Phelps Brook Watershed and Walden Woods Pond

Windsor, Connecticut

Eastern Connecticut Environmental Review Team Report

Eastern Connecticut Resource Conservation & Development Area, Inc.

Phelps Brook Watershed and Walden Woods Pond
Windsor, Connecticut

Environmental Review Team Report

Prepared by the
Eastern Connecticut Environmental Review Team
of the
Eastern Connecticut
Resource Conservation and Development Area, Inc.

for the
Windsor Town Manager and
Windsor Inland Wetlands
and Watercourses Commission

January 2003

CT Environmental Review Teams
1066 Saybrook Road, P.O. Box 70
Haddam, CT 06438
(860) 345-3977

Acknowledgments

This report is an outgrowth of a request from the Windsor Town Manager and the Windsor Inland Wetlands and Watercourses Commission to the Hartford County Soil and Water Conservation District (SWCD). The SWCD referred this request to the Eastern Connecticut Resource Conservation and Development Area (RC&D) Executive Council for their consideration and approval. The request was approved and the measure reviewed by the Eastern Connecticut Environmental Review Team (ERT).

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

The field review took place on Tuesday, October 29, 2002.

Nicholas Bellantoni	State Archaeologist Office of State Archaeology (860) 486-5248
Ruth Klue	District Program Coordinator Hartford County Soil & Water Conser. District (860) 688-7725
Charles Lee	Lakes Management Program DEP - Inland Water Resources Division Planning and Standards (860) 424-3716
Alan Levere	Environmental Analyst III, Wetland Reviewer DEP - Environ. & Geog. Information Center (860) 424-3643

Dawn McKay	Biologist/Environmental Analyst III DEP - Environ. & Geog. Information Center (860) 424-3585
Don Mysling	Senior Fisheries Biologist DEP - Inland Fisheries Division Habitat Conservation & Management Program (860) 567-8998
Nisha Patel	Sanitary Engineer III DEP - Stormwater Management (860) 424-3840

I would also like to thank Cyd Groff, Windsor inland wetlands agent, Normand Thibeault, CME/CPK Design (former inland wetlands agent) Kevin Cubberly, Griffin Land, Michelle Carlson, Fuss & O'Neill, Thom Hayes, Konica Business Technologies, Inc., and Steve Downs, Uni-Source Worldwide, Inc., for their cooperation and assistance during this environmental review.

Prior to the review day, each Team member received a summary of the proposed project with location and soils maps. During the field review Team members were given additional maps and information. Some Team members made individual or additional visits to the project site. 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 town and landowners. This report identifies the existing resource base and evaluates its significance to potential and existing development, and also suggests considerations that should be of concern to the town. The results of this Team action are oriented toward the development of better environmental quality and the long term economics of land use.

The Eastern Connecticut RC&D Executive Council hopes you will find this report of value and assistance in studying and evaluating existing conditions and future projects in the Phelps Brook watershed.

If you require additional information please contact:

Elaine Sych, ERT Coordinator
CT ERT Program
P. O. Box 70
Haddam, CT 06438
(860) 345-3977

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Introduction

Introduction

The Windsor Town Manager and the Windsor Inland Wetlands and Watercourses Commission have requested assistance from the Eastern Connecticut Environmental Review Team in conducting a review of a portion of the Phelps Brook Watershed and Walden Woods Pond (a.k.a. Walden Lake and Walden Meadow Lake).

The study area is approximately 177 acres at the headwaters of Phelps Brook watershed in the northeast central portion of Windsor. The site is bounded on the east by Marshall Phelps Road, to the west by Prospect Hill Road and the south by Day Hill Road. Phelps Brook is a tributary to the Farmington River. This portion of the watershed is characterized by commercial/industrial properties along Day Hill Road, an existing residential development and areas of fields and forest which drain to the existing 2.2 acre Walden Woods Pond. The Windsor IWWC has approved an application for a wetlands permit for a new multi-family residential development on a 56 acre parcel around the Walden Woods Pond (Walden Woods Parcel "C"), which proposes to use the pond for stormwater detention.

Objectives of the ERT Study

The town has requested this review in response to concerns about the condition of Walden Woods Pond and watershed impacts from current and future development. A review of watershed conditions will help guide the town to take appropriate measures to improve the water quality and aesthetics of Walden Woods Pond and to assist them in evaluating future land use decisions in the watershed.

The ERT Process

Through the efforts of the town manager and inland wetlands and watercourses commission this environmental review and report was prepared for the Town of Windsor.

This report provides an information base and a series of recommendations and guidelines which cover the topics requested by the commission. Team members were able to review maps, plans and supporting documentation provided by the town and 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
4. Presentation of education, management and land use guidelines.

The data collection phase involved both literature and field research. The field review was conducted on Tuesday, October 29, 2002. Some Team members made individual and/or additional site visits. 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.

Figure 1

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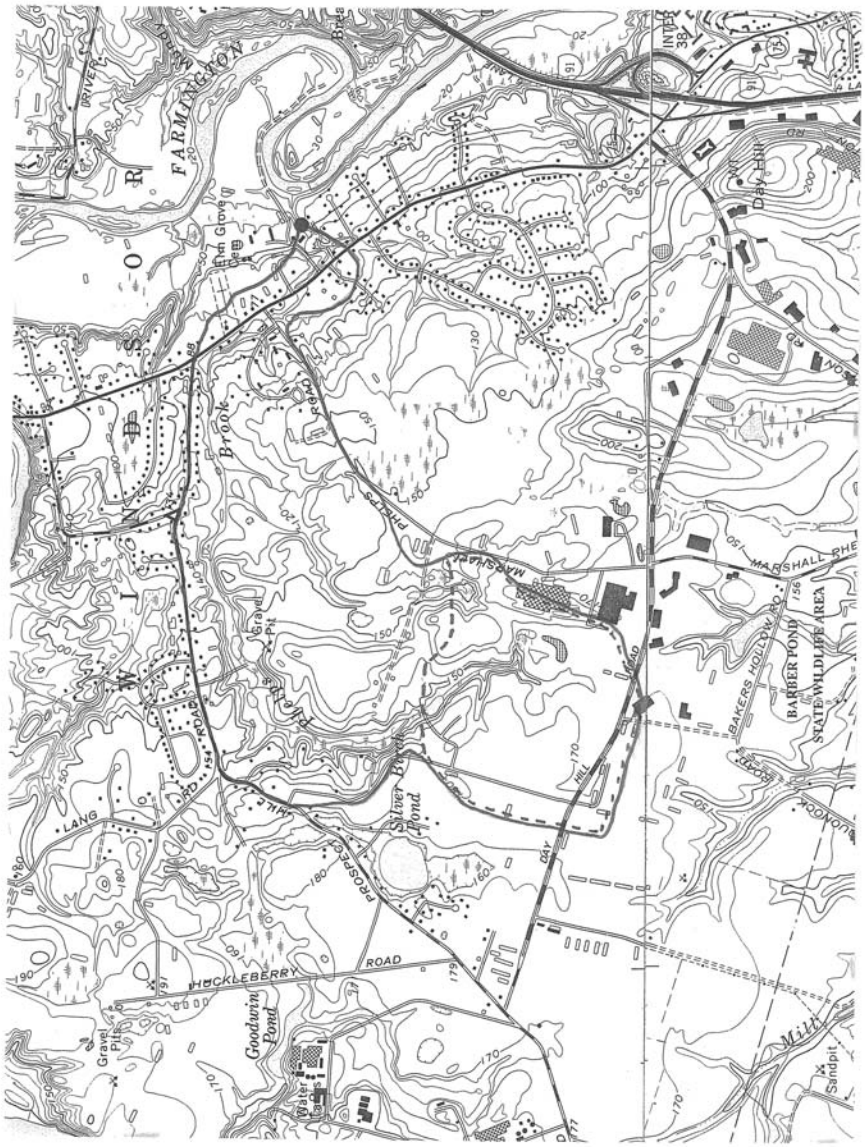
Location Map and Topographic Map
Scale 1" = 2000'

——— Phelps Brook Watershed
– – – – Walden Pond Parcel "C" Drainage Area



Soil and Water Conservation District Review

This Hartford County Soil and Water Conservation District (HCSWCD) section of the report addresses soils, drainage, erosion and sedimentation control, and water quality issues in the study area both for existing conditions, and for a proposed development.

The Phelps Brook Watershed is a small area in northeast central Windsor that drains into the Farmington River, which in turn flows into the Connecticut River in Windsor. The study area is the 177-acre portion of the watershed area beginning at the headwaters of Phelps Brook. Several large Day Hill Industrial Park enterprises and their associated roads, an existing residential development, and areas of fields and woods currently drain into the study area. Once agricultural, the study area is now a complex mix of land uses, having gone through a good deal of change over the last two-three decades. Existing zoning currently allows for additional commercial/residential development. The proposed siting of a new ±220 unit high-density residential development on 56 acres has been a catalyst for closer examination of water quality issues in the headwater area. Consequently, the town has requested an ERT Team study, so that town staff and citizens can use data and analysis from the study to inform future planning.

Existing Conditions and Land Uses

Soils

- There are two separate soil studies for Hartford County, the official 1950's Soil Survey, and more recent data compiled by NRCS soil scientists and posted on the internet. The latter is not yet the official "data of record". The two surveys are consistent for this site, and the site maps included in this report are from the more recent survey.
    - The pond and the streambed are underlain by Saco Silt Loam soils, 0 - 3%. Saco Silt Loam is frequently flooded, very poorly drained floodplain soil. There is generally standing water much

of the winter and spring. The soil generally occurs in slight depressions that border terrace escarpments or uplands, in old oxbows and narrow floodplains. In fact, for about half its entire length before it drains into the Farmington River, Phelps Brook flows in an oxbow surrounded by narrow steep escarpment slopes whose uplands give way to more level and fertile soil. All soils in the study area except for the Saco soils are sandy and well-drained.

- In the older Soil Survey, the soils on the steep slopes were classified as Terrace Escarpments, sand and gravel (*Tg*). This soil consists of sandy or sandy and gravelly materials on slopes of more than 15%. Tg soils are rated as a medium erosion hazard. They are somewhat excessively well drained, moderately to rapidly permeable, and have slopes from 15-45%. What are identified as *Tg* soils in the older soil survey are identified as the rapidly permeable Hinckley gravelly sandy loam soil in the newer soil survey. These soils are formed in sandy/gravelly glaciolacustrine deposits.

  Most of the soils in the study area are the upland Windsor, Merrimac, and Agawam soils. These soils tend to be sandy, well-drained to excessively well drained, and are nearly level to gently rolling. These soils are well suited to urban development and agriculture.

Wetlands and Watercourses

- **Phelps Brook Headwaters.** The headwater of Phelps Brook drains into Walden Woods Pond. The headwater consists of an eroded stream fed along its course by at least eight stormwater channels (four pipes with outlets, three asphalt spillways, and the base of a constructed berm). All these channels drain untreated stormwater runoff from industrial-commercial roofs and parking lots.

  The headwater stream is eroded and downcut, severely in some locations. It contains at least two partially washed out and bypassed dams. Riprap from stormwater outlets extends into the stream in a few locations. There is a good deal of sand and sediment within and along the watercourse, at least some of which is likely deposited road

sediment. The sediment extends as far as the inlet to Walden Woods Pond.

There are narrow wetlands along the brook and the lake. Initially the wetlands are forested, then become meadow and marsh. At the pond, the wetlands are marsh, wet meadow/emergent pond shore, and wooded marsh. All the Phelps Brook and Walden Woods Pond-associated wetlands were characterized by Michael Klein, a registered soil scientist, as providing moderate quality wildlife habitat, flood storage, groundwater recharge, sediment trapping, and nutrient removal. The wetland soils adjacent to the stream are well suited to absorb and infiltrate stormwater.

- **Walden Woods Pond.** It appears that Walden Woods Pond was originally created for the use of tobacco farmers, sometime between 1953 and 1964. Thus the pond's sediment bed is likely to contain agricultural runoff, and may contain nutrients and pesticides. Currently the pond serves as detention for commercial runoff. Residential development/road runoff also enters the pond from the north through a stormwater outlet. The lake level is controlled by a concrete rectangular weir at the lake's north end. A swale enters the pond from the west that drains channeled stormwater from the existing residential development.

  The lake and its wetlands provide habitat for fish, reptiles, amphibians, and birds. It is also possibly home to the Eastern Box Turtle, a CT Special Concern species.

  The area upland to the pond begins as steep thickly-wooded terrace, ranging from 70 to 120 feet in width, with 6-46% slopes on the eastern side of the pond, and with 19-45% slopes on the western side.

- **Vernal Pools.** There are two vernal pools in the vicinity of the pond. Vernal Pool 1 is east of the pond, close to Marshall Phelps Road. Vernal Pool 2 is about 900 feet southeast of the pond and 900 feet southwest of Vernal Pool 1. Both are on the property called Parcel C, the parcel currently under consideration for development.

The two pools have been described as "productive breeding habitats for a variety of frogs and salamanders... feeding and basking areas for turtles and snakes, (and) nesting and migratory stopover points by waterfowl." (Michael Klein) Conductivity of both the vernal pools is one third that of the pond, providing higher quality amphibian habitat (Kimberly Schultz, limnologist, SUNY Syracuse).

- **Vernal Pool 1** is surrounded by Tg soils with steep slopes in the 15-25% range. Its watershed is about six acres. Stormwater reaching Vernal Pool 1 is mostly from sheet drainage from the surrounding wooded terraces. Stormwater from Walden Meadow Road is discharged on the opposite side of the road and has little effect on Vernal Pool 1. Vernal Pool 1 is probably more disturbed than Vernal Pool 2, given the proximity of the road and past grading adjacent to the pool. Common Reed, an aggressive invasive plant, has proliferated in and around the pool.

  A narrow band of wetland vegetation around the pool contains red maple, cottonwood, buttonbush, winterberry, sedges, and other wetland plants (Michael Klein). It has been noted in site habitat assessment reports (Klein, Schultz) that substantial wooded buffers around the vernal pools are important for adult wildlife.

  Mechanical removal of the Common Reed is important to the health of the pool.

- **Vernal Pool 2** is a semi-permanent pond that lacks an inlet but may have some partial outlet. Wetland plants there include Red Maple, buttonbush, winterberry, sedges, etc. Very high water quality was noted in this pool, indicating a minimum of disturbance (Kimberly Schultz)

Stormwater Impacts/Erosion and Sedimentation Control

- **Phelps Brook Headwaters**. There are no quantitative data about stormwater flow into this area. The beginning of Phelps Brook has been substantially altered over the last 20-30 years with a number of stormwater outlets. It seems likely that stormwater discharges

will continue to modify the stream-course through erosion unless better management practices are implemented. The first step for coordinated planning for this area would involve gathering and assessing quantitative stormwater data for the area, so that informed decision making can be made.

- **Existing Residential Development and Walden Woods Pond.** Water quality data collected in early April of 2001 for Walden Pond indicate high levels of oil and grease, total dissolved solids, and total and organic nitrogen. (Fuss and O'Neill) Data from April and May of 2001 (collected by Fuss and O'Neill, and separately in May (by Kimberly Schultz) suggest that road runoff has likely caused elevated lake salinity, and elevated nutrients, especially phosphorus, from lawn run-off (Kimberly Schultz). Elevated nutrients alter water chemistry, promoting large surface algal blooms, decreased available oxygen, and thus compromised wildlife habitat values. The pond has been variously categorized as mesotrophic-eutrophic (David Bell, PhD, EcolSciences), to near eutrophic (Fuss and O'Neill), to eutrophic (Kimberly Schultz).

- Available information suggests that untreated runoff from the existing residential development is causing sedimentation, high levels of oil and grease, nutrient loading and increased salinity in the lake. Lower sedimentation and oil/grease levels could be attained by installing swirl concentrator units (such as Vortechnics or other brands that are as effective at sediment removal, etc.) at the existing stormwater outlets and at the west swale. An additional mitigating step would be regular and frequent cleaning of catch basins and outlets.

  Mitigation of high nutrient and salinity levels is more difficult to achieve. Measures that might decrease salinity levels could include stockpiling of snow in pervious areas, street cleaning during the winter, and intensive cleaning in early spring. High nutrient levels, which may be caused by lawn fertilizers, could be reduced through a fertilizer reduction program.

  There is a question, discussed in a number of reports, as to whether dredging the pond would improve water quality by increasing flow and reducing existing sediment deposits. A number of factors would

need to be considered, chief of which is the potential release of accumulated agricultural fertilizers and pollutants. Sediment testing must be done of the dredge spoils, if dredging is anticipated in the future.

- **Downstream Impacts.** While it is possible that sediments from Phelps Brook are carried downstream of Walden Lake, it is difficult to determine the extent of sedimentation without quantitative data and analysis. In any case, were an improved weir structure constructed, the extent of downstream sedimentation may be reduced by increasing the residence time in the pond. The proposed residential development plans include an improved weir. (Please refer to the Water Quality Assessment section for further discussion concerning the modifications to the outlet structure.)

  Similarly, it is difficult to determine how many specific pollutants are being retained within the study area, and how many are flowing downstream. It would be helpful to gather water quality data downstream to help determine upstream impacts.

Proposed Development

- **Development at Parcel C.** The question the town posed was whether water quality would be compromised were there to be high-intensity development on Parcel C. A proposal for development has been submitted for approval by the town (approval has been granted by the Windsor IWC, and an aplication has not yet been submitted to P&Z), and has been a source of differing expert opinions regarding its impacts.

  Included here is a listing of likely impacts to water quality were a high-density development constructed, even if the high-density development included best management practices and devices for preserving water quality.

  Even with use of the best water-quality treatment structures, twenty percent of sediments and hydrocarbons, generated largely through new roads and driveways, will still enter the lake. De-icing agents from roads/driveways/walks and nutrients from the use of fertilizers may enter the lake through the storm drainage system.

The wider the roads of the development, the more severe the water quality impacts. Increased traffic on Walden Meadow Road will contribute more oils and grease, which will enter the lake through the existing stormwater system, which is currently untreated. Clearing of the woods will interrupt a small wooded wildlife corridor, will decrease woodland habitat, and habitat quality for adult species associated with vernal pools. The less clearing, especially in the vicinity of the vernal pools, the less disruption to wildlife. All of the above impacts would be decreased with a decrease in density.

Specific Comments Regarding the Development at Parcel C.

- **Design.** Should the town decide that the water quality impacts described above are acceptable, it appears that the current proposal has many positive design features. Use of the following measures will help reduce water quality impacts: 1. stormwater quality treatment structures ("swirl concentrator units") at the stormwater system outlets, 2. riprap, level spreaders, and water quality basins, and 3,200 foot overland runs for stormwater infiltration before draining into the pond. It is suggested that catch basins have sump depths of four feet or more.

  Use of the existing west swale to create a detention and stormwater treatment basin would maximize the potential for infiltration and treatment of stormwater in the western part of the development. All opportunities for creating internal detention areas for diversion of stormwater before the water enters the lake should be used.

  Vernal Pool 1 is to the east of the proposed construction. Some runoff may reach Vernal Pool 1 from proposed units 3-6, though the edge of the wetland is over 100 feet away. Vernal Pool 2 is on the central south border of the proposed development site, about 100 feet from proposed disturbance. A small amount of the water draining into Vernal Pool 2 is on land proposed for development, and would continue to sheet drain after development. Natural drainage patterns do not suggest that significant stormwater runoff from the proposed development would reach Vernal Pool 2.

  While Michael Klein estimates that clearing near to the vernal pools may reduce species numbers (but not diversity), he found the

current plan acceptable as proposed. Kimberly Schultz recommended 200 foot buffers around the vernal pools as a minimum for protection of habitat. These two experts may be in basic agreement as to the actual specific impacts, but make differing judgments about their significance and acceptability. The town will need to set their standards as to what level of habitat loss they will accept.

The minimizing of clearing of woods and the minimal use of lawn areas in the proposed design are effective measures for reducing erosion, fertilizer usage, and habitat loss. It also should be noted that the terraced banks of the lake in Parcel C will remain wooded. Since terrace escarpment banks are unusually steep compared to most stream and lake banks, it is important to develop a plan so that concentrated stormwater does not discharge over and down the banks, because of the potential for erosion. The proposed development is engineered in such a way, via use of storm drainage systems and curbing, to minimize non-point and point source discharge over the steep areas of the terrace.

Michael Klein's report on the proposed development indicates that a conservation easement will be established 100+ feet from the vernal pools. This information did not seem to be incorporated into the actual plans yet. A previous recommendation by Michael Klein that adjacent fields and lawns, especially those near to Marshall Phelps Road, be reforested to make up for the removal of other forested habitat areas, would seem to be a useful measure.

Scheduled and regular clean-outs of catch basins, outlets, infiltration beds, and swales are important for optimal mitigation of the development .

- **Construction**. In regards to water quality impacts during construction, the detailed sequencing plan involving initial establishment of stormwater management, and of sedimentation and control measures, appears thorough and acceptable. A double layer of silt fence and hay bales placed at the limit of construction throughout the site and across the major drainage swale in the western part of the property is adequate. Where steep grades are to be created, erosion control matting will be used. However, consultants on the project (Michael Klein, Kimberly Schultz) have

recommended that in the vernal pool areas, diversion trenches rather than silt fence be used to intercept runoff, with outlets to temporary sediment basins

Study Area Planning

- **Planning for overall water quality in the Phelps Brook study area.** Within the last two or three decades this small-sized watercourse/wetland area has begun to receive a large amount of untreated stormwater. The water quality in the study area is affected by two major classes of sources:
  - A. Untreated point-source stormwater draining from the roofs and parking lots of commercial/industrial corporations. The water quality impacts and relative contribution to existing water quality problems are currently unstudied and unknown, but are likely to be substantial.
  - B. The untreated stormwater draining into Walden Woods Pond from existing residential development has most likely contributed to pond eutrophication processes.
  - C. The current proposal for high-density residential development, while well-designed for water quality protection, would nonetheless contribute increased levels of pollutants to the watershed, and will remove some wildlife habitat. Experts disagree as to significance of the impacts.
  - D. Existing conditions downstream are not known at this time.

Perhaps the most important step that could be taken in the study area would be to convene all property owners who currently or potentially will contribute stormwater to the watershed to develop a coordinated plan to reduce current and prevent future water quality impacts. Since it seems that a number of the watershed properties and drainage easements are owned by common or interrelated owners, the process of convening and coordinating the interested parties may not be difficult. Reduction of current water quality impacts would decrease the likelihood of significant future impacts, assuming that the water quality impacts of future development are considered and designed with Best Management Practices.

Figure 2

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Soils Map

Figure 3

Phelps Brook Watershed and Study Area

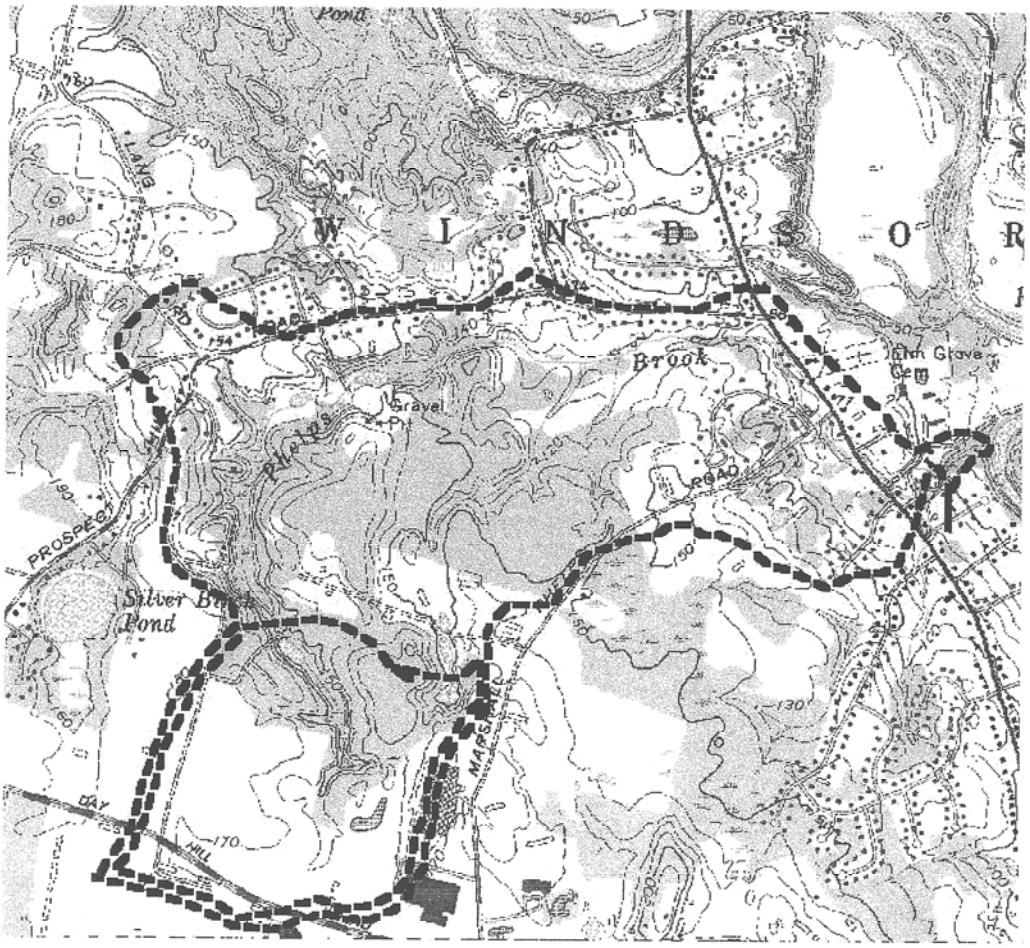


Figure 4

Phelps Brook Study Area

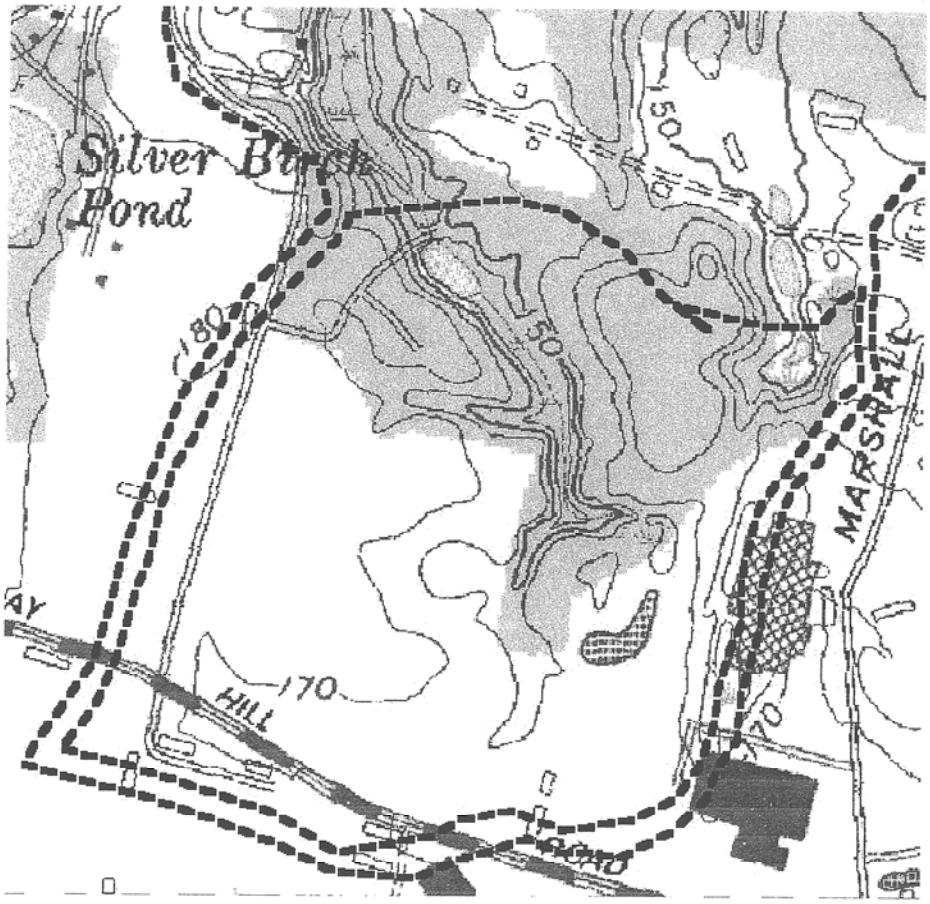


Figure 5

Phelps Brook Study Area Hydrology

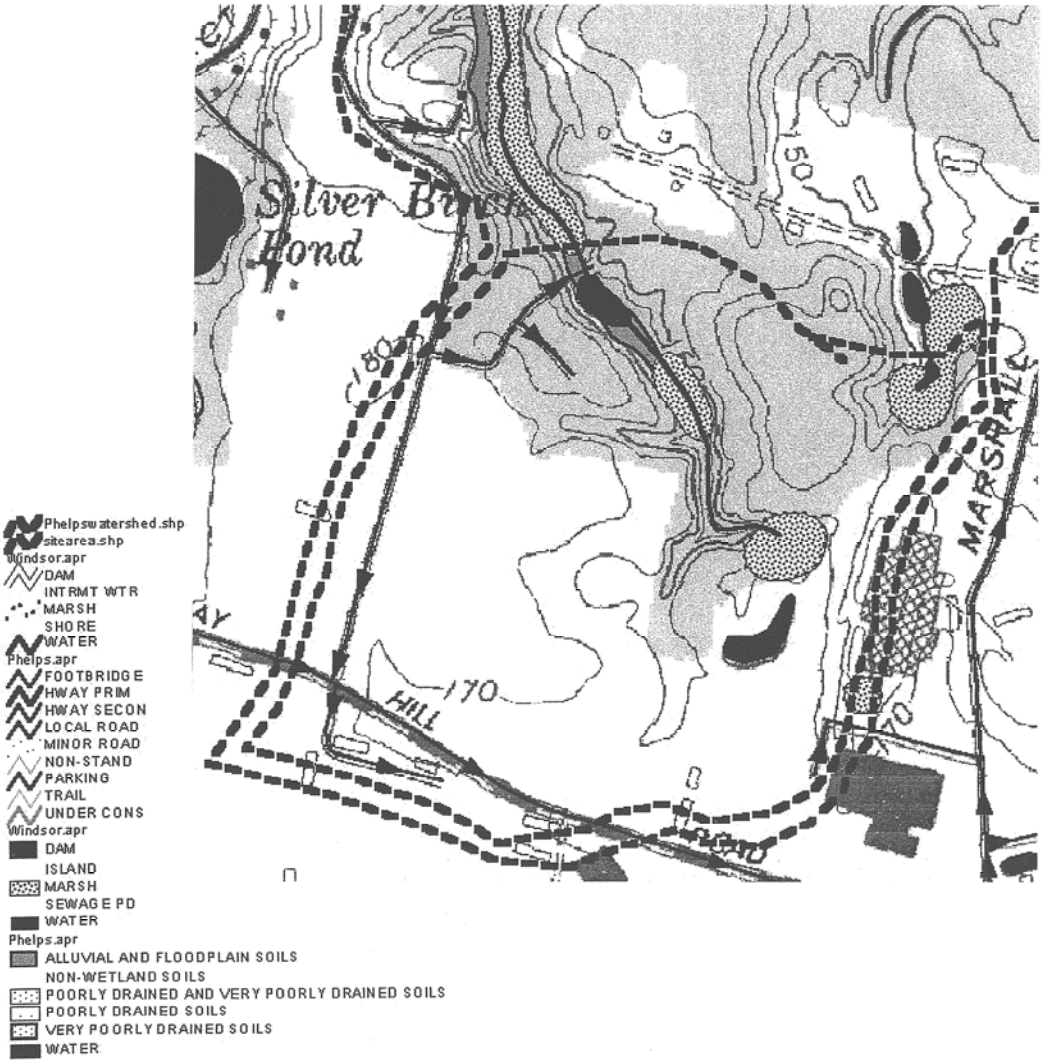


Figure 6

Study Area and Soils

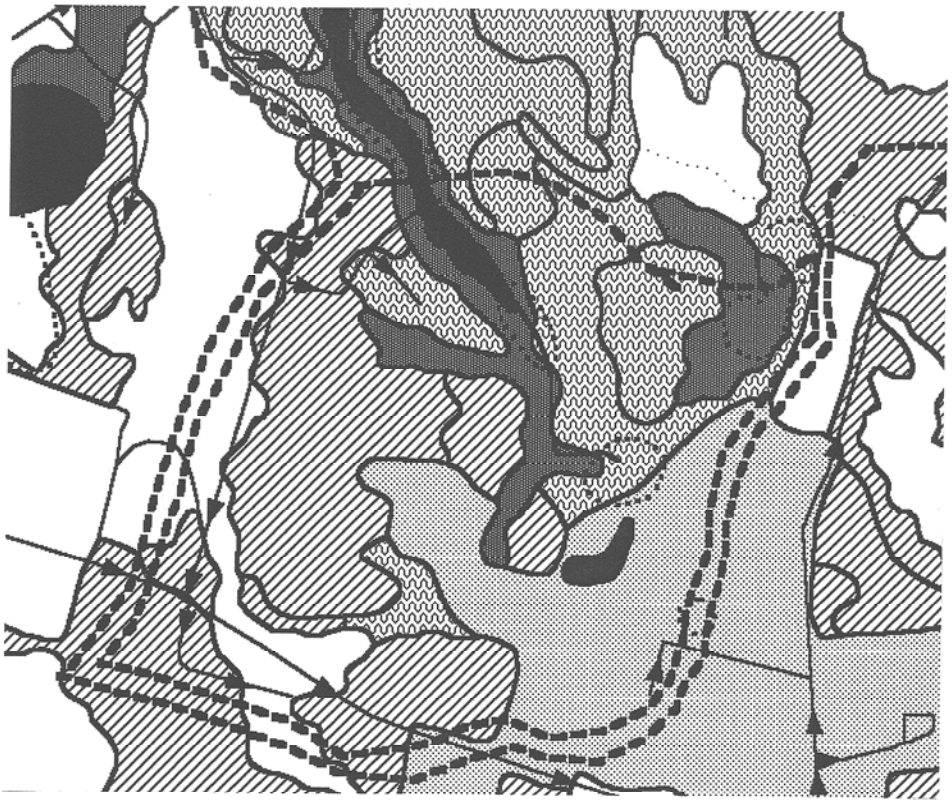


Figure 7

Phelps Brook Study Area Surficial Materials

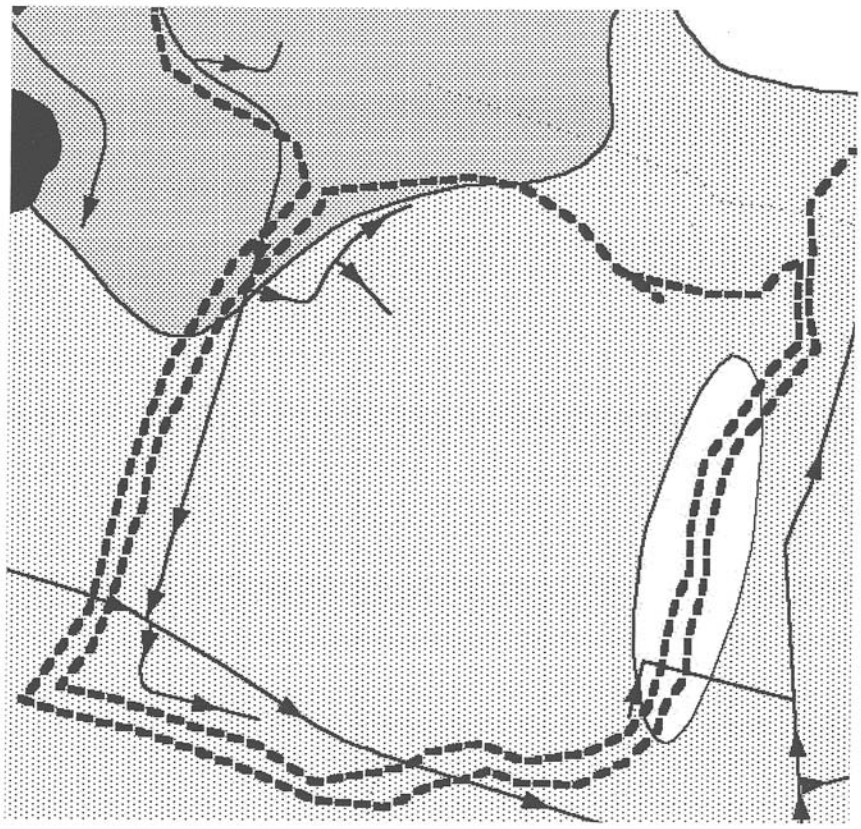


Figure 8

Phelps Brook Study Area Slopes

FOOTBRIDGE
HWAY PRIM
HWAY SECON
LOCAL ROAD
MINOR ROAD
NON-STAND
PARKING
TRAIL
UNDER CONS

Phelpswatershed.shp
sitearea.shp
Windsor.apr
DAM
INTRMT WTR
MARSH
SHORE
WATER
Phelps.apr

Phelps.apr SLOPES
0 %
2 %
3 %
8 %
15 %
25 %

Wetland Review

Watershed Land Use

It is probable that at one time the entire watershed of Phelps Brook was forested. Unfortunately, one of the earliest visual land-use resources generally available, the USGS topographic map dated 1892, made no differentiation between forested and unforested lands as the current topographic maps do.

The next visual references, and the earliest photographic record available, are the 1934 aerial photographs of the entire state. These reveal the study area had two types of land cover. Agricultural use dominated in the form of shade tobacco (~ 66% of the area) with the balance being woodland/forest (~ 34%). The two current vernal areas were apparent then as well. There was no impoundment along the stream course. What is now Walden Woods Pond is visible as a flat-bottom valley with a stream meandering through it. At this time the tobacco fields were quite well established. (See Figure 9)

The dam that formed the pond does not appear on the 1946 topographic map (Figure 10) or the 1953 version. The pond first appears on topographic maps that were fully revised for 1964. Thus, sometime between 1953 and 1964 the dam was constructed, and the pond came into being. Figure 11 shows the area on the Windsor Locks USGS Topographic map revised to 1984 on the 1964 base map.

Taken together, these resources show that the nature of the land use at the headwaters of Phelps Brook has changed significantly in the past seven to eight decades. A first cut land-use survey taken from the 1995 Metropolitan District Commission (MDC) aerial photograph shows these numbers:

Woodland & Water Bodies	27%
Agriculture	41%
Impervious Surface (Roofs, Roads, Parking)	20%
Corporate Lawns	12%
	100%

Where 70 years ago 100% of the drainage was in agriculture or trees, that number now is 68%. Thus, about 60 acres, or roughly one third, have been altered (assuming that the study watershed is ~187 acres). One of the more important numbers for this discussion is the amount of impervious surface in the study area. The study area is approximately 20 percent impervious.

It appears that every hydrologic unit in this watershed has been altered for many decades as well. Based on the field walk the Team took, some of the alterations have been deleterious to the brook hydrology. Typically, moisture gathers from a large area in a headwaters before converging into what would visually be recognized as a watercourse. As it flows downstream, drainage is added and the stream course grows in size.

When this land was all forested the ground infiltration of precipitation would have been at its highest possible rate as a percentage of rainfall. This infiltration would have worked its way down into the soils and ultimately ended up recharging the stream. This watercourse would have been well established to be mapped as a perennial stream on the 1946 topographic map.

But by the late 1920s (and possibly earlier) about two thirds of this drainage was in shade tobacco, one third in woods. As can be seen on the 1934 photo both vernal areas were contributing to their respective hydrologic systems. Additionally, the stream flowed unimpeded out of this drainage area.

Sixty-one years later, in 1995, all three of these hydrologic units have been altered. The wetland that was serving as the headwaters wetland of the southeast fork of Phelps Brook has been isolated by an MDC right of way. It now appears as Vernal Pool #2. What is now Vernal Pool #1 is the result of a road which broke the hydrologic connection between it and the two ponds north of it. And a dam has impounded Phelps Brook resulting in Walden Woods Pond.

The pond is a weir controlled impoundment which outlets to the northwest. The dams' effect on the water is typical of all impoundments. Incoming water is slowed to the point of stillness, and as a result, drops its sediment load to the pond bottom.

In addition to the stream in-flow, runoff from developed land outside of this drainage outlets into the pond. It is visually apparent at the north end of the pond where this inlet is located that great amounts of sediment - most likely road sands - are deposited into the pond as a result.

Erosion

At the northeast corner of the Unisource property there is an outlet pipe. It was not known at the field visit exactly the area of drainage for this pipe but it does include the Unisource property. Where the water discharges from the pipe it passes into a large basin. It was dry the day of the field visit but it would appear the basin is undersized for the water it must detain and the energy it must dissipate. Below the basin, storm water discharge runs downslope to a sort of check dam-like structure. Water flows around both sides of this stone structure and continues downslope. Just below the check dam, severe erosion and down cutting have taken place. The water which once used to pass slowly over the nonpaved surface and infiltrate over many acres now flows rapidly after a storm event and is focused into, and then out of, one pipe. The speed of the water exiting the pipe during peak storm runoff provides the water with tremendous erosive force. This waterway is a classic example of what the effects of impervious surfaces can do in the watershed.

One of the main questions that arose in the field was whether the stream that has carved itself into the landscape below the outlet pipe has stream bottom deposition of road sand or if its sandy bottom is borne of the eroded soil adjacent to the stream. Opinions differed on the source of the sand.

Clearly the largest visually apparent sediment source in the pond at the time of the field visit is from the inlet pipe at the northwest end of the pond, not where the stream enters.

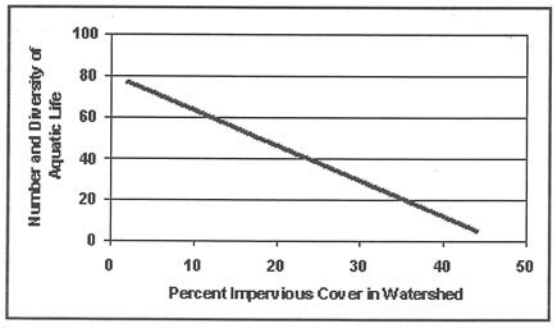
Many of the ERT Team walked from the outlet pipe downstream to the point where the stream enters the pond. The group witnessed the downcutting, the depths of which measured as much as 30 inches, that has taken place. The Center for Watershed Protection (CWP) in Ellicott City, Maryland www.cwp.org reports that impervious surfaces produce

16 times more stormwater runoff than forest. Thus, if the discharge pipe and detention basin system has been added to since its original construction, it can be clearly seen on the landscape now to be an ineffective and non-functioning system.

Summary

- The CWP has found and reported the effects of imperviousness on water quality. When impervious surfaces in a watershed reach 10 percent of the total, stream degradation (stream and water quality) occurs. At 15% impervious surface aquatic health of the stream falls off sharply (see chart below). Stream degradation is severe at 25% impervious surface in the watershed.

The graph below shows that as the percentage of impervious cover increases, the diversity of a stream decreases.



More than a hundred small watersheds studies have shown that there is a sharp decrease in aquatic life as imperviousness increases. Frequently, in areas where impervious cover prevents water from replenishing groundwater supplies, stream flow is low during dry periods. *(Chart and language re: percentages of impervious surfaces are from the Center for Watershed Protection)*

- The pond should be tested for nutrients; Nitrogen and Phosphorus. These are typical runoff problems for headwaters watersheds that feature agriculture and elevated impervious surfaces. The soils that the watercourse passes through/over are well drained and acidic.

Thus, the nutrient levels arriving at the pond are most likely elevated from local nutrient sources (agriculture and/or corporate lawns) and are likely contributing to the eutrophication state of the pond.

- The large and lengthy eroded area downstream from the outlet pipe at the edge of the Unisource property needs to be reviewed and remedied. It would seem that steps need to be taken to slow the speed and to dissipate the energy of the runoff and collect the sediment load before allowing the water to move downstream.

Summary

At this time the watershed is at a fork in the road. Watershed land-use decisions will have to be made to determine if the continued increase of impervious surface and the inevitable deterioration in stream/water quality is worth the price of development.

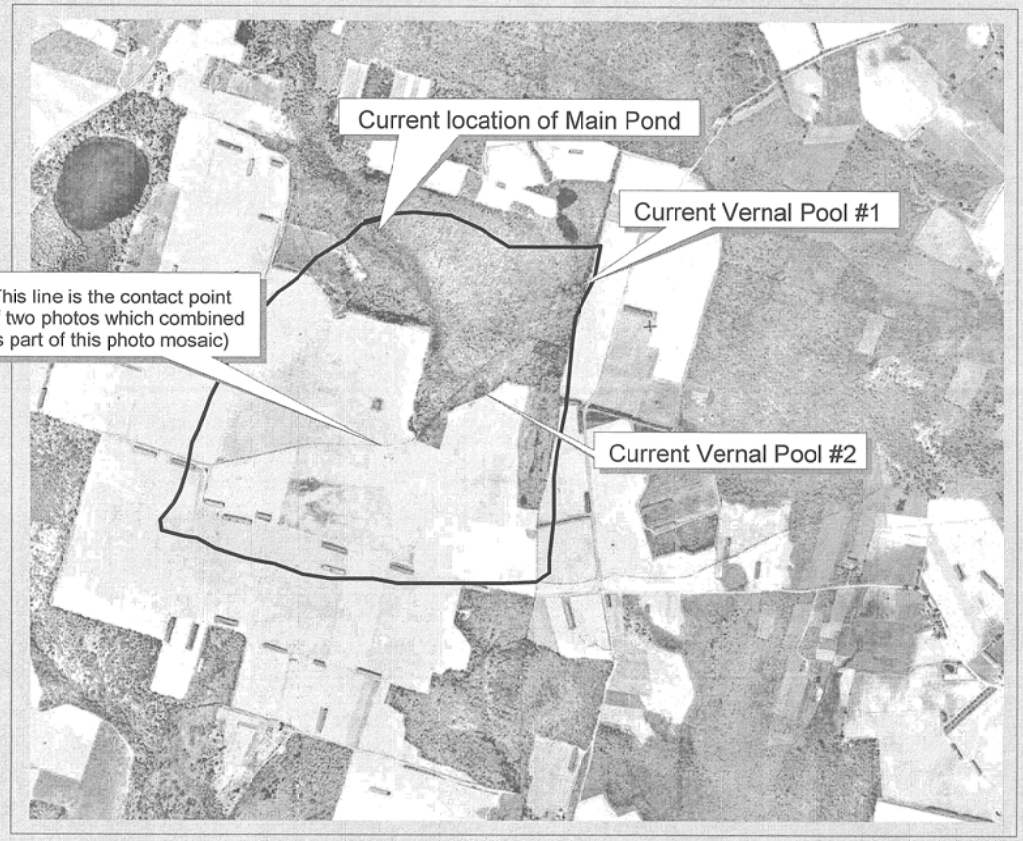
One benefit of the proposed construction on Parcel "C" is the installation of four Vortechnics units to capture road sands and sediments. But as good as these units are, 20 to 25% of sediments will continue to discharge into the pond and/or watercourses. Thus, the Vortechnics units simply prolong the inevitable sediment buildup in the streams and water bodies. None-the-less, schedule of cleanouts and maintenance of these units should be in place and assigned to one of the town commissions to monitor its upkeep.

The other aspect of water quality is nutrient loading. Fertilizer residue from agricultural use and large lawns can and should be measured, compared against the norm for the area, and corrected.
The maintenance of streamside buffers should be a constant in any future land-use planning (for all watercourses in town, not just this location). The filtering and shading effects of wooded buffers has been well documented and is one of the greatest, simplest and most effective water quality preservation tools. The resulting riparian areas form travel routes for wildlife and act as excellent, no-cost overland sheet flow filters.

The percentage of impervious surface in the study area will continue to increase. But the town has the opportunity to decide the future of the

watershed's water quality by deciding what type and how much development will cover the landscape in the future.

1934 Aerial Photograph



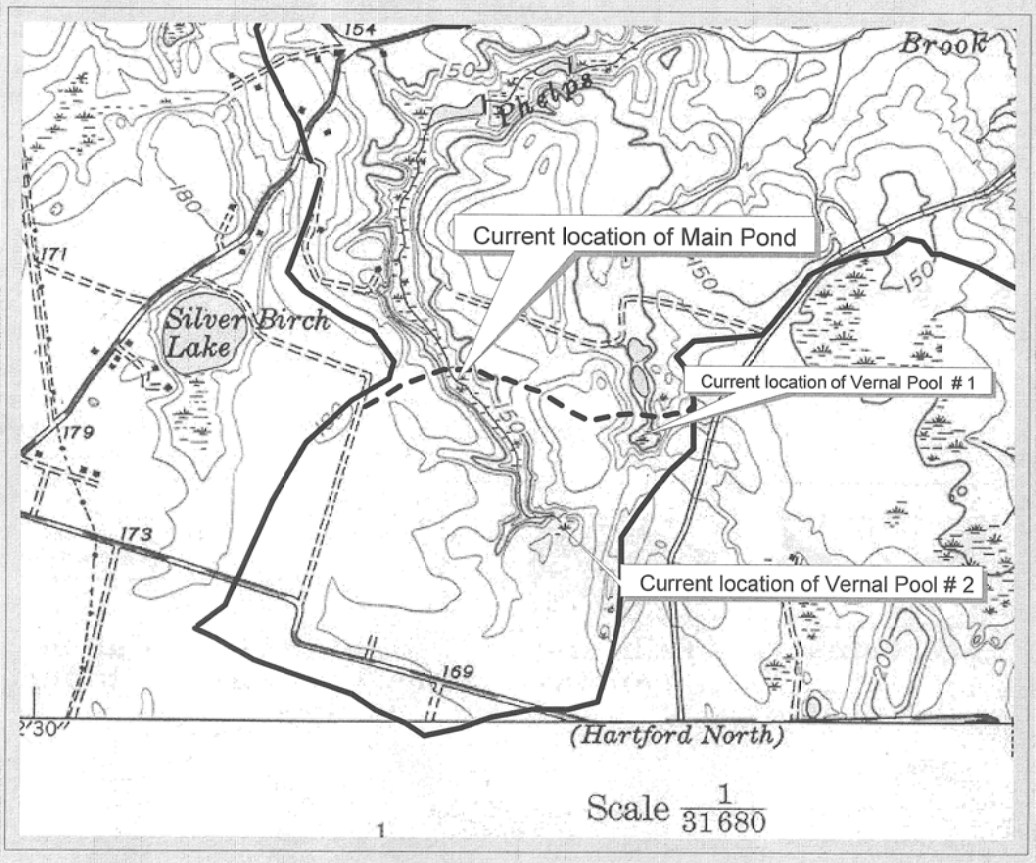
Boundaries extremely estimated; wetland sites are correct

N
W E
S

26

Figure 9

1946 USGS Topographic Map



1946 USGS Windsor Locks Topographic Map, Surveyed in 1943

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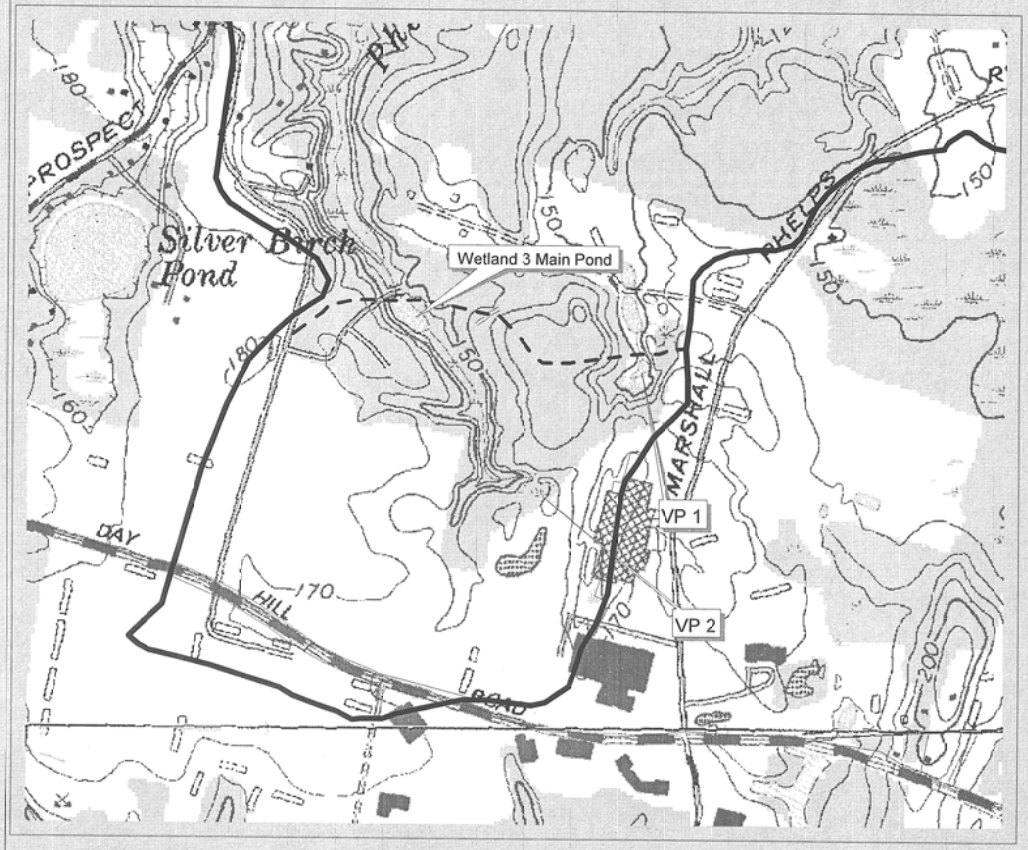
Figure 10

1984 Photorevised USGS Topographic Map



1984 Photorevision of the 1964 base USGS Topographic Map

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Figure 11

Water Quality Assessment

Among the many concerns listed for the Environmental Review Team (ERT) regarding the "Phelps Brook Watershed and Land Use Study" are questions regarding the current condition of Walden Woods Pond (Pond) and the impacts from Walden Woods Phase II (Parcel "C") development to the water quality of the Pond. The following includes a review of the various documents provided to the ERT with regards to the current water quality of the Pond and the potential impacts to the Pond from the Walden Woods Phase II (Parcel "C") development. These documents are listed at the end of this section.

Water Body Trophic Overview

The assessment of the trophic category of the Pond is a key factor in this review. Lakes and ponds are often classified according to their trophic category. Trophic categories are used as a way to describe a water body's level of fertility and thus its level of biological productivity. The three basic trophic categories are oligotrophic, mesotrophic and eutrophic. Oligotrophic lakes are deep clear infertile lakes with little algae and few rooted aquatic plants. Eutrophic lakes are usually shallow with rooted aquatic plant growth and are often plagued by extensive algae blooms. The fertility of lakes in the Mesotrophic category is between the fertility of oligotrophic and eutrophic lakes. The additional category of highly eutrophic or hyper eutrophic is assigned to water bodies that are extremely fertile.

Many conditions contribute to the trophic condition of a lake or pond. Some characteristics are natural such as the size of the drainage basin, also known as the watershed, and the lake volume. Small water bodies with large drainage basins will tend to be eutrophic because greater quantities of phosphorus and nitrogen have to be assimilated into a smaller volume of water than in a large lake with a small drainage basin. The Walden Woods Pond drainage basin is about 80 times larger than the surface area of the Pond. This ratio is considered to be very large indicating that Walden Woods Pond has a natural tendency to be a productive pond with an advanced trophic state. However, runoff from land uses that generate above background level nutrients such as developed land with impervious surfaces, agriculture operations, and

fertilized lawns will advance a water body's trophic state beyond its natural tendency. To maintain a lake or pond's natural trophic state when the drainage basin generates nutrients above the natural loading, watershed management practices need to be employed that reduce sources of nutrients, and controls the rate and concentration of nutrients in runoff.

Trophic Condition of Walden Woods Pond

When determining the trophic category of a water body, spring and summer data should be collected and compared to a standard trophic classification system. Figure 12 is the trophic classification system developed by CT DEP in conjunction with the Connecticut Agricultural Experiment Station. Similar data needs should be collected and analyzed to accurately determine the trophic category of Walden Woods Pond. The information provided to the ERT is not sufficient to classify Walden Woods Pond. However, the limited data provided by the consultants suggests that the pond is highly eutrophic. No information or data is provided to support the consultant's conclusion that the Pond is meso eutrophic or even eutrophic.

The information provided to the ERT does not support the suggestion that Walden Woods Pond is relatively stable and that changes in nutrient concentrations are unlikely to cause significant changes in biological productivity. The appropriate data and analyses have not been provided to determine how the Pond will respond to the Parcel "C" development. Supporting data and analyses should be provided to determine the increased nutrient load to the Pond from the Parcel "C" development. This new nutrient load from the Parcel "C" development then needs to be added to the existing nutrient load before a prediction of the future water quality can be made.

Although Walden Woods Pond has characteristics that would make it naturally eutrophic, the trophic state of the Pond is probably also influenced by runoff from the agricultural fields, roadway runoff, and industrial parking lots and lawns within the drainage basin. However, without a thorough analysis of the nutrient loading to the Pond, the extent natural conditions influence the trophic state, as opposed to land use within the drainage basin, cannot be determined.

Dredging

The consultants suggest that the geometry of the Pond does not lend itself to a cost-effective dredging program. However, their review of dredging is not based on data collected specifically to assess the feasibility of dredging the Pond. Dredging could improve both water quality and fishery habitat. At a minimum, spot dredging may be useful in removing the road sand deposits that have built up in the Pond. Basic information is needed to determine the volume of sediment that could be removed, dredging method, permits required, and costs before dredging is dismissed. Given the current conditions of the pond, dredging should be further evaluated as a restoration method. CT DEP Lakes Management Program has been involved with dredging many ponds and lakes throughout the state and is available to discuss dredging in more detail.

Modification of Outlet Structure

The consultants propose a plan to modify the outlet structure of the Pond by reducing the width of the existing weir from 7.5 feet to 3 feet. The modification is proposed to keep runoff from the Parcel "C" development below existing runoff rates. The proposed modification to the outlet structure will increase the retention time of the Pond. Increasing the retention time will further degrade water quality. Algal cells will stay in the Pond longer and form even denser algae blooms of longer durations than the Pond currently experiences. Additionally phosphorus that may be unavailable for algae could become available with a longer retention time. No calculations indicating the current retention time, or the retention time with the proposed modification, are provided.

Review of aerial photos show that the Pond was constructed before 1965 when the surrounding area was predominately in agriculture. The pond was probably built for agricultural purposes and preexisted most industrial and residential development in its drainage basin. Retaining storm water to control flows in a water body that is not specifically designed and created as a control structure is inconsistent with Connecticut Water Quality Standards. Furthermore, the proposed modification to the outlet structure may require a DEP Inland Water Resources Division Dam Safety Permit and/or a Water Diversion Permit.

Before the outlet structure is modified, the developer should contact the DEP Division of Inland Water Resources to determine whether a Dam Safety Permit and/or a Water Diversion Permit are required.

Stormwater Controls

The Walden Woods Phase II (Parcel "C") proposal includes stormwater controls that will remove many of the pollutants generated from the subdivision by retaining suspended solids and infiltration into the ground. The stormwater drainage controls will need to be maintained in order to be effective. No maintenance schedule has been provided to the ERT. The report states "Once discharged, the released water travels a minimum of 200 feet overland before reaching the edge of any wetland." Discharged water from Water Quality Basin #1 will flow over land only 80 feet before entering the wetland surrounding the Pond. Also, assurance should be provided that discharged water from Water Quality basin #1 does not cut an erosive channel in the sandy soils.

Overall the stormwater controls proposed provide a level of treatment that represents standards expected for new developments and are improved over the level of control found in older subdivisions. The concentration of phosphorus and nitrogen discharged to the Pond from the water quality basins will be determined by the length of time the stormwater will be in the basins, infiltration into the ground, and nutrient uptake by aquatic vegetation. Although this level of treatment is improved over past practices, the extent of impervious surface that will be created completely around the Pond will probably elevate the concentration of nutrients in stormwater discharged to the Pond beyond the current preexisting conditions. Impacts to the Pond from dissolved nutrients in stormwater are not adequately evaluated in the information provided to the ERT. Nitrogen is critical for rooted aquatic plant growth and is a concern for lakes in Connecticut. The Pond has no unique conditions that would support more denitrification and make nitrogen unavailable for plant growth. Phosphorus, the critical nutrient for problematic blue green algae, is not mentioned.

Conclusion

The information reviewed does not accurately depict the current trophic status of the Walden Woods Pond. The data provided depicts spring

conditions rather than worse case summer conditions. Nevertheless what data is available indicates that the Pond is a highly eutrophic water body. A highly eutrophic category is a much further advanced trophic state than suggested in any of the reports. The proposed modification to the existing outlet structure of the Pond could have detrimental effects to the water quality and may require a Dam Safety and/or a Water Diversion Permit from DEP Division of Inland Water Resources. Stormwater controls will remove some of the nutrients generated from the Parcel "C" Development but will probably not remove nutrients to the level that currently preexists the development. The residents of the area including the new Parcel "C" homes will probably find the Pond unsuitable for most recreational pursuits and may find the Pond an undesirable landscape feature. Management of the conditions of the Pond's advanced trophic state will require professional assistance. The Town should seek assistance reviewing the reports provided from the various parties assessing the current and future trophic status of the Pond. DEP Lakes Management staff (860) 424-3716 are available to meet with Town of Windsor officials to discuss the existing information that has been provided to the ERT through the Town and to discuss future water quality management of the Pond based on the Proposed Parcel "C" Development.

Documents Provided to the ERT and reviewed as part of the evaluation of water quality for Walden Woods Pond:

"Drainage Report Walden Woods Parcel "C"", Fuss and O'Neill, Revised August 20,2001.

Letter from David M. Bell, Ph.D. to Ms. Michelle Carlson of Fuss and O'Neill regarding the trophic status of the Pond, August 29, 2001.

"Current Water Quality and Potential Impacts of Construction Plans at Walden Woods: Revised Independent Evaluation", Assistant Professor Kimberly Schultz, Ph.D., December 2001.

Memo from Chris Ecsedy of Fuss and O'Neill to Norman Thibeault, May 15, 2001.

Figure 12

Criteria for trophic categories are as follows:

Trophic Classification - The trophic criteria is based on survey of 115 lakes in Connecticut. The lakes are grouped into six trophic categories: oligotrophic, early mesotrophic, mesotrophic, late mesotrophic, eutrophic, and highly eutrophic. Trophic status is determined from water quality monitoring data for total phosphorus (average between the spring and summer surface sample), total nitrogen (average between the spring and summer surface sample), summer chlorophyll-a, summer Secchi depth, and summer macrophyte density.

Total phophorus is monitored since it is usually the nutrient which limits phytoplankton productivity. Total nitrogen is monitored because it is closely related to planktonic productivity and may be limiting to macrophyte productivity. Summer chlorphyll-a, taken as a surface sample, is monitored as a measure of phytoplankton density during the peak growth period. Summer macrophyte areal coverage and density is monitored to assess the relative importance of the plant community as an expression of lake primary productivity.

Criteria of trophic categories are as follows:

1. Water Column Data:

Category	Total P	Total N	Summer Chlorophyll-a	Summer Secchi Depth (meters)
Oligotrophic	0-10	0-200	0-2	>6
Early Mesotrophic	10-15	200-300	2-5	4-6
Mesotrophic	15-25	300-500	5-10	3-4
Late Mesotrophic	25-30	500-600	10-15	2-3
Eutrophic	30-50	600-1000	15-30	1-2
Highly Eutrophic	>50	>1000	>30	0-1

2. Macrophyte Data:

Macrophyte are aquatic plants which are large enough to be seen without magnification. Macrophyte data is reviewed in conjunction with the water column data to classify relatively shallow water bodies exhibiting significant macrophyte productivity. If macrophyte growth is very extensive (75-100% of water body area) and dense, the lake is classified as "highly eutrophic" regardless of the water column data. If macrophyte growth is extensive (30-75% of waterbody area) and dense, the lake is classified as "mesotrophic" when the water column indication is oligotrophic, and is classified "eutrophic" when the water column indication is mesotrophic or eutrophic.

Stormwater Management

Of the various issues which are of concern to the Town of Windsor, the purpose of this section is to comment specifically on the erosion and sediment control issue related to the development of Parcel "C", the improvements which can be made to nearby existing discharges to Walden Woods Pond, and the improvements which can be made to the stormwater drainage system along Day Hill Road.

The development of Parcel "C" will be subject to the requirements of the Department of Environmental Protection's (DEP) General Permit for the Discharge of Stormwater and Dewatering Wastewaters Associated with Construction Activities ("the construction general permit"). Many of the requirements of the construction general permit overlap with the requirements of local agency(ies) and the Connecticut Guidelines for Soil Erosion and Sediment Control ("the guidelines").

Since the proposed development of Parcel "C" involves the disturbance of over five acres, the owner or developer of the site must register this site with the DEP thirty days prior to the commencement of construction activity. Additionally, a Pollution Control Plan ("the PCP") must be prepared and kept on site during the entire life of the construction project.

The PCP must include a site map as described in Section 6(b)(6)(A) of the construction general permit and a copy of the erosion and sedimentation (E & S) control plan for the site. An E & S plan which has been approved by the Town of Windsor in conjunction with the DEP Inland Water Resources Division (IWRD) and the local Soil and Water Conservation District may be included in the PCP. The PCP and site map must include specifics on controls that will be used during each phase of construction, pursuant to Section 6(b)(6)(B) of the construction general permit. Specific site maps and controls must be described in the PCP, as well as construction details for each control used. The construction general permit requires that "the plan shall ensure and demonstrate compliance with the guidelines." The Plan must be flexible to account for adjustment of controls as necessary to meet field conditions.

The PCP must demonstrate that the post-construction stormwater treatment system has been designed with a goal of 80% removal of total suspended solids, pursuant to Section 6(b)(6)(C)(iii)l) of the construction general permit. Such measures may include, but are not limited to, stormwater detention basins, stormwater retention basins, swirl concentrator technology structures (such as *Vortechnics*, *Downstream Defender*, *Stormceptor*, *Stormtreat*, or similar), vegetated swales, deep catch basin sumps (4'+) and stormwater infiltration devices. The PCP must also discuss the installation of velocity dissipation devices at all discharge locations as a post construction stormwater management measure. A detail of proposed measures as well as drainage calculations must be provided. If site conditions allow, DEP recommends the installation of retention or detention basins because of maintenance, cost, and efficiency considerations. The elimination of point sources through the use of level spreaders or curb elimination should also be evaluated.

The construction general permit (Section 6(b)(6)(D)) requires inspections of all areas at least once every seven calendar days and after every storm of 0.1 inches or greater. The PCP must also allow for the inspector to require additional control measures if the inspection finds them necessary, and should note the qualifications of personnel doing the inspections. Ongoing inspections and adjustments of controls will be an important aspect of this project. Additionally, the PCP must include monthly inspections of stabilized areas for at least three months following stabilization.

The following comments are specific to the proposed project based on review of the site plans submitted on October 31, 2002 and discussion with town officials and the engineering consultant on October 29, 2002:

- The installation of 3 Vortechnics units in the Aspen Greens and Ellsworth Pond storm drainage system to handle post-construction stormwater runoff is consistent with the requirements of the construction general permit and will provide for adequate total suspended solids removal. Although not required by the general permit, the installation of additional Vortechnics unit(s) to treat the existing stormwater discharge(s) (such as the discharge near the pond outlet structure) will significantly reduce the suspended solids

loading to Walden Woods Pond ("the pond") and improve water quality.

- In addition to the installation of anti-tracking pads, silt fencing and hay bales, and erosion control matting as shown in the site plans, it may be necessary to install sediment traps/basins (with 134 cubic yards of water storage per acre drained) and/or drainage/diversion swales. The PCP must provide information on drainage areas, and if any one drainage area (including both roadway and house construction) exceeds 2 acres, a sediment basin/trap will be required.

- The Department recommends that CB-22 be provided with a deeper sump (3-4'), if possible, to provide more storage and sediment removal.

- If dewatering is necessary, the PCP must address how dewatering wastewaters generated onsite will be managed in accordance with Section 6(b)(6)(C)(ii) of the construction general permit.

- In order to reduce erosion potential, DEP recommends that construction activities be phased to the maximum extent possible so that unstable areas are minimized. The construction general permit also requires that any inactive area left disturbed for over 7 days be temporarily stabilized. Areas left disturbed over 30 days must be temporarily seeded.

- Any areas left disturbed beyond the planting season (after October 1) must be stabilized for the winter. Stabilization should be in the form of properly selected erosion control matting or a spray-on "soil cement" type of armor mulch.

- Since stormwater runoff from Unisource Worldwide Inc. and Day Hill Road are resulting in the deposition of sediment and causing extensive erosion to the south of Walden Woods Pond, a drainage study should be conducted in this area. The treatment (for total suspended solids, etc.) of stormwater, the installation of velocity dissipation devices at discharge outfall(s), and the stabilization of the eroded channel should also be evaluated.

- In conclusion, for each new proposed development, the following are some general practices which should be evaluated and pursued in order to reduce the impact of development on natural resources:
  - the infiltration of stormwater runoff from roof drains and roadways via infiltrators, retention basins, detention basins, rain gardens, etc.
  - the construction of roadways with a maximum width of 24 feet to reduce the area of imperviousness.
  - the installation of curb-less roadways to promote sheet flow of stormwater runoff.

The Natural Diversity Data Base

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

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

Aquatic Resources

Site Description

The Walden Woods Parcel "C" residential complex consisting of 37 duplex Units and 13 apartment buildings with 80 Units is proposed for development on a 56 acre parcel located southerly off Walden Meadow Road. Walden Woods Pond, a 2.2 acre impoundment excavated in the headwaters of Phelps Brook, is centrally located in the proposed development. The pond had reportedly been constructed as a water supply source for the irrigation of agricultural fields which had formerly occupied the Walden Woods site. A berm conveying Walden Meadow Road over Phelps Brook along with a concrete drop structure at the pond outlet have been constructed to increase the pond's capacity to detain additional stormwater generated from developed areas on the Walden Woods site.

Bathymetric information for Walden Woods Pond is currently unavailable. Based upon site conditions, it is presumed that the pond is shallow with maximum water depths of less than 10 feet. The northern and western pond shoreline is steeply sided with the eastern and southern shore having a more gradual slope. A stream enters at the pond's southern shore; the stream has deposited a sediment delta within the pond. Stormwater discharged from a section of Walden Meadow Road has created a sediment delta immediately east of the pond outlet structure.

Despite extensive development on the Walden Woods site, dense growths of band of conifers, hardwoods and woody shrubs predominate as vegetation around Walden Woods Pond. Submergent aquatic vegetation is sparse in the Pond, however, there was a notable bloom of unicellular algae. Physical habitat in the pond is comprised of water depth, aquatic vegetation and fallen or overhanging shoreline vegetation.

The Department of Environmental Protection classifies Walden Woods Pond and the headwaters of Phelps Brook as *Class* A surface waters. Designated uses for surface waters of this classification are potential

drinking water supply, fish and wildlife habitat, recreational use, agricultural, industrial and other legitimate uses including navigation.

Aquatic Habitats and Resources

With a shallow water depth and moderate aquatic plant growth, Walden Woods Pond call be classified as a warm-water resource. Formal surveys have never been conducted to evaluate the resident fish population nor are there any records available which document intentional fish liberation. 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 warm-water lakes and ponds in Connecticut. There was evidence of angler use of the pond.

Surface flow to the Phelps Brook segment immediately downstream of Walden Woods Pond is primarily from groundwater and leakage from the pond. As such, a significant length of stream downstream of the pond may be intermittent in flow and be unable to provide for fish support. The Inland Fisheries Division has conducted fish surveys in a section of Phelps Brook near the Farmington River confluence. At that location, creek chub *(Semotilus atromaculatus)* was the only species collected.

Impacts

Plot plans depict the site development as maintaining a vegetated buffer in excess of 200 feet around Walden Woods Pond and in excess of 100 feet along the intermittent tributary at the pond's southern shore. Vegetated buffers of these widths should adequately serve as a "filter" to prevent sediments, nutrients, fertilizers, and other non-point source pollutants originating on developed upland areas from entry into the pond. Such non-point source pollutants can degrade habitat and water quality. Please refer to the attached documentation presenting Inland Fisheries Division policy and position regarding vegetated riparian buffers for additional information (see Appendix A).

Stormwater runoff from the proposed Walden Woods Parcel "C" will be discharged to Walden Woods Pond. Residential dwellings, parking lots,

driveways and roadways constructed on the multi-unit housing development site will create a significant amount of impervious surface. Studies conducted in Maryland demonstrate that on sites with 35-50% impervious surface coverage, 35% of fallen precipitation is lost to evapotranspiration, 20% to shallow soil infiltration, 15% to deep soil infiltration and 30% to off-site runoff. In comparison, precipitation falling on sites with a natural ground conclude with losses of 40% to evapotranspiration, 25% to shallow soil infiltration, 25% to deep soil infiltration and 10% to off-site runoff.

Of concern with the alteration of the hydrologic cycle specific to the Walden Woods Parcel "C" site are the potential loss of groundwater recharge and the quality and quantity of stormwater runoff to Walden Woods Pond. On sites maintained with significant amounts of natural ground cover, a considerable percentage of fallen precipitation infiltrates into the soil and contributes to groundwater recharge. Ground-water is part of the local water table which is connected to surface waters such as Walden Woods Pond. The local water table provides seepage to the pond during dry periods and maintains a base water surface elevation flow essential to biological and habitat integrity. A significant reduction or loss of groundwater recharge can lead to a lowering of the water table and a reduction water surface elevation of the pond during extended dry weather periods and potentially a reduction in flow available to Phelps Brook downstream of the pond.

Based upon published studies, it can be estimated that roughly 30% of the precipitation falling on impervious surfaces of the Walden Woods Parcel "C" site has the potential to result in off-site runoff to Walden Woods Pond. Materials that accumulate on paved surfaces during dry periods are washed into the pond by rainfall runoff or snowmelt. Petroleum products, heavy metals, sand and salt are the most common of the pollutants originating from impervious surfaces such as parking areas and roadways. Although the discharge of these materials may not directly contribute to episodic kills of aquatic life because of dilution in stormwater, the continued discharge over time is anticipated to degrade habitat and water quality. This will ultimately diminish the ability of Walden Woods Pond to support a diverse aquatic species assemblage. Stormwater runoff from impervious surfaces during summer months can result in an unnatural change in the pond's water temperatures which is commonly referred to as thermal pollution. Literature reports

of studies in Maryland which found urban runoff raising the summer water temperature in surface waters as much as 20° Fahrenheit. It was reported that water temperatures rose 9° Fahrenheit in some surface waters streams after "treatment" of stormwater runoff in detention or retention structures.

Fish and other aquatic species are responsive to changes in water temperatures. A rise in water temperatures can inhibit the over-summer survival of insect and fish species fish or off-set critical life functions (e.g. spawning, egg incubation, juvenile development) of aquatic insects and fish. As water warms, it's ability to hold dissolved oxygen becomes lessened. A decrease in dissolved oxygen levels can cause fish kills.

The land use change resulting from the proposed Walden Woods Parcel "C" site may not only promote localized impacts to Walden Woods Pond but may also contribute to the cumulative impacts associated with urbanization on a watershed-wide scale in the Phelps Brook drainage basin. Maryland studies noted incremental deterioration in stream water quality and physical habitat with increased percentages of impervious surface within the watershed. Watersheds with 10 -15% impervious surface coverage were found to cause slight degradations of physical stream habitat with significant impacts occurring as the percentage of impervious surface progresses from 25 -50% total watershed coverage.

Recommendations

In an effort to eliminate the potential for impacts to Walden Woods Pond and Phelps Brook, the following measures should be incorporated into the design of the proposed Walden Woods Parcel "C" site:

- Detention/water quality basins should not be created in vegetated riparian buffers within 100 feet of Walden Woods Pond or it's tributary stream.

- Areas within the buffer altered by prior land use should be allowed to re-establish to a condition similar to that found in undisturbed riparian buffer habitat or be replanted to accelerate the successional

process. Vegetation selected for replanting within the riparian buffer shall be native and non-invasive.

- The riparian buffer should be deeded to a municipal or private entity to prevent future development and to assure an appropriate conservancy. Public access should be allowed within the buffer.

- The detention/water quality basin(s) should be constructed to accommodate a sufficient amount of stormwater to alleviate temperature related impacts associated with stormwater which may ultimately discharge to Walden Woods Pond. The basin(s) should also be vegetated with a variety of plant species which are known to have a high capacity for nutrient uptake. The plant species shall be native and non-invasive. The basin(s) should have an irregular shape to increase the surface area available for planting. The irregular shaped basin(s) would also blend better into the landscape.

- In lieu of roadway and parking lot curbing, use sheetflow and vegetated swales to promote groundwater infiltration.

- Utilize permeable pavement where ever suitable.

- Establish comprehensive erosion and sediment control plans with mitigative measures (detention-infiltration/water quality basins, haybales, silt fence, etc.) to be installed prior to and maintained through all phases of site development. Land clearing and other disturbance should be kept to a minimum with all disturbed areas being protected from storm events and be restabilized in a timely manner.

- Limit regulated activities adjacent to riparian buffer zones to historic low precipitation periods of the year. Reduced precipitation periods of summer to early fall provide the least hazardous conditions when working near sensitive aquatic environments.

Literature Reviewed

Maryland Department of Environmental Resources - Programs and Planning Division, *Low Impact Design Strategies - An Integrated Design Approach.* June 1999. (Prince George's County, MD)

Archaeological Review

A review of the State of Connecticut Archaeological Site files and maps show one archaeological site in the project area. The site represents a Native American encampment near the confluence of Phelps Brook and the Farmington River, occupied at some unknown time period. Historic review, along with topographic and environmental features, of the project area suggests a high sensitivity toward additional undiscovered archaeological resources.

The cultural landscape of the project area evidences human occupation and utilization dating to over 4,000 years ago. Informant data suggests that Indian stone artifacts have been recovered from plowed fields that testify to prehistoric settlements along the Farmington River and Phelps Brook. Historically, the area was the homeland for the Pequonock Indian tribe. In addition, extant barns and landscapes testify to the historically important tobacco industry in the Connecticut River Valley. Areas of particular archaeological sensitivity would be elevated, well-drained soils along Phelps Brook. Past housing and gravel mining have effected some of these areas, however, many such areas remain undisturbed and offer potential to yield important information about Windsor's past.

The Office of State Archaeology strongly recommends an archaeological reconnaissance survey for the project area should future plans require any subsurface disturbances. This survey should be conducted to identify all cultural resources in the areas planned for development and provide recommendations on their significance and preservation. The survey should be conducted in accordance with the Connecticut Historical Commission's Environmental Review Primer for Connecticut's Archaeological Resources.

The Office of State Archaeology would look forward to working with the Town of Windsor in the conservation and preservation of its cultural resources along the watershed.

Appendix A

For Appendix Information Please Contact the ERT Office at 860-345-3977

ABOUT THE TEAM

The Eastern Connecticut Environmental Review Team (ERT) is a group of professionals in environmental fields drawn together from a varety of federal, state and regional agencies. Specialists on the Team include geologists, biologists, foresters, soil specialists, engineers and planners. The ERT operates with state funding under the supervision of the Eastern Connecticut Resource Conservation and Development (RC&D) Area — an 86 town region.

The services of the Team are available as a public service at no cost to Connecticut towns.

PURPOSE OF THE TEAM

The Environmental Review Team is available to help towns and developers in the review of sites proposed for major land use activities. To date, the ERT has been involved in reviewing a wide range of projects including subdivisions, landfills, commercial and industrial developments, sand and gravel excavations, elderly housing, recreation/open space projects, watershed studies and resource inventories.

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 project site and highlighting opportunities and limitations for the proposed land use.

REQUESTING A REVIEW

Environmental reviews may be requested by the chief elected official of a municipality or the chairman of town commissions such as planning and zoning, conservation, inland wetlands, parks and recreation or economic development. Requests should be directed to the chairman of your local Soil and Water Conservation District and the ERT Coordinator. A request form should be completely filled out and should include the required materials. When this request is approved by the local Soil and Water Conservation District and the Eastern Connecticut RC&D Executive Council, the Team will undertake the review on a priority basis.

For additional information and request forms regarding the Environmental Review Team please contact the ERT Coordinator: 860-345-3977, Eastern Connecticut RC&D Area, P.O. Box 70, Haddam, Connecticut 06438.