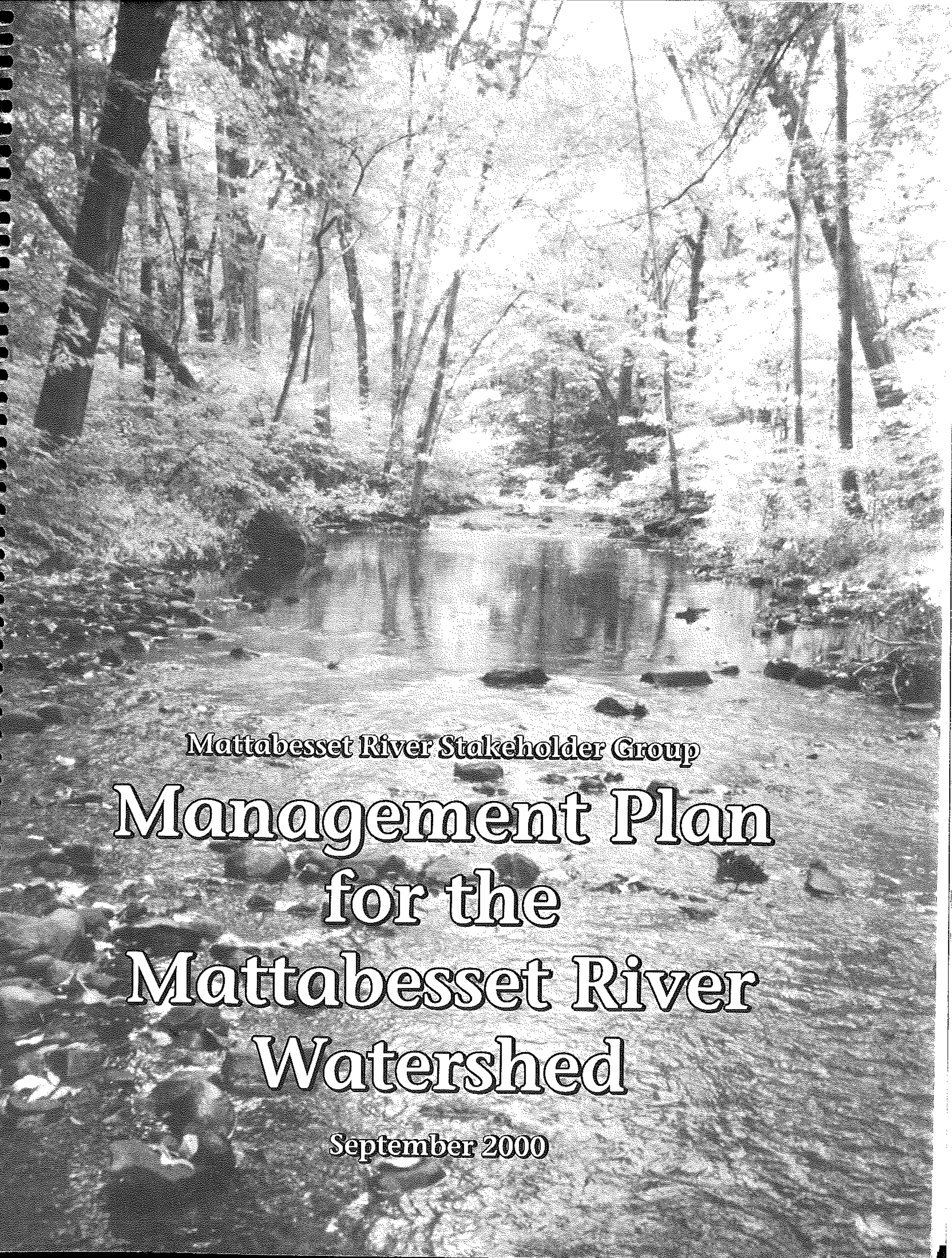
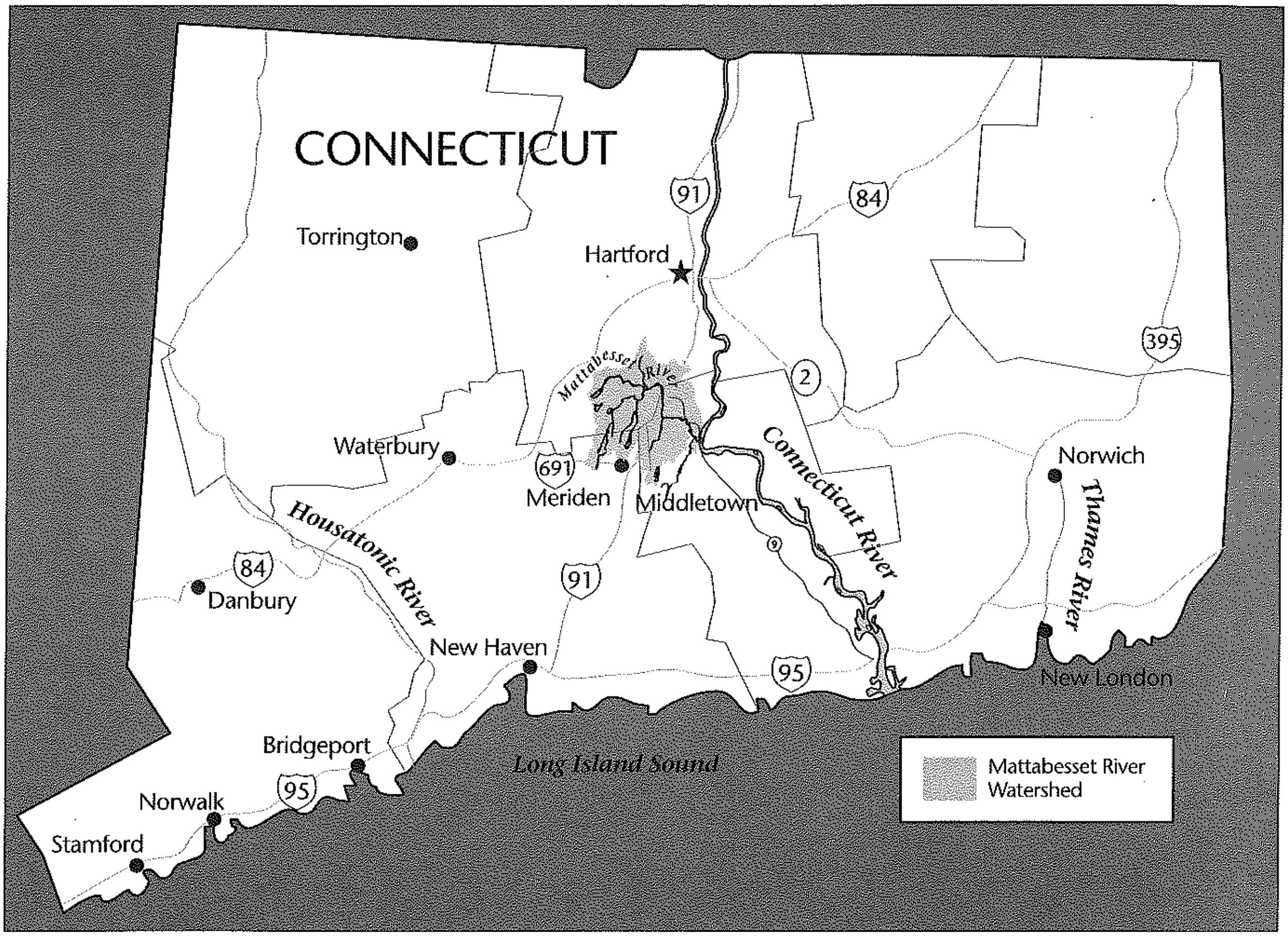


Mattabesset River Stakeholder Group

Management Plan for the Mattabesset River Watershed

September 2000



The Mattabesset River watershed is located in central Connecticut.

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Vision Statement

The vision of the Mattabesset River Stakeholder Group is that heightened awareness and respect for the Mattabesset River Watershed will lead to improvements in land use and water management in the watershed, and that, in turn, the health of the Mattabesset River will be restored to a swimmable and fishable condition.

WE, the undersigned, recognize that the Mattabesset River Watershed contains a wealth of natural resources that have the potential to provide valuable ecological, recreational, and commercial benefits to the community and its wildlife. We pledge to support the Mattabesset River Stakeholder Group and to work towards achieving the goals of the Management Plan for the Mattabesset River Watershed:

1. To restore and maintain fishable and swimmable conditions in the Mattabesset River Watershed consistent with the goals of the state water quality standards;
2. To encourage and promote land use most appropriate for ensuring the protection and improvement of water quality, habitat, and recreation opportunities through partnership with public and private entities;
3. To make watershed information a basic component of the community's knowledge; and
4. To identify and obtain funding sources to support the implementation of the goals and objectives of the Management Plan for the Mattabesset River Watershed.

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Berlin Land Trust
Berlin Planning and Zoning Commission
Capitol Region Council of Governments
Central Connecticut Health District
Central Connecticut Regional Planning Agency
City of Meriden
City of Middletown
City of New Britain
Cromwell Conservation Commission
Cromwell Department of Public Works
Cromwell Inland Wetlands Commission
Cromwell Planning Commission
CT Department of Environmental Protection
CT General Assembly
Hungerford Nature Center
Mattabassett Sewer District
Mattabeseck Audubon
Mattabesset River Watershed Association
Middlesex County Chamber of Commerce
Middlesex Land Trust
Midstate Regional Planning Agency
New Britain Water Department
Northeast Utilities
Rocky Hill Inland Wetlands Commission
Sawmill Pub
Stanchem Inc.
Town of Berlin
Town of Cromwell
Town of Middlefield
Town of Newington
Town of Rocky Hill
Town of Southington
Trout Unlimited
United States Geological Survey
United States Department of Agriculture/Natural Resources Conservation Service
United States Environmental Protection Agency

Acknowledgements

The Mattabesset River Stakeholder Group would like to thank all who have contributed their knowledge, ideas, time, and hard work to the production of the Management Plan for the Mattabesset River Watershed. The Mattabesset River Stakeholder Group realizes that all efforts to produce this management plan stem from the voluntary, heartfelt desires of our members to improve the health of their watershed.

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Norman Topf	Town of Rocky Hill Open Space/ Wetlands Commission
William West	StanChem Inc.
Jimmie Woods	Aetna

List of Organization Acronyms

CRWP	Connecticut River Watch Program
CT DEP	Connecticut Department of Environmental Protection
MRWA	Mattabesset River Watershed Association
MSG	Mattabesset River Stakeholder Group
NEMO	Nonpoint Education for Municipal Officials
NRCS	Natural Resources Conservation Service
SWCD	Soil and Water Conservation District
TU	Trout Unlimited
US EPA	United States Environmental Protection Agency
USGS	United States Geological Survey

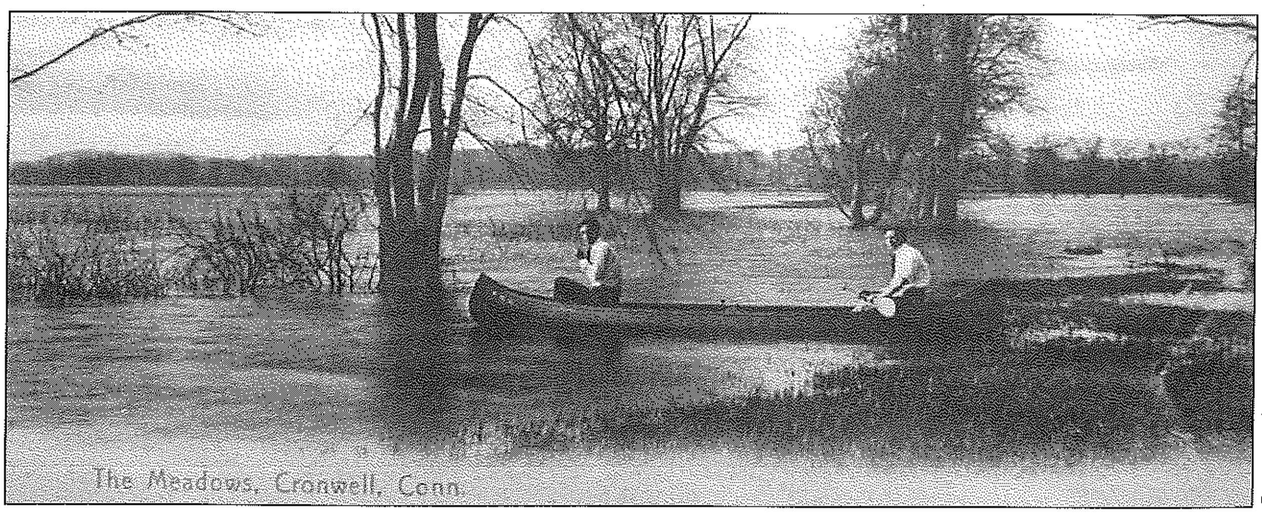
Executive Summary

THE MATTABESSET RIVER STAKEHOLDER GROUP (MSG) IS PLEASED TO PRESENT A management plan for restoring and preserving the environmental health of the Mattabesset River Watershed. The Mattabesset River Watershed is a 45,000-acre area in central Connecticut whose waters drain into the Mattabesset River. Land area within ten municipalities is included in the watershed, and is home to approximately 90,000 residents. The Coginchaug River Watershed contributes an additional 25,000 acres of drainage area to the Mattabesset River Watershed. However, the Coginchaug meets the Mattabesset less than one mile above the mouth of the Mattabesset River, and does not affect water quality within most of the Mattabesset River Watershed. As a result, the data and discussions within this State of the Watershed report do not include the Coginchaug River Watershed unless specifically noted. The people who live and work within the Mattabesset River Watershed comprise a community whose lifestyles are keenly affected by the state of the watershed. In turn, this community shapes watershed health through its land use practices, regulations, and overall attitudes toward the natural environment.

The large stake that the watershed community holds in its natural resources has served as a key motivation in establishing MSG, a partnership of local organizations committed to improving the health of the Mattabesset River Watershed and promoting respect for its values. MSG was established in October 1999 with the objective of creating a draft management plan for the Mattabesset River Watershed by early 2000.

After reviewing the current status of issues affecting the Mattabesset River Watershed, MSG identified four major topics of focus for its watershed management plan: (1) water resources, (2) land use, (3) education and outreach, and (4) funding/partnership needs. Four subcommittees were then formed to design a plan that addressed these major topics of concern. The subcommittees developed goals with supporting objectives and tasks to address specific watershed issues. The work of the subcommittees was then combined into a nine-goal management plan for the watershed.

MSG will utilize the strength of its partnerships with the municipalities, environmental organizations, federal and state agencies, and concerned citizens to implement the management plan and to create a healthier future for the Mattabesset River Watershed.



Courtesy of Cromwell Belden Library

With white shirts and ties canoeists enjoy the flooded Cromwell Meadows in this 1905 postcard.

Illustration—Pat Rasch

Nine Goals of the Plan

GOAL #1 Create awareness among watershed residents about the network of rivers and streams that comprise the Mattabesset River Watershed.

GOAL #2 Educate watershed residents about the link between land use and water quality.

GOAL #3 Promote sustainable land use practices in the Mattabesset River Watershed.

GOAL #4 Restore and maintain wildlife habitat in the Mattabesset River Watershed.

GOAL #5 Protect wetland and watercourse areas from development and other disturbances.

GOAL #6 Identify, investigate, correct, and prevent pollution problems.

GOAL #7 Restore and maintain in-stream and riparian habitat to support healthy fish populations and other aquatic life.

GOAL #8 Evaluate and balance in-stream flow needs, including flow volumes necessary for aquatic life habitat, drinking water supply, and other consumptive water uses.

GOAL #9 Obtain a consistent and stable funding stream to accomplish the action plan's objectives.

Our Local, State, and Federal Partnership

Goal #1: Create Public Awareness

- Utilize public resources and facilities to educate citizens of all ages about the basics of watershed science
- Sponsor community recreational events drawing attention to the watershed's river, streams, and land
- Use mass media channels to distribute information throughout the watershed

Goal #2: Educate Public on Land Use and Water Pollution Linkage

- Inform the watershed community about land use practices that reduce impacts to streams
- Provide education to municipal officials regarding stormwater and nonpoint source pollution

Goal #3: Promote Sustainable Land Use

- Develop a comprehensive inventory to identify areas for preservation, restoration and recreation
- Assist in the protection of open space through acquisition or other means to improve ecosystem health
- Facilitate appropriate recreational uses along the Mattabesset River and its tributaries
- Encourage conservation development practices that minimize impact on natural resources

Goal #4: Restore and Maintain Wildlife Habitat

- Control or diminish the prevalence of invasive species
- Reduce fragmentation and destruction of wildlife habitat by inappropriate land use practices

Goal #5: Protect Wetlands from Development

- Promote buffer regulations in watershed towns to improve water quality and wildlife habitat
- Protect wetland systems

Goal #6: Identify and Correct Pollution Problems

- Continue water quality monitoring and assess changes in water quality
- Continue to improve stormwater management throughout the watershed
- Continue to improve erosion and sediment control regulations throughout the watershed
- Develop a sanitary sewage maintenance plan for the watershed
- Develop a septic system maintenance program to assure the effective functioning of septic systems

Goal #7: Restore Habitat for Healthy Fish

- Minimize the impacts of development on riparian and in-stream habitat
- Restore or enhance streamside and in-stream physical conditions
- Restore anadromous fish populations in the Mattabesset River and tributaries
- Foster cold water fisheries in the Mattabesset River and tributaries

Goal #8: Evaluate Stream Flow

- Calculate a water budget for the Mattabesset watershed to resolve water use conflicts
- Establish a Flow Work Group of individuals and organizations to develop a flow allocation policy

Goal #9: Obtain Consistent and Stable Funding Stream

- Identify potential and appropriate funding mechanisms

SWCD	Towns	MSG	Land Trusts	MRWA	CRWP	TU	NEMO	CT DEP	US EPA	NRCS	USGS
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Project History

For the past seven years, the Middlesex County Soil and Water Conservation District has been working on this long-term effort to improve water quality conditions in the Mattabesset River, with the ultimate goal of restoring the river to a fishable and swimmable condition. The Mattabesset project is funded in part by the CT Department of Environmental Protection through an EPA Clean Water Act Section 319 nonpoint source grant.

Watershed project activities have focused on implementation of Best Management Practices to mitigate the effects of stormwater runoff; restoration of degraded areas; and education of town staff, land use commissioners, developers and contractors on the methods needed to prevent and control polluted runoff. The District has also initiated inter-town cooperation and coordination in the watershed toward the development of a comprehensive watershed management plan, assessing water quality conditions and stream health, and public outreach and involvement.

The District's nationally recognized Connecticut River Watch Program (CRWP), a volunteer river monitoring, protection, and improvement program, monitors the health of the Mattabesset River and its tributaries. CRWP, developed and implemented in 1992 as part of the Mattabesset River Watershed Project, is designed to meet two major objectives: to build awareness about river resources and water quality, and to collect scientifically credible data that can be used to identify and address water quality problems.

In the last year the District completed a comparative review of municipal land use regulations in the watershed towns, produced a State of the Watershed Report (1999) which has been used as the basis for development of the watershed management plan and is summarized in the following section.

Photo—Pat Rasch

Canoeists enjoy a day on the river. Although Route 9 is a only few hundred feet away, it is well hidden by the streamside forested buffer.

State of the Watershed

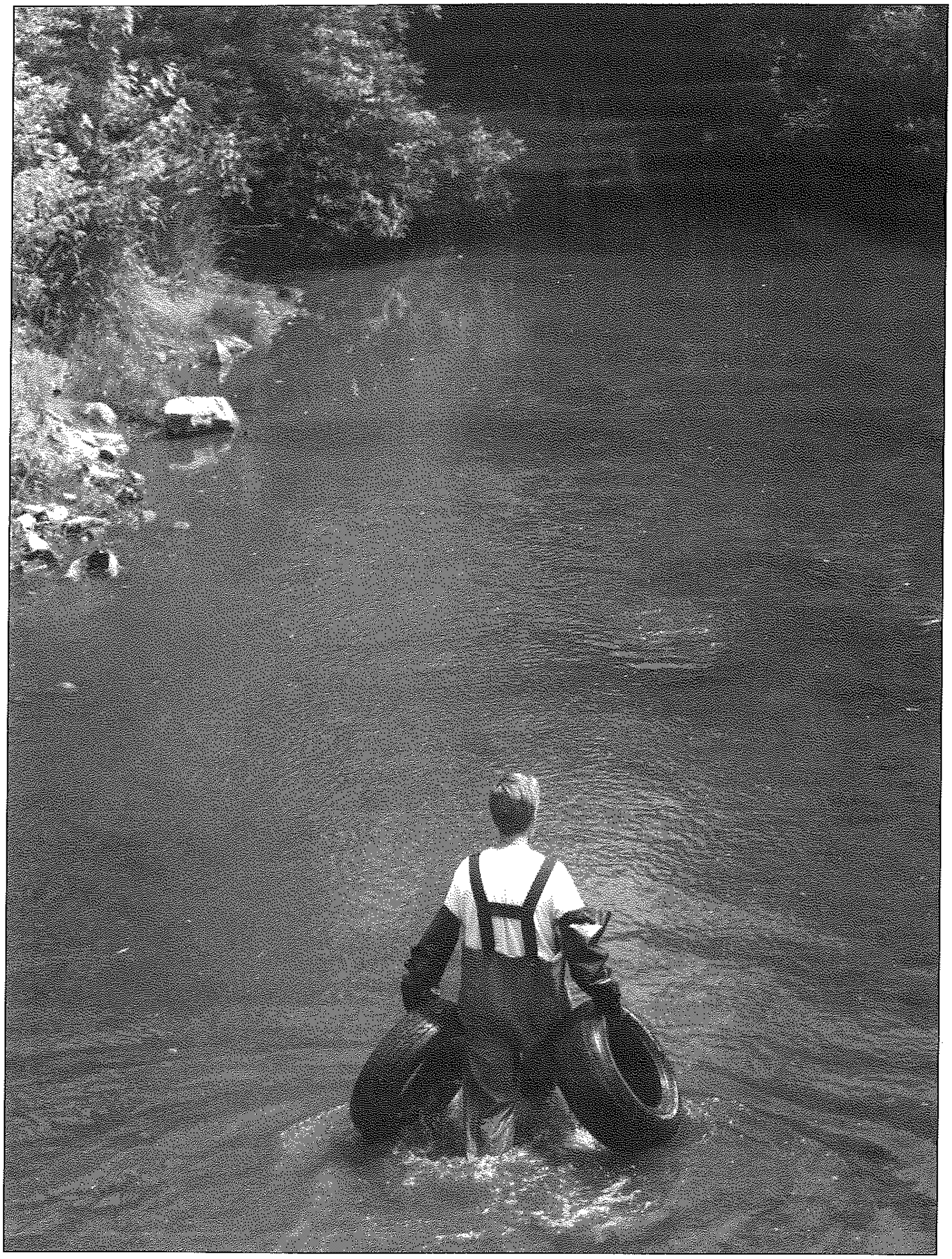


Photo by Cloe Poisson / *The Hartford Courant*

A community volunteer helps with a river clean-up.

State of the Watershed

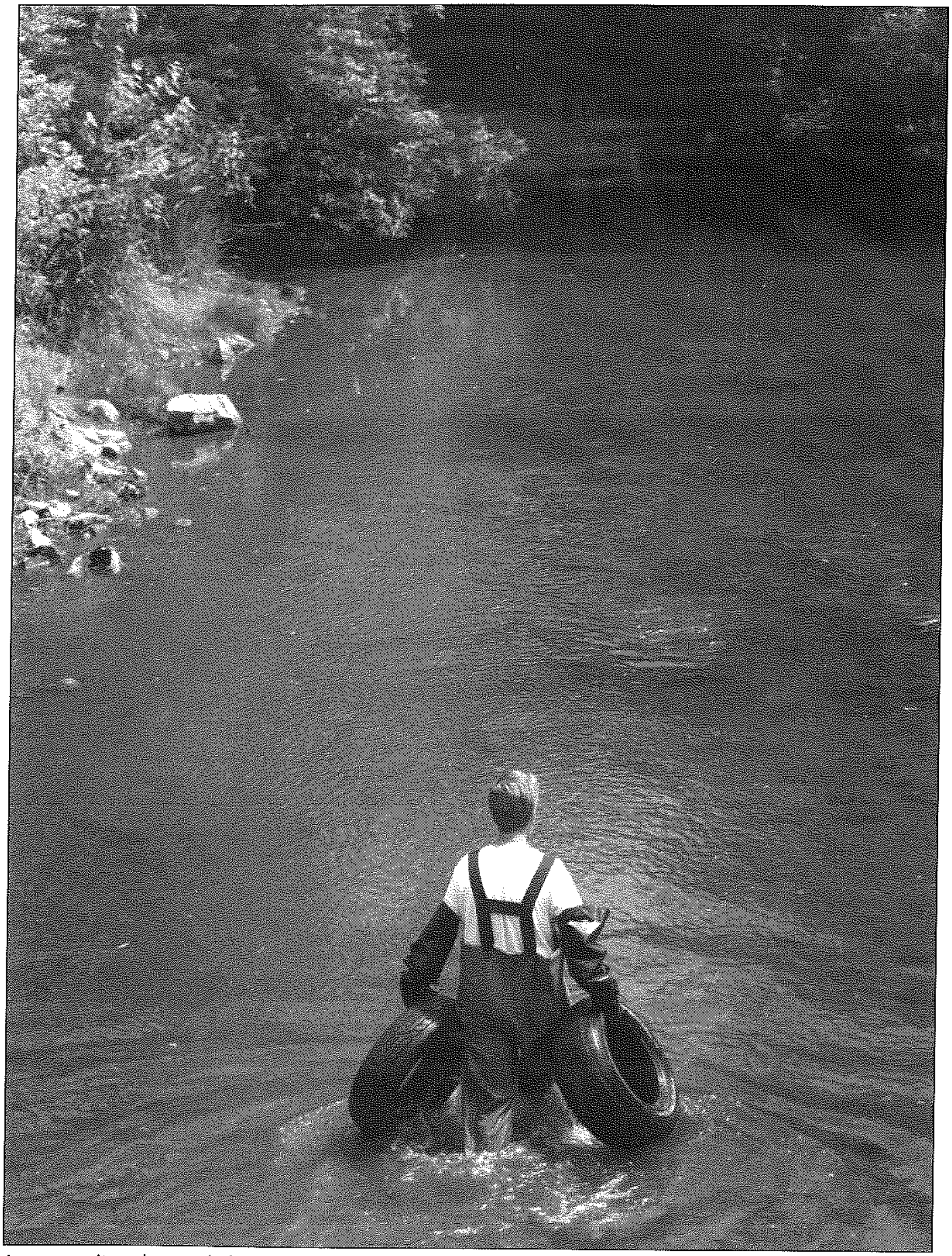


Photo by Cloe Poisson / *The Hartford Courant*

A community volunteer helps with a river clean-up.

State of the Watershed

Introduction

The Mattabesset River Watershed is a 45,000 acre area in central Connecticut that drains into the Mattabesset River. The Mattabesset River originates in the highlands of Meriden, and flows eastward towards its outlet at the Connecticut River just above the Portland Bridge. Land area within ten municipalities is included in the watershed (see Table 1), and land use practices within each of these communities affect the quality of the waters that flow into the Mattabesset River and its tributaries.

The Coginchaug River Watershed contributes an additional 25,000 acres of drainage area to the Mattabesset River Watershed. However, the Coginchaug meets the Mattabesset less than one mile above the mouth of the Mattabesset River, and does not affect water quality within most of the Mattabesset River Watershed. As a result, the data and discussions within this State of the Watershed report do not include the Coginchaug River Watershed unless specifically noted.

Water quality in the Mattabesset River has improved dramatically since 1968, when the establishment of the Mattabassett Sewer District curbed the discharge of raw sewage into the river. However, water quality testing over the past seven years by the Connecticut River Watch Program (CRWP) and the United States Geological Survey

Table 1.

Land Area of Municipalities in the Mattabesset River Watershed*
*source: MAGIC Internet Site, 1999.

Town	Town Acreage	Acreage in Basin	% of Town in Basin
Berlin	17356.1	16930.4	97.5
Cromwell	8301.2	5429.2	65.4
Meriden	15324.5	1401.5	9.1
Middlefield	8401.1	928.1	11.0
Middletown	27170.9	9021.1	33.2
New Britain	8596.9	3208.2	37.3
Newington	8394.5	2775.3	33.1
Plainville	6308.5	228.6	3.6
Rocky Hill	8834.7	2976.2	33.7
Southington	23376.1	1889.6	8.1
Totals	**132,065**	**44,788**	

(USGS) shows that the Mattabesset River and its tributaries still experience degradation due to nonpoint source pollution, or what we call "polluted runoff." Potential sources of polluted runoff include contaminants picked up by rainwater running over driveways, roads, agricultural fields and lawns; failing septic systems and sewage infrastructure; and poorly contained waste disposal sites. As a result of one or more of these sources, extensive stretches of river within the watershed experience high bacteria and nutrient levels.

Accommodating the needs of a growing population has required alterations to be made to the natural state of the watershed. Although the construction of roads, houses, industries, and commercial buildings are perhaps the most obvious adjustments to the watershed, several other developments affect the condition of the Mattabesset River. Withdrawal of water for public drinking supplies and industrial or agricultural uses can affect the flow rates of the Mattabesset River and its tributaries. The construction of dams and culverts along the river may mitigate the damage incurred by floods, but they also cause erosion and sedimentation in the river channels and impede fish migration routes.

Photo—Stephanie Shakofsky

Culvert at the mouth of Coles Brook in Cromwell discourages fish migration by disturbing the natural streambed and disrupting the natural streamflow.

An Historical Perspective of the Mattabesset River Watershed

The Mattabesset River and its tributaries flow through the Central Lowlands, or Central Valley[1], of Connecticut, an area characterized by large meandering rivers and generally flat land, interrupted occasionally by rolling hills and divided lengthwise by a distinctive north-south ridge. The landscapes and patterns of land use in the Lowlands derive from the geological history and make-up of the area (Bell, 1985).

Often referred to as Connecticut's Central Park, this area began formation about 225 million years ago, during the early Mesozoic Era, when the super-continent Pangaea began to break apart into the separate continents we know today. Connecticut was located near the center of Pangaea close to the equator, creating a hot, often wet, climate. A "great crack," or rift, formed a long, narrow and deep valley through the middle of our state. This depression filled with sediments from the eroding hills to the east and west and with lava flows that rose from the earth's interior. The sediments were compacted into soft, easily eroded, red and brown sandstones, while the lava flows solidified into very hard traprock (basalt). These deposits were tipped to the east and later faulted and eroded to create the highly visible traprock ridge (the Metacomet) of the Central Valley, part of which forms the drainage divide of the Mattabesset watershed (Bell, 1985).

CLIMATE

Today, Connecticut's climate lies somewhere between the warm tropics of the Jurassic and the frigid ice age that existed 18,000 years ago. Connecticut has a humid temperate climate, with cold, snowy winters and warm summers. Temperature varies according to season, with minimum January temperatures between 7.5°F and 26°F, and maximum July temperatures between 77°F and 88°F. Precipitation occurs throughout the year, with an average annual rainfall of 30–50 inches (NWDC website).

Since its formation during the Mesozoic, drastic climate change has occurred within the Connecticut Valley. Above the bedrock lie extensive glacial deposits, which record the existence of large glaciers, the last of which began to retreat from Connecticut about 18,000 years ago. The rivers and streams in the watershed flow through sediments deposited by the glacier, including "glacial till" and "stratified drift." Glacial till blankets most of Connecticut and consists of a mixture of different size particles—silt, sand, and gravel—that was transported by the glacial ice. Stratified drift occurs in the present river valleys, and consists of sorted layers of sand and gravel carried by the streams and lakes that formed during the melting of glacial ice.

Beginning about 10,000 years ago, as the last glacial ice retreated from New England, Native American populations settled Connecticut and the areas along the Mattabesset and Coginchaug rivers. When Europeans arrived, the Mattabessec and Wangunk Indian tribes inhabited this area, and have been nicknamed the "River Indians" due to their reliance on the rivers for subsistence (Guillette, 1979). The main staple for the River Indians was corn, and the Indians planted their cornfields along the fertile river floodplains of the Mattabesset River. In addition to agriculture, the tribes used the land within the watershed for hunting, gathering, and fishing. They led a semi-sedentary lifestyle, moving their villages to the forests during the winter months for hunting, and returning to the rivers in the spring for fishing and agriculture.

Once Europeans began to settle Connecticut, land use along the Mattabesset River

1 This unusual region goes by several names, including Connecticut Valley, Central Valley and Central Lowlands. Because region is not actually one big valley, but a broad low-lying zone divided in two by a high ridge (the Metacomet) that runs its entire length, Central Lowlands is perhaps the most accurate of the three (Bell, 1985).

changed. By 1765, most of the Wangunk and Mattabessec land had been sold to European settlers (DeForest, 1851). Agriculture continued to be the dominant land use practice through the Revolutionary War era. However, the availability of more fertile lands in western New York, northern Ohio, and Pennsylvania led to the mass abandonment and great migration of Connecticut farmers during the 1800s. Those who stayed worked in the many factories that were springing up along the rivers and streams, and manufacturing became a major economic force (Gibbons et al., 1992).

Beginning in the mid-1800s, brick-making became an industry that flourished for about 100 years. Brick companies mined the thick clays that had been deposited during the retreat of the last glacier. By 1900, over 30 clay pits had been excavated in central Connecticut (Loughlin, 1905). Brick-making activities within the Mattabesset Watershed centered along Newfield Street in Middletown (Klattenberg, 1992) and within a 2 square mile area in Berlin and New Britain, along Farmington Ave and Christian Lane in Berlin and from Willow Brook Park to South Street in New Britain (Teski, pers. comm.).

The dramatic change in land use practices over the past century from farming to business and industry manifests itself as a decline in agricultural acreage (Figure 1).

Courtesy of Cromwell Belden Library

A 1905 postcard shows the Quarry Hole in Cromwell.

Population growth also soars during this time, almost tripling in number between 1930 (about 30,000 residents) and 1998 (about 77,000 residents) (Figure 2).

Prior to the 1930's population growth and the accompanying stresses on the river, the Mattabesset provided valuable recreational opportunities. The river supported a significant fish population, as well as a large fishing club. In 1903, the Middletown Press reported that an eight pound shad had been caught in the Mattabesset. Today very few shad are found in the river.

Figure 1.

Agricultural Land Use in the Mattabesset River Watershed Since 1930
(including the Coginchaug River Watershed)*

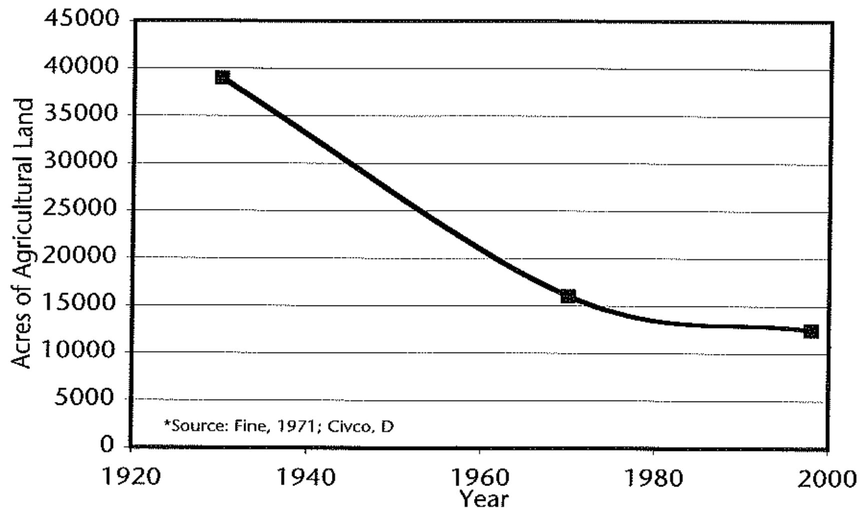
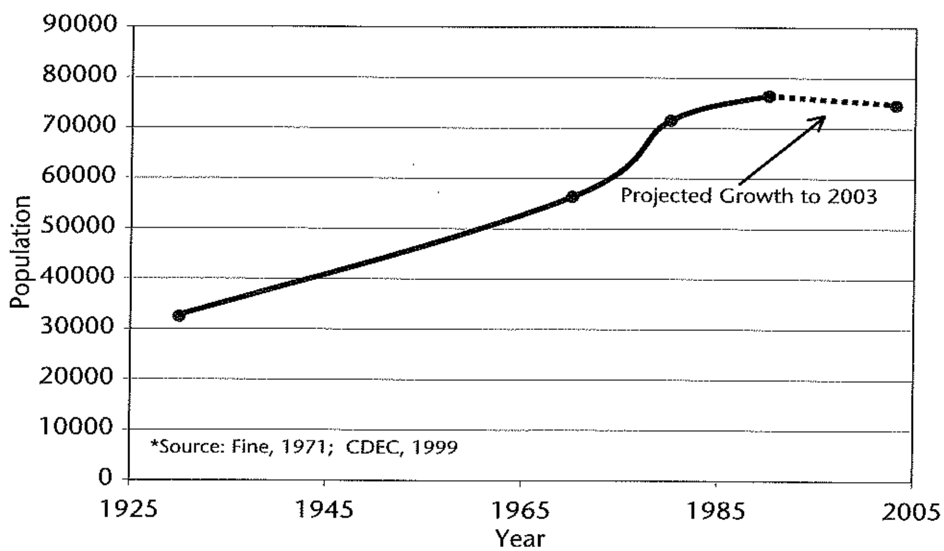


Figure 2.

Population Growth in the Mattabesset River Watershed since 1980*



Water Resources

Water Quantity

The Mattabesset River Watershed comprises a regional drainage basin within the larger Connecticut River Major Basin (CT DEP, 1982) (Figure 3). The natural headwaters of the Mattabesset River are the intermittent streams that feed Merimere Reservoir (394 feet above sea level) in Meriden. These streams are born from the rain and groundwater flowing from East Peak, a section of Meriden's traprock ridge system known as the Hanging Hills. East Peak is the highest point in the Mattabesset River Watershed at an elevation of 976 feet a.s.l. Merimere Reservoir feeds Stocking Brook, which flows northeast through Berlin and eventually combines with John Hall Brook to form the Mattabesset River (Nosal, 1997).

The Mattabesset River has been designated as a "water quality hotspot" by the Connecticut River Forum due to the degradation it experiences from low flow rates, pesticide contamination, nutrient enrichment, bacteria concentration, and turbidity (Connecticut River Forum, 1998). The low-flow, low-gradient characteristics of the Mattabesset River contribute to the river's susceptibility to pollution impacts, as pollutants cannot be effectively diluted. The mean daily discharge rate in the Mattabesset River averages about 75 cubic feet per second (cfs) at the USGS gaging stations in East Berlin (Table 2). However, high precipitation as well as spring runoff may cause much greater flow rates, with peak discharges in the Mattabesset recorded as high as 2980 cfs (USGS Internet Site).

Along its course, the volume of the Mattabesset River increases as a result of contribution from tributary basins. Belcher Brook, Willow Brook, Webster Brook, and Sawmill Brook comprise four major tributaries of the Mattabesset River, and the Connecticut DEP has delineated subregional basins around each of these.

Belcher Brook flows northward through the town of Berlin and is the first major tributary to empty into the Mattabesset River. Travelling east, the Mattabesset River next receives inflow from Willow Brook and Webster Brook, which flow southeast through New Britain and Berlin. Finally, Sawmill Brook flows northward through Middletown and meets the Mattabesset River about 4 miles from its mouth.

Inflowing water from tributary subbasins contributes not only to the discharge rate of the Mattabesset River, but also to its water quality. The Connecticut Water Quality classifications for the Mattabesset River and tributaries provide a framework for assessing the health of the watershed.

Connecticut Water Quality Standards are established in accordance with Section 22a-426 of the Connecticut General Statutes and Section 303 of the Federal Clean Water Act. The Standards include water quality classifications, which are used to establish priorities for pollution abatement projects. The classification system specifies the designated uses that must be supported in a water body, as well as criteria that define the water quality necessary to support those uses. Surface waters are designated as Class AA, A, B, C, or D (Table 3).

Classifications also can be expressed as an existing condition, with a higher water quality goal. For example, in a Class B/A water body the present water conditions support a classification of "B," but the water quality goal for that water body is "A." Water bodies designated as Classes C or D do not meet water quality conditions for one or more designated uses in Class B waters. Pollution of Class C waters usually originates from combined sewer overflows, urban runoff, inadequate water treatment, or community-wide septic system failures. In Class D waters, contamination is evident not only in the water, but also as toxic compounds within bottom sediments and/or fish and shellfish tissues (CT Water Quality Standards, 1992).

Upstream of Willow Brook, the Mattabesset River is classified as a Class AA inland surface water in the reservoirs, and as Class A and B/A waters within the stream itself. Belcher Brook contributes B/A waters to the Mattabesset River. Due to the polluted inflow of Willow Brook, a Class C/B river in its lower reaches, the Mattabesset River's waters also degrade to Class C/B status downstream. Webster Brook and Sawmill Brook have been given respective water quality classifications of B/A and A (Murphy, 1987).

Table 2.

Mattabesset River Discharge Rates

Water Year	Annual Discharge (cubic feet/ year)	Average Discharge (cubic feet / sec)
1961	2.39 x 109	75.8
1962	2.02 x 109	64.0
1963	2.27 x 109	71.8
1964	1.87 x 109	59.3
1965	1.61 x 109	51.2
1966	2.56 x 109	81.2
1967	2.58 x 109	81.5
1968	2.36 x 109	75.0
1969	3.05 x 109	96.8
1970	2.00 x 109	63.3
1995	-	51.9
1996	3.38 x 109	107.0
1997	3.04 x 109	96.5
Average	**2.43 x 109**	**75.0**

*Source: USGS Water Resources internet site: *http://h2o.usgs.gov*

Figure 3.

Mattabesset River Watershed Towns and Basic Hydrography

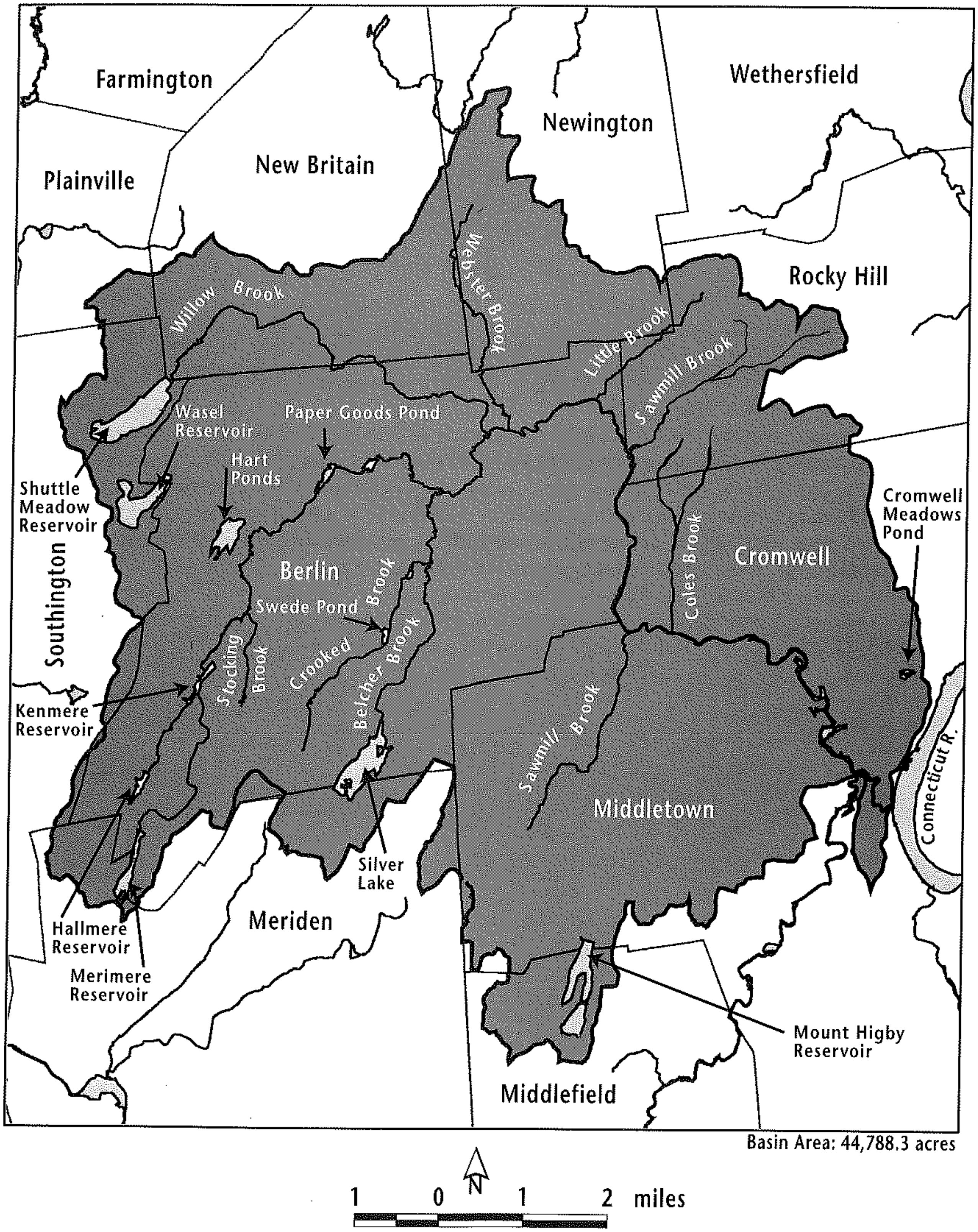


Table 3.

Designated Uses for CT Inland Surface Water Quality Classifications

Designated Uses	Classification AA	A	B	C	D
Existing/ proposed drinking water supply	X				
Potential drinking water supply	X	X			
Fish & wildlife habitat	X	X	X		
Recreation	X	X	X	Designated uses of Class C and D waters vary among water bodies according to individual conditions.	
Agriculture supply	X	X	X		
Industrial supply	X	X	X		
Navigation		X	X		

*Source: CT Water Quality Standards, 1992

Connecticut's most recent statewide water quality classification update was compiled in 1987 (Murphy, 1987). Consequently, the classifications of the streams described above may not accurately reflect current conditions for all streams. At present, CT DEP is working to update their classifications of Connecticut's water bodies. Revisions are expected to be complete sometime during the year 2000.

Photo—Pat Rasch

The Mattabesset River runs under the old trolley bridge behind West Lake development in Middletown.

Water Quality

Recent Records

In 1992, the Connecticut River Watch Program (CRWP) initiated a water quality monitoring program in the Mattabesset River Watershed and presently is undertaking its eighth year of data collection. Data have been assimilated from 23 sites along the Mattabesset River and its tributaries. Each year, water chemistry and bacterial data are collected during July and August, and benthic macroinvertebrate data are collected during the fall. Parameters such as pH and total alkalinity consistently show healthy levels of acidity in the watershed. However, at most sampling sites bacterial counts, nutrient levels, and metal concentrations indicate significant problems with nonpoint source pollution in the river.

One pollution indicator in the Mattabesset River Watershed is the high levels of enterococcus group and fecal coliform bacteria found in the main stem and tributary streams. Between 1992–1998 all of CRWP's sampling locations in the Mattabesset River Watershed, except the headwaters site at John Hall Brook, exceeded the criteria in the CT Water Quality Standards for enterococcus group and fecal coliform bacteria levels in Class B inland surface waters (Brawerman, 1999)[2]. High concentrations of these bacteria indicate possible contamination of the water body by human and/or animal waste, and point toward the possible presence of other disease-causing organisms that make water unsafe for swimming.

Exact sources of indicator bacteria are often difficult to pinpoint, but could include failing on-site septic systems, domestic and wild animal manure, and urban runoff. Bacterial concentrations in the Mattabesset River tend to peak during rainfall events. This pattern supports the argument that storm runoff carries waste products to the Mattabesset, and that nonpoint source pollution is a significant problem in the watershed. Conversely, bacterial concentrations in the Mattabesset River remain high even during base flow conditions, when rainfall and storm runoff do not contribute to stream discharge. These chronically high bacteria levels suggest that, in addition to storm runoff, steady sources of bacteria such as failing septic systems probably exist within the Mattabesset River Watershed (Brawerman, 2000).

Bacterial measurements made by USGS at the East Berlin gaging station support the problem with waste pollution in the Mattabesset River. Between 1995–1997, forty-four percent (44%) of samples collected at the USGS station exceeded the Class B standard for fecal coliform (not to exceed 400 colonies/100mL in more than 10% of samples). Further, seventy-five percent (75%) of USGS samples exceeded the Class B standard for enterococci (not to exceed 61 colonies/100mL in any one sample) (Davies et al., 1996; Davies et al., 1997; Davies et al., 1998).

In addition to contributing high bacteria counts to the rivers, waste pollution and runoff from fertilized land manifest themselves as high nutrient (i.e. nitrogen and phosphorus) levels in the Mattabesset River and in certain tributaries. A stream's nutrient load is the total mass of nutrient that flows through the stream over a given time. In the Mattabesset River, nutrient loads tend to increase with distance

2 Enterococci levels not to exceed 61 col/100mL in any one sample and not to exceed a geometric mean of 33 col/100mL over a 30-day period. Fecal coliform levels not to exceed 400 col/100mL for 10% of samples and not to exceed a geometric mean of 200 ol/100mL over a 30-day period.

downstream as the river runs through more urban areas and receives input from storm runoff and polluted tributaries (Figure 4).

In typical aquatic ecosystems, phosphorus is the nutrient that limits growth of algae and aquatic plants. Because natural concentrations of phosphorus vary greatly among aquatic ecosystems, neither the state of Connecticut nor the US EPA designates specific water quality criteria for phosphorus. However, the EPA does have an historical guideline for phosphorus levels in streams, which states that,

> "to prevent the development of biological nuisances and to control accelerated or cultural eutrophication, total phosphates... should not exceed... 0.1 mg/L total P."

Between 1993 and 1997, CRWP data show that phosphorus concentrations in the Mattabesset River exceeded the EPA guideline in 50% of the main stem samples and in the 20% of tributary samples. Phosphorus as well as nitrogen loads increase in the Mattabesset during high flow events (Figures 5 & 6), pointing to storm runoff and nonpoint source pollution as the primary sources of nutrients to the river.

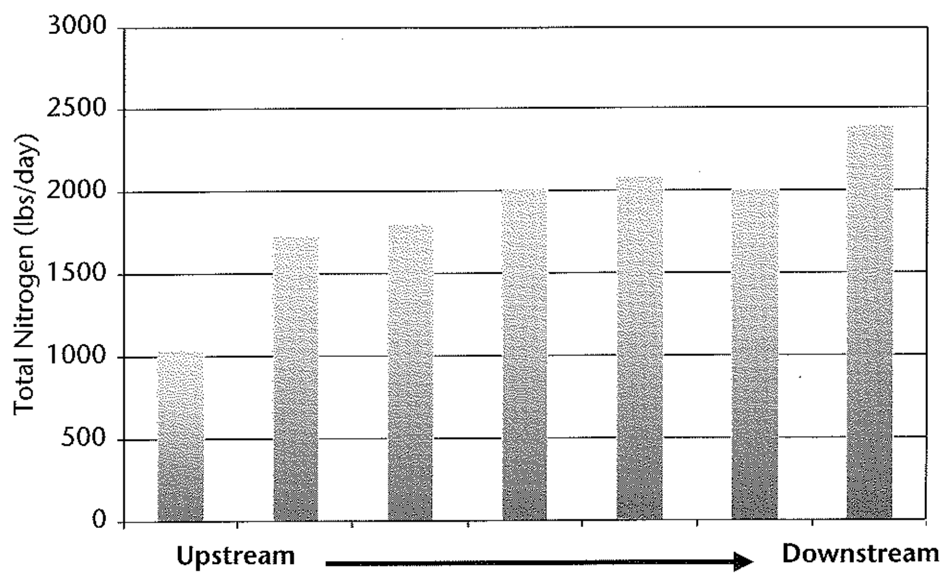
Nutrient Loading

The amounts of nutrients shed off our land and into our rivers is even more pronounced if we add up nutrient loading in the Mattabesset over an entire year. An average of 50 lbs of phosphorus flows into the Mattabesset River each day, which sums to more than 18,000 lbs of phosphorus each year. Nitrogen loading is even greater, with an average of 594 lbs/day, or almost 217,000 lbs of nitrogen per year flowing through the Mattabesset River. Much of the nutrient load in the Mattabesset originates from polluted runoff that flows over agricultural fields, urban streets, and lawns.

Figure 4.

Nitrogen Loading (lbs/day) on the Mattabesset River Main Stem

Listed from Upstream to Downstream



*Source: Mattabesset Sewer District

Figure 5.

Daily Phosphorus Loading on the Mattabesset River Main Stem

CRWP Data (Kirby Road, Berlin)

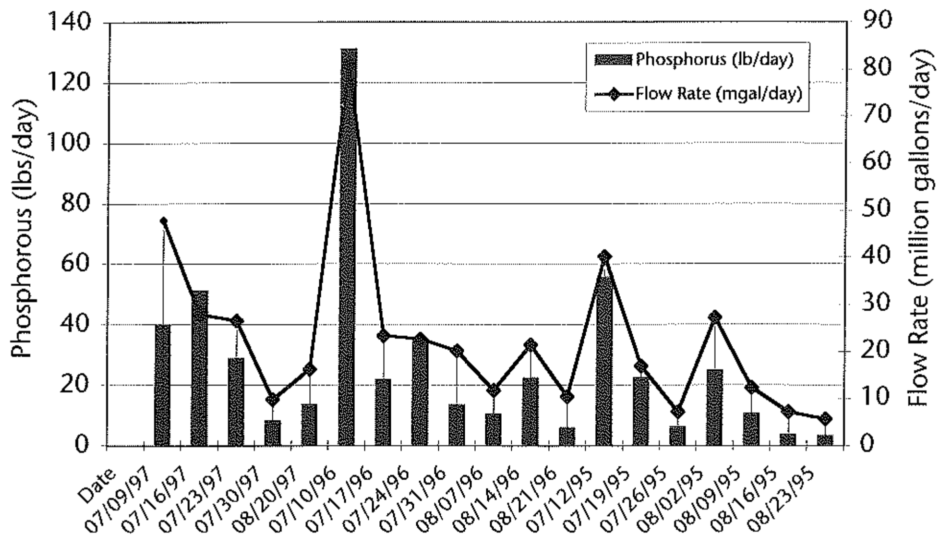
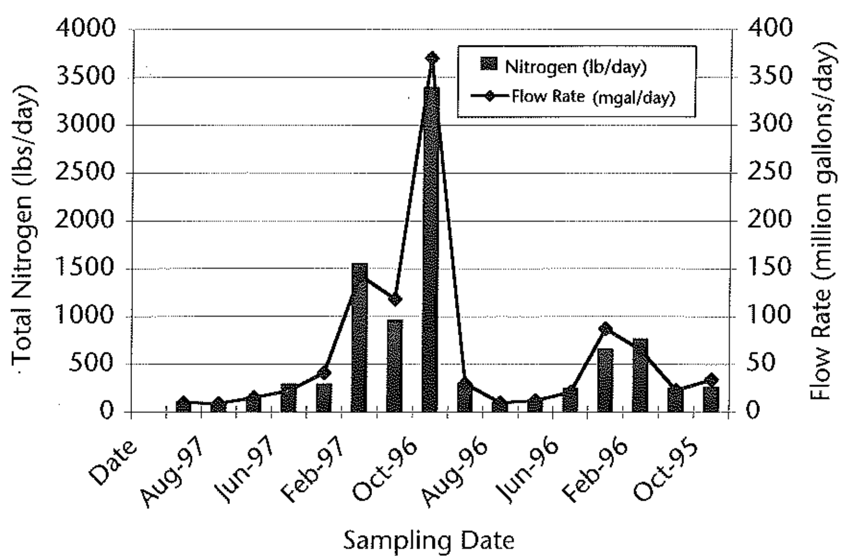


Figure 6.

Daily Nitrogen Loading on the Mattabesset River Main Stem

USGS Data (Rt. 372, E. Berlin)



Special Concern: Turbidity

A fairly common notion among residents of the Mattabesset watershed is that the Mattabesset River is a naturally "muddy" river, due to the erosive characteristics of the watershed soils. It is true that during high runoff events, the waters of the Mattabesset River often become clouded with suspended sediment that colors the river reddish-brown. However, turbidity data provided by USGS and CRWP indicate that the Mattabesset River is not naturally turbid. Rather, peaks in turbidity are a result of soil erosion from unnaturally exposed areas of soil.

The Mattabesset River itself flows through the Berlin Clay unit, a fine-grained, reddish-brown clay deposit that was laid down during the last glaciation in the former Glacial Lake Middletown (London, 1985; Loughlin, 1905). As is the general rule with consolidated clay deposits, the Berlin Clay unit has a naturally high resistance to erosion due to the electrostatic binding properties of clay particles (Patrick, 1995).

Sediment & Turbidity: Impacts on Aquatic Life

Excessive sediment inflow to a river creates cloudy or turbid waters, measured as turbidity. Unnaturally high turbidity is dangerous to fish. It reduces sunlight penetration in the water, impairs sight-feeding fish and clogs fish gills and eventually leads to suffocation. When the sediment settles out of the water column and onto the bed of the river, it can smother the eggs and larvae of aquatic organisms.

Extending throughout the Mattabesset watershed are soils composed primarily of various consistencies of loam (a mixture of sand, silt, and clay). Under natural conditions, vegetation stabilizes and protects these soils from rainsplash and erosion. However, if the soils become devegetated and exposed, as often occurs at building sites or at road cuts, soil erosion may skyrocket to over 100 times the natural rate (Dunne & Leopold, 1990). Storm runoff flowing over unvegetated soil loosens soil particles more easily, transporting them away from their original site, and, subsequently, into the river.

In an attempt to determine storm runoff's contribution of to turbidity in the Mattabesset River, the Middlesex County Conservation District compared turbidity measurements taken along the river during a drought to measurements taken during normal weather conditions. During the drought of summer 1999, CRWP monitored four sites along the Mattabesset River. The lack of rain assured us that little storm runoff had flowed into the Mattabesset River, and that the concentration of suspended solids carried by the river had not been elevated above base level. The 1999 turbidity data show a low background level of turbidity in the Mattabesset River during baseflow conditions, averaging between 2.0–3.0 NTU.

Turbidity levels in the Mattabesset River are normally higher than those recorded during the summer of 1999. However, USGS and CRWP data show that, even under normal weather conditions, turbidity levels in the Mattabesset remain fairly low[3] (medians of 3.6 and 5.0 NTU, respectively), and that peaks in turbidity greater than 1000 NTU correspond with large storm events (Davies, 1996–1998; Brawerman, 1999).

This correlation indicates that the primary cause of high turbidity readings in the Mattabesset is storm runoff, which transports large loads of suspended sediment to the river. As shown by the 1999 turbidity data, the Mattabesset River itself is not downcutting through the soil and adding significant turbidity to the river. Rather, man-made situations such as construction sites, roadcuts, and agricultural fields have exposed extensive areas of soil in the Mattabesset River Watershed to the elements, causing unnaturally high turbidity in the Mattabesset River during storm events.

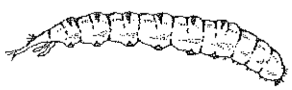
3 Based on Gregory & Levings, 1996. Water was "clear" between 0.5–2.4 NTU, and "turbid" at values greater than 12 NTU.

Photo—Stephanie Shakofsky

Improperly installed silt fence at a construction site. Silt fencing acts as a trap capturing sediment before it leaves a site. Fencing should be buried at least 6 inches below the ground surface to efficiently trap any sediment (note the sunlight under the fencing).

Photo—Jane Brawerman

Heavy rains swell the River with muddy or turbid waters.



Benthic Macroinvertebrates[4]

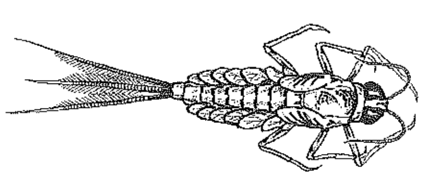
The effects of nonpoint source pollution on aquatic life in the Mattabesset River are easily seen through an examination of the river's benthic macroinvertebrate community. The benthic macroinvertebrate community in the Mattabesset River lacks diversity and organisms that are sensitive to pollution, and does not meet the criterion in Connecticut's water quality standards.

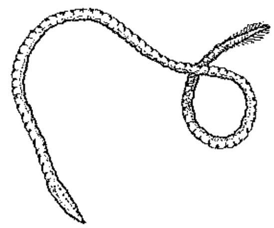
Benthic macroinvertebrates are bottom dwelling organisms–aquatic insects, mollusks, worms and crustaceans–that can be seen with the unaided eye. These organisms are good indicators of water quality for several reasons: many are sensitive to pollution; the composition of the community is a good reflection of long-term water quality since they live in the stream year-round; they cannot easily escape pollution; and they are relatively easy to collect. The types and numbers found can indicate water quality conditions (Brawerman and Dates, 1997).

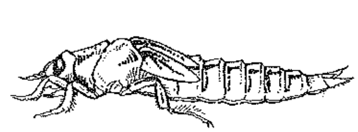
Connecticut's criterion for benthic macroinvertebrates is a narrative criterion. It states that water quality shall be sufficient to sustain a diverse community of indigenous species; all functional feeding groups and a wide variety of taxa shall be present, however one or more may be disproportionate in abundance; waters currently supporting a high quality community shall be maintained as such; and the presence and productivity of stoneflies, mayflies and pollution intolerant beetles and caddisflies may be limited due to cultural activities (CT DEP, 1992).

A number of standard indices were used to analyze benthic macroinvertebrate results, several of which are summarized in the report. They are:

- ***Organism Density,*** the total number of organisms in the sample. Different types of pollution affect density in different ways. Nutrient enriched water tends to have a greater density while both toxicity and physical habitat degradation (e.g. from sedimentation) tends to decrease density. Healthy sites should have a minimum of 150 organisms.
- ***EPT Richness,*** the number of different kinds of macroinvertebrates in each of three insect orders: Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies). These three orders contain many families that are sensitive to water quality changes. Generally, the more EPT families the better the water quality and habitat. There should be a minimum of 10 families.
- ***% Contribution of Dominant Family,*** the percentage of the sample made up of the family containing the most organisms. In general, no one family should dominate the sample. Degrees of impairment are: <30%, non to slightly impaired; 30–50%, moderately impaired; >50%, severely impaired.







Illustrations—Joyce Powzyk

4 Adapted from Brawerman, 2000

- ***Percent Model Affinity,*** the percent similarity between the composition of each sample collected and the composition of a reference community.[5] Impacts are: >64%, no impact; 50–64%, slight impact; 34–49%, moderate impact; <34%, severe impact.

Analysis of selected indices demonstrates several upstream to downstream trends in the Mattabesset, including decreasing density, EPT Richness, and % Model Affinity, and increasing % Contribution of Dominant Family (Table 4). Density values are higher than the minimum of 150 for a healthy site and are not cause for concern. These values may indicate nutrient enrichment, and declining values may be the result of increasingly degraded habitat. The low values of EPT Richness, even in the most upstream site, indicate poor water quality and habitat overall; no sites meet the minimum of 10 families for a healthy site (Figure 7). Values for % Contribution of Dominant Family indicate that the river is moderately to severely impacted, with the most severe impacts in the most downstream main stem site. Percent Model Affinity values show slight impacts (50–64%) in the five upstream main stem sites, and moderate impacts (34–49%) in the downstream site and Willow Brook.

Also of note is the fact that stoneflies were virtually absent from all Mattabesset sites monitored. As a group, or order, stoneflies contain the organisms that are most sensitive to pollution.

Figure 7.

EPT Richness
Mattabesset River sites 1992–1998

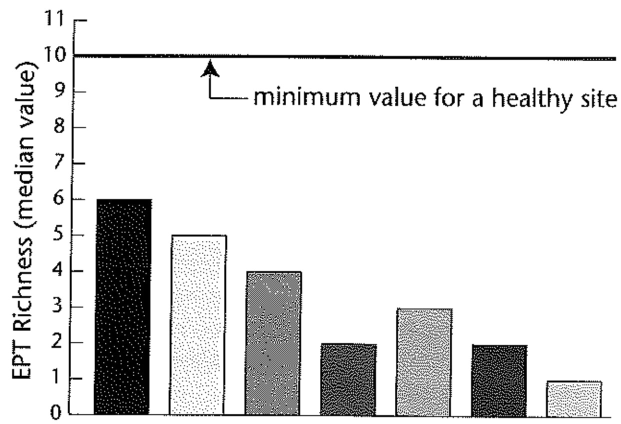


Table 4.

Benthic Macroinvertebrate Analyses Median Values of 1992–1998 Results

(Upstream to Downstream Main Stem Sites and Willow Brook in Berlin)

	Route 71A Berlin	Lower Lane Berlin	Wethersfield Road Berlin	Berlin Street Cromwell	Kirby Road Cromwell	Krauszer Market Rte. 372 Cromwell	Willow Brook Berlin
Organism Density/ Sample Unit	1072	948	992	1176	808	558	363
EPT Richness	6	5	4	2	3	2	1
% Contribution of Dominant Family	57%	41%	52%	50%	67%	72%	64%
Percent Model Affinity	57%	55%	54%	51%	51%	48%	41%

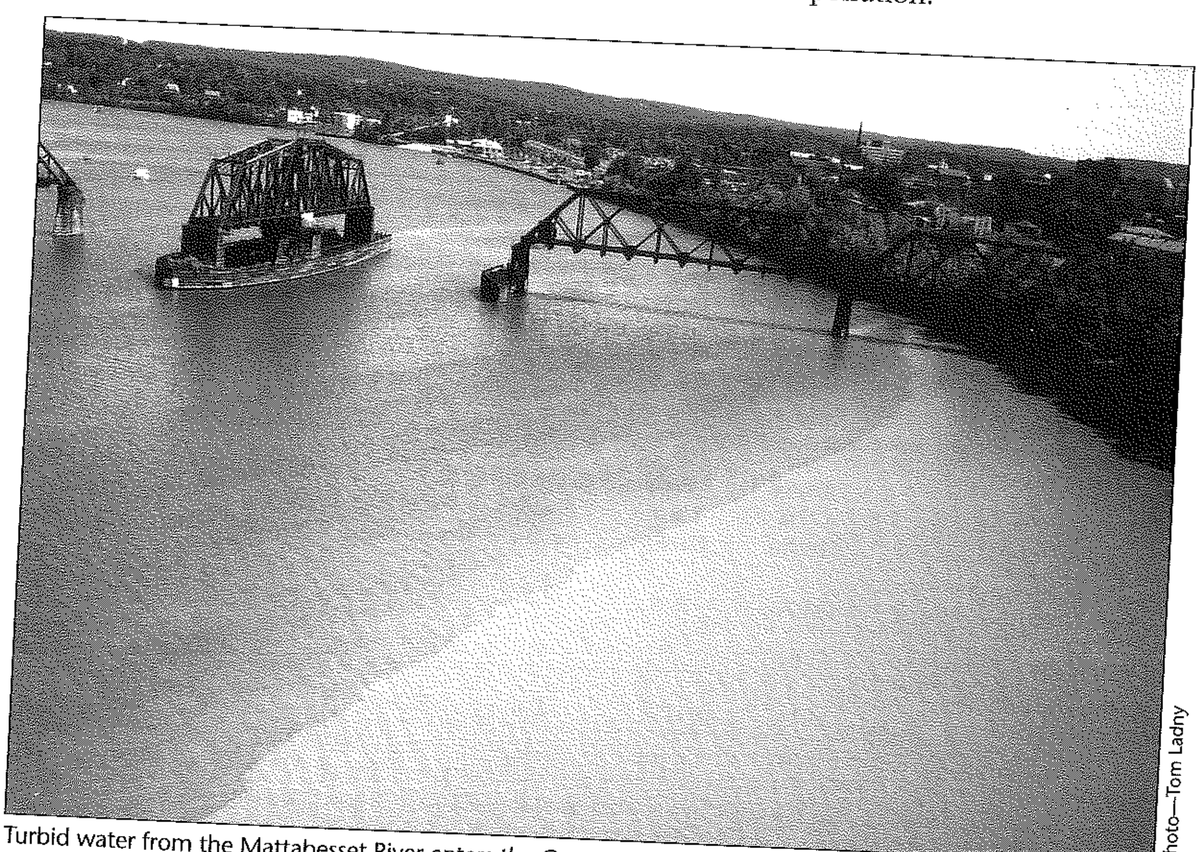
5 A reference or "ideal" community was developed by the CT DEP based on data from the Salmon, Shepaug, Saugatuck, Eightmile and Natchuag Rivers. The community consists of 38% mayflies, 5% stoneflies, 31% caddisflies, 8% midges, 10% beetles, 1% worms, and 7% other.

Historical Records

Although degradation of water quality in the Mattabesset River is apparent today, the decline in direct sewage discharge to the river has improved its water quality tremendously since 1968. At present, average levels of fecal coliform in the Mattabesset River range from 278–1039 col/100mL. In contrast, monthly monitoring records during the summers of 1946–1949 showed consistent concentrations of fecal coliform above 24,000 colonies/100mL, reaching as high as 200,000 col/100mL during the summer of 1949 (CT Department of Health, 1946–1949). Similar bacterial concentrations (coliform ≥ 20,000 col/100mL) were recorded in the river between 1967 and 1968. These numbers contrast sharply with those recorded after 1968, when the Mattabassett Sewer Authority came into existence. Almost immediately after the Mattabassett Sewer Authority began treating sewage from the Mattabesset River Watershed, coliform levels dropped to as low as 2400 col/100mL, and remained below 20,000 col/100mL in 80% of the samples taken between 1969 and 1970 (CT DEP 1967–1973).

In only a few years, the Mattabesset River was restored from a virtual sewer drain to its present condition as a valuable water resource. Such a drastic improvement in water quality shows that there is still hope of addressing the current water quality issues in the Mattabesset River, even if nonpoint source pollution is more difficult to eradicate than point source pollution.

> **"In the early 1960s the Mattabesset River ran grey and the smell was so bad some days it 'bout knocked you over. When the sewer District went on line in 1968 it took about three years before the fish came back and the river ran blue again."**
>
> —Long Time Mattabesset River Resident



Photo—Tom Ladny

Turbid water from the Mattabesset River enters the Connecticut River after a large storm event. This photo was taken from the Portland bridge looking downstream of confluence.

Wetlands and Watercourses

One component of restoring the water quality of a river involves preserving wetland areas and other natural buffer zones between the river and developed areas. Wetlands and buffer zones help to preserve water quality by providing infiltration areas for otherwise direct urban runoff, thus decreasing stream bank erosion and filtering out certain pollutants before they enter the river.

Adopted in 1972, Connecticut's Inland Wetlands and Watercourses Act has encouraged the preservation of wetlands and buffer zones by giving the DEP and municipal authorities jurisdiction to regulate construction surrounding wetlands and watercourses. All municipalities in the Mattabesset River Watershed require permitting of regulated activities within wetlands under section 22a-36–22a-45 of the Connecticut General Statutes. Some towns require specific buffer zones adjacent to wetlands and watercourses while others determine setback requirements on a case by case basis (Table 9).

At present, 1629.2 acres of wetlands exist within the Mattabesset River Watershed, including 1621.2 acres of forested wetland and 8.0 acres of unforested wetland (Civco, D). Cromwell Meadows is the largest wetland within the watershed, and covers over 600 acres at the confluence of the Mattabesset and Coginchaug rivers (Fine, 1971). Recent physical surveys conducted along the Mattabesset River and tributaries revealed that stream buffers of less than twenty-five (25) feet exist in many locations between watercourses and developed areas. Further, a number of lawns extend to the edge of the stream banks without allowing for growth of naturally vegetated buffer zones (Bowers & Brawerman, 1999).

Photo—Ed Pawlak

Streamside vegetation has been removed from John Hall Brook where it flows through a golf course in Berlin.

Water Supply

As of 1985 in the state of Connecticut, a supply population of about 3.2 million people averaged over 400 million gallons per day (mgd) of water use, with 75% of the water supply (296 mgd) drawn from surface water bodies and 26% of the water supply (105 mgd) drawn from ground water sources (MacBroom, 1998). Extensive suburban development in the Mattabesset River Watershed makes it inevitable that some surface water must be extracted from the watershed for residential, industrial, and commercial uses. However, excessive water withdrawal from a watershed becomes a concern if stream flow diminishes to unnaturally low levels. A low-flow river may become too shallow for fish migration, dissolved oxygen levels may decline, and pollutants may become concentrated to toxic levels.

Seven drinking water reservoirs are located within the Mattabesset River Watershed, and serve the towns of Middletown, Meriden, and New Britain (Table 5).

Table 5.

Daily Withdrawals and Capacities of Drinking Water Reservoirs in the Mattabesset River Watershed

Water Department	Reservoir	Subregional Basin	Purpose	Average Daily Withdrawal (mgd)	Capacity (million gallons)
Middletown	Mount Higby	4604 (Sawmill Bk)	Distribution	1.3	260
Meriden	Merimere	4600 (Mattabesset)	Distribution	1.5–1.8	340
	Hallmere	4600	Storage	-	128
	Kenmere	4600	Storage	-	109
New Britain	Shuttle Meadow	4602 (Willow Bk)	Distribution	6–8	1356
	Wasel	4602	Distribution	2–4	900
	Hart Ponds	4600	Storage	-	252

Hallmere Reservoir, Kenmere Reservoir, and Hart Ponds are designated as water storage sites, and are used for water supply only during drought. However, daily water withdrawal from the four distributional reservoirs in the watershed totals between 9.8–15.1 million gallons per day (mgd). The average daily withdrawal of water from the reservoirs (12.9 mgd) is equal to 27% of the average daily flow in the Mattabesset River (48.4 mgd).

Because each of these reservoirs feeds a stream that eventually drains into the Mattabesset River, increased withdrawals from these reservoirs could decrease the already low flow of the Mattabesset River, especially during droughts. Such a problem is evident in Crooked Brook in Berlin, a tributary of the Mattabesset River that frequently dries up before reaching Swede Pond as a result of withdrawals from residential water pumps (J. Creighton, pers. comm.).

Dams/Impoundments

Dammed drinking water reservoirs retain significant volumes of water within the Mattabesset River Watershed. Although these reservoirs are not always full, they could theoretically hold up to 3.3 billion gallons of water within the watershed.

In addition to the drinking water reservoirs, three additional impoundments exist along the Mattabesset River main stem. StanChem Pond, Railroad Pond, and Paper Goods Pond are located within the town of Berlin, and all were constructed for industrial purposes in the early 1900s. Railroad Pond was dammed in 1903 and supplied cooling water to a steam electric plant. Paper Goods Pond is the former site of hydroelectric power generation for Sherwood Industries, but has been out of service for over 40 years. Industrial use of Railroad and Paper Goods ponds ceased during the latter part of the 20th century, and the town of Berlin acquired the two impoundments as town property in 1976 and 1997, respectively. StanChem Pond is the only impoundment of the three that remains operational today for industrial use. At present, StanChem Inc. recirculates cooling water from their manufacturing plant through StanChem Pond (Joe Shaskis, pers. comm.). All three of the impoundments retain river water, but perhaps more importantly, the location of these dams along the main stem of the Mattabesset River makes them an impediment to fish migration.

Discharges and Wastewater Treatment

At present, only two permits are held for point source discharges into the Mattabesset River. In February 1996, the DEP issued an NPDES permit (National Pollutant Discharge Elimination System) to StanChem Inc. allowing the company to discharge non-contact cooling water into StanChem Pond at an average rate of 250,000 gallons/day and at a maximum rate of 676,800 gallons/day. The permit specifies that the temperature of the discharge must not raise the temperature of the receiving stream above 85%°F or more than 4°F above the normal temperature of the stream. StanChem is required to perform quarterly monitoring in the Pond for acute toxicity of discharge waters.

The Water Management Bureau of the DEP holds the only other NPDES permit for a point source discharge to the Mattabesset River. For the purpose of improving fisheries habitat and recreational boating, the DEP has undertaken the project of dredging Silver Lake, a former peat bog on the border of Berlin and Meriden that previously had been dammed and converted into a lake. The permit allows DEP to discharge an average of 2,400,000 gallons/day and a maximum of 4,800,000 gallons/day of dredge waters out of Silver Lake, which feeds Belcher Brook. Issued in 1995, this discharge permit expires in February 2000.

As mentioned above, the construction of sewage treatment facilities such as the Mattabassett Sewer Authority (est. 1968) has reduced greatly the volume of sewage discharge to the Mattabesset River. The expansion of sewer connections has also decreased the number of septic systems within the watershed municipalities (Table 6).

Although the construction of sewer lines has decreased the volume of sewage that flows into the Mattabesset River, the inflow of sewage to the river has not been eliminated. Failing sewage infrastructure and illegal hook-ups to sanitary and storm sewer lines can cause leaks in the pipes, as well as overflows during high flow events.

An aging sewer system and recent failures of sewer lines has forced New Britain to

Table 6.

Statistics on Sewer Connections in Mattabesset Watershed Towns*

Sewer District	Volume Treated / Discharge Loc.	Municipality	Sewered Population		Unsewered Population	
			#	%	#	%
Mattabassett District Sewer Authority	19mgd / Connecticut River	Berlin	11,300	75%	3,820	25%
		Cromwell	4,700	59%	3,300	41%
		Middletown	4,635	35%	8,660	65%
		New Britain	75,622	100%	0	0%
Middletown Sewer Dept.	3.5mgd / Connecticut River	Middletown	18,120	60%	12,080	40%
Metropolitan District Sewer	9mgd / Connecticut River	Newington	26,765	95%	1,410	5%
Meriden Sewage Treatment Plant	8.9mgd/ Quinnipiac River	Meriden	50,785	~90%	5,640	~10%

* Note: Table 6 does not include expansion of sewer connections in recent years.

evaluate the health of its entire sanitary sewer system. In 1996, the city carried out a Phase I study to pinpoint segments of the collection system to be investigated under a Phase II Sewer System Evaluation Survey (SSES). Eight (8) of the eleven (11) segments highlighted for the Phase II inflow study, and six (6) of the fourteen (14) segments highlighted for Phase II infiltration study are located within the Mattabesset watershed (Maguire Group, 1998). New Britain completed its Phase II SSES in 1998. At present, the city is negotiating a contract with Maguire Group, for a five-year, $10 million sewer construction and remediation project, which is expected to begin in April 2000 (John Thiesse, pers. comm).

On-going Pollution Clean-up

Pollution within the Mattabesset River watershed threatens community drinking water supplies as well as the health of fish and wildlife resources within the watershed. It is not necessary to discharge pollutants directly into a water body in order to contaminate the water body. Illegal waste disposal by manufacturers and industries, and improper use and disposal of household products allow harmful chemicals such as oil, pesticides, herbicides, PCBs, and solvents to infiltrate into groundwater or to be carried away with runoff during storm events. In either case, the contaminants eventually end up in the lakes and rivers within the watershed.

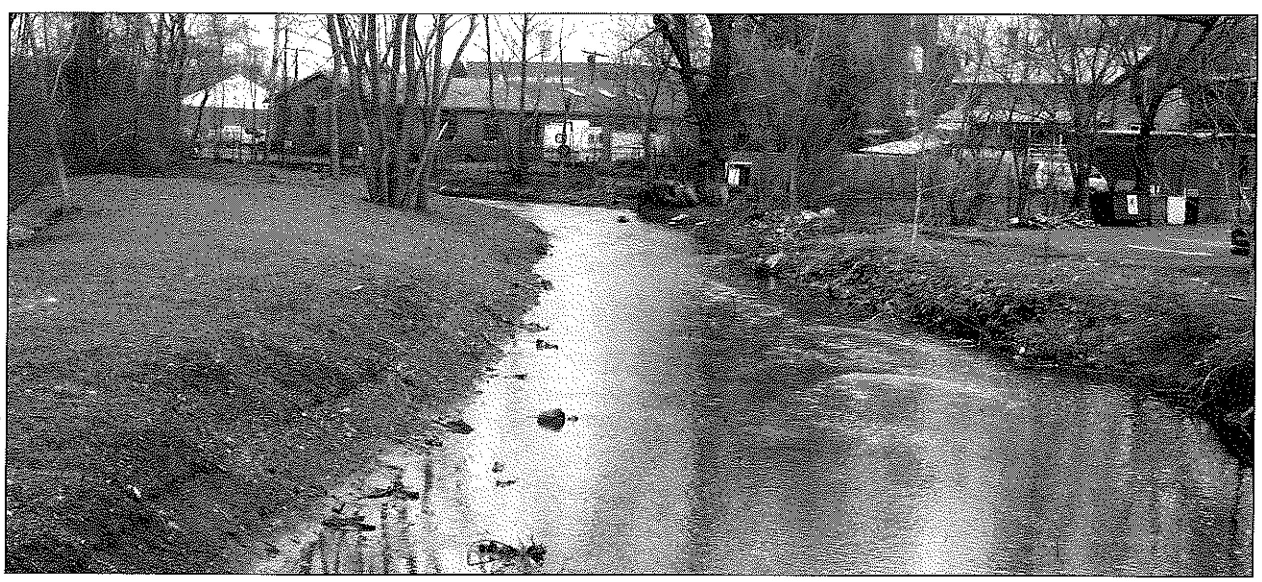
Through government programs such as CERCLA (Comprehensive Environmental Response, Compensation, and Liability Act, otherwise known as "Superfund"), and the DEP Bureau of Water Management, at least twelve hazardous waste disposal sites have been identified in the Mattabesset River Watershed (CT DEP, 1999). Under the direction of state remedial programs and the Property Transfer Program, seven of the twelve sites have undergone pollution remediation treatment.

Remediation activities at these sites include (1) cleaning up solvents and metals dumped into lagoons, (2) excavating and removing illegally buried waste drums, (3) conducting groundwater studies to minimize the contamination from waste spills, (4) capping and containing landfills, and (5) eliminating discharges of acids and metals into dry wells and sewers.

In addition to industrial waste problems, everyday incidents such as oil and gas leaks from cars, littering, spraying lawn and garden pesticides, or allowing car-wash soap to run into storm drains contribute to the contamination of our water resources. The Middlesex County Soil and Water Conservation District and the Mattabesset River Watershed Association have held public outreach activities such as River Week and a storm drain stenciling project with hopes of educating the community on ways to decrease pollution and maintain a healthier watershed.

In 1998, community volunteers for the Connecticut River Watch Program identified several areas requiring clean-up or remediation activities along watershed streams. Volunteers conducted physical surveys on 23 stream segments in the watershed. A list of degraded areas and sites indicating potential pollution sources was compiled from the survey results (Bowers & Brawerman, 1999). The more general findings of the stream walk surveys are listed below.

- Stream buffers of less than twenty-five (25) feet exist in many locations due to adjacent development.
- Suburban development is the most commonly sited land use in areas adjacent to streams, with some forest, agriculture and commercial/industrial.
- Lawns are kept right up to the edge of streams in many areas, and yard waste was found in and near the streams.
- Stream banks were eroding in many locations.
- Algae growth in streams is prevalent.
- Stormwater discharge pipes were noted often as impairments.



Photo—Ann Hadley

Loss of streamside vegetation and nearby development are common problems in the Mattabesset watershed.

Land Use

Land use patterns and zoning determine the image of a town—how much forested upland and open space is preserved; the layout of neighborhoods, commercial areas, and industrial areas; and quality of life issues such as traffic flow, noise, and air pollution.

Land use planning has a direct effect on the amount of nonpoint source pollution reaching the streams and water bodies within a watershed. Whether a parking lot is constructed directly on the border of a stream, or with grassland or vegetated buffer zones between the lot and the stream, will affect the concentrations of automobile gas and oil reaching the stream.

By siting development appropriately through watershed-conscious zoning, land-use plans can help municipalities to maintain the health of their water resources. One difficulty in formulating a watershed-friendly land use plan is the fact that several towns may exist within one watershed. Ideally, all watershed towns should convene as a single planning unit despite corporate boundaries.

We must traverse the corporate boundaries of ten municipalities and three counties in order to consider the entire Mattabesset River Watershed. The watershed also lies within the jurisdiction of four regional planning districts, and three county conservation districts (Table 7). Some municipalities contribute larger areas to the watershed than others, but each has a stake in shaping watershed development.

Table 7.

Jurisdictions of Regional Planning Districts and Conservation Districts

Town	% of town area in watershed	Regional Planning District	County & Conservation District
Berlin	97.5	Central	Hartford
Cromwell	65.4	Mid State	Middlesex
Meriden	9.1	South Central	New Haven
Middlefield	11.0	Mid State	Middlesex
Middletown	33.2	Mid State	Middlesex
New Britain	37.3	Central	Hartford
Newington	33.1	Capitol	Hartford
Plainville	3.6	Central	Hartford
Rocky Hill	33.7	Capitol	Hartford
Southington	8.1	Central	Hartford

Land Use Regulation

Municipal land use regulations and plans of conservation and development demonstrate a town's current view of how it should be developed, including what type of development (i.e. residential, commercial) and where it can occur. Land use commissions (i.e. planning & zoning and inland wetlands) are established in each municipality to enforce compliance with the town's building codes, zoning and wetland regulations, and other town ordinances. Towns are required by state statute to update their plans of conservation and development every 10 years.

Table 8 shows the dates of publication or enactment of land use regulation documents for each municipality in the Mattabesset River Watershed. Contained within these documents are the municipal regulations for wetlands & watercourses buffer zones, stormwater management, and erosion & sedimentation control. Each of these regulations affects stormwater runoff and hydrologic conditions within the watershed.

Table 8.

Municipal Regulations: Dates published or enacted*

Municipality	Plan of Development	Zoning regulations	Wetlands & watercourses	Floodplain Management	Subdivision regulations
Berlin	1992	1950; 1997	1990	1977; 1982	1949; 1995
Cromwell	1994	1974; 1998	1988; 1994	See zoning regulations	1954; 1994
Meriden	1985; 1989	1927; 1998	1975; 1998	N/A	1950; 1988
Middlefield	1978	1998	1998	See zoning regulations	1976; 1992
Middletown	1991; 1997[1]	1992; 1998	1997	See zoning and subdivision regulations	1992
New Britain	1984	1967; 1999	1989; 1999	1998	1968; 1993
Newington	1996	1929; 1998	1991	See zoning regulations	1940
Rocky Hill	1985; 1987	1988; 1999	1989; 1999	1980	1979; 1986
Southington	1991	1957; 1999	1974; 1999	See plan of development & zoning regulations	1956; 1999

* Where there are two dates, the first indicates date enacted; the second, amended portions.

1 Individual chapters and amendments enacted in 1989, 1991 & 1997. Two publications reviewed: "Basic Information 1997" (Pub. 1997) and "Guiding the Future: Plan of Development for the Year 2000" (Pub. 1991)

Wetlands & Watercourses Regulation

Regulatory review areas between developments and wetlands or stream corridors are important for maintaining water quality, as well as flood control, habitat and visual buffers. A regulatory review area is that area of land between the boundary of a wetland or watercourse and a specified distance within which the town requires a permit for any activity that may occur in that area. Wetland and watercourse regulations vary greatly among towns. Some towns require a 100-foot review area for permits while other towns require no specific review zone (Table 9). The town of Rocky Hill has recently increased their review area from 50 feet to 100 feet.

Table 9.

Inland Wetland Regulations & Regulatory Review Area Requirements

Municipality	General Wetlands & Watercourses Setback Requirements	Other Regulation Requirements	
		Vegetative Buffer	*Buffer free of Structures*
Berlin	No specific Review area	100′ For Open Space Subdivision & Design Open Space Development Only	200′ For Open Space Subdivsion & Design Open Space Development Only
Cromwell	50′		
Meriden	50′		
Middlefield	Within 100′ requires permit		
Middletown	50′	100′ required for watercourses & wetlands of public water supply.	
New Britain	No Specific Review area		
Newington	100′	50′	50′ for principal buildings
Rocky Hill	100′		
Southington		20–50′	

Stormwater Management Regulation

Construction of buildings, parking lots, roads, and bridges changes the hydrology of an area. These developments increase water velocity and volume of runoff–often with extraordinary effects on peak discharge rates, downstream channel degradation, habitat loss, changes in water temperature, increased erosion and sedimentation, and contamination of water resources from polluted runoff.

In the Mattabesset River Watershed, all municipalities require stormwater drainage profiles to be submitted as part of their Zoning Regulations. However, none of the watershed towns outline specific provisions for managing increases in stormwater runoff after a site is developed (Table 10). Reassessing and implementing more complete stormwater management regulations could be a simple means of reducing polluted runoff in the Mattabesset Watershed.

Table 10.

Stormwater Management Requirements

Town	Requirements	Basis for Requirements
Berlin	Drainage system based on 100-year flood runoff in fully developed watershed.	25-year design storm
Cromwell	On site detention of the 50-year storm for developments over 5 acres. Design must consider to groundwater recharge.	Pipe design based on 10-year storm
Meriden	Drainage must accommodate the 10-year storm. Minimum 25-year storm design for watercourses or trunk stormwater sewers.	Site plans must include 10 and 25- year design storm info.
Middlefield	No increase allowed in peak flow of 2-, 10-, and 100-year storms. Stormwater detention volume for 100 year storm is required.	Conservation Rural Districts 1 or 2 are not allowed to increase peak runoff to any wetland or watercourse outside the District. Same requirements for subdivision.
Middletown	Runoff rate outside the subdivision must not exceed previous runoff.Drainage designs based on maximum development of watershed. Drainage designs for watersheds over 1 sq. mile based on 100-year storm. Storm detention based on 50 year storm.	
New Britain	Site plans and Permit Applications require stormwater facilities.	
Newington	10-year design storm minimum.	
Rocky Hill	Specific storm drainage requirements outlined. No detention or volume requirements specified	
Southington	Drainage systems must be designed to handle drainage from subdivision & future subdivisions upgradient. Detention basins store minimum of 25-year storm. All development is required to meet ZIRO requirements (zero increase in runoff). Employment of bio-filter ponds is required for pre-treating runoff before being discharged into detention basins.	

Erosion & Sedimentation (E&S) Control Regulation

Especially at large suburban development sites, builders excavate massive amounts of soil and remove trees and vegetation for the purpose of modifying the landscape and making construction easier. Without proper E&S control, huge influxes of sediment can flow into nearby streams during storms, even to the point of clogging the stream flow.

Numerous excavation and construction projects are presently underway in the uplands of the Mattabesset River Watershed. In order to prevent erosion of silt, sand, and debris from such sites, responsible builders or project foremen use a few simple methods of E&S control during construction activities. Building temporary structures such as silt fences creates physical barriers to sediment runoff. Further, phasing in clearing and grading activities so that only small portions of the site are cleared at any one time, and planting cleared land as soon as possible, prevent long-term exposure of bare land to the elements. Contractors must submit Erosion & Sedimentation Control Plans as part of the site application required by a town's zoning regulations, subdivision regulations, and inland wetland and watercourse regulations (Table 11).

Table 11.

Erosion & Sediment Control Regulations

Municipality	Responsible Authority	Requirements
Berlin	P&Z Commission	Zoning regs. detail requirements. Single families exempt if < 0.5 acres.
Cromwell	P&Z Commission	Any plan including subdivision requires control plan.
Meriden	Planning Commission	Control plan required over 0.5 acre, under 0.5 acre optional by comm. Single family exempt. Policy for new site plans & developments of zero increase in runoff.
Middlefield	P&Z Commission	Plan required for over 0.5 acre disturbance.
Middletown	P&Z Commission	Plan required for more than 0.5 acre disturbance.
New Britain	P&Z Commission	Plan required for over 0.5 acre disturbance.
Newington	P&Z Commission	Plan required for over 0.5 acre disturbance.
Rocky Hill	P&Z Commission	Plan required for over 0.5 acre, single family exempt & farming or nursery stock exempt.
Southington	P&Z Commission	Site plans, subdivision plans, and zoning plots plans require E&S control plan.

Impervious Surface

The conversion of farmland, forest and wetland to rooftops, roads, parking lots, and sidewalks creates a layer of impervious surface. These surfaces cannot absorb or infiltrate rainfall, and thus impervious surface is a useful indicator with which to measure the impact of land development on our waterways. Recent research has shown that the amount of impervious surface in a watershed can be used to predict how severe stream degradation will be. As little as ten-percent impervious surface in a watershed has been linked to stream degradation, with the degradation becoming more severe as impervious cover increases (Figure 9)[6].

A recent analysis of the amount of impervious surface in the Mattabesset River watershed shows 18.35% impervious surface in the watershed, a level that causes definite impacts to our streams (Table 12). Further, a build-out analysis based on current zoning indicates that impervious surfaces could reach over 50% in the near future (Veklund et al, 1998).

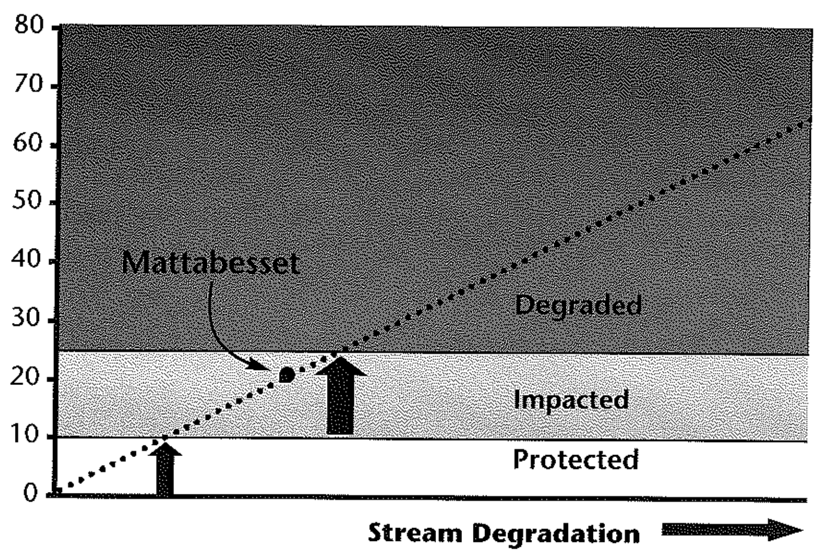
Impervious Surfaces & Runoff

Because of impervious surfaces, a typical street generates 9 times more runoff than a wooded area of the same size.

—U.S. EPA

Figure 9.

River Health & Imperviousness



6 adapted from: Schueler, 1994.

Table 12.

Land Use in Watershed

(impervious categories in bold type)

Categories	Acres	Percentage
Commercial, Industrial & Pavement	**3,793**	**8.5**
Residential & Commercial+	**6,302**	**14.1**
Rural Residential+	**343**	**0.8**
Turf & Tree Complex	4,904	11.0
Turf & Grass	1,982	4.4
Nursery Stock	51	0.1
Pasture & Hay & Grass*	4,457	10.0
Pasture & Hay / Exposed Soil*	325	0.7
Exposed Soil / Cropland*	390.4	0.9
Scrub & Shrub*	144	0.3
Deciduous and Mixed Forest*	14,274	31.9
Coniferous Forest*	5,225	11.7
Forest / Clear Cut	39	0.1
Deep Water	1,074	2.4
Shallow Water & Mud Flats	168	0.4
Non-forested Wetland	496	1.1
Forested Wetland	126	0.3
Exposed Soil and Sand	683	1.5
Total	**44,775.2**	**100%**

+ Only partially impervious

* Open Space

Adapted from: 1995, University of Connecticut, Storrs.

Residential Land Use

A significant amount of acreage within the watershed—more than 65%—is devoted to residential use (Table 13). Residential development is necessary to accommodate an increasing population. However, housing developments continue to sprout up in the Mattabesset River Watershed despite the predicted leveling-off in watershed population over the next several years (Figure 2). Devoting large tracts of land to residential zoning has several impacts on the health of the watershed. Housing development contributes impervious surface and thus increased stormwater runoff to the watershed. Moreover, chemical applications to lawns and other household disposals add pollutants to our waterways. More households also mean more demand on local water resources to provide water for drinking, bathing, cleaning, and watering lawns and gardens.

Table 13.

Zoned Land Use in Acres of Watershed*

Zoning Class	Acres
Commercial	3402
Industrial	4466
Open Space	4120
Residential 1	16598
Residential 2	9887
Roads	1622
Water	175
Total	**40,270**

*Source: Veklund et al, 1998

Open Space

Photo—Danielle Piraino

Spruce Brook, which begins in Middletown and traverses through Berlin before meeting the Mattabesset is threatened by development.

In order to mitigate the impacts of extensive residential and commercial development in the watershed, towns have acquired parcels of open space that remain protected from development. Open space includes the preserved natural areas, as well as developed recreational facilities and school grounds. The most recent list of designated open space in the Mattabesset River Watershed was compiled in 1971 (Table 15) (Fine, 1971). Unfortunately, this list is not current. Land trusts, utility companies, and municipalities have added several areas of protected open space over the last 25 years.

The 1971 open space report recommended the preservation of five critical areas in the watershed as open space (Fine, 1971). The first tract was named the "Mattabesset Wetlands," located in Berlin on the south side of the Mattabesset River south of Corbin Avenue, near Berlin Station. Today, a small portion of this area is preserved as open space by the town of Berlin, and most of the remaining area is used for agriculture. The entire area is zoned as either single family or single and two-family residential use.

The Mattabesset River itself flows through the second area, called the "Mattabesset Land and Water Conservation Area." This parcel of land is located in Berlin and is bounded by Wethersfield Road on the north, Berlin Street on the south, Beckley Road on the west and interstate 91 on the east. A small amount of land is kept as open space by the town of Berlin. The remaining open areas are used as utility right of way or open woodland and riparian areas. The unprotected sections of this parcel are zoned as "planned industrial".

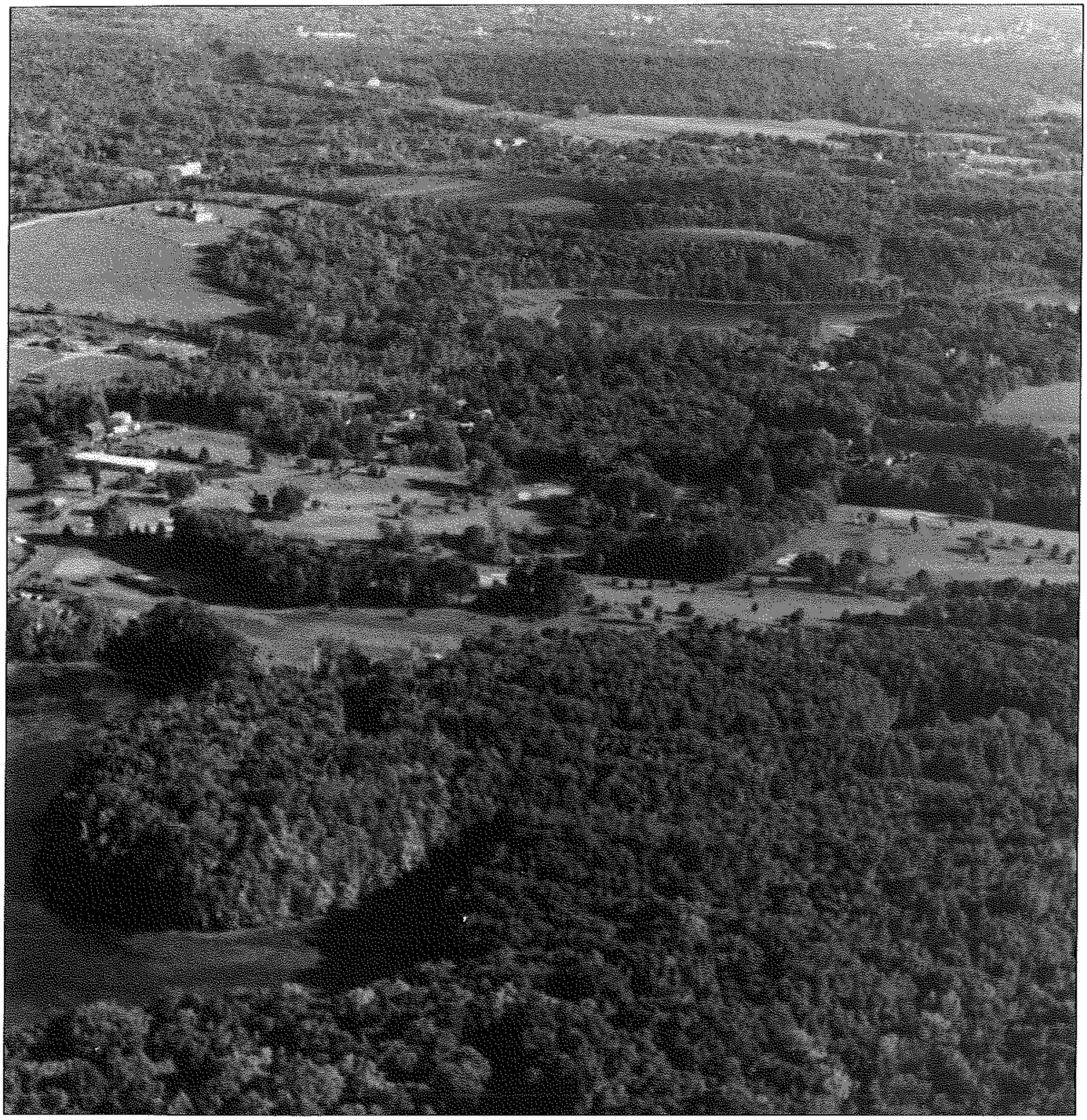
The third area is described as the Mattabesset River Linear Green Belt. It is located on both sides of the Mattabesset River, south of route 372, to the west and north of Cromwell Meadows. It was recommended for purchase as a buffer strip and "to prevent costly development in the flood plain".

The fourth recommendation for protection by easement or purchase was to add 100 acres to the 500-acres of state-owned area in Boggy Meadow, at the confluence of the Mattabesset and Coginchaug rivers.

Finally, the fifth recommended parcel consisted of a 30-acre parcel adjacent to Highland Pond, now protected by Mattabeseck Audubon Society and Middlesex Land Trust. This area was also recommended for open space preservation in the 1989 Middletown Plan of Development.

Though some land has been purchased since the Fine Report in 1971, most areas have not been preserved as open space. In all five cases, however, large areas of the recommended plots are still undeveloped and potentially available for purchase.

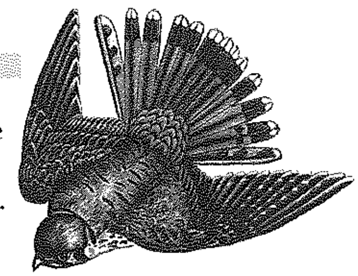
Even as remaining open areas come under increasing pressure from development, critical habitat and recreational areas are being preserved. For example, the city of Middletown has added approximately 727 acres of open space to the city since 1991. There are many organizations concerned with preserving open space in the watershed, including: the Berlin Land Trust, Middlesex Land Trust, Mattabeseck Audubon Society, The Nature Conservancy, home owner associations, utility companies, town conservation or open space commissions, and various public agencies. In more urbanized areas of the watershed, remaining undeveloped land tends to be situated in critical areas such as steep slopes and ridge tops or land adjacent to waterbodies.



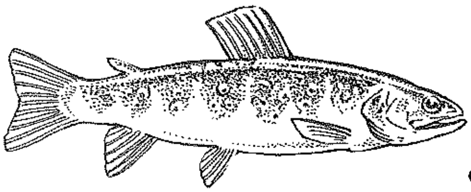
Photo—District Archives

Large tracts of forested areas in the watershed remain vulnerable to development.

Habitat



Several important and unusual natural habitats that exist within the region of the Mattabesset River Watershed include freshwater tidal wetlands, freshwater and migratory fish habitat, and traprock ridges.



Some Fish Species of the Mattabesset

Freshwater:

- Bluegill
- Brook lamprey (a state threatened species)
- Brook trout
- Brown bullhead
- Brown trout
- Chain pickerel
- Common shiner
- Fallfish
- Largemouth bass
- Pumpkinseed
- Redfin pickerel
- White sucker

Migratory:

- Alewife
- American eel
- American shad
- Blueback herring
- Sea lamprey
- White perch

(Hagstrom et al, 1990)

Freshwater Tidal Wetlands

Cromwell Meadows, also known as Round Meadow and Boggy Meadow, is a large freshwater tidal wetland located at the confluence of the Coginchaug and Mattabesset rivers. The Nature Conservancy recognizes Cromwell Meadows as a critical site in the Tidelands Area of the Connecticut River, one of the forty "last great places in the Western Hemisphere." Cromwell Meadows is also a Special Focus Area with a high priority rank within the Silvio O. Conte National Fish and Wildlife Refuge, due to its special biological values. The large wetland area provides habitat for migrating wood ducks, black ducks, teal, and nesting wood ducks. It is also an important nursery for anadromous fish species (fish that migrate from the ocean to freshwater or tidal streams) including alewife, blueback herring, American shad, gizzard shad, sea lamprey and white perch (semi-anadromous) (U.S. Fish & Wildlife Service, 1995). These fish species depend on the Mattabesset for reproduction, and travel upstream from the Connecticut River as far as the Stanchem Pond.

Fish Habitat

The Mattabesset River itself becomes an important habitat for several freshwater and migratory[7] fish species. Of particular importance is the habitat that the river provides for brook lamprey, a threatened freshwater fish species that has been surveyed within its reaches. Tributaries of the Mattabesset provide habitat for rainbow and brook trout that are stocked by the Department of Environmental Protection (CT DEP, 1999). Although the Mattabesset main stem is no longer a prime trout fishing area, populations of wild brown trout have been surveyed in the upper reaches of the river: north of Route 71A in Berlin, and at the Berlin Street crossing in Berlin (Hagstrom, pers. comm.).

Traprock Ridges

In addition to providing habitat for aquatic species, the Mattabesset River Watershed provides critical habitat for upland species. Traprock ridges form the southern and western borders of the Mattabesset River Watershed, and offer a unique collection of habitats that support several uncommon plant and animal species.

Calcium-rich soils, created by the weathering of basalt, provide the nutrients necessary to sustain plants usually associated with limestone soils (Lee, 1985).

7 Migratory fish include anadromous and catadromous species. Anadromous fish migrate from the ocean to freshwater tidal streams to spawn, and catadromous fish migrate from freshwater streams to the ocean to spawn.

Photo—Pat Rasch

Found along traprock ridges in the Mattabesset watershed, the prickly pear cactus sports gorgeous yellow blooms.

The Importance of Traprock Ridges

Lamentation and Ragged mountains in Berlin, the Hanging Hills of Meriden, and Middletown's Mount Higby are all part of a nearly continuous series of traprock ridges that extends from Branford, CT to Northampton, MA (Bell, 1985).

The nutrient-rich soils and diverse microclimates of traprock ridges are two features that allow rare species to flourish there.

Traprock ridges are also important sources of drinking water in the Mattabesset River Watershed, and feed the reservoirs located at their bases, including Hallmere, Merimere, Mt. Higby, Shuttle Meadow, and Wasel reservoirs.

Heat-loving species enjoy the warm, dry microclimates of exposed ridgetops and talus slopes. The yellow corydalis flower (*Corydalis flavula*) and the falcate orange-tip butterfly (*Anthocharis midea*), two species common to the warmer climate of the southeastern United States, have been found at the top of Mount Higby and other Connecticut ridges. The prickly pear cactus (*Opuntia humifosà*), a resident of desert environments, survives in the dry, rocky soils of the ridgetops. New England's only lizard, the five-lined skink, enjoys the dry environment of the talus slopes. Rare amphibians flourish on the moist eastern slopes of the ridges. The state-listed box turtle and marbled, spotted, and red-backed salamanders abound in this environment (Lee, 1985).

The traprock ridge habitats have been threatened in recent years by the spread of housing developments. In 1995, the state of Connecticut passed legislation allowing towns to restrict development on ridges. Within the Mattabesset River Watershed, Berlin, Meriden, and Middlefield passed new regulations that prohibit development within 150 feet of ridges. The City of Middletown also tried to pass similar regulations, but without success.

Conclusion

This report has outlined the state of the Mattabesset River Watershed in a general sense. Beyond the scope of this report, the stakeholders who live and work within the watershed will decide which topics require further investigation, and which actions will be taken to determine the future of the Mattabesset River Watershed.

Table 15.

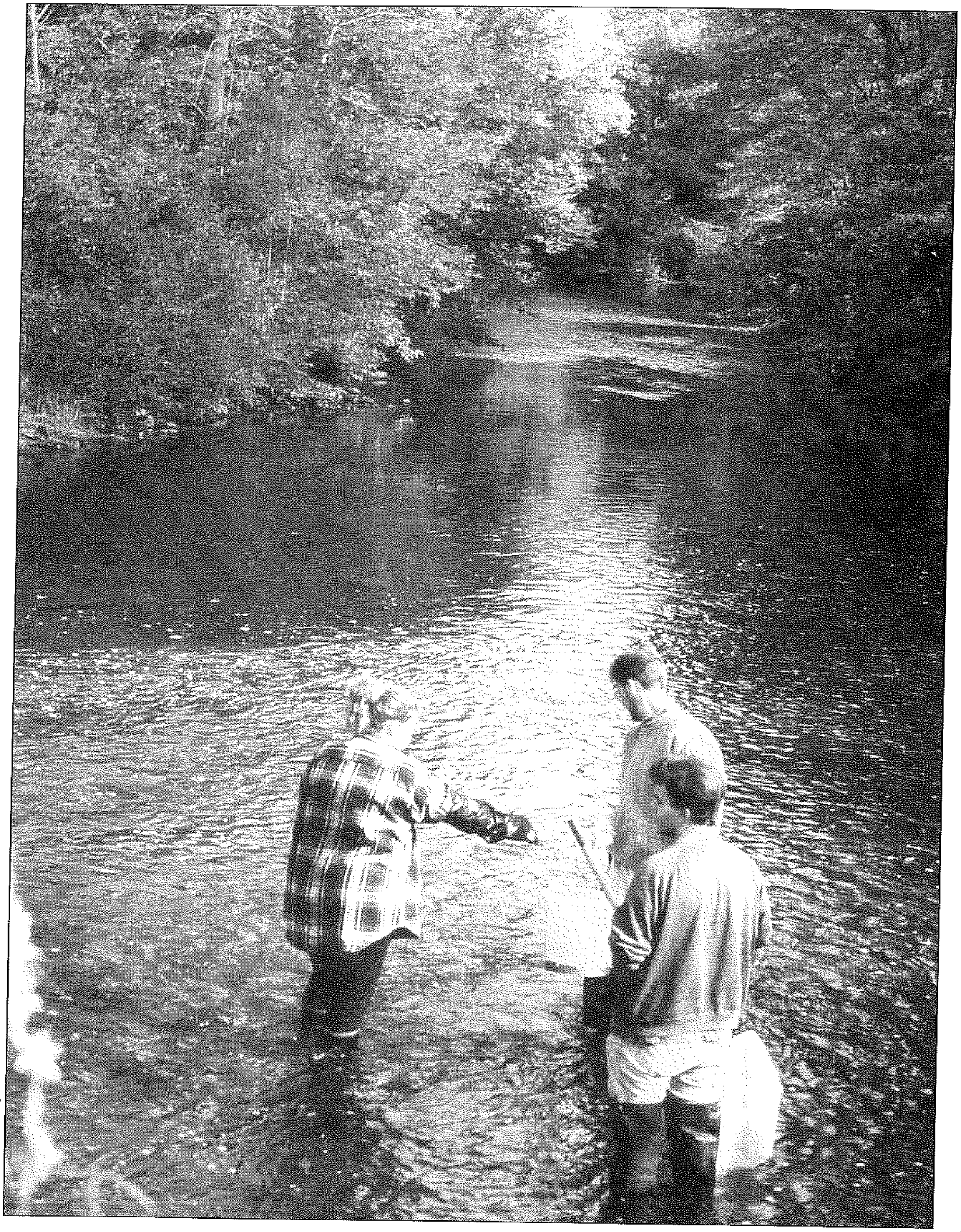
Existing Open Space in the Mattabesset River Watershed

Name	Town	Acres	Facilities
West Peak State Park	Berlin	35	A, L, M
Merimere Reservoir	Berlin/Meriden	50	B, E
Hallmere Reservoir	Berlin	20	B, E
Kenmere Reservoir	Berlin	20	B, E
Kensington Fish Hatchery	Berlin	41	B
Silver Lake	Berlin/Meriden	150	A, G, I
Lamentation Mountain State Park	Berlin/Meriden	48	A, M
North Brook Well Site	Berlin	8	C
Timberline Golf Course	Berlin	338	B, Q
Hart Ponds	Berlin	100	B, E
Ragged Mt. Memorial Reserve	Berlin	553	B, L, N
Wasel Reservoir	Berlin/Southington	103	B, E
Shuttle Meadow Reservoir	Southington	205	B, E
New Britain Water Company Site	New Britain/Southington	143	B
Shuttle Meadow Country Club	New Britain/Berlin	338	C, I, P, Q
Walnut Hill Park	New Britain	89	B, O
Martha Hart Park	New Britain	38	B, O, P, R
Willow Brook Park	New Britain/Berlin	87	B, H, O, T
Hungerford Park	Berlin	85	B, N, O
Paper Goods Pond	Berlin	20	B, I
Railroad Pond	Berlin	15	B, I
Brickyard Ponds	Berlin	126	C, I
Willow Brook Site	Berlin	40	C
Patterson School	Newington	73	B, O
Webster Brook Site	Newington	5	B
Webster Park	Berlin	52	B, J
Berlin Fair	Berlin	120	C, R
Middletown Water Company Site	Middletown/Middlefield	1000	B
Mt. Higby Reservoir	Middletown/Middlefield	122	B, E
Van Buren Moody School	Middletown	34	B, O
Westfield Falls	Middletown	4	B, I, M
Camp Poplar	Middletown	18	C, H, O
Cromwell Meadows	Middletown/Cromwell	500	A, D, K

Facilities

A State Owned
B Municipally Owned
C Privately Owned
D Wetlands
E Water Supply
F Fish Hatchery
G Boating
H Swimming
I Fishing
J Camping
K Hunting
L Hiking
M Picnicking
N Riding
O Playfields
P Tennis
Q Golf Course
R Winter Sports

The Plan



Photo—Ann Hadley

Introduction

The management plan is a culmination of efforts by the District, municipalities, landowners, affected businesses, federal and state environmental agencies, and environmental organizations in the watershed. The planning process for the development of the management plan began in July 1999. Project oversight was delegated to the working subcommittees and the Steering Committee which were formed in September 1999.

Plan Implementation

The Mattabesset Management Plan is a partnership among local governments, businesses, state and federal regulatory agencies, and environmental organizations throughout the watershed. Oversight and coordination of the plan will be administered by the Steering Committee which is composed of the four subcommittee chairs, four municipal representatives, four state and federal agency representatives, two non-profit representatives, two landowners, one open seat, and a seat for the Middlesex County Soil and Water Conservation District as convener.

The plan has been organized into three phases. The beginning phase (Phase I), scheduled for implementation in the first 18 months, will focus on on completing high profile, in-progress projects with an emphasis on community outreach and education.

In Phase II of the plan we will build on our successes in Phase I and begin to implement projects that will draw on the resources of the local, state, and federal agencies. Phase II is scheduled for implementation in years 2 to 5.

Phase III of the plan includes the long-term projects that will rest on the success of Phase I and Phase II implementation. Phase III is scheduled for implementation in years 5 to 10.

The Mattabesset River Stakeholder Group recognizes that this plan and its implementation are a significant beginning to the management of development, redevelopment, and individual decisions about land-use and water resources management in the watershed. We also recognize the need to accommodate growth in the Mattabesset watershed while protecting this sensitive natural resource.

Photo—Gina Amoroso / *The Middletown Press*

Young River Watch volunteers assist in water quality monitoring of the river.

GOAL #1 Create awareness among watershed residents of the network of rivers and streams that comprise the Mattabesset River Watershed.

A critical task for implementing the management plan is to first create awareness about the value and importance of the watershed. Even the best-designed watershed plan will founder without sufficient community support and, in turn, community support is often necessary for official government support.

Phase I

Objective:

Utilize public resources and facilities to educate citizens of all ages about the basics of watershed science, the flora and fauna that live in different watershed habitats, and the benefits of a clean and healthy watershed.

Supporting Tasks:

1. Provide information to residents about the Mattabesset watershed using library displays that show the entire watershed, but focus on areas of the River and the tributary streams that are within their municipality.
2. Install signs that label the River and tributaries at all road crossings.

Objective:

Sponsor recreational opportunities for the general public in the watershed that draw attention to the watershed's river, streams, and the land within.

Supporting Tasks:

1. During the spring and summer, sponsor regular canoe trips down the Mattabesset for the public.
2. Sponsor watershed upland hikes to bring citizens into the head-water areas of the watershed.
3. Sponsor clean-ups along the River and tributary streams.

What is a watershed anyway?

A watershed is an area of land that, due to its natural drainage pattern, collects precipitation and deposits it into specific marshes, streams, rivers or lakes.

Often called a drainage basin or hydrologic unit, a watershed can cover a large multi-state area like the Connecticut River watershed, which, in turn, is composed of smaller areas like the watershed of the Mattabesset. The Mattabesset, in turn, is composed of even smaller watersheds like Willow Brook watershed in New Britain and Coles Brook watershed in Cromwell.

Objective:

Use mass media channels to distribute information throughout the watershed.

Supporting Tasks:

1. Disseminate information via the Mattabesset River Watershed Association website (www.crosswinds.net/~mrwa).
2. Cultivate local newspaper contacts that will readily pick up a story pertaining to the Mattabesset River Watershed.

3. Explore communication channels in addition to newspapers (i.e. television, radio, school programs, videos, etc.) for distribution of information about the Mattabesset River watershed and the management plan.

Phase II

Objective:

Utilize public resources and facilities to educate citizens of all ages about the basics of watershed science, the flora and fauna that exist within watershed habitats, and the benefits of a clean and healthy watershed.

Supporting Tasks:

1. Encourage high schools and middle schools in the watershed to incorporate DEP's Project SEARCH into curriculum. (This CT DEP hands-on educational program is already being used at Berlin High School and New Britain High School).
2. Sponsor presentations within elementary schools that entertain and educate kids about watershed functions and activities using Project WET or similar programs.
3. Sponsor public presentations about Mattabesset River Watershed flora and fauna in conjunction with town conservation commissions and other groups.

Objective:

Sponsor recreational opportunities for the general public within the watershed that draw attention to the watershed's river, streams, and the land within.

Supporting Tasks:

1. Sponsor a contest to name those streams in the watershed that are not named.
2. Sponsor bike tours of 5, 10, 25, and 50 miles throughout the watershed that integrate watershed information. *(These events could double as fundraisers.)*
3. Sponsor on-the-river recreational events at the large condominium complexes in Middletown and Cromwell.

Photo— Ann Hadley

Town of Cromwell Public Works Department helps remove old cars from the river. The cars were donated to Bishop's auto shop on Rt. 372 in Cromwell.

Objective:

Use mass media channels to distribute information throughout the watershed.

Supporting Tasks:

1. Produce a documentary video about the Mattabesset River that can be shown on local television stations.

Phase III

Objective:

Use mass media channels to distribute information throughout the watershed.

Supporting Tasks:

1. Continue to disseminate information via the Mattabesset River Watershed Association website (www.crosswinds.net/~mrwa)
2. Continue to cultivate local newspaper contacts with regular press releases and invitations to all watershed events.

Photo—Ann Hadley

Middletown Boy Scout troop members stencil storm drains with "Don't Dump Drains to River" reminder.

GOAL #2 Educate the community about the link between land use and water quality.

How we use and develop the land directly affects the health of our streams and the surrounding habitats. Everyday activities—constructing roads and buildings, using fertilizers, herbicides and pesticides on farmland and lawns, walking our dogs, driving to work, washing cars—cause pollution that may eventually end up our streams. Fortunately, simple changes in how we carry out these activities can reduce the amount of pollution that we leave on the landscape, and greatly improve water quality in our rivers and streams.

Phase I

Objective:

Inform the watershed community about land use practices that reduce impacts to streams.

Supporting Tasks:

1. Target outreach and education to all streamside property owners about the importance of maintaining and restoring riparian buffers.

Phase II

Objective:

Inform the watershed community about land use practices that reduce impacts to streams.

Supporting Tasks:

1. Educate citizens about the harmful effects of disposing of wastes into storm drains.
2. Educate citizens about the detrimental effects of excessive use of fertilizers, pesticides and herbicides on their lawns and gardens, and how best to apply them to minimize harm.
3. Educate citizens about the importance of timely street sweeping. Encourage citizens to request sweeping records from their town halls.
4. Educate citizens about the need for buffer regulations to protect streams in their towns. Send mailings with petitions that citizens can send to town officials to encourage establishing or enlarging buffers along streams.
5. Educate citizens about the harmful effects of impervious surface development to the River, streams and riparian areas.

Objective:

Provide education to municipal officials about stormwater and flood management.

Supporting Tasks:

1. Provide education and technical assistance to municipalities, CT DOT, and contractors in support of the Phase II Storm Water Rule.
2. Hold workshops for municipal officials on innovative stormwater management techniques and ground water recharge.
3. Hold workshops for local flood control officials with the goal of adopting a coordinated drainage standard.
4. Incorporate the Mattabesset River watershed community into the CT DEP's municipal flood plain management and mitigation workshops.
5. Educate watershed municipalities on ways to reduce flood insurance rates for their residents through the Community Rating System (i.e. outreach projects, keeping flood-related documents in the public libraries, implementing good storm water management, performing drainage system maintenance, and seeking open space preservation).

Phase III

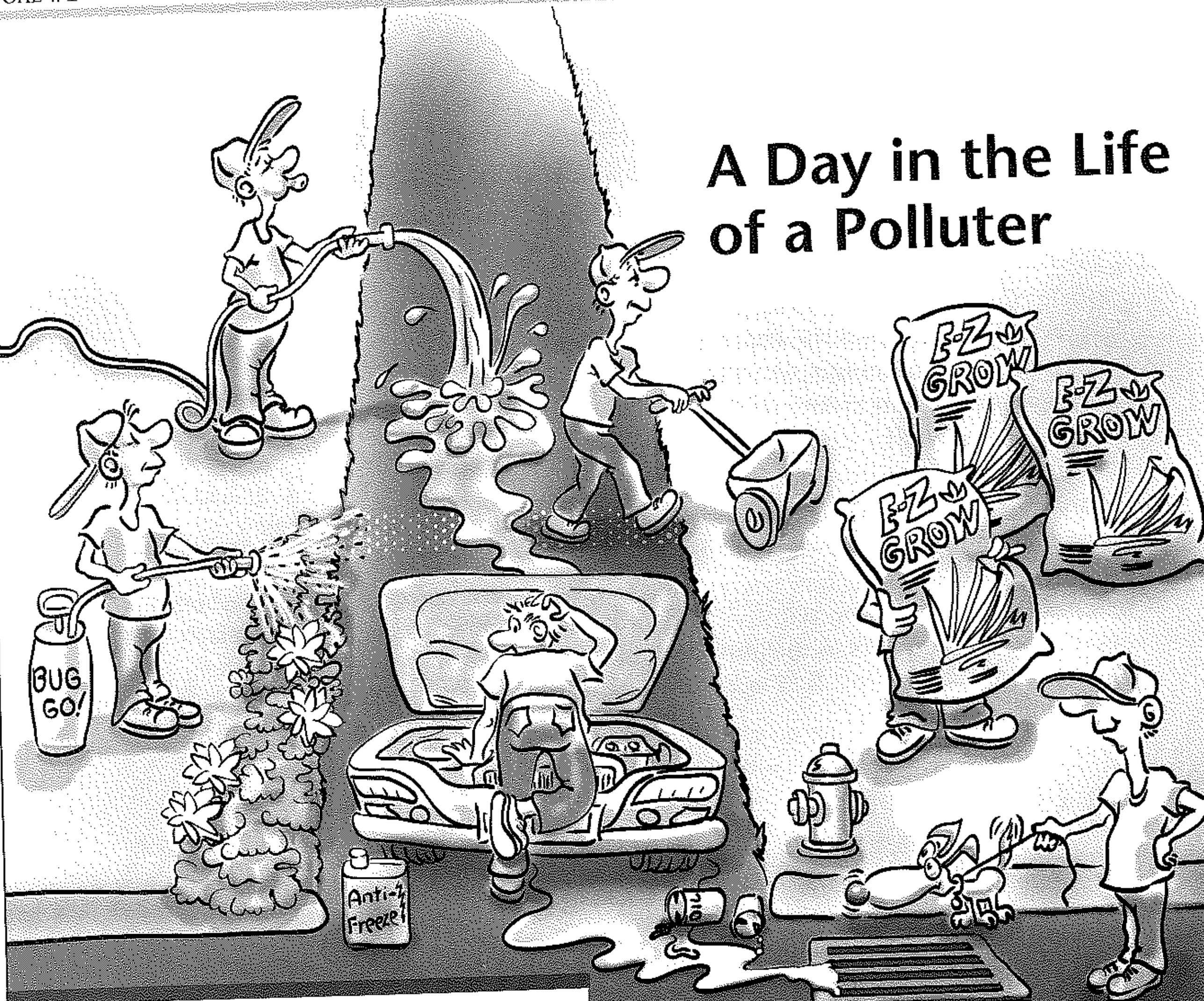
Objective:

Inform the watershed community about land use practices that reduce impacts to streams.

Supporting Tasks:

1. Continue to educate residents, land use boards and commissions, developers, and other relevant groups about the value and importance of watershed stewardship.
2. Educate residents, land use boards and commissions, developers, and other relevant groups about the value and importance of wetlands.
3. Inform residents, land use boards and commissions, developers, and other relevant groups about the detrimental effects of non-native invasive species.
4. Educate developers of the importance of establishing stream buffers.
5. Educate towns on alternative building practices such as conservation developments.
6. Educate landowners, developers, and municipal officials about the benefits of energy efficient homes and alternative building materials, and provide a resource list of environmentally responsible building alternatives.
7. Educate towns about the benefits of alternative waste water systems, gray water and septic systems.

A Day in the Life of a Polluter



1. Test your soil to determine the correct amount of fertilizers and keep fertilizer off paved areas so that it doesn't wash nutrients into streets and storm drains. Landscape with native plants that support native wildlife and require less water and fewer pesticides.

2. Select porous materials like gravel for walkways and driveways to increase infiltration and decrease surface runoff.

3. Never pour toxic household chemicals down the drain or on the ground. Take them to your local hazardous-waste collection center.

4. Clean up after pets to avoid runoff of nutrients and pathogens into streams and rivers.

5. Recycle used oil and antifreeze at your local service stations. Schedule regular tuneups for your car to reduce deposits of toxic pollutants.

Illustration—Pat Rasch

GOAL #3 Promote sustainable land use practices in the Mattabesset River Watershed.

Phase I

Objective:

Facilitate appropriate recreational uses along the Mattabesset River and its tributaries.

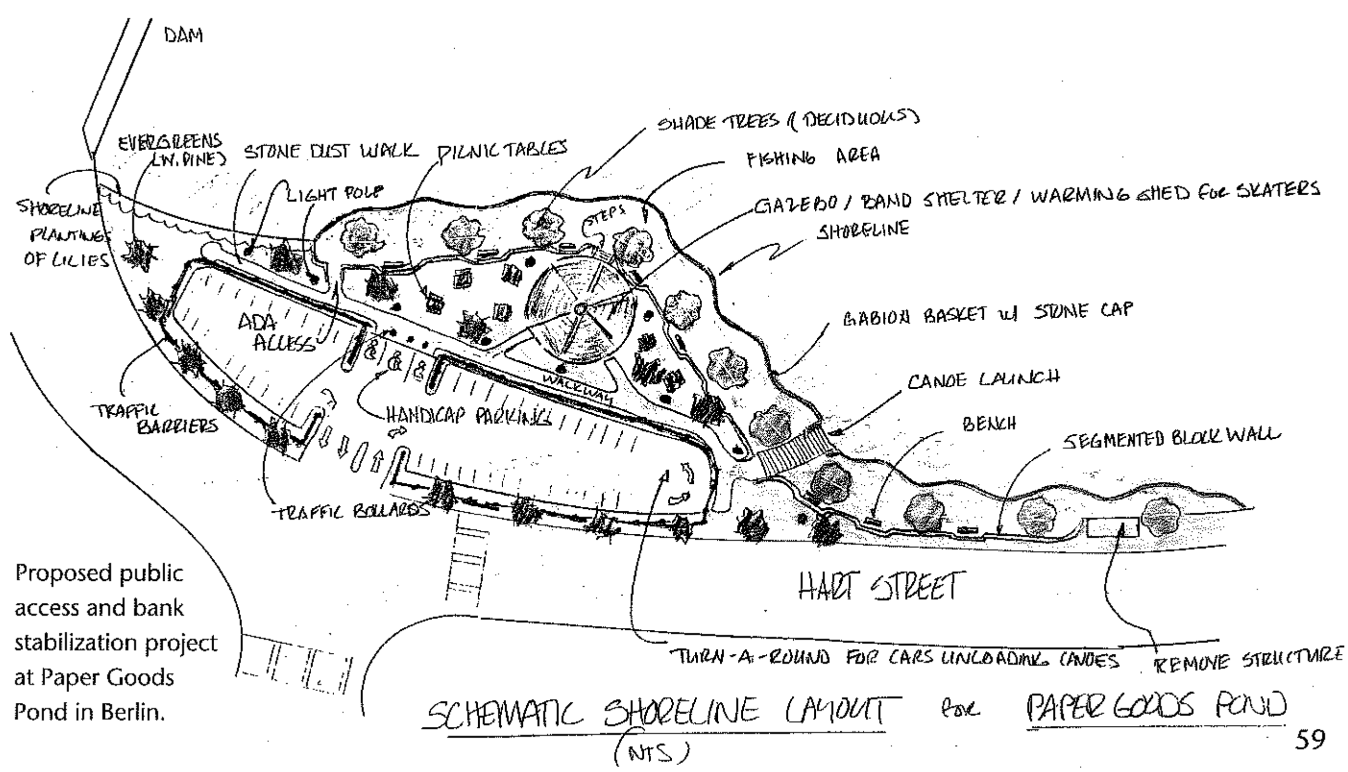
Increasing opportunities for appropriate public access and recreation in the Mattabesset will make it easier for the residents to enjoy the river, and will promote community stewardship of our natural resources.

Supporting Tasks:

1. Promote the Berlin Paper Goods Pond bank stabilization, shoreline trail and canoe launch project.
2. Promote the Cromwell Canoe Launch and River Guide project.
3. Develop an inventory of public access areas (existing and potential) with map, location, size of the area, ownership, and potential active and passive uses (list should not impact sensitive areas). Identify additional appropriate areas for recreational use along rivers and streams.
4. Work with State legislators representing the watershed to amend Section 12-107(e) of the CGS (classification of land as open space lands) to provide towns and the state with the right of first refusal for properties designated as open space.

In March 2000, the Cromwell Town Council approved a license agreement with the owners of Sawmill Pub, initiating the first public access point on the Mattabesset River.

Cromwell's First Selectman Stanley Terry was quoted by the Hartford Courant "if you stop and think about it, it's a great recreational opportunity that may even get more people interested in expediting the cleanup of that river."



Proposed public access and bank stabilization project at Paper Goods Pond in Berlin.

Phase II

Objective:

Develop a comprehensive inventory of watershed lands to identify areas for preservation, improvement/restoration, and appropriate recreation.

The Mattabesset River Watershed hosts a wide range of land uses, including downtown areas, suburban neighborhoods, rural farmlands, forests, traprock ridges, and rich wetlands. Our natural resources can sustain a certain level of development before they begin to degrade becoming unsuitable for wildlife habitat. By creating a readily accessible inventory of land in the watershed, land planners can identify the natural resources and development potential of each area, and make informed decisions about municipal zoning, open space preservation, and recreational use.

Supporting Tasks:

1. Identify parcel size, location, ownership, and land use category utilizing a Geographic Information System (GIS) and create a database with parcel attributes.
2. Create a map showing land uses and natural resource features (overlay with existing GIS street and hydrology maps).

Objective:

Assist in the protection of open space through acquisition or other means to improve ecosystem health and to enhance aesthetics within the watershed.

Acquiring and protecting undeveloped land is an effective method for preserving critical habitat. In the Mattabesset River Watershed, natural areas that are most easily damaged by urban and suburban development include wetlands, floodplains, forests, and traprock ridges. These habitats can be protected through purchase, easements, and tax breaks.

Supporting Tasks:

1. Adopt land selection criteria (for example: high priority may be given to land closer to headwaters, land that has high biodiversity, or areas of critical habitat).
2. Using the land use inventory, identify open space lands to be protected and develop a list of prioritized land acquisitions, protection and enhancement/restoration areas.
3. Investigate the state of existing regional open space plans and determine their stage of implementation.
4. Provide landowners and towns with open space protection informational packet. For example, educate eligible property owners of the Public Act 490 program. Public Act 490 allows farms, forests, and open space lands to be taxed at a "use value" rather than the higher tax category of "market value".
5. Ensure that watershed towns' plans of conservation and development include an open space component and that the goals are consistent with the MSG Management Plan.
6. In coordination with watershed towns and local land trusts, identify and utilize existing funding mechanisms including the State Farmland Preservation Program and the State Open Space Grant Program to acquire lands.

Objective:

Encourage conservation development practices that minimize impact on natural resources.

In the face of a growing economy, land development is almost inevitable. However, alternative methods of development exist that minimize the erosion, pollution, and loss of habitat associated with development. By implementing these alternative methods of development, we can effectively support the growth needs of our community and preserve our natural environment at the same time.

Supporting Tasks:

1. Review existing regulations for environmental appropriateness, e.g. road width, impervious surfaces, curbing, sidewalks, and bicycle paths/lanes.
2. Educate towns and the public on the benefits of open space associated with developed areas.
3. Provide citizens and town planning staff with visual representations of redeveloping existing "strip mall" areas into smaller pedestrian friendly commerce villages that provide housing, retail stores, and restaurants.

Phase III

Objective:

Encourage conservation development practices that minimize impact on natural resources.

Supporting Tasks:

1. Encourage towns to promote use of existing or vacant structures for new businesses through tax incentives.
2. Modify regulations in watershed towns to incorporate stream protection requirements into regulations to promote conservation-based development (for example, encourage the reduction of impervious surfaces by modifying requirements for road width and using engineered swales instead of curbing where practical).

Photo—Stephanie Shakofsky

Using porous pavement, like this stone driveway, instead of impervious surfaces like blacktop increases infiltration and decreases runoff pollution.

GOAL #4 Restore and maintain wildlife habitat in the Mattabesset River Watershed.

Phase I

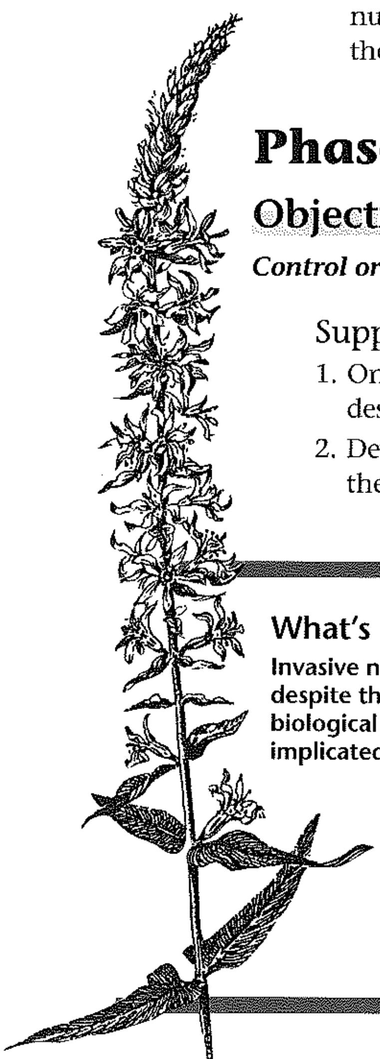
Objective:

Control or diminish the prevalence of invasive species.

Invasives are plant species that are not native to an area but, once introduced, have the ability to colonize large areas and replace the native vegetation. Invasive non-native species are a threat to natural ecosystems because they often replace native species that provide important food sources and habitat for native wildlife, thereby reducing biological diversity in the watershed.

Supporting Tasks:

1. Provide a list of invasive non-native species to appropriate groups. Encourage local nurseries and home improvement centers to offer more native species and discourage the sale of invasive non-native species.



Phase II

Objective:

Control or diminish the prevalence of invasive species.

Supporting Tasks:

1. On a subwatershed basis, identify sites degraded by invasive non-native species and design and implement specific invasive species reduction/restoration projects.
2. Develop and implement an ongoing monitoring program to measure the success of the program.

What's an invasive species?

Invasive non-native species don't usually show up on lists of major environmental problems. But despite their relative lack of public recognition, invasive species pose one of the greatest threats to biological diversity, behind habitat loss and degradation. Nationwide, non-native species have been implicated in the decline of 42% of species listed under the Endangered Species Act.

Freed from the control of the predators, parasites, and competitors found in their original habitats, invasive non-native species often spread unhindered—degrading natural communities, altering ecological processes, and threatening the survival of native plants and wildlife.

Purple loosestrife, the "purple plague" that chokes wetlands, is still sold for landscaping in many Connecticut garden centers.

Objective:

Reduce fragmentation and destruction of wildlife habitat by inappropriate land use practices.

Wildlife species require large enough tracts of land to gather food and find appropriate shelter. When roads and buildings are constructed, they often cut through the home range of an animal population. Fragmenting the land in this way often disturbs migration, hunting, and breeding patterns of animal inhabitants.

Supporting Tasks:

1. Make recommendations regarding habitat needs for general wildlife support.
2. Designate areas as wildlife sanctuaries utilizing the land use inventory.
3. Identify habitats that could support threatened and endangered species utilizing the land use inventory and Connecticut's Natural Resource Diversity Database information.

Phase III

Objective:

Control or diminish the prevalence of invasive species.

Supporting Tasks:

1. Implement specific invasive species reduction/restoration projects.

Photo—courtesy of The Nature Conservancy

A stand of *Phragmites australis* in Cromwell Meadows. Phragmites often out-competes native wetland flora.

GOAL #5 Protect wetland and watercourse areas from development and other disturbances.

Phase I

Objective:

Promote a standard regulatory review area in watershed towns to improve water quality, aquatic habitat, and riparian wildlife habitat.

Regulatory review areas are distances from the edge of wetlands and watercourses that may not be disturbed unless a special permit from the town is obtained. These regulatory review areas are important for protecting and maintaining water quality, groundwater infiltration, stream bank stability, and wildlife habitat. Establishing a minimum 100 feet review area in all watershed towns will help to prevent future degradation of our water resources.

Wetlands: Special Places

Historically considered "wastelands" to be filled in for development, today we recognize wetlands as indispensable natural environments. Many wildlife species depend on wetlands for some portion of their life cycle.

We now know that wetlands are also critical to maintaining water quality. They produce oxygen, filter pollutants, remove silts and sediments, absorb organic and inorganic chemicals, and recycle and reuse these nutrients.

Supporting Tasks:

1. Develop an information package to enable watershed towns to compare and contrast their regulatory review regulations, and to make informed decisions about the benefits of establishing a 100-foot regulatory review area adjacent to wetlands and watercourses.
2. Follow up with Inland Wetlands/Conservation Commissions to assist in the adoption of the 100-foot regulatory review area.

Phase II

Objective:

Protect intact wetland systems

Wetlands are extremely critical and sensitive areas. Wetlands protect water quality by filtering pollutants as water flows through them, and they provide essential habitat to a diverse assemblage of bird, amphibian, and insect species. Extreme caution should be used when developing the land around wetlands—even minor changes in slope of the land can change the way water flows to a wetland, causing the wetland either to dry up or to drown.

Supporting Tasks:

1. Complete a wetlands inventory for each subwatershed and develop an updated wetlands map.
2. Encourage the re-establishment, restoration, and enhancement of wetlands as part of new development or redevelopment projects.

Phase III

Objective:

Promote a standard regulatory review area in watershed towns to improve water quality, aquatic habitat and riparian wildlife habitat.

Supporting Tasks:

1. Develop riparian restoration projects at a commercial site and at a residential site that demonstrate the design, implementation, and water quality benefits of a setback or riparian buffer.

Photo—Ann Hadley

A stream bank restoration project along West Swamp Brook in Berlin incorporated coconut fiber rolls for bank stabilization.

GOAL #6 Identify, investigate, correct, and prevent pollution problems.

Phase I

Objective:

Continue water quality monitoring and assess changes in water quality.

Collecting stream flow and water quality data at regular intervals helps us to assess the present health of our streams and the environmental issues facing them, and alerts us to potential sources of water pollution. Long-term water quality monitoring is needed in order to detect changes in stream health over time.

Supporting Tasks:

1. Reinstate the United States Geological Survey (USGS) gaging station and continue the water quality monitoring program on the Mattabesset River.
2. Continue monitoring water quality in the Mattabesset River and its tributaries through the Connecticut River Watch Program (CRWP). Prioritize monitoring sites and water quality indicators for more detailed investigations of pollution problems.
3. Designate a Connecticut DEP water permits and enforcement field inspector for the Mattabesset River Watershed.

Phase II

Objective:

Continue water quality monitoring and assess changes in water quality.

Supporting Tasks:

1. Establish a technical advisory committee to interpret water quality monitoring results and design future monitoring projects to assess water quality and key issues in the Mattabesset River Watershed.
2. Initiate or continue focused monitoring projects for issues or activities of concern in the watershed. Potential projects include (a) storm-event monitoring, (b) Silver Lake and Paper Goods Pond reclamation projects, (c) construction site runoff monitoring, and (d) monitoring possible failing sewer and septic systems.
3. Initiate a stream segment adoption program to provide continuing visual monitoring of the watershed.
4. Maintain the State of the Watershed database for water quality related information collected in the watershed. Obtain relevant data and information from the Connecticut River Watch Program, Middlesex County SWCD, USGS, local Health Departments, CT DEP, and other sources.


Photo by Corey Lowenstein / *The Hartford Courant*

Connecticut River Watch lab volunteers identify macroinvertebrates from a sample taken from the Mattabesset River. Because of their sensitivity to pollution, macroinvertebrate populations are an indication of water quality.

Objective:

Continue to improve stormwater management throughout the watershed.

When it rains or snows, the water that runs off city streets, parking lots, and construction sites washes sediment, oil, grease, toxins, pathogens, and other pollutants into nearby storm drains. Once this pollution enters the sewer system, it flows—untreated—into local streams and rivers. Known as stormwater runoff, this pollution is a leading threat to public health and the environment.

Supporting Tasks:

1. CT DEP will issue a general permit for municipal separate stormwater systems (MS4s) in compliance with the NPDES Phase II Stormwater Rule, and subject all municipalities and state-owned or operated roads within the Mattabesset River Watershed to its requirements.

In 1987, amendments to the federal Clean Water Act required EPA to establish regulations for managing stormwater runoff through the National Pollutant Discharge Elimination System (NPDES). Phase I of the program, initiated in 1990, regulated municipal stormwater systems serving large populations (over 100,000), construction sites above 5 acres, and most industrial activities. On December 8, 1999, the Stormwater Phase II Rule took effect. The Phase II Rule is the next step in EPA's effort to "preserve, protect, and improve the Nation's water resources from polluted stormwater runoff" and will improve control on stormwater runoff from smaller urbanized areas and smaller construction sites.

Stormwater Runoff vs Raw Sewage (Treated and Untreated)

(all values in milligrams/liter or parts per million)

Urban Contaminant	Runoff	Raw Sewage	Treated Sewage
Total Suspended Solids	150	220	20
Total Phosphorous	0.36	8	2
Total Nitrogen	2	40	30
Lead	0.18	0.10	0.05
Copper	0.05	0.22	0.03
Zinc	0.21	0.28	0.08
Fecal Coliform/100milliliter	50,000	100,000,000	200

2. Work with watershed municipalities and the Connecticut Department of Transportation (CT DOT) to obtain permit coverage under the stormwater general permit for MS4s, which requires municipalities and other owners or operators of roads in "urbanized areas" to implement programs and practices to control polluted stormwater runoff.
3. All watershed municipalities and CT DOT will develop and implement programs and practices to control polluted stormwater runoff, components of which will include: (1) public education and outreach; (2) public participation/ involvement; (3) illicit discharge detection and elimination; (4) construction site runoff control; (5) post-construction runoff control; and (6) pollution prevention/good housekeeping.
4. Identify areas on a subwatershed basis in need of stormwater retrofits through aerial photography and ground-truthing, and prioritize the retrofits based on location in watershed, severity of the problem, stream sensitivity and hydrologic energy balances including flood prone or potential flood areas.
5. Watershed municipalities will adopt consistent stormwater drainage standards into their zoning regulations, which meet the requirements of different land use and habitat characteristics.

Objective:

Continue to improve erosion and sediment control regulations throughout the watershed.

In the Mattabesset River fine muds blanket much of the formerly rocky streambed, and during storm events, suspended sediments color the River a deep reddish-brown. Such pollution is caused by the unnatural erosion of soil from areas stripped of their vegetation. Improvements in erosion and sediment control regulations in the watershed are needed to reduce the influx of sediment to our streams, and to restore the aquatic habitats smothered by silt.

Supporting Tasks:

1. Encourage watershed municipalities to modify existing erosion and sediment control regulations to require that an erosion and sediment control specialist (provided by the developer) be responsible for each development project, based on model regulations.
2. Work with watershed towns to modify existing erosion and sediment control regulations to require construction site phasing, based on model regulations.

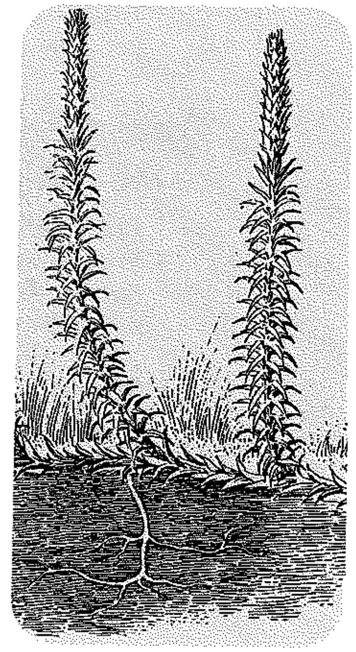
Natural Vegetation Acts as a Filter:

Vegetation absorbs the energy of falling rain.

Roots hold soil particles in place.

Vegetation helps to maintain absorptive capacity.

Vegetation slows runoff velocity and catches sediment.



Objective:

Develop a septic system maintenance program to assure the effective functioning of septic systems in the watershed.

Eight years of summertime water quality data collected by the Connecticut River Watch Program show that bacterial levels in streams of the Mattabesset River Watershed consistently exceed Connecticut's Water Quality Criteria. These chronically high bacteria levels point to failing septic systems as one possible cause of the contamination. Septic systems require periodic maintenance in order to function properly, and simple upkeep can extend the lifetimes of septic systems and dramatically reduce the input of human waste to streams.

Supporting Tasks:

1. Within each municipality, establish accurate maps of existing septic systems, including the location, size, and age of each system.
2. Conduct preliminary investigations of non-sewered areas to determine where pollution from failing septic systems is likely (e.g. visual surveys, bacteria testing in nearby streams).

Phase III

Objective:

Continue to improve stormwater management throughout the watershed.

Supporting Tasks:

1. Implement high priority stormwater retrofit projects in the watershed.

Objective:

Develop a sanitary sewage maintenance plan for the watershed.

Failing sewage infrastructure and illegal hook-ups to sanitary sewer lines can result in leaks in the pipes, as well as overflows during high flow events. Improved maintenance of sewer lines in the Mattabesset River Watershed will minimize sewage inflows to the streams and reduce bacterial contamination caused by human waste.

Supporting Tasks:

1. Within each watershed municipality, establish accurate maps of (a) the existing sanitary sewer system and (b) areas targeted for future sanitary sewer service. Maps will include the location, size, age, and construction materials of each system.
2. Encourage watershed municipalities to inspect their sewer lines through the Sewer System Evaluation Survey, and to implement the recommended corrections. (This survey is in progress in New Britain and is in the planning stages in Berlin).
3. Implement a recurring 5-year maintenance program for televising and cleaning the sanitary sewage system.
4. Purchase the equipment necessary for proper maintenance of the sewer system and provide contracts for such maintenance.
5. Conduct an assessment of capital improvement needs of all wastewater-pumping stations and develop a multi-year implementation plan.
6. Conduct an assessment of the response capabilities of the sewer system to blockage, backup into basements, overflows, and mechanical failure.
7. State and regional agencies will provide technical assistance to municipalities in support of the above tasks.

A 1997 survey of Mattabesset watershed residents showed that of 504 residents surveyed, 492 strongly felt that their town should do more to protect the quality of the river (that's 98%)!

Objective:

Develop a septic system maintenance program to assure the effective functioning of septic systems in the watershed.

Supporting Tasks:

1. Based on preliminary investigations, conduct sanitary surveys of non-sewered areas to determine the extent and severity of failing septic systems.
2. Implement corrective actions in areas of failing septic systems (for example: repair of individual systems or extension of sanitary sewers).
3. Develop and adopt an incentive-based model ordinance for septic system inspection and maintenance for watershed municipalities. Include an education program for individuals and businesses affected by the ordinance.

GOAL #7 Restore and maintain in-stream and riparian habitat to support healthy fish populations and other aquatic life.

Phase I

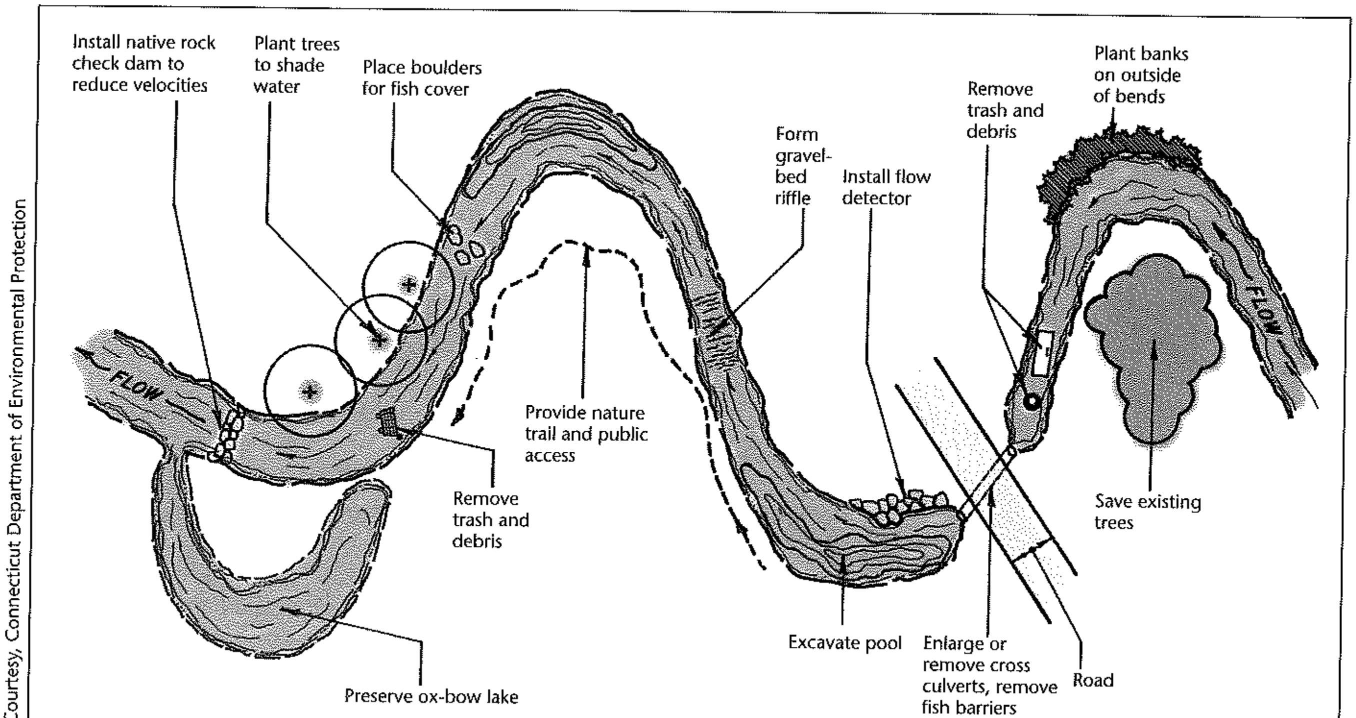
Objective:

Minimize the impacts of development on in-stream habitat.

In many areas, the Mattabesset River and tributaries have been disrupted by human activities, damaging in-stream habitat. Eroded stream banks, very low flows, loss of streamside vegetation, and unnaturally silted and sandy streambeds are among the problems that threaten aquatic life throughout the watershed. These impacts can make a stream inhospitable to certain fish species and many species of aquatic insects. An unnatural source of sand in streams is road sand. The accumulation of road sand in stream can be easily prevented through timely street sweeping, minimizing application rates, and other management practices.

Supporting Tasks:

1. Work with each watershed town to reduce the amount of road sand in the stream bottom through a prioritization of street sweeping and catch basin cleanout based on size, location to stream, sensitivity of stream, time of year, and integrity of the current stormwater mitigation system.
2. Meet with Department of Transportation to review the Department's road sand policies.



Typical streamside restoration measures.

Phase II

Objective:

Minimize the impacts of development on riparian and in-stream habitat.

Supporting Task:

1. Follow up with outreach to the watershed towns to reduce the deposition of road sand in the stream bottom on a watershed wide basis through minimizing application rates and further improving maintenance activities (e.g. street sweeping, catch basin clean-out).

Objective:

Restore or enhance streamside and in-stream physical conditions.

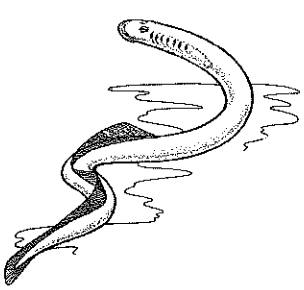
Both in-stream and streamside improvements are needed in the Mattabesset watershed to restore natural stream habitat conditions and foster healthy aquatic ecosystems. For example, stream bank plantings will improve stream shading and stabilize banks, and structures placed in the stream like boulders will provide cover for fish.

Supporting Tasks:

1. Identify and evaluate streamside and in-stream conditions and develop recommendations for streamside and in-stream restoration/enhancement projects on a subwatershed basis.

Objective:

Restore anadromous fish populations in the Mattabesset River and tributaries.



Anadromous fish are those fish species that migrate from the ocean to freshwater to spawn. At least five anadromous fish species have been found in the Mattabesset River including alewife, american eel, blueback herring, american shad, sea lamprey. However, dams and degraded streambed conditions in the Mattabesset River may prevent these species from migrating to proper upstream habitats to live and breed.

Supporting Tasks:

1. Research historic use of the Mattabesset River and tributaries by anadromous fish populations.
2. Evaluate existing stream conditions and barriers to passage and design structures (e.g. fish ladders) and in-stream improvements that encourage use of the streams by anadromous fish.

Objective:

Foster cold water fisheries in the Mattabesset River and tributaries.

Cold water fish species, including trout, require cool stream temperatures, adequate stream flow, and a gravelly streambed in order to thrive. In the Mattabesset River Watershed, cold water fisheries suffer due to summertime low flow conditions, elevated water temperatures, and unnaturally silty and sandy streambeds. Projects to improve stream shading, and *groundwater infiltration, will help to restore cold water fisheries in the Mattabesset River Watershed and enhance in-stream physical conditions.*

Supporting Tasks:

1. Identify watershed areas suitable for cold water fisheries.
2. Select several areas suitable for habitat restoration demonstration projects on publicly owned property.
3. Plan and implement demonstration projects, including restoration of riparian areas to ensure adequate stream shading and protection/improvement of water quality, and streamside and in-stream improvements to enhance cold water fisheries habitat.
4. Mitigate unnatural sources of water warming to maintain year-round water temperatures suitable for trout.

Phase III

Objective:

Restore or enhance streamside and in-stream physical conditions.

Supporting Task:

1. Implement streamside and in-stream restoration/enhancement projects on a sub-watershed basis.

Objective:

Restore anadromous fish populations in the Mattabesset River and tributaries.

Supporting Tasks:

1. Implement necessary fish ladders and in-stream improvements that encourage use of the upper watershed streams by anadromous fish.

Photo—Stephanie Shakofsky

The Stanchem Dam in Berlin is the first obstacle to migrating fish in the Mattabesset.

GOAL #8

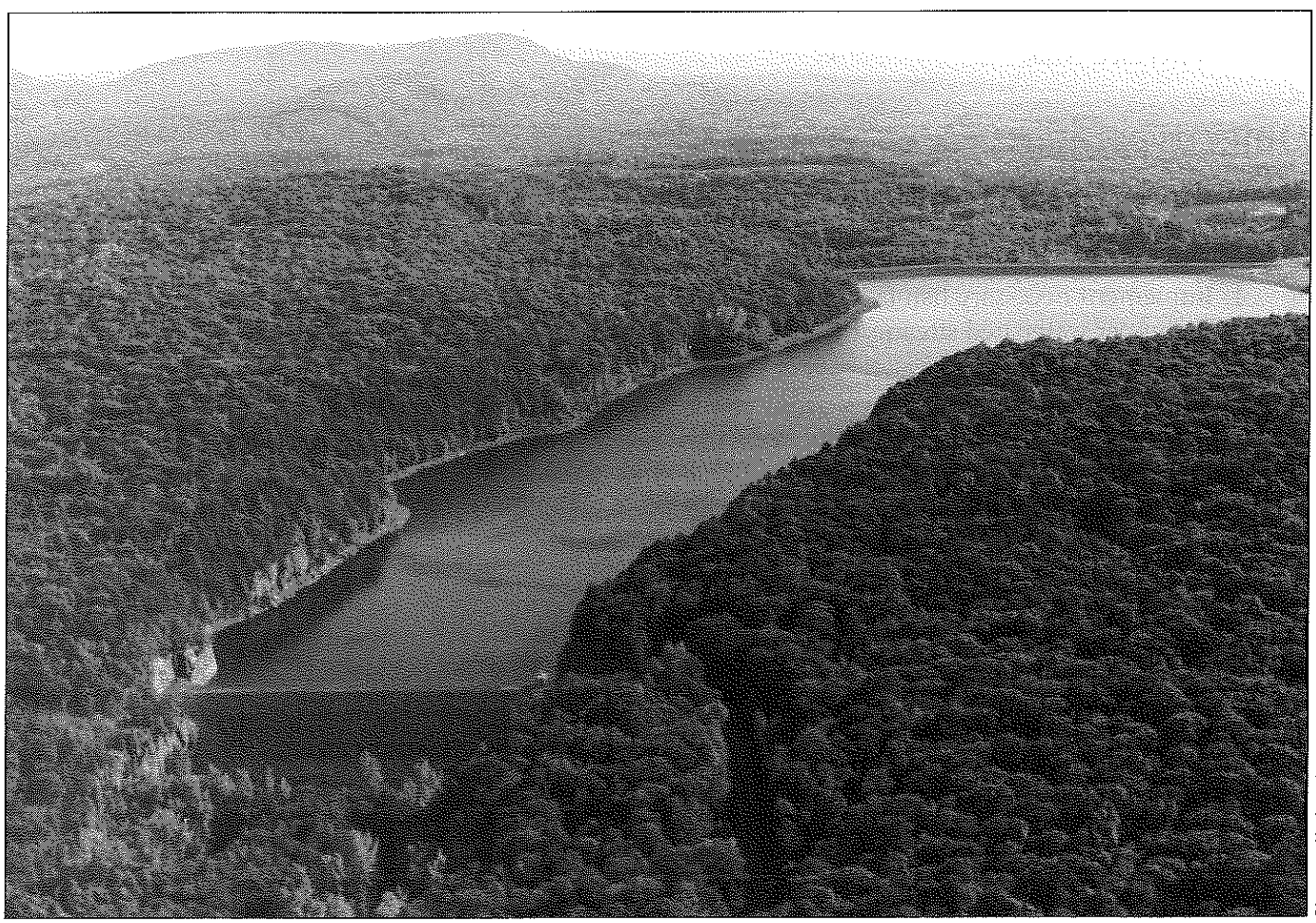
Evaluate and balance in-stream flow needs, including flow volumes necessary for aquatic life habitat, drinking water supply, and other consumptive water uses.

Phase I

Objective:

Calculate a water budget for the Mattabesset watershed to resolve water use conflicts and allow for the development of comprehensive flow and water allocation management plans.

The Mattabesset River and its tributaries suffer from extremely low levels of stream flow during summer months. These low flow levels result in elevated stream temperatures and bacteria concentrations in the Mattabesset. By quantifying water withdrawal and water detention, and by determining the natural flow rates of the streams in the watershed, we will equip ourselves with the information necessary to create a sustainable plan for water allocation.



Photo—Clyde Selner

 Merimere Reservoir in Meriden, part of the City of Meriden's water supply, is the headwaters of the Mattabesset River.

Supporting Tasks:

1. Gather information about the status of water allocation in the watershed. Compile and review other relevant data and information including benthic macroinvertebrate community data and fisheries community data. Develop a list of potential sources of water to the Mattabesset River, including water conservation, storm water infiltration, upstream storage, and others.
2. Review current and historical watershed flow information, and identify streams at risk of inadequate flow. Utilize hydrologic modelling to determine minimum flow requirements for streams at risk of inadequate flow.
3. Calculate a Water Budget for the Mattabesset River Watershed to show where water is and what it is doing over extended time.
4. Obtain and disseminate information about DEP's report to General Assembly and its implication for the Mattabesset River Watershed. The Connecticut DEP has compiled a report for the Connecticut General Assembly that recommends a re-evaluation of registered water diversions. Prior to 1983, individuals did not need to obtain a permit for diverting water. This report recommends that diversions registered before 1983 go through a renewal process for their diversions.

Phase II

Objective:

Establish a Flow Work Group of individuals and organizations in the watershed who represent various water use interests to develop a flow allocation policy.

Accounting for all water use needs in the Mattabesset River Watershed and balancing these needs with flow volumes for aquatic life requires input from all parties with specific interests in water use.

Supporting Tasks:

1. Identify all individuals and organizations with specific water use interests and solicit their participation in the Flow Work Group.
2. Develop a flow allocation policy.

Phase III

Objective:

Establish a Flow Work Group of individuals and organizations in the watershed who represent various water use interests to develop a flow allocation policy.

Supporting Tasks:

1. Implement the flow allocation policy in the watershed.

GOAL #9 Obtain a consistent and stable funding stream to accomplish the plan's objectives.

Phase I

Objective :

Identify potential and appropriate funding mechanisms

Stormwater utilities are a well-established, equitable, and feasible financing option that provide a dedicated revenue source for stormwater and watershed management. A Natural Resource Defense Council report stated that as of 1996 over 300 stormwater utilities were in operation in at least 20 states (by contrast, there are thousands of water, sewer, and irrigation districts in the country.)

Supporting Tasks:

1. Compile a directory of funding sources available through federal, state, and local governments, private foundations, and other organizations. Cooperate with watershed-based organizations to support their fundraising efforts.
2. Conduct a survey of watershed towns to measure the potential success of instituting a municipal fee structure. (Based on similar fee structures across the nation, these fees could be used for construction and maintenance of stormwater drainage systems, review of stormwater management plans, inspection and enforcement activities, watershed planning, and water quality monitoring.)
3. Identify projects/activities requiring non-monetary resources and connect those projects to their appropriate resource.

Phase II

Objective:

Identify potential and appropriate funding mechanisms

Supporting Tasks:

1. Cooperate with watershed-based organizations to support their fundraising efforts through federal, state, local, and private funding sources.
2. Identify projects/activities requiring non-monetary resources and connect those projects to their appropriate resource.

Phase III

Objective :

Identify potential and appropriate funding mechanisms.

Supporting Tasks:

1. Continue to pursue local, state, and federal grants, donations, and memberships.
2. Identify projects/activities requiring non-monetary resources and connect those projects to their appropriate resource.

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Glossary

alkalinity:	a measure of the capacity of water to neutralize acids. Compounds such as bicarbonates, carbonates, and hydroxides combine with or release hydrogen ions as a means of buffering drastic changes in pH. Alkalinity must be more than 20mg/L to effectively neutralize acids.
buffer zones:	naturally vegetated borders that help to reduce runoff and nonpoint source pollution to a water body by providing zones of infiltration and bank stabilization adjacent to the stream, river, pond or water body, as well as providing homes for wildlife.
culvert:	a drain or channel constructed for the purpose of directing surface water flow.
degradation:	the act of lowering the quality of water or other natural resources to a less usable state.
discharge rate:	the volume of water flowing through a watercourse over a specified unit of time; usually measured as cubic feet per second (cfs) or million gallons per day (MGD).
drainage basin:	land area from which all water drains into a common outlet, same as watershed.
enterococci:	a subgroup of the fecal streptococci group of bacteria that is fecal specific and can be found in domestic animals and birds as well as humans. The DEP and the Department of Health Services have adopted Enterococci as the preferred indicator for evaluating the sanitary quality of bathing waters.
erosion:	the process of breaking up soil and rock through the actions of wind, water, and ice to produce sediment.
eutrophication:	the process of nutrient enrichment in aquatic systems, which causes algal blooms and growth of aquatic weeds. It is a natural aging process that occurs in lakes and reservoirs, ultimately converting them to dry land, but activities that overload water bodies with nutrients and sediment can accelerate the process.
fecal coliform:	a broad-based indicator of possible fecal contamination from a variety of sources such as untreated wastewater and/or the presence of animal feces which may contain disease-causing bacteria.
hazardous waste:	any waste material, source material, or special nuclear material which may pose a present or potential hazard to human health or the environment when improperly disposed of, treated, stored, or transported (CT General Statutes 22a-38).
headwaters:	the natural waterbody located at the highest elevation within the watershed.

impervious	surfaces that do not allow infiltration of water into the ground, i.e. surfaces: paved roads, parking lots, and roofs.
infiltration:	percolation of water into soil or other porous material beneath the land surface.
nonpoint source pollution:	any water contamination that does not originate from a point source (see point source pollution); contamination that occurs when rainwater or snowmelt washes over plowed fields, city streets, or suburban backyards, picking up soil particles and pollutants (i.e. nutrients, pesticides), and eventually flowing into a groundwater or surface water body.
NTU:	abbreviation for "Nephelometric Turbidity Units," a measure of light scattering and clarity of the water.
pH:	a measure of the acidity, or the concentration of hydrogen (H+) ions, in a water body. It is measured on a scale of 0 (most acidic) to 14 (most alkaline), with 7 considered "neutral."
point source pollution:	water contamination originating from a clearly identified discharge source, such as an industrial.
remediation:	any action taken to improve, restore, or protect the natural ecological condition within the watershed.
riparian:	land and vegetation adjacent or near the banks of a stream, river, lake, or pond. This term originates from the latin word ripa meaning bank or shore.
runoff:	water from rain, snow, or irrigation that flows over the land surface to a particular water body instead of percolating into the ground.
sedimentation:	the transportation and deposition of loose material produced by erosional processes.
septic system:	an on-site system that provides for the treatment and disposal of domestic waste. Usually consists of a septic tank, where organic solids settle out and are partially broken down, and a drainage bed or leach field, where the remaining liquid wastewater is dispersed and treated by filtering through the soil.
watercourses:	rivers, streams, lakes, ponds, swamps, and all other bodies of water, natural or artificial, public or private (CT General Statutes 22a-38).
watershed:	a geographic region within which all ground and surface water drains into a common outlet.
wetlands:	land that consists of any of the soil types designated as poorly drained, very poorly drained, alluvial, and floodplain by the National Cooperative Soils Survey (CT General Statutes 22a-38).

Contacts and Resource Information

Volunteering

These organizations are involved in various river improvement activities:

Mattabesset River Watershed Assoc.
P.O. Box 7174
Kensington, CT 06037
Contact: Dick Schmidt (860) 828-0803

The Nature Conservancy
55 High Street
Middletown, CT 06457
Contact: Katherine Doak (860) 344-0716

Connecticut River Watch Program
deKoven House, 27 Washington St.
Middletown, CT 06457
Contact: Jane Brawerman (860) 346-3282

Technical Assistance

The following organizations provide services which may include educational materials resource publications, and hands-on project assistance:

Middlesex County Soil and Water Conservation District
deKoven House, 27 Washington St.
Middletown, CT 06457
Contact: Stephanie Shakofsky (860) 346-3282

Nonpoint Education for Municipal Officials (NEMO)
UCONN Cooperative Extension Center
1066 Old Saybrook Road, P.O. Box 70
Haddam, CT 06438
Contact: Leslie Kane (860) 345-4511

Natural Resource Conservation Service
Connecticut Basin Area
627 River Street
Windsor, CT 06095
Contact: Vivian Felten (860) 688-7725

Hartford County Soil & Water Conservation District
627 River Street
Windsor, CT 06095
Contact: Mike Kallen (860) 688-7725

Department of Environmental Protection
Rivers Program
79 Elm Street
Hartford, CT 06106
Contact: Elizabeth Marks (860)424-3704

Educational Materials

The following organizations provide educational guides and materials on enhancing and protecting your watershed:

Connecticut River Watershed Council
One Ferry Street
Easthampton, MA 01027
Contact: Tom Maloney (413) 529-9500

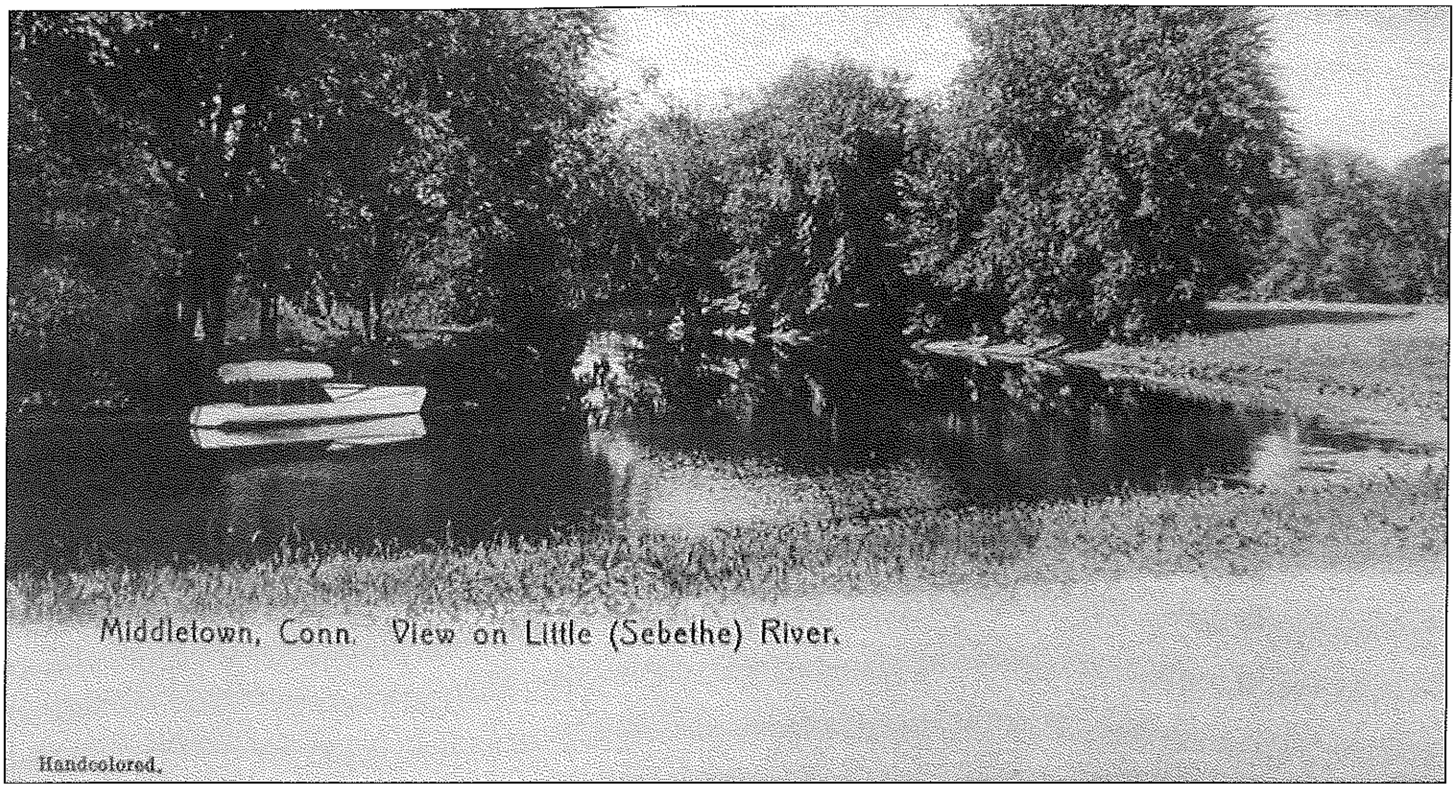
The Rivers Alliance of Connecticut
111 Main Street
Collinsville, CT 06022
Contact: Margery Winters (860) 693-1602

CT Department of Environmental Protection
79 Elm Street
Hartford, CT 06106
Contact: General Info (860) 424-3000

Trout Unlimited of Connecticut
186 Sandy Hollow Road
Gales Ferry, CT 06335
Contact: Curt Nelson (860) 464-8246

US EPA Region 1
Office of Ecosystem Protection
Nonpoint Source
One Congress Street
Suite 1100 (CCT)
Boston, MA 02114-2023
(617) 465-3564

Courtesy of Cromwell Belden Library



A 1905 postcard shows a canopied boat on the Mattabesset. The Mattabesset River has also been known as the Little River and the Sebethe River.

Courtesy of Berlin-Peck Memorial Library

Mattabesset Fishing Club, 1910

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