THE CHESTER CREEK WATERSHED PROJECT

PHOTO BY HAROLD MALDE

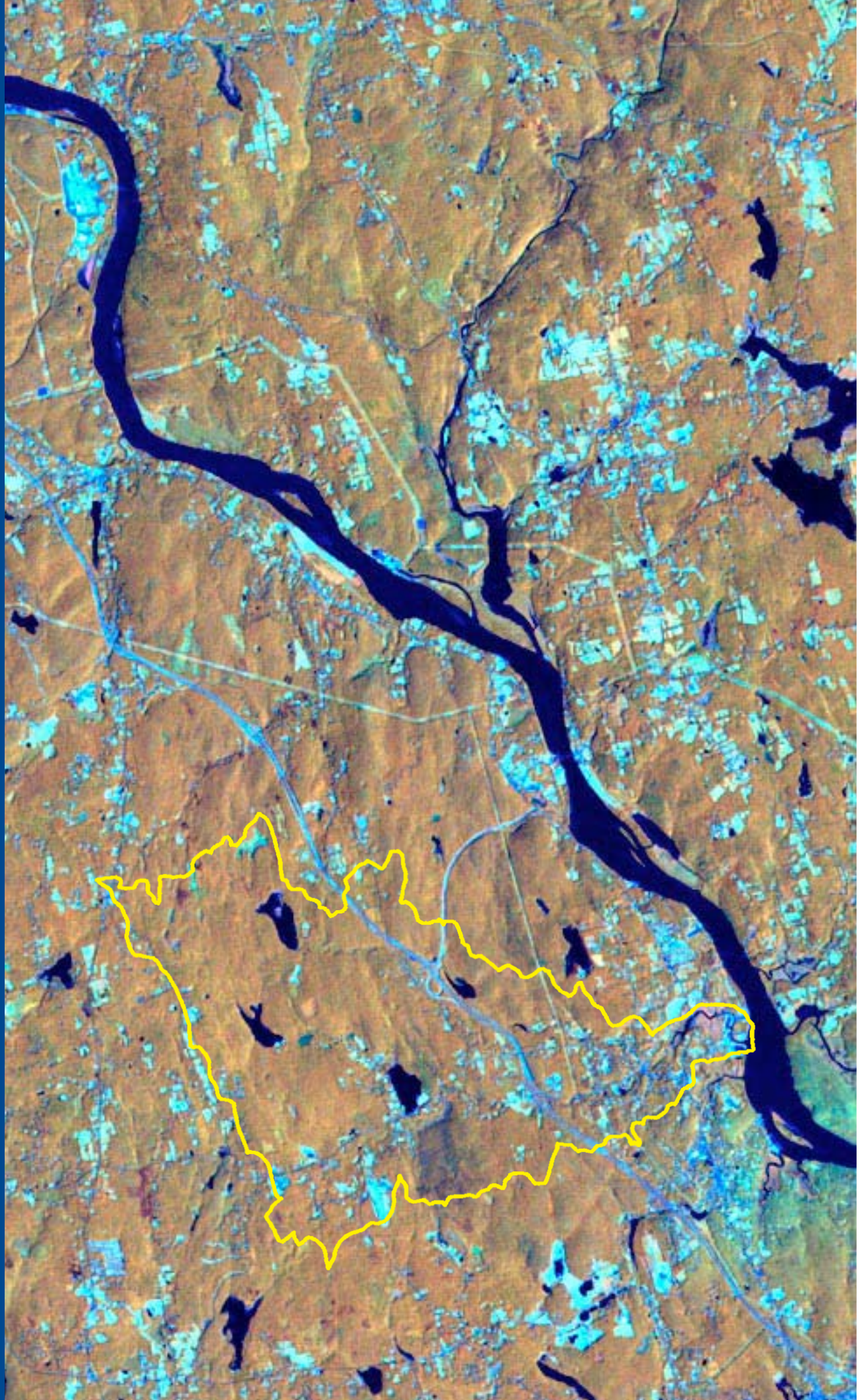
A Progress Report

on a Unique

Natural Resource

Management Partnership

NEMO



Satellite image showing the region of the Chester Creek Watershed (outlined in yellow). *Landsat TM, August 28, 1995 - Spectral Bands 4, 5, 3 ©EOSAT, Inc.*

Project Partners:

- *University of Connecticut Cooperative Extension System*
- *The Nature Conservancy, Connecticut Chapter*
- *University of New Haven*
- *Town of Chester, Connecticut*

A UNIQUE APPROACH TO FOSTERING ENVIRONMENTAL STEWARDSHIP

PHOTO BY HAROLD MALDE

Chester Creek near the intersection of Routes 154 and 148 in the Town of Chester.

The Chester Creek Watershed Project is a natural resource management initiative demonstrating that nonregulatory public education programs planned and conducted in close cooperation with local residents and officials can effectively protect natural resources and foster environmental stewardship. Through information gathering and a series of public education programs supported by geographic information system (GIS) mapping technology, the Project is providing town residents and decision makers with information and tools that they can use to make better decisions regarding the use and management of their local natural resources.

The Project is an ongoing public/private collaboration between the Town of Chester and a project team from the University of Connecticut Cooperative Extension System, The Nature Conservancy-Connecticut Chapter, and the University of New Haven. The Project began in 1993, supported by a one-year seed grant from the U.S. Environmental Protection Agency (EPA) Region I; the educational initiatives begun in that year, however, are open-ended and will extend into the foreseeable future. Accordingly, this report describes a work in progress.

COLLABORATION TO PROTECT A LAST GREAT PLACE: A PROJECT TAKES SHAPE

In March, 1993, the Tidelands of the Connecticut River region was designated by The Nature Conservancy (TNC) as one of forty "Last Great Places" in the western hemisphere. The Tidelands region encompasses the lower 37 miles of the Connecticut River, from the Rocky Hill/Glastonbury area of Connecticut to the mouth at Long Island Sound. The region is the southernmost portion of the Connecticut River watershed, a major basin which incorporates an extensive area surrounding the River from the Canadian border down through Vermont, New Hampshire, Massachusetts and Connecticut (figure 1). The Tidelands stretch of the River was singled out because of its exemplary complex of high quality salt, brackish and freshwater tidal marshes, and the many threatened and endangered species that the complex supports.

The Last Great Places designation constitutes a commitment by TNC to preserving the ecological integrity of an area far too large to be addressed solely by TNC's traditional methods of land protection. The full name of the initiative, "Last Great Places: An Alliance for People and the Environment," refers to this realization that a broader, more collaborative approach is needed. This new TNC emphasis is also mirrored by several recent federal and state initiatives, including the creation of the Silvio Conte Fish and Wildlife Refuge by the U.S. Fish and Wildlife Service, the formulation of a "Special Area Management Plan" for the area by the Connecticut Department of Environmental Protection, and the designation by the federal government of "Wetlands of International Importance" in the lower River.

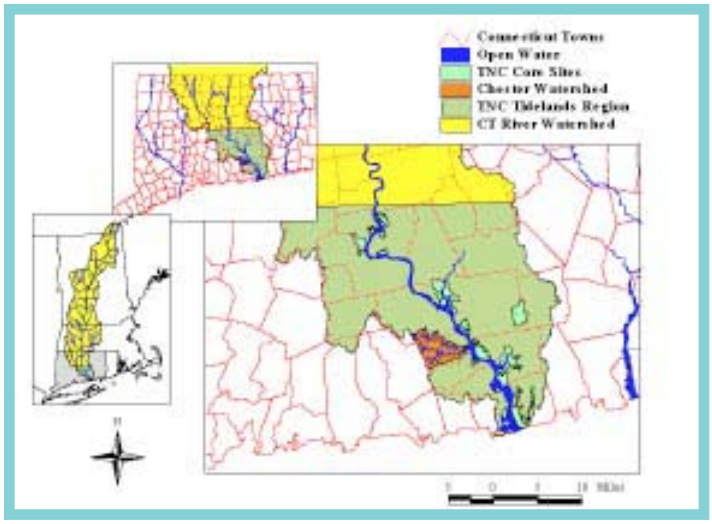


Figure 1. The Tidelands of the Connecticut River, with core sites identified by The Nature Conservancy.

In the final analysis, all these large-scale conservation efforts will require that public agencies and private organizations work together to promote and assist natural resource conservation at the local level. Land use and resource management issues at the regional or watershed level are complex, and have not lent themselves well to resolution through conventional regulation and enforcement approaches. The strong "home rule" of municipalities in the Northeast also serves to work against "broad brush" solutions mandated by federal or state authorities. Education - of local officials, of individual landowners, of the general public - can be an effective, nonregulatory alternative for addressing these complex issues.

At the time of the Tidelands announcement, the University of Connecticut Cooperative Extension System (CES) Nonpoint Education for Municipal Officials (NEMO) Project had been working with coastal communities in Connecticut, including one town in the Tidelands region, on the issue of nonpoint source water pollution. The NEMO project team had developed an effective educational method-

ology using GIS as a tool to help municipal officials understand the impacts of land use on water quality and options available for managing those impacts.

For CES educators and TNC staff, who had worked together on a number of efforts in the past, the Tidelands designation served as the catalyst for increased collaboration. Discussions on applying the general NEMO approach to the Tidelands area resulted in the Chester Creek Watershed Project. The collaboration links the expertise in natural resource management education of CES with the ecological expertise of TNC, as well as expertise in GIS technology from the University of New Haven (UNH).

THE CHESTER CREEK WATERSHED

At the time of the Last Great Places designation, TNC-Connecticut Chapter identified 17 "core sites" in the Tidelands, based on their assessment of habitat value (figure 1). The first step in selecting a project site was to view these core wetlands not as isolated units, but as natural resources affected by the activities in the local watershed subbasins draining to them. Of the 17 areas, potential project sites were considered based on the natural resource base, land use patterns, availability of digital data, watershed size, and the number and enthusiasm of the affected towns. Based on these criteria, Chester Creek was selected because:

- the watershed contains a wealth of natural resources;
- the watershed contains a mix of land cover, providing opportunities for a range of education and conservation programs;
- considerable existing digital data were available through state agencies and universities;
- the watershed occupies a manageable area for the purposes of a pilot study;
- the Town of Chester (which occupies much of the watershed) demonstrated strong interest in participating in the project and using its final products.

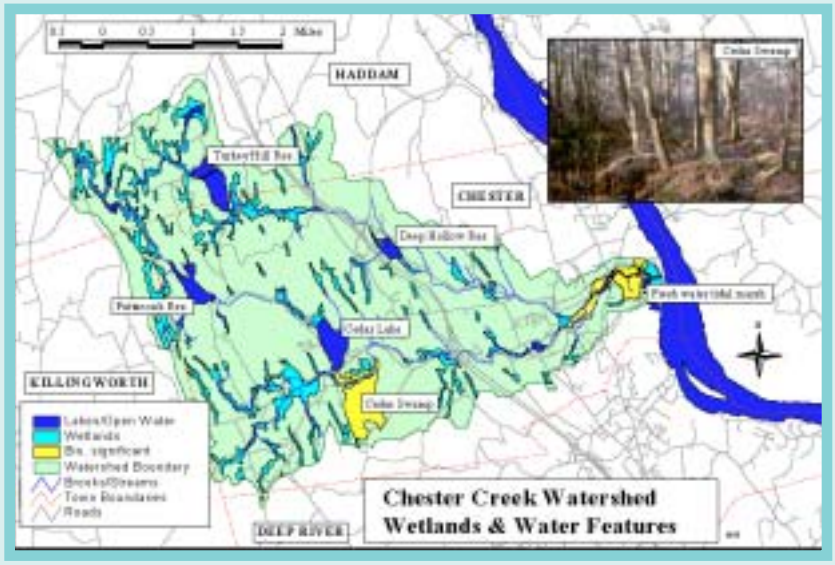


Figure 2. Water features of the Chester Creek watershed, with the Chester Creek freshwater tidal marsh and Cedar Swamp highlighted.

The 14.5 square-mile Chester Creek watershed is located on the western bank of the Connecticut River, approximately 25 miles upstream of Long Island Sound. The watershed lies within the boundaries of three municipalities, with 79% of the watershed in the Town of Chester, 17.5% in the Town of Haddam, and 3.5% in the Town of Killingworth. The area contains a wide variety of aquatic resources, including tidal and upland wetlands, privately and publicly owned recreational lakes, and public drinking supply reservoirs. Two areas of particular biological significance are the Chester Creek freshwater tidal marsh and the Cedar Swamp (figure 2).

Cedar Swamp is one of the few intact stands of Atlantic White Cedar left in the state.

The freshwater tidal marsh includes high and low marsh, tidal creeks and inlets, and mud flats exposed at low tide. These areas are home to a wide variety of marsh plants, including large stands of wild rice and sweet flag, and a state-listed plant species of special concern. The high quality of the marsh makes it an important site for water fowl traversing the Atlantic flyway. Chester Creek also plays a key role in supporting the Connecticut River's ecologically and economically important fish community, with the tidal portion of the Creek serving as a spawning and nursery habitat for roughly 25 fish species.

The Cedar Swamp is a unique habitat that was listed as a National Natural Landmark in 1973. This extensive stand of Atlantic White Cedar, which has escaped logging in the past, is uncommon in Connecticut and particularly susceptible to stormwater runoff and impacts of development.

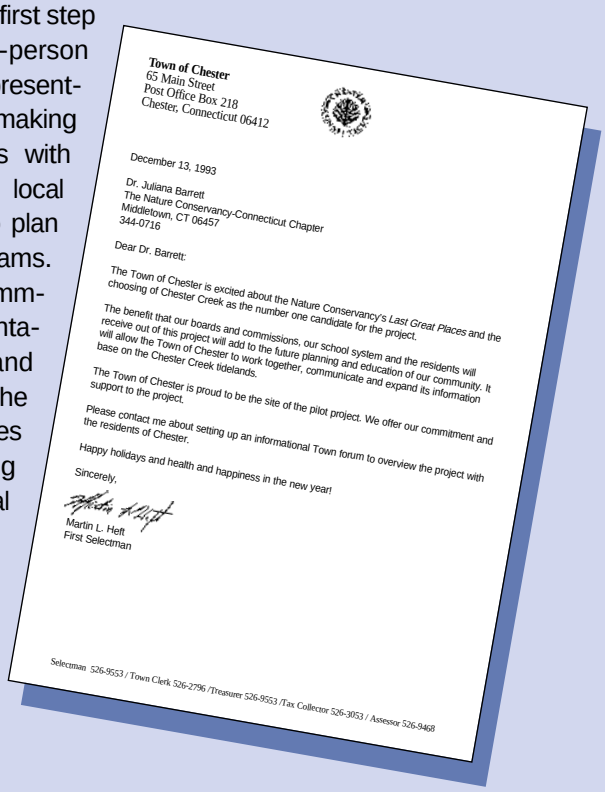
A UNIQUE PROJECT: PARTNERSHIP, TECHNOLOGY, & EDUCATION

A Partnership with Chester

ADVISORY COMMITTEE

- *Board of Selectmen*
- *Conservation Commission*
- *Planning & Zoning Commission*
- *Harbor Management Commission*
- *Inland Wetlands Commission*
- *Historical Society*
- *School Board*
- *Land Trust*

The unique approach of the Project is to combine technology and targeted educational programs within the context of a close working partnership with town leaders. Thus, the Project did not truly begin until this partnership was cemented by a letter of support from the Town of Chester's First Selectman (figure 3). Once this was done, the first step was the assembly of an 8-person Project Advisory Committee representing town land use decision-making groups. The Committee works with the Project Team to identify local problems and concerns, and to plan and publicize educational programs. Even more importantly, the Committee serves as the true implementation arm of the Project, and Committee members are at the forefront of all proposed changes and initiatives in town stemming from the Project's educational efforts.



Town of Chester
65 Main Street
Post Office Box 218
Chester, Connecticut 06412

December 13, 1993

Dr. Juliana Barrett
The Nature Conservancy-Connecticut Chapter
Middletown, CT 06457
344-0716

Dear Dr. Barrett:

The Town of Chester is excited about the Nature Conservancy's *Last Great Places* and the choosing of Chester Creek as the number one candidate for the project.

The benefit that our boards and commissions, our school system and the residents will receive out of this project will add to the future planning and education of our community. It will allow the Town of Chester to work together, communicate and expand its information base on the Chester Creek tidelands.

The Town of Chester is proud to be the site of the pilot project. We offer our commitment and support to the project.

Please contact me about setting up an informational Town forum to overview the project with the residents of Chester.

Happy holidays and health and happiness in the new year!

Sincerely,

Martin L. Heft
First Selectman

Selectman 526-9553 / Town Clerk 526-2796 /Treasurer 526-9553 /Tax Collector 526-3053 / Assessor 526-9468

Figure 3. Letter of support from Martin Heft, First Selectman for the Town of Chester.

Making Technology Work at the Local Level

The technical side of the Project involves the use of computerized mapping technology known as "geographic information systems," or GIS (see box). The idea is not to promote or use GIS as an end in itself, but to use it as an educational tool for visualizing complex data and relationships in an understandable and accessible manner. To this end, the project team set about to:

- develop a GIS database containing natural resource and land use information for the watershed;
- prioritize and target educational programs and conservation activities within the watershed based on the relationships between natural resource and land use data shown by the GIS, and conduct a series of natural resource management education programs for the targeted groups;
- provide a GIS database and educational maps which can be used as reference materials for local land use decision makers, and assist town leaders in setting up a local repository for this information; and,
- use project results and experience to outline a model methodology that can be employed in other areas.

WHAT IS GIS?

GIS stands for "geographic information system," which is, very generally speaking, computerized mapping. A GIS is a computer system capable of assembling, storing, manipulating and displaying any data that is referenced to a location. This data can be anything from typical map data (locations of highways or houses) to natural resource data (topography, soil types) to demographic data (population density).

GIS allows geographic data of this type to be displayed, compared and analyzed in ways that would be prohibitively time consuming or even impossible using conventional maps and overlays. Because of this, GIS is rapidly becoming an invaluable management and planning tool in all types of professions worldwide.

When the Project was initiated, there was a considerable amount of existing digital data (appropriate for use in the GIS) for the Chester Creek watershed. The Project Team collected and reorganized the existing data, determined the critical missing pieces, and then digitized these remaining "data layers." The combination of existing and new data layers is listed below. The GIS provides ready and flexible access to this wealth of information, enabling the Project Team to analyze the data, create educational maps and programs, and target the most appropriate audiences for these programs.

GIS DATA LAYERS

Land Cover	Soils	Roads
Water Features	Drainage Basins	Parcel Boundaries
Open Space	Wetlands	Zoning

Conservation Through Education

Several major educational efforts are now underway in the Chester Creek watershed. The University of Connecticut Cooperative Extension System is the lead agency for these educational initiatives, but each program is expected to involve long-term commitments on the part of all the Project partners. Because these are collaborations that will continue to evolve and unfold over the course of several years, they should be viewed as works in progress.

Nonpoint Education for Municipal Officials (NEMO)

Review of the land cover and zoning data suggested the appropriateness of a NEMO program (see box), which relates land use to water quality and targets volunteer commissioners serving on local land use boards, such as the Planning and Zoning and the Conservation and Inland Wetlands Commissions. An initial NEMO program was given by UConn CES staff in June 1994 to a group including representatives of these commissions, plus Land Trust members, Harbor Management Commission representatives, and interested citizens.

Using local photographs and GIS maps, the NEMO program described the workings of watersheds, the threats of nonpoint source pollution, the land use patterns within Chester Creek watershed, and the connections between these. Perhaps the most significant aspect of the initial program was the zoning "build-out" analysis, which allows commissioners to consider the possible water quality ramifications of their current land use plans by looking at impervious surface coverage estimates and resulting water quality in the future. Research shows that there is a strong correlation between the amount of impervious surfaces (concrete, asphalt, rooftops) in a watershed and the health of the receiving stream. To assess imperviousness, current levels are estimated from satellite-derived land cover, and compared to the "build-out", based on zoning regulations (figure 4). Each of the local watershed areas are categorized as having either relatively low levels of imperviousness protective of stream health (green), higher levels where streams are impacted (yellow), or still higher levels where degradation is severe (red). In the Chester Creek watershed, the build-out analysis served to underscore that even in a watershed with a rural character, large-lot residential zoning, and extensive open space, the potential exists for significant degradation of water resources.

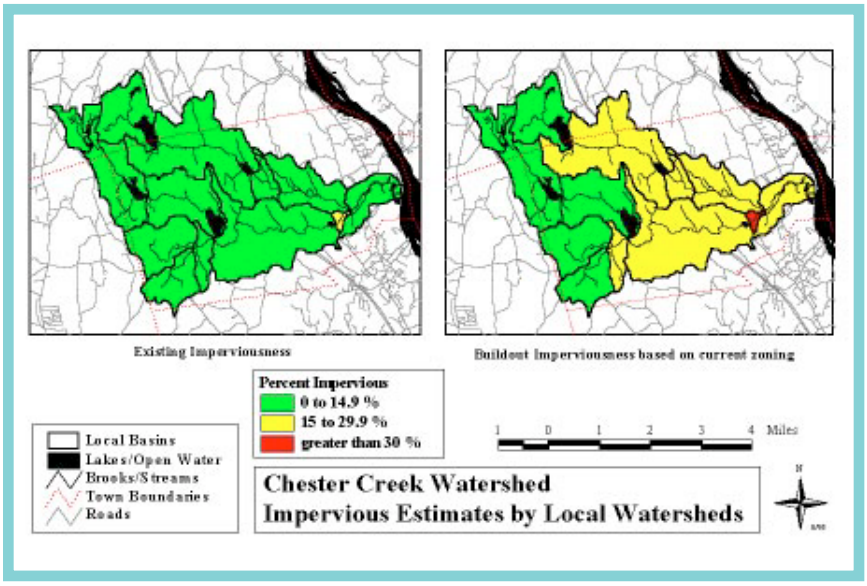


Figure 4: Current and future estimates of impervious cover in the local basins of the Chester Creek watershed.

With the June presentation as the jumping off point, the NEMO team began to work with land use boards, the regional planning agency, and the Town Advisory Committee along a number of lines. For the Chester Creek watershed, the standard NEMO information was augmented with data on open space and property lines. In addition, after the June program the NEMO team decided to upgrade the land cover data, using aerial photographs to create a new land cover map for the watershed (figure 5) that was more detailed than the stan-

dard NEMO satellite-based land cover. Both the information presented in June and this new information will figure significantly in follow-up programs in town. For instance:

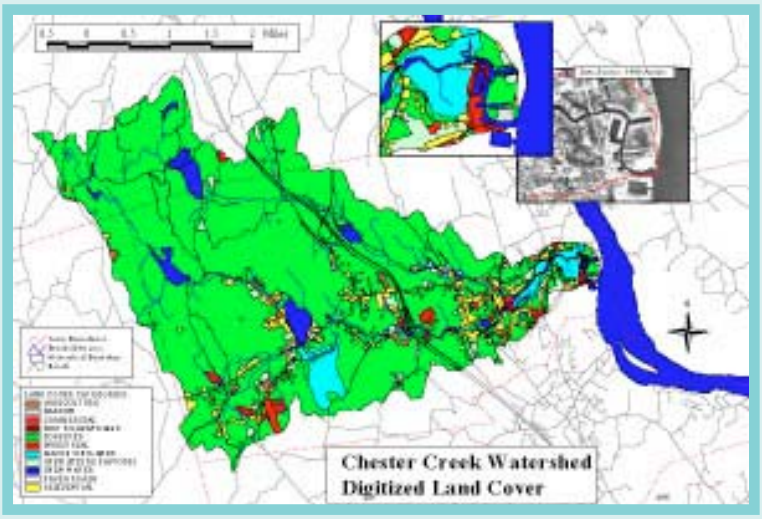


Figure 5: The land cover of Chester Creek watershed, as derived from aerial photographs, with enlarged comparison of land cover and aerial photo.

- Follow-up NEMO presentations are being planned for all appropriate town boards and commissions using the improved, aerial photo-based land cover information. In addition, maps are being provided to these commissions for their use in decision-making.
- The NEMO team is working with the Conservation Commission and the Land Trust in the preparation of an Open Space Plan.
- The NEMO team is working with the Planning and Zoning Commission and the Connecticut River Estuary Regional Planning Agency on model stormwater management regulations to be added to town subdivision and zoning regulations.

NEMO is a pilot project focused on protecting water quality by educating local land use decision makers on the connections between land use and water quality. The project emphasizes the impacts of nonpoint source pollution resulting from different land uses and offers suggestions for managing those impacts. Using GIS, the team highlights relationships between a town's water resources, watersheds, land use/land cover, and zoning, and also performs "build-out" analyzes. Impervious surface estimates are used to indicate the degree of urbanization and to highlight and predict possible water quality consequences resulting from future development. Initiated in 1991 with USDA Extension Service funding, the project has been developed by UConn CES, in cooperation with the Connecticut Sea Grant College Program and the UConn Department of Natural Resources Management and Engineering.

NEMO
Nonpoint Education for Municipal Officials

Pervious surfaces like this one adjacent to Great Brook allow water to better infiltrate the soils, decreasing the amount of polluted runoff transported to waterways.

Forestry Education

Forest covers 84% of the Chester Creek watershed—a figure that, surprisingly, is not unusual for the Connecticut landscape. However, further GIS analysis of the land cover and parcel (property line) data revealed that the ownership pattern is anything but typical, with only about 55% of the land held in private ownership, far below the state average. Even so, private woodlot owners constitute a key audience for natural resource management programs, especially in light of the data on lot size, which show a landscape highly fragmented into small residential lots (figure 6), many of which are wooded. Woodlot owners, therefore, have been and continue to be a key target audience for the Project.

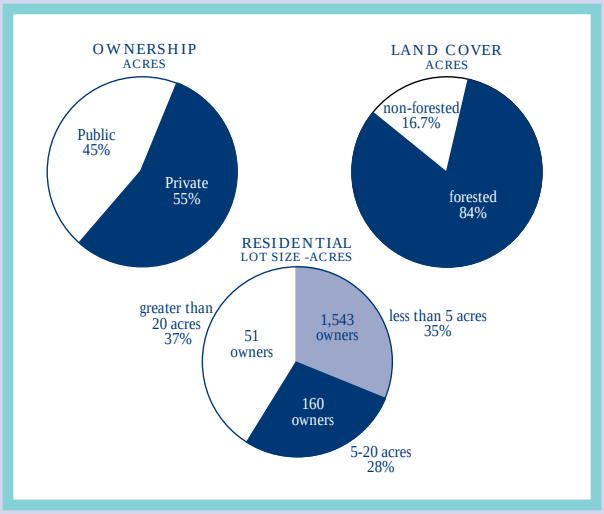


Figure 6. GIS-derived watershed data used to target forestry education.

To further support the forestry aspect of the Project, UConn CES obtained a special "forest ecosystem management" grant from USDA Cooperative State Research, Education and Extension Service's Renewable Resources Extension Program. The grant allowed acquisition of yet another GIS data layer for the Project—satellite-based land cover that can distinguish between forest plant communities (figure 7). Armed with this cutting-edge data and with the help and sponsorship of the Conservation Commission and the Land Trust, an initial forest management presentation was made to watershed residents in February of 1995.

For this program, GIS technology was used not only for analysis and education, but in yet another way — as a means of specifically identifying the target audience for an educational initiative. Land cover and parcel data were used to identify woodlot parcels of 5 acres or more in the watershed; this information was linked with the town tax assessor's database, and flyers announcing the educational program were then mailed directly to more than 200 owners with over 5 acres of wooded property. The result was an excellent turnout of the watershed residents who could most benefit from the program.

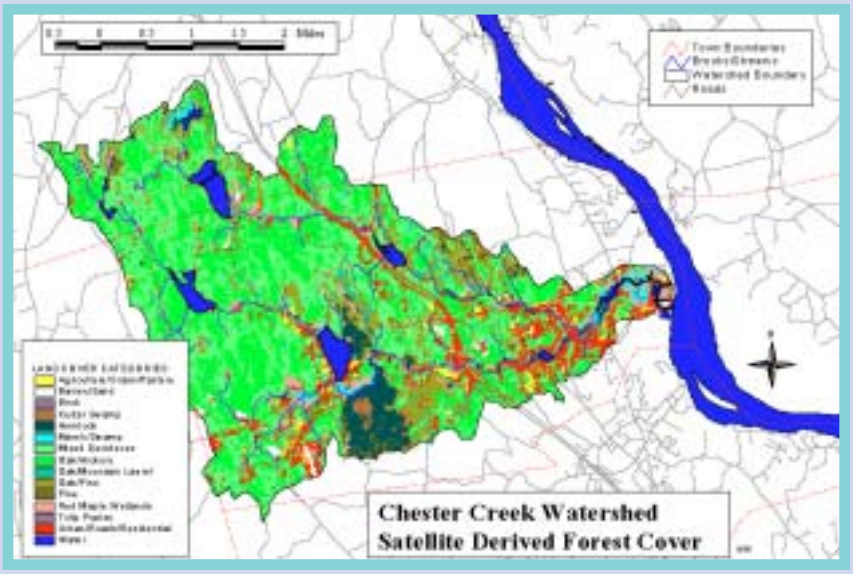
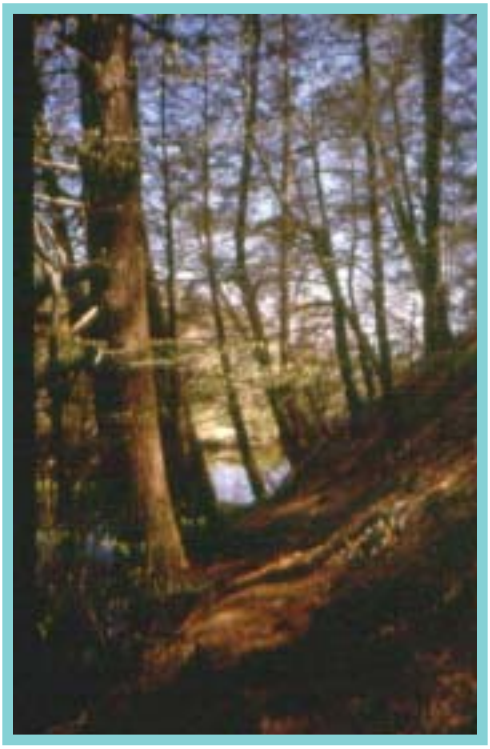


Figure 7. Forested land cover in the Chester Creek watershed.

UCONN CES FORESTRY education programs work with landowners to help them understand their forest ecosystems. The programs educate landowners on basic forest and wildlife ecology, hydrology, soil-plant-water cycles, factors influencing ecosystem dynamics (including land fragmentation, land use activities, exotic pests), habitat enhancement and improvement techniques, best management practices in commercial harvesting, estate planning, and long-term land protection tools.



A riparian area along Pattaconk Brook, showing steep slopes susceptible to erosion and hemlocks suffering from the pest known as the hemlock woolly adelgid.

Using the new land cover data, the program presented information on the forests of the Chester Creek watershed. Given the data on land cover and property sizes, the emphasis was on the challenges of forest ecosystem management in a fragmented landscape—a topic relevant to most of the Northeast, if not the entire country. In addition to descriptions of the existing wooded areas, the wildlife benefits of forested land were reviewed, and public forest management was covered by a forester from the Department of Environmental Protection (CTDEP). Various points made in the course of the presentation were highlighted by examples of two demonstration forest stewardship plans within the watershed being developed with CES assistance.

Based on this positive beginning, UConn CES has several follow-up forestry education efforts underway, including:

- working with the citizens, landowners, and local forest resource professionals to finalize and adopt forest ecosystem stewardship goals;
- working with municipal commissions to incorporate these goals and forest resource data into a chapter revision in the Plan of Conservation and Development;
- identifying volunteer homeowners in the community and training them on small lot/backyard habitat and forest stewardship (less than 5 acres); enabling volunteers to assist other small lot owners; and mailing information on goals, stewardship and plan development to the owners;
- promoting availability of CTDEP Public Service Foresters to mid-size parcel owners (5 to 10 acres) and mailing information on goals, stewardship and plan development to the owners; and
- conducting stewardship workshops on large (greater than 10 acres), privately owned lots to educate and assist landowners.

Environmental Stewardship at Home

Analysis of the relationship between land parcel data and water resources made clear that a considerable percentage of Chester's population lives along watercourses (figure 8). The prevalence of septic systems, and the field observation that many residential lawns extend to the water's edge, further served to highlight the important role that these residents play in the health of the watershed's resources. The Project's third major educational thrust therefore focuses on "Environmental Stewardship at Home" (see box), which discusses what residents can do in their homes, gardens, and yards to prevent and minimize negative impacts on water quality. This effort kicked-off with a "Sound Gardening" program in May 1995, sponsored by the Chester Garden Club.

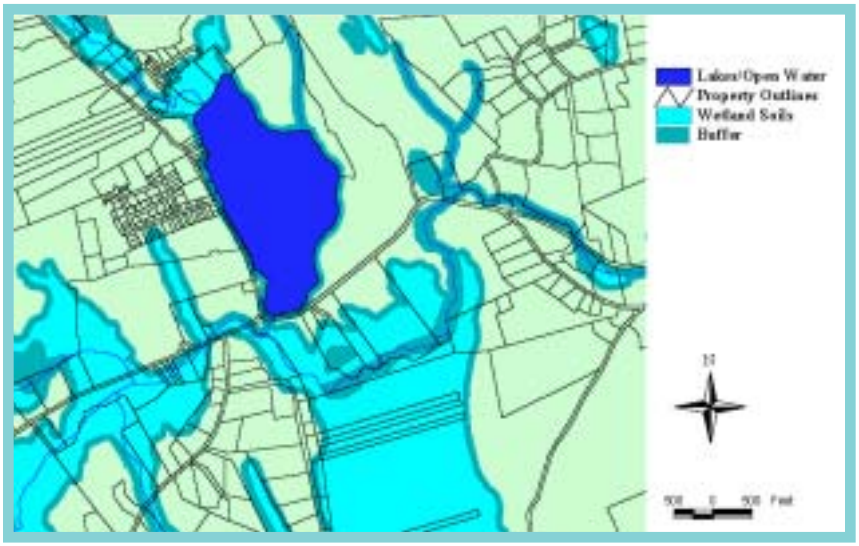


Figure 8. An area of the Chester Creek watershed showing parcel boundary data overlaid on water features.

The Project team is planning further presentations targeted to residents throughout the watershed. Following a similar methodology to the forestry programs, GIS data for land parcels and water features will be used with the town assessor's database to target a direct mailing for future programs to streamside property owners. The Project Team and Advisory Committee are also working together to explore the possibilities of training volunteers to work with homeowners and setting up "demonstration yards" that can provide examples for other residents on both the techniques and the results of sound environmental practices in the home and yard.

A compost pile helps recycle yard and kitchen waste into valuable compost that can improve the quality of the soil and its ability to hold water.

THE UCONN CES ENVIRONMENTAL STEWARDSHIP AT HOME PROGRAM, which has evolved from the "Sound Gardening" program, is a collaboration of UConn CES with Connecticut Sea Grant. The program educates landowners and interested groups about reducing the amount of potential contaminants introduced into the environment by a variety of practices including over-fertilization, indiscriminate use of pesticides, improper septic system management, and over-watering. The program presents alternative practices for pest management, watering, landscaping, soil erosion, gardening, composting, septic system operation, and household hazardous waste management.

THE PROJECT CONTINUES

The Chester Creek Project has been developed as a model for nonregulatory, collaborative environmental protection founded on information and education. Since the Project's inception, it has been recognized that changes at the local level typically take several years to solidify, once a "seed" has been planted via educational programs. That being said, much has already been accomplished, with more to come.

Project "Spin-offs" Demonstrate the Ripple Effect of Educational Programs

- *Scientists from the University of Massachusetts Environmental Institute are conducting cutting-edge research in the watershed (and other areas) on the relationship of urbanization to wetlands health, and are working closely with the NEMO team.*
- *The Chester Elementary School received a grant from the Rockfall Foundation, enabling them to conduct successful new educational programs focused on Chester Creek. The school is now striving to continue these programs in this and coming years.*
- *There is new interest in volunteer water quality monitoring in the watershed, and funds are actively being sought to support a new monitoring effort.*

First, an extensive GIS database of natural resource and town data has been assembled for the watershed. While this is a significant accomplishment, it is not in itself enough to produce impacts. However, the determination of both the Project Team and the Advisory Committee to put this information to good use is beginning to foster real change. On the municipal level, an open space plan is being assembled, and stormwater management regulations are being considered. On both the municipal and individual levels, forest stewardship is being promoted and taught for both small and large woodlot owners, and is in the process of being incorporated into official town documents. On the level of the individual, streamside property owners have been targeted for educational programs that will help them minimize their impacts on water quality. Finally, as is often the case with effective educational programs, the Project has served as a catalyst for other watershed-related efforts in town (see box).

In April of 1995, on the 25th anniversary of Earth Day, First Selectman Martin Heft accepted for the Town of Chester an award for the Chester Creek Watershed Project from the Connecticut Resource Recovery Authority. The certificate reads, "in recognition of outstanding contributions to the community for the development of programs and activities that effectively promote local citizen involvement in preserving and conserving the environment."

In August of 1995, after over a year of work with the Chester Creek Project, the Advisory Committee submitted a report to the Board of Selectmen with recommended actions to be taken by the Town. These included:

- developing comprehensive watershed management and open space plans through the joint efforts of town commissions and others under a Conservation Commission separate from the Inland Wetlands and Watercourses agency;
- holding joint meetings of the Conservation and the Planning and Zoning Commissions to review water quality issues and forest management strategies;
- providing access at Town Hall to the GIS computer database and an index of Town planning and conservation materials;
- continuing environmental studies focused on the Chester Creek watershed at the Chester Elementary School; and
- investigating the development of a Chester Natural Resources Center.

The many partners of the Chester Creek Watershed Project will continue to help town residents and decision makers better understand and manage their local natural resources.

A SECOND WATERSHED PROJECT BEGINS

Based on the positive results and promise of the Chester Creek Project, the EPA has granted start-up funds to the TNC/UConn team for another watershed project in the Tidelands region. The second project focuses on the 63 square-mile Eightmile Regional basin, which includes major acreage in the towns of East Haddam, Lyme and Salem (figure 9). Tributaries in the watershed flow into the Eightmile River, which then drains to critical wetlands in Hamburg Cove on the eastern shore of the Connecticut River.

Hamburg Cove, in the Eightmile River Watershed.

Although it is roughly patterned after its predecessor across the River, the Eightmile Project has its own unique characteristics. The project team and a three-town Advisory Committee are in the process of reviewing the data gathered on water features, forest types, soils, zoning, and lot lines, and have begun to plan educational programs based on this information and the needs of the communities.

As the Chester Creek and Eightmile River Projects progress, both the Project Team and the towns involved are learning more about combining GIS technology and public education to better manage natural resources. In the future, the Project Team hopes to expand these efforts to encompass additional watershed areas draining to the Tidelands region.

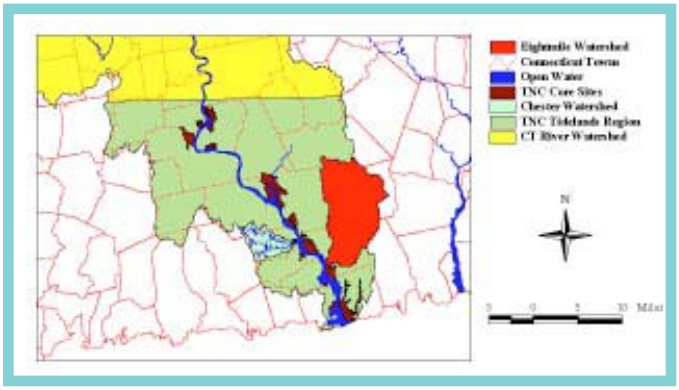


Figure 9. The Eightmile River Watershed in the Tidelands region of the Connecticut River.

FOR MORE INFORMATION

For more information on the Chester Creek Watershed and Eightmile River Watershed Projects, please contact:

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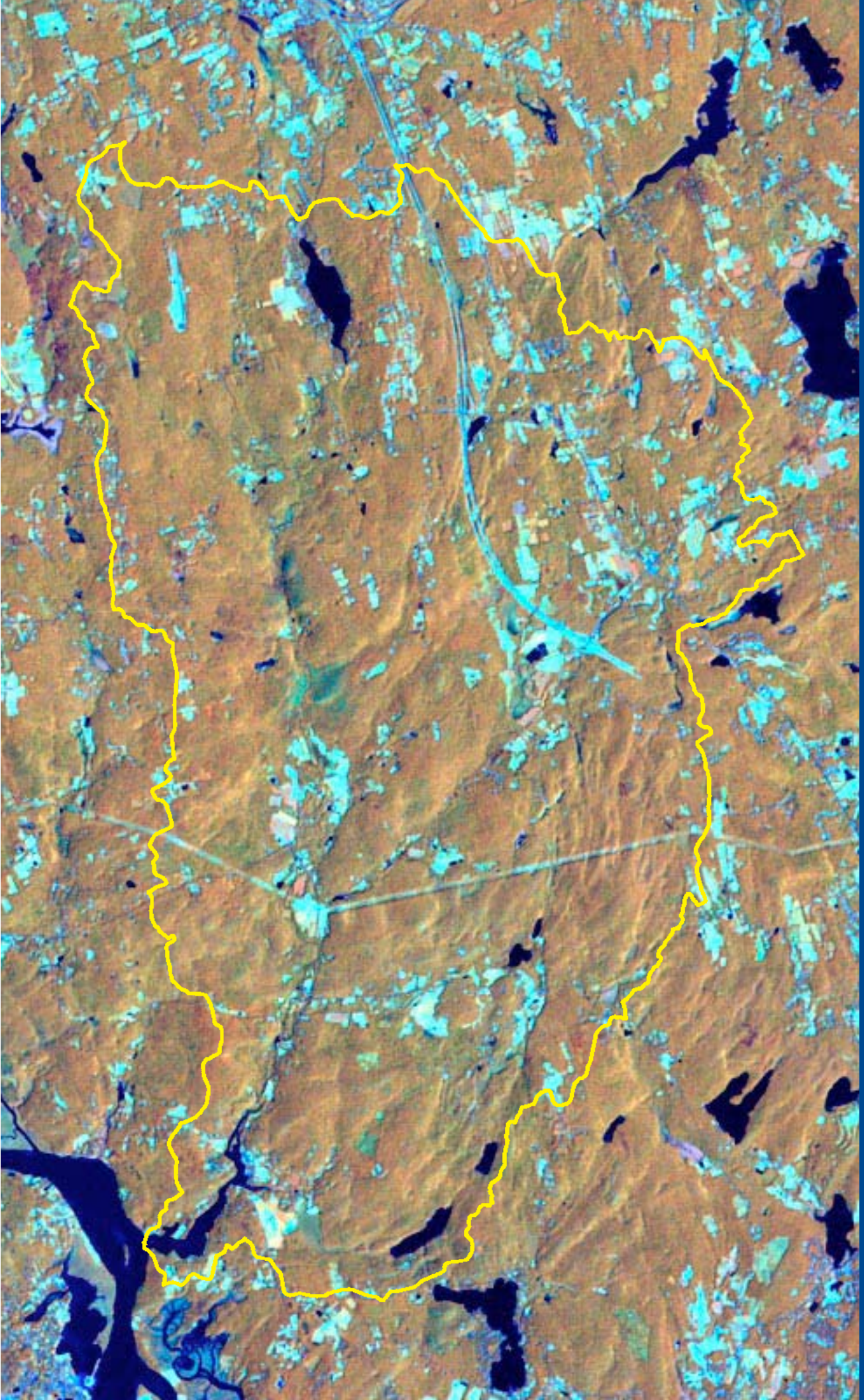

Satellite image showing region of Eightmile River Watershed (outlined in yellow). *Landsat TM, August 28, 1995 - Spectral Bands 4, 5, 3 ©EOSAT, Inc.*

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