershed are easy to observe by trails and boardwalks. From an educational perspective, the many aspects of this stream and its watershed can be compared and contrasted with others, far more developed, within the City.
- There were many concerns specifically regarding degradation of wetlands due to sedimentation. It is clear and the comparative aerial photos show there has been land building, or accretion, due to sedimentation over the years. But to remedy this, the city will have to make a concerted effort to ease the Brook's sediment loading within the pond's watershed since most

of the sediments are carried into the pond by its tributaries, especially from the north and the east.



The outline of the "special" watershed west-north-west of the pond. The photo is from 1990.

- Erosion from motorized vehicles must be cut back. Some trails are eroded to a depth of waist and even chest height. Granted the soils are sand based and easily disturbed, but that is all the more reason to be concerned about the sediment runoff which inevitably is working its way downhill.
- Post notices and block existing travel paths against motorized vehicle use (there is enough tree deadfall around that a scout project should have no trouble making motorized transit through the park more irritation than fun). Post the park boundaries as does the state forest system so park users will be more aware of its borders.
- Any active (versus passive) development must be kept away from the wetlands. Many of the development proposals offer a variety of options for passive recreation. As described above, trails through the area provide study access for the small watershed and remain excellent options for educational use.
- If it is confirmed that sediments are carried into the Pond via the streams, an effort to control this will have to be cooperatively planned. Often road sand is one of the major sedimentation problems. If that is the case in Birge Pond, a regular schedule of storm drain/catch basin clearing will help. It is a tremendously difficult task to clean the catch basins regularly for any municipality. Still, some communities have worked out that if only a percentage can be cleaned each year, the critical ones for the preservation of the Pond will be high on the list.
- It may be possible to obtain some water testing gratis from a local environmental consulting business. If done well, the firm ends up with some good press and the lake water gets an assessment. One of the concerns is the level of nutrient loading into the Pond. Additional

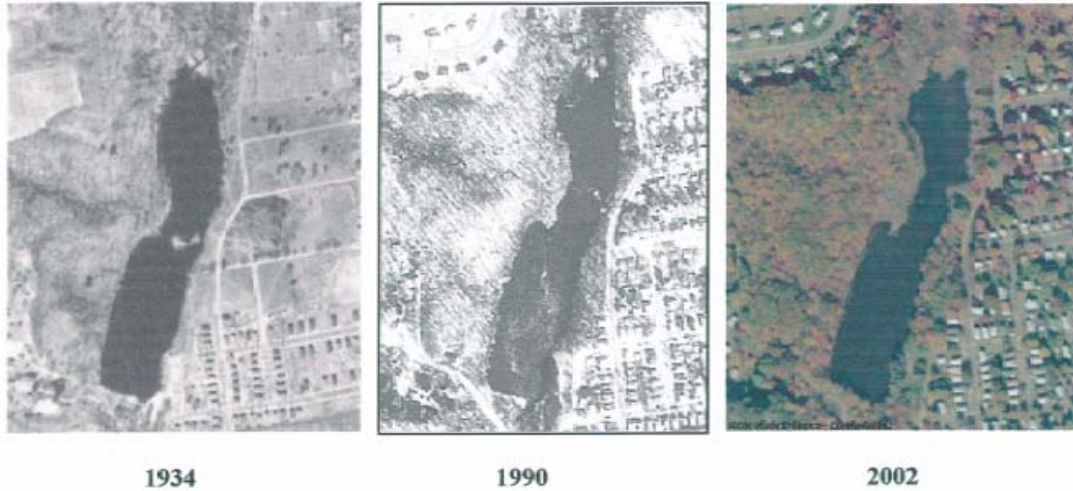
concern is the possibility that oil and gas product is in the runoff from the subdivision to the east. The wetlands reviewer on the Team suspected some oil product may be part of the inflow from this subdivision. Also at that location it appeared that the sedimentation basin was not functioning correctly. The rip-rap was no longer providing a full damming effect on the outflow from the subdivision pipe.

- Cap and seal the large underground tank the team visited on the field walk. This is a potential liability concern to the City.

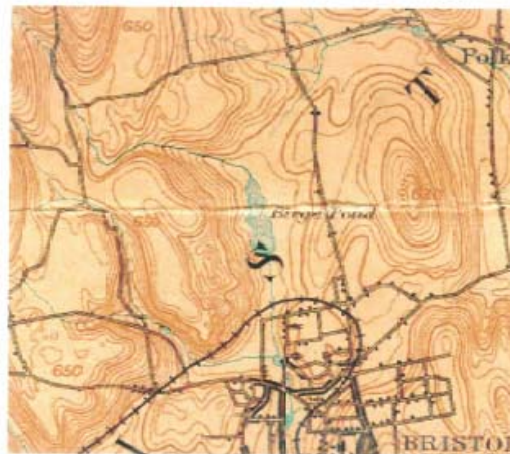
Sedimentation in the Pond Over the Years

There were questions about the sedimentation of the Birge Pond due to stream-carried road sediments. The three photos below show the changes in the pond shoreline over two spans of years. The two left-hand photos were taken 56 years apart. Twelve years separates the changes between 1990 on the center photo and 2002 on the right (Courtesy of MapQuest). Noticeable delta building areas, (i.e., accretion of sediments) can be distinctly seen in three locations on the most recent photo. The first location is at the north end of the pond near the location of Birge Pond Brook's inflow. Especially in these past 12 years the delta building is noticeable, possibly due to reasons mentioned above.

In addition, the land is "growing" in the east-north-east with the addition of an almost pointy triangle of land apparent just in the last twelve years. Other areas have changed as well. Review of the photographs provides a large visual statement.



Below is the 1893 USGS topographic map for the area. The map was surveyed in 1889-1890; more than 110 years ago. Notice the neighboring land use of the Pond and the use of the land in the watershed at the time.



Aquatic Habitats

The waterbodies found within the Hoppers-Birge Pond property are Birge Pond, Birge Pond Brook, and an unnamed stream which is tributary to the pond. Birge Pond was created by impounding Birge Pond Brook with additional supply being provided by the unnamed tributary stream. Bathymetric information for Birge Pond (made available through a preliminary dredging proposal submitted November 2001 by Baystate Environmental Consultant) indicates the 10.3+ acre impoundment has an average water depth of 3.7 feet and a maximum depth of 8.7 feet. The western shoreline of the pond is steeply sided with the remainder of the shore having a more gradual slope. Outfalls from roadway stormwater drainage systems discharge at several locations along the pond's eastern shore. Significant sediment deltas have formed in the pond at the discharge points.

The City of Bristol has maintained the land around Birge Pond as undeveloped open space. Dense growths of hardwoods and woody shrubs predominate as vegetation around the pond. Birge Pond supports an abundant growth of emergent and submergent aquatic vegetation. Physical habitat in Birge Pond is comprised of aquatic vegetation and fallen or overhanging shoreline vegetation.

Birge Pond Brook traverses a broad wetland prior to entering the northern end of Birge Pond. The brook is contained in a channel which is roughly 12 feet in top of bank width and has normal flow depths which average approximately 1.5 feet. The low gradient channel creates a surface flow predominated by moving pool interspersed by shallow riffle. Substrate of the brook is composed of cobble, gravel, coarse sand, and sand-silt fines.

The unnamed stream enters Birge Pond along its north-west shore. The stream originates in wooded uplands then passes through a wetland prior to entering the pond. The stream channel is less than 10 feet in width and has a normal flow

depth of 9 inches or less. The stream transitions from a moderate to low gradient channel with its surface flow shifting from shallow riffle to shallow moving pool. Substrate of the brook is composed of small boulder, cobble, gravel, coarse sand, and sand-silt fines.

Hardwoods and woody shrubs predominate as riparian vegetation along Birge Pond Brook and the unnamed stream on the Hoppers-Birge Pond property. The vegetation provides both watercourses with a nearly complete overhead cover. Physical instream habitat is provided by the water depth in pools, undercut banks, and fallen or overhanging riparian vegetation.

The Department of Environmental Protection classifies Birge Pond, Birge Pond Brook, and the unnamed stream as *Class AA* surface waters. Designated uses for surface water of this classification are existing or potential drinking water supply, fish and wildlife habitat, recreational use, agricultural and industrial supply and other purposes.

Aquatic Resources

Birge Pond can be classified as a warmwater resource as it has shallow water depths and abundant aquatic plant growth. The Inland Fisheries Division (the "Division") has never conducted surveys to evaluate the resident fish population. The pond is anticipated to support bluegill (*Lepomis macrochirus*), largemouth bass (*Micropterus salmoides*), golden shiner (*Notemigonus crysoleucas*), and brown bullhead (*Ameiurus nebulosus*). These fish species are common to warmwater lakes and ponds in Connecticut.

Water supply to the pond is primarily from Birge Pond Brook which receives drainage from a ±900 acre watershed. As common to small ponds created on streams with large watersheds, Birge Pond is susceptible to eutrophication, that is the process of nutrient enrichment and basin filling. The eutrophication process

in the pond is anticipated to have occurred at an accelerated rate since its creation given the significant land use change within its watershed. As the eutrophication process advances, the ability of a pond to support a diverse aquatic community becomes lessened. To curtail the eutrophication process in Birge Pond and to restore aquatic habitat, the City of Bristol has recently proposed to remove 46,000 cubic yards of sediment from the entire pond bottom. The excavation of sediment will increase the average water depth to 6.5 feet; the maximum water depth will also increase to 12.8 feet.

There is well-founded need for the removal of accumulated sediments from Birge Pond. The City of Bristol proposes to hydraulically dredge sediment from Birge Pond; this dredging technique is strongly supported by the Division as it prevents off-site sediment transport and preserves the resident fish community. Excavated sediments will be discharged to a containment basin constructed at a gravel pit located north of the pond. The sediments will be allowed to dry for up to a year before being removed.

Birge Pond Brook and the unnamed stream have the physical characteristics of coldwater streams. Although fish population surveys have never been conducted, brook trout (*Salvelinus fontinalis*) were observed in both watercourses on the date of the ERT field review. Blacknose dace (*Rhinichthys atratulus*), fallfish (*Semotilus corporalis*), creek chub (*Semotilus atromaculatus*), tessellated darter (*Etheostoma olmstedi*) and white sucker (*Catostomus commersoni*) may also be present in Birge Pond Brook as it provides suitable habitat for these species.

Recommendations

1. Land Management This ERT study had been requested by the City of Bristol to “. . .determine the type(s) of recreational activities that are feasible and will provide the highest and best public recreational uses of the Hoppers-Birge Pond

property.” The Hoppers-Birge Pond property has been maintained as forest intertwined with hiking trails. In so doing, vegetated buffers around the property's wetlands and surface waters have been maintained. To date, this has provided an effective means of protecting aquatic habitats and surface water quality. Therefore, it is important that the property continue to be managed as forested open space which is made accessible by a trail network.

2. Maintenance of Riparian Buffers Should there be future land use change on the Hoppers-Birge Pond property, it is imperative that vegetated buffers be maintained around Birge Pond, Birge Pond Brook, and the unnamed stream. The buffer should have a **minimum width of 100 feet**. Research has indicated that a buffer zone of this width prevents damage to aquatic ecosystems that are supportive of diverse species assemblages. Riparian vegetation performs a variety of unique functions essential to a healthy aquatic ecosystems. Such functions include filtering of sediments, nutrients, and other non-point pollutants from overland runoff; maintaining water temperatures suitable for survival of resident fish; providing bank and channel stability; supplying a source of large woody debris for physical habitat; providing a substantial food source for aquatic insects which represent a significant proportion of food for resident fish; and serving as a “reservoir” storing surplus stormwater runoff for gradual release into surface waters during summer and early fall base flow periods. Please refer to the attached documentation presenting Division policy and position regarding riparian buffers for additional information (see Appendix).

3. Trail Maintenance There several trails on the Hoppers-Birge Pond property which are used for hiking. One trail is adjacent to the unnamed stream and crosses Birge Pond Brook and its associated wetlands via a boardwalk. Currently, pedestrian use of this trail has not impacted either watercourse. However, should trail usage increase (as is evident on other trails on the property) significant soil erosion can be anticipated. Eroded soils can be transported

downslope to the streams which, once deposited, can eliminate or degrade physical habitat. Ultimately, such deposition can decrease the streams ability to sustain the existing fish population.

The following are measures recommended for trail maintenance:

- Pedestrian traffic should be limited to authorized trails only. The development of unauthorized trails should not be allowed and be eliminated if they are noted.
- Establish a trail maintenance plan to conduct routine trail inspections and make corrective repairs to those situations potentially causing erosion and sediment events.

4. Birge Pond Dredging. The dredging of Birge Pond will increase the area available for fish and other aquatic species but will create a fairly sterile environment, one which is lacking physical habitat diversity. The city of Bristol should consider shaping the pond bottom with irregular contours or creating underwater peninsulas from the pond shoreline. Should neither of these options be feasible due to the composition of ponds sediments, structures constructed of conifers or conifers and deciduous brush should be installed. Such structures create a habitat preferred by largemouth bass and bluegill. To be most effective, each structure should be constructed of six or seven, 4 to 6 foot tall conifers (or conifer/deciduous brush) lashed together and weighted sufficiently to sink and remain stable and upright on the lake bed. The structures should be placed in areas of the pond where they are overtopped with at least three feet of water and spaced 75 to 100 feet apart.

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5. Birge Pond Fishing Piers. Shoreline angler access to Birge Pond is possible along the entire pond shoreline, however, it may be difficult in a number of locations. Existing angler access locations should be stabilized to prevent erosion. The city of Bristol should also consider constructing one or two fishing piers to allow access especially for young anglers or those with physical limitations. Division staff can provide assistance in site selection and design of the piers.

6. Wellfield Development The Bristol Water Department had recently proposed the development of a well on the Hoppers-Birge Pond property for additional supply to the municipal system. Several potential well sites were identified on the property; the site selected was at the headwaters of the unnamed stream. Groundwater analysis and pump tests indicated the well could yield up to 250,000 gallons of water per day. It is anticipated that there would be a 1:1 relation in groundwater withdrawal to loss of flow in the unnamed stream.

The groundwater withdrawals proposed are anticipated to cause reductions in the stream's water surface elevation with the most notable reductions occurring during low precipitation periods of the year. The reduction of water surface elevation will have the greatest impact on riffle habitat. Riffles are essential to river systems because they provide turbulence that oxygenates water; support higher densities of macroinvertebrates, and are thus important food-producing areas for fish; and provide spawning and nursery habitat for most if not all stream fish species. Either a periodic (several hours per day) or prolonged desiccation of substrate will preclude the riffles ability to support aquatic biota and may set an additional stress on the aquatic community by decreasing dissolved oxygen levels during critical summer periods.

In extreme situations where there is a complete or nearly complete desiccation of riffles, the stream can become segmented into a series of isolated pools rather than providing a continuum of flowing water. This in turn creates a migration barrier which prevents fish and macroinvertebrates from accessing habitats important to their life cycle.

Given the potential for impacts associated with development of the well, the Bristol Water Department should pursue an alternate source for future supply.

Forest Vegetation

The study area totals 207 acres of which 193 acres are forested. Birge Pond takes up the remaining 14 acres.

The forested portion can be broken down into four forest cover types, red maple swamp, mixed hardwood, mixed oak-hardwood, and oak-pitch pine. (See Forest Cover Map)

Forest Cover Type Description

1-Red Maple Swamp: This type occupies three acres along the western and northern portions of Birge Pond. Red maple pole and small sawtimber sized trees dominate this type which grows on poorly and very poorly drained soils. Other tree species associated with red maple are black gum and elm. Shrub species present in the understory are winterberry, highbush blueberry, and spicebush. Herbaceous vegetation present includes sedges, ferns, false-hellebore, and skunk cabbage. Vine growth present is grape and poison ivy.

The poorly drained soils and high water table restricts forest management activities and trail construction.

2-Mixed Hardwoods: This type is comprised of two parcels totaling 10 acres. The first five-acre parcel is along a brook that empties into Birge Pond from the west. The second parcel, also five acres, is located south of Ambler Road, along the outflow of the pond. The mixed hardwood pole and small sawtimber sized trees present in the main canopy are red maple, black birch, yellow poplar, white birch, red oak, beech, elm, white ash, black cherry, sugar maple, and black locust. Shrub species present are spicebush, witch hazel, and winterberry. Vine growths present are grape and poison ivy.

Forest management activities are restricted by the type's proximity to the streambeds and the seasonally high water table.

3-Mixed Oak-Hardwood: This type covers 167 acres and is the dominant cover type on the property. The oak pole and small sawtimber sized trees present in the main canopy are red oak, black oak, scarlet oak, chestnut oak, and white oak. Other hardwood tree species present are black birch, red maple, hickory, black locust, aspen, black cherry, and beech. Conifer tree species present are pitch pine, white pine, and hemlock. The understory trees species present are American chestnut and flowering dogwood. Shrub species present are witch hazel, mountain laurel, huckleberry, and maple-leafed viburnum.

Hinckley soils are the dominant soils underlying the property. These soils are located on terrace, outwash plain, valley, kame, and esker formations. The parent material consists of sand and gravel deposits. The slopes in the type range from 3 to 45 percent. These soils are deep, excessively drained, and have rapid permeability with low moisture availability. Deep-rooted tree species like oaks and drought resistant species such as pine are able to grow on these soils.

Fire has been a major influence in this type for several decades. The droughtiness of the soils and the steep abrupt slopes of the topography causes fire behavior to become extreme at times. This fire history has limited the occurrence of conifers in the type and accounts for the open understory. Tree size and quality is dependent on the trees' location on the slope. The smaller, poor quality trees are found at the top of the slope, while larger better quality trees are at the bottom. The trees' age is estimated to be 85 years old.

Poor tree growth, steep slopes and the incidence of fire limit forest management activities. Trail construction should be limited to areas with slight to moderate slopes.

4-Oak-Pitch Pine: This 13-acre cover type is located along the Shady Dell Road in the center of the property. The oak species in the main canopy are the same as in cover type 3. Pitch pine is the dominant conifer species in this type. Shrub species found in this type are blueberries, huckleberries, and sheep laurel. Herbaceous growth includes winterberry and clubmosses.

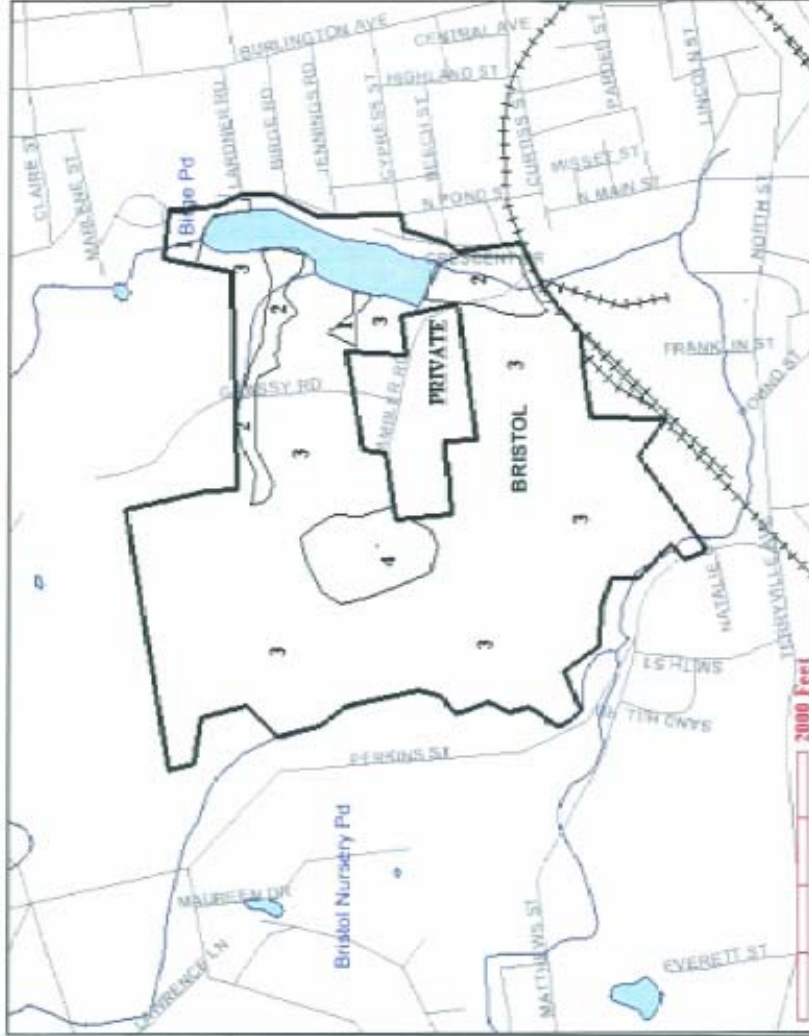
The soil characteristics are similar to type 3 except that the slopes are not as steep, 3 to 15 percent. The incidence of fire is similar to the previous type, but the lack of steep slopes may have lessened the fire behavior. Pitch pine is adapted to grow in areas with a history of fire. Efforts should be made to retain and enhance the growth of pitch pine, as it is the only conifer that will thrive under the present growing conditions. Pitch pine in the main canopy should have their crowns freed of competition from hardwoods.

Evidence of charcoal making was found in this type. Charcoal mound sites were seen along portions of the Shady Dell Road. These sites, cleared of woody growth, would be more apparent to the trail users.

Management Considerations

The first step in managing the property is to locate and mark the boundary lines. Refer to the attached publication "Knowing Your Boundaries." (See the Appendix) Once the property's boundaries have been suitably located and marked, then signage indicating the allowed uses of the property could be posted. This may reduce the illegal activities occurring on the property.

HOPPERS-BIRGE POND FOREST COVER MAP
BRISTOL, CONNECTICUT



Legend

- Town Lines**
- Blks
 - Town
 - Coastline
 - Railroads
 - Airports
 - GDT Roads (Zip Geocode)
 - Hydrography Lines
 - Water
 - Dredged Channel
 - Dam
 - Aqueduct
 - Hydrography
 - Marsh or Quag
 - Water
 - Isolated Area
 - Dam
 - Aqueduct



Forest Cover Types Indicated by Numbers

1:18000

This map is for illustrative purposes only. Data may not be complete or current.
Environmental Data and Geographic Exchange

Source(s):
DEP, GDT

The Natural Diversity Data Base

The Department of Environmental Protection's (DEP) Environmental & Geographic Information Center (EGIC) Database records indicate that a species of special concern, Eastern Box turtle (*Terrapene c. carolina*) is in the vicinity of this project. Additionally, the Wildlife Division has wintering bald eagle (*Haliaeetus leucocephalus*), which are federally threatened and state endangered, use records for the shoreline trees of Birge Pond in January when there is open water. If possible all old growth trees at or exceeding 12" dbh should be left standing near the waterside.

Eastern box turtles require old field and deciduous forest habitats, which can include power lines and logged woodlands. They are often found near small streams and ponds, the adults are completely terrestrial but the young may be semiaquatic, and hibernate on land by digging down in the soil from October to April. They have an extremely small home range and can usually be found in the same area year after year.

Please be advised that the Wildlife Division has not made a field inspection of the project area nor have they seen detailed plans or timetables for work to be done. Impacts to this species are difficult to predict without detailed project plans.

Please be advised that should state permits be required or should state involvement occur in some other fashion, specific restrictions or conditions relating to the species discussed above may apply. In this situation, additional evaluation of the proposal by the DEP Wildlife Division should be requested. Consultation with the Wildlife Division should not be substituted for site-specific surveys that may be required for environmental assessments.

Recreation Planner

Comments

Recreation Planning

Introduction

One of the purposes of this ERT is to recommend an appropriate management strategy for the City of Bristol owned Hoppers-Birge Pond Property. Containing 207 acres, the tract consists largely of rolling to hilly glacio-fluvial deposits including a number of large, striking kettle holes, which give it a quite unique physical character. It also includes the 14 acre Birge Pond along its eastern margin and a roughly 25 acre privately-owned in-holding including several residences.

Previously owned by the former General Departure Company and utilized as a source of water, the Hoppers-Birge Pond Property was purchased by the City of Bristol in 1973. Because the acquisition involved Federal and State grants-in-aid, permanent dedication as open space is mandated unless at least equivalent replacement acreage is provided. The adjoining, recently acquired Roberts Property is similarly encumbered with open space dedication. Although the Roberts Property is primarily a leveled, former sand and gravel excavation area, therefore sharply contrasting with the Hoppers-Birge Pond Property, for management purposes it should be considered an integral part of the +250 acre publicly owned open space tract.

Use Proposals to Date

Since its acquisition in 1973, a range of open space management options have been proposed including:

1. Basically preservation as a natural area to protect its unique geologic features, although also including a system of hiking trails, limited

recreational development at Birge Pond (see #2 below), and protection of its aquifer potential (reportedly 500,000 gallons/day).

2. Dredging of Birge Pond (now planned) and development of a circum-pond trail (completed).
3. A variation on #1 and #2 above is seen in the management proposal by the Environmental Learning Centers of CT Inc. which would also involve a paved bike trail, gravel bog walk and dog run, amphitheater and picnic pavilions.
4. Mining the property's substantial sand and gravel deposits and subsequently developing a municipal golf course.
5. Development of active recreational facilities on the mined-out portion of the former Roberts Tract south of James P. Casey Road, together with protection and buffering of the Roberts Kettle on the remainder of the tract.

With seeming public consensus on options #2 and #5 (dredging Birge Pond and development of recreational facilities on the Roberts Property), the basic debate is between options #1 and #4: natural area preservation versus mining and golf course development. The clearest statement of public opinion to date as reported to the ERT Team is the 1998 referendum (15,252 to 2,736 vote to preserve the Hoppers-Birge Pond area in a natural, undeveloped state).

Existing Management Problems and Limitations

1. Unauthorized off-road vehicle (ORV) use with resulting erosion, gullyng of tracts fragile soils, exacerbated by its hilly character.
2. Siltation impact on Birge Pond, a natural phenomenon intensified greatly by historic sand and gravel operations upstream of the pond.
3. Gullyng caused by surface runoff from sand and gravel operations immediately north of the Hoppers.

4. The existing private in-holding including residences which limits management ability to control vehicular access from the south off Crescent Drive and which poses some limitations on developing a comprehensive management plan for the property.
5. Private ownership of the adjoining Schaffrick Property which contains the largest kettlehole, a glacial esker, and a significant stretch of the existing trail.

Management Recommendations

This reviewer concurs in general with use proposal options #1, #2, and #5 as providing a balance between protecting a unique natural feature, while also providing protection to the underlying aquifer plus active recreational opportunity which will not negatively impact this environmental resource. Specific recommendations include:

1. Access - vehicular access to be provided off James P. Casey road at the Roberts Tract and on Ambler Road adjacent to Birge Pond. Because of the proposed ballfields at the Robbers tract, more than the 20 spaces suggested in management option #3 will be needed.
2. Developed Facilities
 - a. **Roberts Tract** - ballfields with possible toilet facilities , water, night lights(?), also possible picnic pavilion.
 - b. **Birge Pond** - a small informal picnic area with several picnic tables and along-road parking spaces seems adequate. Also provision of a casual non-motorized boat launch site and maintenance of the existing trail around the pond is recommended. Planned dredging will improve the pond's potential for public fishing opportunity and small boating. However, its volume is inadequate to support public swimming and steep banks following dredging could pose safety issues.
 - c. **Trails** - a well marked loop nature/hiking trail system with

access off James F. Casey and Ambler Roads is compatible with the basic preservation strategy for the Hoppers and is therefore recommended. On the other hand, the paved trail suggested in Management option #3 is not recommended. Also the problem of ORV use is recognized. Posting against ORV use is recommended along Ambler Road. Combined with "NO PARKING" signage except at the picnic area and periodic police patrol, such action may help limit this activity. However, reported ORV access off the railroad tracks into the Hoppers remains a threat. Should fencing here be considered?

3. Increased management control - acquisition of the Schaffrick Property or at least the kettle and environs portion should be considered a high priority. A secondary priority would be to acquire the western, undeveloped part of the private in-holding if and as available for purchase.
4. Environmental Rehabilitation - in addition to the dredging of Birge Pond attention should be given to correcting existing areas of gullying/erosion, caused both by ORV misuse and sand and gravel operation runoff, to prevent further damage to the property.

Archaeological Review

Archaeological Review

The Office of State Archaeology (OAS) and the State Historic Preservation Office (SHPO) note that *A Cultural Resource Sensitivity Reconnaissance of the Proposed Hopper's-Birge Recreation Area Bristol, Connecticut*, was undertaken by Heritage Conservation and Interpretation, Inc. (Rutsch 1978). This archival and preliminary walk-over indicated that 19th century industrial archaeological features (dam and headrace), which represent an upstream reservoir for the N.L. Birge & Sons Knitting Mill that is located outside the ERT study area, lack engineering/industrial importance and no longer possess archaeological integrity. Lacking further data, this study indicates that the industrial archaeological remains are not eligible for the National Register of Historic Places.

Conversely, the OAS and SHPO believe that the kettle hole vicinity may possess moderate to high sensitivity for Native American archaeological resources as possible hunting traps. As a result, the Office of State Archaeology and the State Historic Preservation Office recommends that a Phase I reconnaissance survey be conducted for the project area, in order to identify and mitigate any cultural resources on the project area that would be effected by construction activities. All archaeological studies should be conducted in accordance with the Connecticut Historical Commission's *Environmental Review Primer for Connecticut's Archaeological Resources*. In addition, their offices are prepared to offer any technical assistance in conducting the survey.

Appendix

Soils Information

Soils Map

Soils Report

Non-Technical Descriptions

Recreation Limitations Report

Inland Fisheries Division

**Position Statement - Utilization of 100 Foot
Buffer Zones to Protect Riparian Area in
Connecticut**

**Policy Statement - Riparian Corridor
Protection**

Forest Stewardship Fact Sheet - Knowing Your Boundaries

**For Appendix Information please contact the ERT Office at
860-345-3977 or e-mail at connecticutert@aol.com**

About the Team

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

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

Purpose of the Environmental Review Team

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

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

Requesting an Environmental Review

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

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