

Connecticut River

Water Resources Management Plan

Headwaters Subcommittee
Executive Summary - 2009



The Headwaters Region

This water resources plan summary is an updated and expanded edition of the regional volumes of the Connecticut River Joint Commissions' 1997 *Connecticut River Corridor Management Plan*. The plans are a requirement of the N.H. Rivers Management and Protection Act. It is one of five regional plans created by volunteer members of CRJC's local river subcommittees, assisted by the CRJC conservation director. The full plans for each regional subcommittee, plus the 2009 CRJC *Connecticut River Water Resources Management Plan - Riverwide Overview*, are available at www.crjc.org.

The Headwaters Subcommittee includes representatives of the riverfront towns from Pittsburg to Northumberland, N.H. and Canaan to Maidstone, Vt. Planning boards and commissions can review its recommendations and integrate them into their local master plan, and select appropriate recommendations for adoption into their zoning ordinances.

The Headwaters Region - The 80-mile Headwaters segment begins at the river's source at Fourth Connecticut Lake at the Canadian border. The river falls over 1,800 feet from Fourth Lake to the breached Wyoming Dam. Offering some of the finest trout water in the Northeast, the river passes through boreal forest and fertile farmlands. For the better part of a century, starting in the mid-1800s, the river's headwaters were scoured, straightened, dammed, and flooded to move timber downstream to waiting mills during the legendary Connecticut River log drives. While the quality of the river deteriorated less here than in downstream reaches, it too has improved with the investment in modern septic systems, wastewater treatment plants, manure storage facilities, and use of best management practices.

Economic Value of Clean Water - Good water quality is important economically for the Headwaters region. Studies in New Hampshire have found that its rivers and lakes annually contribute an estimated \$1.5 billion in total sales and \$247 million in property taxes to its economy (2002 dollars). Statewide, fishing, boating, and swimming have the same economic impact as snowmobiling, ice-fishing, downhill skiing, and cross-country skiing combined. Overall, water-based recreation in New Hampshire's Great North Woods region generates over 400 jobs, over \$9 million in personal income, and more than \$26 million in business sales, totaling about seven percent of the recreational revenue generated by anglers, boaters and swimmers in New Hampshire. A perceived decline in water clarity and purity in the Great North Woods could lead to a loss of some 30 jobs, a loss of about \$650,000 in personal income and a loss of nearly \$2 million in business sales.

A. Condition of the Connecticut River Today

Water Quality - Very good water quality, adequate dissolved oxygen, and an aquatic food web that is for the most part in excellent condition distinguish the Headwaters segment of the river. Still, the river carries bacteria, nutrients, sediments, and other forms of pollution, and faces new challenges from riverside development and the invasive diatom *Didymo*. Much of the region suffers from low pH, partly because of the chemistry of its rocks and thin soils and

partly because of acid rain. High water temperatures can occur in summer, due partly to lack of shading where riverside trees have been removed or to low flows. Turbidity and sedimentation can be a serious water quality problem in the Headwaters region. More care is needed to keep sediment from land development and logging from getting into the river and its tributaries.

There is currently no regular, ongoing water quality monitoring program on the Connecticut River. When the N.H. Department of Environmental Services (NH DES) assessed the river in 2004, bacteria levels violated state water quality standards for 50 miles from Stewartstown to the Guildhall/Northumberland bridge, although limited sampling in 2005 did not find such high levels. Bacteria may come from wildlife rather than from farming or other human activities, although high counts may also reflect poor septic systems. There are also bacteria problems in several tributaries. The 2004 findings for bacteria are disturbing, given the popularity of these waters for swimming, canoeing, and kayaking.

Sediment Quality - Recent studies of river sediments by EPA help paint a picture of what is in the silts and sands of the river bottom. There are low levels of pesticides, oils and other engine pollutants, and some metals, but most contaminants are not concentrated enough to threaten aquatic life. Just below Pittsburg village, however, more pollutants appeared than anywhere on the northernmost 200 miles of the river except for a flooded industrial site near White River Junction. "Paris Green," an arsenic compound, was once used on Pittsburg farms later inundated by Lake Francis. The highest concentration of manganese was found in the Mohawk River near Nash Equipment. Fourth Connecticut Lake also carries pesticides and dioxins, and enough arsenic, cadmium, lead, and mercury to have an effect upon aquatic life.

Toxins in Fish Tissue - In 2000, EPA and the four Connecticut River states conducted the first river-wide study of fish tissue in the nation. While few fish were studied in the Headwaters region, the results are still sobering. The study found that mercury concentrations were significantly higher upstream than downstream. Mercury poses a risk to people who eat the fish and to fish-eating wildlife. Much of the mercury appearing in Connecticut River fish is believed to come from Midwest power plants and urbanized eastern seaboard emissions. DDT, PCBs, and dioxins were also found in small amounts. Dioxins can be produced through burning trash in backyard barrels, now illegal.

Invasive species - While most of the invasive plants that plague the river below the Headwaters have not yet arrived here, the region was shocked in June, 2007 by the discovery of *Didymo*, a highly invasive diatom, in the designated natural segment at Bloomfield. *Didymo* can form extensive colonies on the bottoms of rocky river beds, smothering aquatic life such as macroinvertebrates. Biologists believe that *Didymo* was introduced on contaminated fishing gear, especially felt-soled waders, and that it could also be spread by any other recreational equipment. It has been identified in the area between the mouth of Perry Stream in Pittsburg to Bloomfield.

Key Recommendations

- **New Hampshire should sponsor a regular water quality monitoring program** that includes bacteria, pH, and turbidity, and the acidity of rain storms. Arrange with local wastewater plants to process bacteria samples to encourage local volunteer monitoring, and reimburse local plants

for this service. State agencies should make water quality monitoring data easily accessible to the public, including those who do not use computers, so the public understands the present condition of the river and its tributaries.

- **Congress and the states should continue to reduce sources of mercury** contamination and acid precipitation.
- **Fishermen and other recreational users must clean their gear** after visiting the river to avoid spreading Didymo.

B. River Flow

Instream Flow - Gages at Indian Stream and North Stratford provide real-time data for flow, precipitation, air temperature, and water temperature on a daily basis via the Internet. Three of the region's five gages were abandoned due to budget cuts by New Hampshire, but the legislature has set aside new funding.

When there is a drought, the Connecticut Lakes retreat naturally, since they are located at the head of the watershed. The lakes are sometimes affected by operations at the Fifteen Mile Falls hydro development 75 miles downstream. If there is not enough natural flow in the river to meet the dams' required minimum release, the lakes may be lowered to provide water for the rest of the river. River flow is also influenced by releases from Murphy Dam. Below Lake Francis, the river valley is a large floodplain of varying width bounded by steep sides. Heavy rain creates flooding on a regular basis, especially when enough water is received in the Lakes to force gates to open at Murphy Dam. Tributaries also have a strong influence on the river, and isolated storms can be restricted to one tributary watershed.

Flooding and Flood Control - The Headwaters region of the Connecticut River, occupying the steepest and highest part of the watershed, has more experience with flooding than any other. Floodplains and wetlands provide natural flood control by storing water, absorbing it quickly and releasing it slowly. The valley from West Stewartstown south into Lancaster and Lunenburg is one of the four most important natural valley flood control areas on the entire 410-mile long river. Here, the river can spread out on 12,000 acres of floodplain and reduce its energy.

Lake Francis is the only dam in the Headwaters Region that was built for flood control, and the dams at First and Second Lakes hold water when possible to reduce spring flooding downstream. Ice has a powerful role in flow and flooding in the area. Unexpected releases from Murphy Dam combined with high water from storms can catch riverfront farmers unaware, stranding equipment and livestock in lower fields as far down river as Guildhall. An effective warning system is urgently needed for public safety and to allow farmers to move equipment and livestock to higher ground.

The Headwaters region is experiencing more frequent extreme storms in recent years, creating local flooding and threatening riverbank stability as well as local roads, bridges, and buildings. Sudden, severe storms have been described as symptoms of climate change. By the end of the century, the Headwaters region may be the only part of the Connecticut River

Valley that retains snow cover for at least 30 days during the winter. Reduced snowpack could affect the flow of much if not most of the river.

Key Recommendations

- **The N.H. Dam Bureau, along with emergency management officials** from towns below Murphy Dam in New Hampshire, Vermont, and Quebec, and TransCanada should work together to develop a effective and reliable system for warning town officials about water releases that could result in flooding below the dam. Essex and Coös County Conservation District managers can assist with contacts for riverfront landowners.
- **Land conservation organizations** and the U.S. Army Corps of Engineers should purchase development rights from willing owners of land in the natural valley flood storage area to help prevent flooding downstream.

C. Working River

Headwaters Region Dams - There are five dams on the mainstem of the Connecticut River in the Headwaters. Moose Falls Dam and Murphy Dam at Lake Francis are owned by the state of New Hampshire, and TransCanada Hydro Northeast owns the dams at First and Second Lakes. Murphy Dam and First and Second Lakes are operated for recreation, water storage, and flood control. They provide flow for TransCanada's downstream hydroelectric facilities and do not generate electricity themselves. Canaan Dam, between Canaan and West Stewartstown, is owned by Public Service Company of New Hampshire, and is preparing for relicensing in 2009. The state rates Murphy Dam as having high hazard potential to life should it fail, although officials report that the dam is extremely safe and well maintained. Should the dam fail suddenly and massively, the Connecticut River would rise 30 feet from Pittsburg to Stratford, and also into Quebec. Flooding would stop 85 miles downstream at Moore Reservoir. There is no early warning system to alert these towns.

Key Recommendation

- **The N.H. Bureau of Emergency Management and DES Dam Bureau** should enlist the help of the federal Homeland Security Agency to install an early warning system that will reach all communities in New Hampshire, Vermont, and Quebec that could be affected by a failure of Murphy Dam. Radio may be the easiest way to communicate with downstream towns.

D. Using the Waters

Water withdrawals - As a designated river in New Hampshire's Rivers Management and Protection Program, the Connecticut River's water is protected from being diverted outside of the watershed. The state requires registration of water withdrawals over a certain size, which helps identify future problems of well interference, declining water tables and/or diminished streamflows, but does not limit withdrawals. Vermont has no system for tracking withdrawals and the amount of water that would otherwise have flowed in the river from Vermont is unknown.

Groundwater and drinking water supplies - Clean drinking water may be our most valuable but under-appreciated commodity. New Hampshire has mapped stratified drift aquifers and regulates new groundwater withdrawals for public community water systems and large withdrawals to prevent harm to existing water users and nearby streams and rivers. Vermont has not mapped aquifers as comprehensively and does not regulate groundwater withdrawals. Groundwater can be contaminated by pollutants which are difficult if not impossible to remove, including salt. Some homes in the region are located on lots too small to keep wells and leach fields properly separated. Colebrook withdraws from an aquifer connected to the Mohawk River, and has purchased land to protect drinking water.

Key Recommendation

- **Towns should take advantage of source water protection** grant and loan programs. Discourage development that puts both wells and septic systems close together on very small lots.

E. Land Use and Water Resources

Wastewater discharges - Most towns now have wastewater treatment plants that discharge to the Connecticut River, and have made improvements to them in recent years. However, at Stratford Hollow, several homes are on lots too small for individual septic systems, and there were straight pipe discharges to Bog Brook. The town won grants to help many homeowners install better treatment. Bog Brook flows into a part of the Connecticut River that is popular for paddling and swimming but is contaminated with bacteria. Several industries discharge wastewater to the river and its tributaries, including Ethan Allen in Beecher Falls and Columbia Sand and Gravel's washing water in settling ponds very close to the river. Before the plant closed, Wausau treated paper mill effluent before returning it to the Upper Ammonoosuc River. Of concern is how medicines that can pass through a wastewater treatment plant could affect fish and other river life.

Key Recommendation

- **Town conservation commissions and regional planning commissions** should teach people to wrap and discard their unused and out-dated medicines in regular household trash rather than flushing. EPA and the states should establish updated rules for disposal or return of unused medicines.

Landfills, Junkyards, and Transfer Stations - Most public dumps have been identified and capped. Canaan is currently searching for a safe location for a transfer station. The unlined Colebrook landfill was sending a plume of contaminated groundwater toward Lime Pond in Columbia, until the town and NH DES reached an innovative agreement for capping and closing the landfill and dealing with the groundwater. At a long-established junkyard near the Mohawk River, scientists found high levels of manganese and other pollutants. Because of these findings, it might be wise to see if there has been an effect on surface and groundwater. Riverbank littering remains a problem at some fishing access points and at some riverfront properties.

Key Recommendation

- **NH DES should work with the owner of the equipment salvage yard** in Colebrook to test surface and groundwater above and below this site, which may be a good candidate for a brownfields study.

Shoreline and Floodplain Development - The value of shorefront property throughout the Connecticut River valley has risen sharply, and development along the Connecticut River and the Lakes has suddenly increased. There is presently no means to guide shoreline development in most Headwaters towns, other than New Hampshire's Shoreland Protection Act. Vermont is the only state in New England that does not have a statewide shoreland protection law. Because building in floodplains takes over valuable farmland, transfers flooding problems downstream, and costs taxpayers money when flooding occurs, Northumberland has passed an ordinance banning construction within the 100-year floodplain. This region's Flood Insurance Rate Maps are often grossly inaccurate. Glacial lakes left behind layers of ancient lake-bottom sediments, called varves, that can create unstable drainage. Siting landfills, bridges, large buildings, and other important structures on varved deposits is risky although their location is not well known.

Key Recommendation

- **FEMA should provide accurate floodplain maps** for Headwaters region towns. Towns should not permit building in the 100-year floodplain, to protect their citizens and businesses from damage, to avoid adding to flooding of their downstream neighbors, and to reduce the public cost of disaster relief.

Roads, gravel pits, and railroads - In the Headwaters region, roads and railroads must often follow streams closely to move through their often steep-sided valleys. Better riparian buffers help hold streambanks in place and capture road-related pollutants. Faulty construction or lack of maintenance of woods roads is a problem. An under-sized culvert or bridge can block with debris in a sudden storm and cause a stream to cut through a road, affecting the Connecticut River. A blocked culvert on Route 3 in West Stewartstown led to severe riverbank slumps above Canaan Dam. Improper road salt storage and loading procedures can lead to trouble, since salt dissolves so easily in water. There are several gravel mining operations close to the river, and downstream farmers report that fine particles of rock powder reach the river which spreads them on their fields nearly every year. The railroad follows the mainstem on the New Hampshire side. Rusting rail cars, stored on tracks near the river, are less often the visual blight they once were.

Key Recommendation

- **Gravel mining operators should process gravel at a safe distance** from the river, to avoid contaminating the water with fine rock powder particles, and take steps to keep such fine material from blowing around. State environmental agencies should monitor and enforce permit conditions for gravel pit construction.

Storm Water Runoff - Cleared, compacted, or paved land sends water downhill faster than when it is captured by thick vegetation and transpired by trees. Stormwater may be washing pet waste into the river and contributing to the higher bacteria levels found here. Good decisions now can keep development from increasing water temperature and adding pollution, ruining the fine fishing for which the region is so well known.

Key Recommendations

- **State agencies should inform developers and landowners** about recent changes in stormwater permitting. Developers should include infiltration methods such as small swales and runoff basins to capture runoff.
- **Loggers should use best forestry management practices** when working near intermittent and year-round streams.

Home Landscapes - Residential development has increased noticeably in the last decade, especially as second-home buyers come to the area. Unlike U.S. farmers, who are professionally trained and certified to apply fertilizers and pesticides in the proper amount and at the proper time in the growing season, homeowners have no such training and are likely to use much more of these potential pollutants than is necessary or advised.

Key Recommendation

- **States should educate owners of shoreland** about the best ways to manage their property. Homeowners living near waterways should retain buffers of native woody vegetation along the banks.

Farms - Prime agricultural soils distinguish much of the floodplain in the Headwaters region. Much of the quality of life on the river has been affected by agriculture, and mostly in a positive way. It is more desirable to see riverbottom land used for farming than developed into house lots. This land offers prime soils of national significance, and, from a homeland security point of view, is essential to supply a local source of food.

Unregulated use of manure and farm chemicals on the Canadian side of Hall Stream is a concern for the river. Some farmers grow corn on river bottom lands more continuously than is good for either the soil or for water quality, since corn land is highly exposed to erosion during flooding. Vermont's Conservation Reserve Enhancement Program has helped at least one Headwaters dairy farm to install a substantial riparian buffer along the river.

Key Recommendations

- **Farmers should voluntarily adopt best agricultural management practices;** learn how conservation easements help keep the farm in the family and the land working; keep good records of yields, fertilizing, and soil/plant tissue analysis; decide on their own to establish/retain filter strips between fields and water courses; and rotate corn frequently with other crops, particularly on flood-prone land. Vermont farmers should make use of the Conservation Reserve Enhancement Program to plant riparian buffers or provide livestock water sources.
- **NH DES should investigate contamination** in Hall Stream, and if necessary, speak with Quebec authorities.

Forests and rivers - The Northern Forest is likely the single most important factor in the water quality, fisheries, wildlife, recreational, scenic, and economic values of the river in the Headwaters Region. Forest landowners who are aware of the many values of streamside forests use forested riparian buffers to control flooding and erosion, trap pollutants, shelter coldwater fisheries, and provide an attractive streambank and recreational opportunities. Current and potential problems include siltation from improperly built stream crossings or skidder trails, harvesting when soils are prone to erosion, and faulty construction or lack

of regular maintenance of woods roads. Flash flooding and siltation can result from increased surface runoff when large areas of forest cover are removed.

Key Recommendations

- **Forest landowners should adopt the principles of sustainable forest management;** develop management plans for their forests and conduct logging with the help of professional foresters; follow guidelines in *Good Forestry in the Granite State*; minimize the visual and water quality impacts of clear-cutting, especially near the river; promote and use integrated pest management to lessen the reliance on chemicals; protect and maintain a forested riparian buffer along waterways; dispose of slash away from streams; consider conservation easements on their property to allow it to continue in active forest management and to contribute to the economic, scenic, and timber resource base of the region, but also allow it to remain unfragmented by development.

F. Riverbank Erosion

Causes of Erosion - Sedimentation and turbidity may be the most important problem threatening water quality in the Headwaters region. The river can run light brown after storms. Erosion is a natural process, but human actions also cause unnatural erosion through poorly designed stream crossings, livestock trampling riverbanks, sudden water releases below dams, boat wakes, and especially removal of the riverside vegetation that naturally holds the bank together.

In 2004, the Connecticut River Joint Commissions sponsored an intensive study of 85 miles of the river from Murphy Dam to Gilman. Results show that one third of the river had been artificially straightened before 1925, probably to remove obstructions for log drives. The resulting long, straight stretches of river are not natural, and the river is now reshaping the resulting sharp corners back into smoother, more natural curves. Straightening the channel has also caused the river to cut down within its bed. The river is now trying to widen and slow as it recovers from these dramatic changes. Therefore it is dangerous to build berms close to the river, because they will not stand up to the river forces at work. A better approach would be to keep development far enough from the river to allow it to continue readjusting without threatening homes or businesses. CRJC provided Headwaters towns with maps showing local erosion sites, bank composition, and riparian buffer condition, along with guidance about how to approach riverbank projects.

Tributaries are also changing the mainstem. Sediment deposited by the Mohawk River in the Connecticut is causing erosion at the Colebrook Business Park. In Stark, sediment deposited by Mill Brook in the Upper Ammonoosuc River watershed is causing erosion near a road close to the river's edge. Heavy land clearing in a tributary watershed may cause too much sediment to wash away. High eroding banks of glacial outwash have a major role in erosion. Sand and gravel sliding down these bare slopes, such as at Brunswick Springs, fall into the river and are deposited in bars that deflect the river current onto nearby riverbanks. Erosion of the 40-foot high bank at the Northumberland Cemetery threatens burials above. CRJC's 2005 study of this site found that the 1980s breaching of the Wyoming Dam has caused the river to drop at least three feet, resulting in higher stream velocity and slumping along the high banks upstream to the cemetery.

Riparian Buffers - Riparian buffers are the single most effective protection for rivers and streams. These strips of shrubs and trees along the banks filter polluted runoff, capture sediment and nutrients, and provide a transition zone between water and human land use. Vegetated buffers are relatively inexpensive and have the added advantage of providing habitat for both land based and aquatic animal species and privacy for landowners. Shading streams with vegetation helps to optimize light and temperature conditions critical to the survival of certain species, such as trout.

The 2004 study found a 67 percent greater chance of finding erosion where there is no riparian buffer. The study found a lack of riparian buffer along a full 20 percent of the riverbank, and concluded that bank stability generally increases as buffer width increases, as long as a buffer is at least 25 feet wide.

Key Recommendations

- **Landowners along rivers and streams should retain and enhance buffers** of native vegetation on their banks to help hold soil together.
- **Towns and landowners should consider conservation easements** to prevent development in places where the river is actively eroding, to give the river room to move.
- **Boaters should abide by state boating laws**, which require travel at headway speed only throughout the Headwaters region of the Connecticut River (except for the lakes), and avoid creating wakes that cause erosion.



The Headwaters Region