

## CONCORD RIVER WATERSHED

The Concord River is formed by the confluence of the Assabet and Sudbury Rivers near the historic Egg Rock and Rude Bridge in the Town of Concord. The river flows north for approximately 15 miles through the towns of Concord, Carlisle, Bedford, and Billerica to the confluence with the Merrimack River in Lowell. Along the way two dams, Talbot Mills Dam and the Centennial Island Hydropower Project Dam, both in Billerica, impound the Concord River. A third dam, the Middlesex Dam has been breached and all that remains are two abutments. There are also three sets of waterfalls in a one mile reach on the Concord River in Lowell ([www.lowelllandtrust.org](http://www.lowelllandtrust.org)). Tributaries to the Concord River include Mill Brook and River Meadow Brook. The Concord River serves as a treated water supply for the Town of Billerica. It also receives discharges from four municipal wastewater treatment plants, as well as several industrial users.

The Great Meadows National Wildlife Refuge comprises 3,600 acres of freshwater wetlands along the Sudbury and Concord rivers. The refuge is part of the larger Eastern Massachusetts National Wildlife Refuge Complex. In the Concord subwatershed there are two man-made impoundments in the Great Meadows Concord Unit. Annually one of the two impoundments is slowly drawn down through late June and early July to “provide feeding and resting habitat for migrating shorebirds and wading birds, as well as to promote the growth of beneficial moist-soil plant species that provide food, cover, and nesting habitat for waterfowl and other avian species” (Prior 2004). The pond is refilled around the end of October. This drawdown has been a management technique practiced intermittently since before World War II when a Mr. Hoar owned the property, and provides an additional benefit of reducing the biomass and density of water chestnuts and American lotus. The USFWS also tries to prevent carp from entering the ponds, damaging the vegetation, and impacting the migratory species (Prior 2004).

The Wild and Scenic Rivers Act provides for three possible classifications of eligible river segments: wild, scenic, and recreational. Eight miles of the Concord River, from the confluence of the Sudbury and Assabet rivers at Egg Rock to the confluence with the Merrimack River, have been designated as recreational by the National Park Service based on ecology, history, literature, and scenery (NPS 1996).

The United States Fish and Wildlife Service has stocked the Concord River with 5,000 to 7,500 herring yearly since 2000. In 2003 they also stocked the waters with 300 American shad (Smithwood 2004).

### ISSUES

As with the Assabet and Sudbury subwatersheds, water quantity and quality are also issues in the Concord Subwatershed. Wastewater discharges and water withdrawals for municipal supply can degrade water quality. Surface water is also used for the propagation of cranberries in Chelmsford/Carlisle. Wastewater management varies from town to town; the Town of Westford has participated in the Comprehensive Community Septic Management Program (Kasper-Dunne 2004 and Appendix F) while Concord and Billerica are developing Comprehensive Wastewater Management Plans to address wastewater and water supply issues. Both have centralized sewer systems that discharge wastewater from secondary wastewater treatment plants and on-site systems. The following paragraphs were excerpted from the Town’s CWMPs to provide background information. Since 1980 Chelmsford has also been working to extend sewers to the entire town; wastewater is discharged to the Merrimack Watershed via the Lowell Regional Water & Wastewater Utility WWTP.

#### *Concord*

##### Water supply

Approximately 89% of the town obtains their drinking water from five active municipal wells (one emergency well) and surface water from Nagog Pond in Acton. There are three non-community wells (Michael’s Restaurant, Valley Sports, and Assurance Technology Corporation) and 11% of the town relies on private wells for drinking water.

##### Wastewater

Wastewater in the Town of Concord is discharged through a centralized system that serves approximately 30% of developed parcels and on-site individual or shared Title 5 systems or larger ground systems. Approximately 66% of the population of Concord is served by on-site systems.

The CWMP suggested that Concord examine on-site systems in the Second Division Brook and Fort Pond subwatersheds in West Concord, the Assabet River Watershed in the West Concord and Spencer Brook study area, the Nashoba Brook subwatershed in West Concord and Spencer Brook study area, and White Pond. Twenty-five miles of sewers and two pump stations serve approximately 33% (5,000 people) of the population. Two-thirds of the system was constructed in 1899 in the Concord Center section of town. The remaining one-third was constructed in 1929. The Town has identified many areas where I/I is problematic and as part of a multi-year effort (still ongoing) has undertaken projects to rehabilitate areas where I/I is occurring. In addition to the Town WWTP off Bedford Street, the Middlesex School maintains a package plant that discharges to Spencer Brook in the Assabet and MCI-Concord also maintains a plant that discharges to the Assabet River. The CWMP Phase I needs assessment identified seven-study areas- Spencer Brook, Estabrook, Elm Brook, Concord Center, West Concord, White Pond, and Fairhaven. The second phase evaluated options and identified next steps that could be accomplished, contingent upon approval from Town Meeting (Stone Environmental and Lombardo Associates 2000a and b).

#### *Billerica*

##### Water supply

The Town has been supplying water to residents since 1899 from the Concord River. The Town maintains emergency connections to Tewksbury, Bedford, and East Chelmsford (Billerica DPW Undated).

##### Wastewater

The Billerica sewer system serves approximately 65-70% (24,700 people) of the population and is comprised of 172 miles of sewer main and 19 pump stations. The Town is extending the sewers to multiple areas, particularly in the River Pines section of town between Route 3 and the Concord River. Billerica has focused on upgrades to the WWTP, operation and maintenance issues, and water treatment plants (Casella 2004). Billerica is working with the consulting firm of Woodward and Curran to develop a report (similar to a Phase I Comprehensive Wastewater Management Plan report) that would identify areas of town not included in the Master Plan and currently served by on-site systems that could benefit from sewer extension projects (Malcuit 2004).

#### *Chelmsford*

Chelmsford was awarded a state revolving loan in 2004 to continue work on its sewer extension project. The project, started in 1980, will sewer 95% of the town (~11,200 homes) when completed in 2008. The remaining 5% of unsewered areas are undeveloped industrial parcels (Spoth 2004).

Hazardous waste sites in the Concord River Watershed, whether federal Superfund sites or state listed 21E sites, can negatively impact surface water quality. There is one Superfund Site located in the Concord River Watershed- the Silresim Chemical Corporation Superfund site in Lowell. Additional information is available in the Summary of Existing Conditions and Perceived Problems section and in the River Meadow Brook segment (MA82A-10). There are also twenty 21E Tier Classified Oil and Hazardous Materials Sites in the Concord River Watershed (Appendix J).

### **RECOMMENDATIONS**

- Bacteria monitoring is needed throughout the subwatershed to document the effectiveness of storm water reduction activities associated with the Phase II community storm water management program and to evaluate the status of the *Primary* and *Secondary Contact Recreational* uses.

## CONCORD RIVER WATERSHED- RIVER ASSESSMENTS

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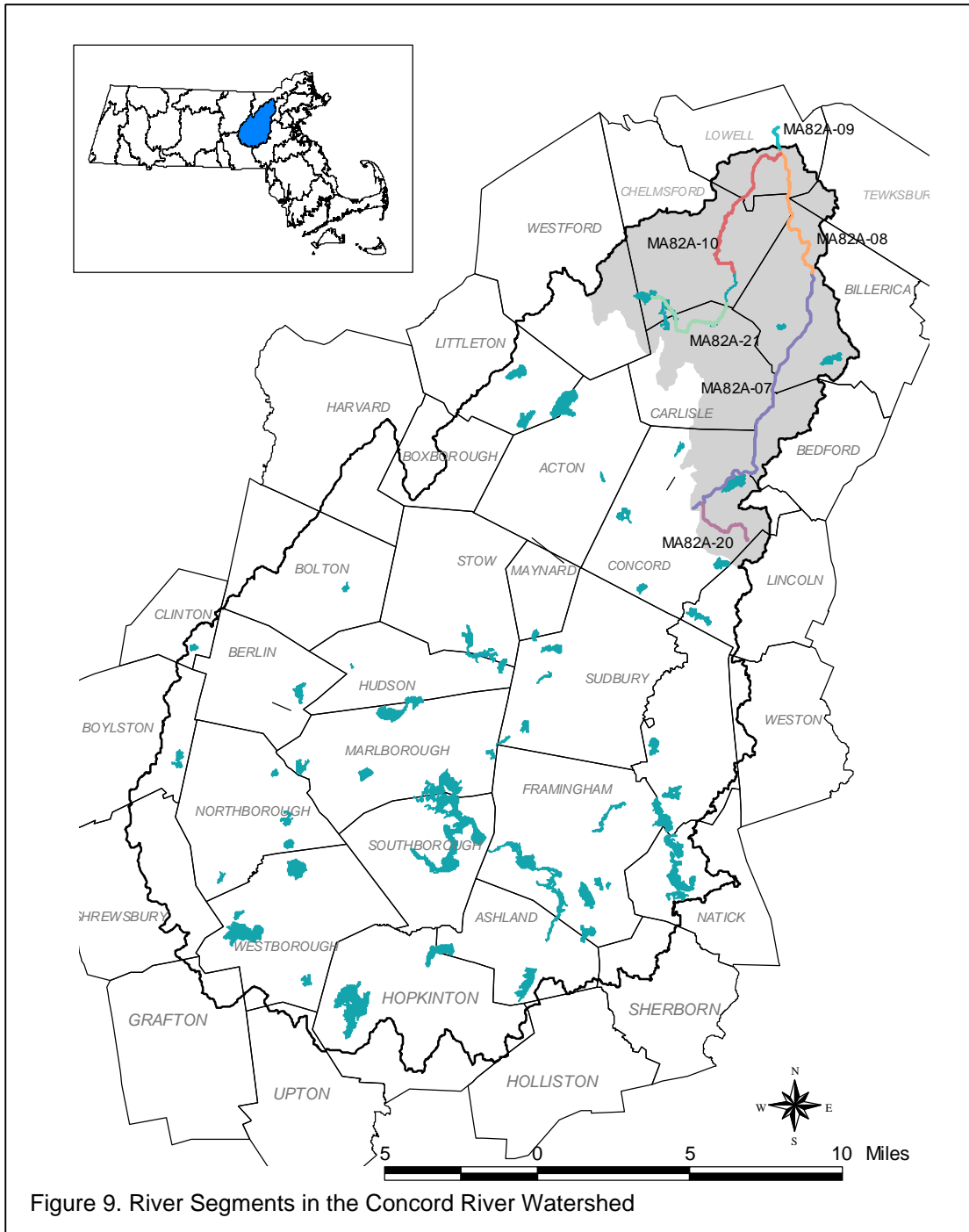


Figure 9. River Segments in the Concord River Watershed

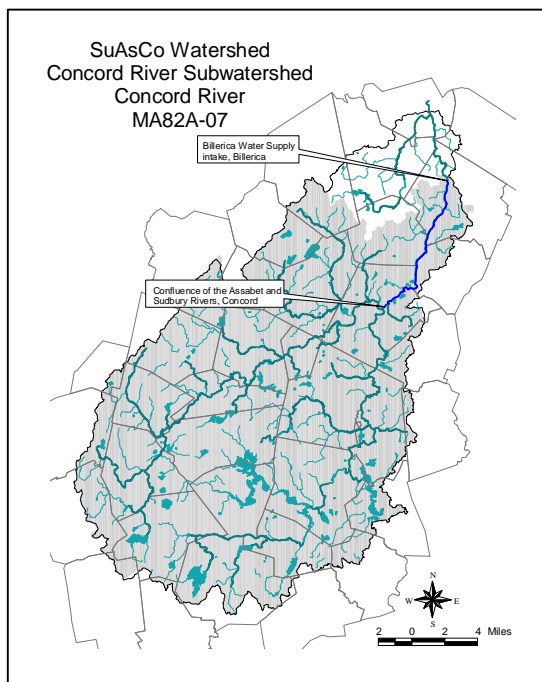
**CONCORD RIVER (SEGMENT MA82A-07)**

Description: From confluence of the Assabet and Sudbury rivers, Concord, to the Billerica Water Supply intake, Billerica  
 Segment Length: 10.4 miles  
 Classification: Class B, Warm Water Fishery, Treated Water Supply

Land-use estimates (top 3, excluding water) for the 367.0 mi<sup>2</sup> subwatershed (including the entire Assabet River and Sudbury River Watersheds) are presented below. An estimate of the impervious area within this subwatershed is 37.6 mi<sup>2</sup> and the percentage of the imperviousness is 10.2%.

- Forest ..... 44%
- Residential ..... 30%
- Open land ..... 6%

Based on the last evaluation of water quality conditions this segment of the Concord River is listed on the 2002 Integrated List of Waters in Category 5. This segment was assessed as impaired and requires a TMDL for metals, nutrients, and pathogens (MA DEP 2003a).



**WMA WATER WITHDRAWAL SUMMARY (APPENDIX E, TABLE E5)**

Facility	WMA Permit Number	WMA Registration Number	Source (G = ground, S = surface)	Authorized Withdrawal (MGD)
Billerica Water Department	9P31403101	31403101	3031000-01S	4.41 (reg) <u>0.89 (perm)</u> 5.30
Richard E. Peterson		31406701	01S (Monument St. Pond)	0.1

**NPDES WASTEWATER DISCHARGE SUMMARY (APPENDIX E, TABLE E1-E4)**

The Town of Concord (MA0100668) is permitted (19 January 2002) to discharge 1.2 MGD of treated sanitary wastewater via outfall 001 to the Concord River. The permit will expire in 2005. The facility's whole effluent toxicity limits are LC<sub>50</sub> ≥ 100% effluent and C-NOEC monitor only. The current permit includes seasonal limits for phosphorus (May 1- October 31 = 0.75 and November 1- April 31 = report) and ammonia-nitrogen (report). The Concord WWTP is a secondary treatment facility that serves approximately 15,000 people. There are currently no industrial users contributing wastewater to the WWTP. The facility uses clari-thickeners for primary clarification followed by plastic media trickling filters for biological treatment. This is followed by secondary clarification with several sand filter beds used seasonally for additional treatment, chlorination, and final discharge via an underground concrete pipe. Ferric chloride is used for phosphorus removal. TRC concentrations in the Concord effluent between September 1996 and March 2004 ranged between 0.01 and 0.11 mg/L (n=27).

The proposed Billerica Water Treatment Plant (MAG640050) is permitted (once the plant becomes operational-MA DEP 2004a) to discharge 0.8 MGD of treatment plant backwash to an unnamed tributary to this segment of the Concord River. This permit expires in 2006. The permit requires that EPA and MA DEP be notified 90 days prior to commencement of discharge.

Billerica Jail and House of Correction (MA0102563, also known as MCI- Billerica) is permitted (14 September 1984) to discharge 0.15 MGD of treated sanitary wastewater via outfall 001 to this segment of the Concord River. This permit expired 14 September 1989. The permit included limits for BOD (30 mg/L), TSS (30 mg/L), settleable solids (0.1 ml/L), fecal coliform bacteria (200 cfu/100mL) and TRC (1.5 mg/L max after 15 minutes peak hourly flow). The facility was issued a Notice of Noncompliance by the MA DEP in

2001 and an Administrative Complaint and Compliance Order by EPA in 2004 due to exceedances of flow, BOD<sub>5</sub>, TSS, settleable solids, pH, TRC, fecal coliform and percent removal of BOD<sub>5</sub>. This facility is expected to tie in to the Billerica sewer and discharge via the Billerica WWTP to the Concord River downstream of this segment. Following the tie-in the Town plans to take over the MCI-Billerica WWTP, rehabilitate it, and resume treating flow from the facility and a planned industrial park. The NPDES permit for any future facility will be issued such that it is consistent with all other NPDES Permits issued in this segment of the Concord River (Casella 2005).

The Town of Billerica (MAG070147) is permitted (31 March 2003) to discharge construction dewatering from the construction of a gravity sewer, pre-fabricated pump station, and force main in the River Pines section to this segment of the Concord River. This permit will expire in 2008.

## **LANDFILLS (APPENDIX K)**

There are two landfills located within this subwatershed- the now inactive Bedford Landfill and the active Bedford Compost Site.

## **USE ASSESSMENT**

### ***AQUATIC LIFE***

#### Habitat and Flow

ENSR collected stream flow measurements on 23 July 2001 at 5 sites along this segment of the Concord River. Flows ranged from 112.4 cfs downstream of Lowell Road in Concord at Station CR08 to 157.4 cfs downstream from Route 3 in Billerica at Station CR04 (ENSR 2003).

On 23 August 2001 ENSR conducted a time-of-travel study using Rhodamine dye through five miles of this segment of the Concord River, beginning in Bedford, downstream from Ball Hill Road at river mile 13, and ending at River Street in Billerica at river mile 8. The reach was between 210 and 280 feet wide and eight to ten feet deep during this survey. The estimated mean time-of-travel was 3.8 days (90 hours and 48 minutes) and the average velocity was estimated to be 0.08 ft/sec. On 10 September 2001, another time-of-travel study was again conducted using Rhodamine dye through the same five-mile reach. The estimated time of travel was 3.6 days (86 hours and 40 minutes) and the average velocity was estimated to be 0.09 ft/sec (ENSR 2003). The 7Q10 at the USGS gage (01099500), located downstream from the Rogers Street Bridge in Lowell (Segment MA82A-09), is 32.2 cfs. The average flow during the August time of travel study was 97 cfs (3 times 7Q10) while in September the average flow was 40 cfs (1.2 times 7Q10).

#### Biology

In July and September of 2001 ENSR conducted aquatic weed mapping along two reaches of this segment of the Concord River as part of the Phase I study for nutrient TMDL development. The first reach was adjacent to Great Meadows Pond #3 and Buttricks Hill, Ball Hill, and Davis Hill in Concord/Bedford. The second reach was near the Riverside Community of Billerica (ENSR 2003).

In July the estimated biomass for reach 1 was 48,000 kg (wet weight). Aquatic vegetation was limited to the areas along the stream banks. Filamentous green algae (FGA) were not identified in Reach 1 in July but in September it was the dominant plant, comprising 22% of the population. *Cladophora* sp. comprised 5% (2,400 kg wet weight) of the population of reach 1 in July and 13% (1,200 kg wet weight) in September. The non-natives *Trapa natans* (water chestnut), *Cabomba caroliniana* (fanwort), *Myriophyllum spicatum* (Eurasian milfoil), and *Potamogeton crispus* (curly-leaved pondweed) were identified in reach 1 in July. Fanwort was the dominant aquatic plant species identified in reach 1 (24%, 12,000 kg wet weight) in July. Water chestnuts were not recorded in the September survey. Duckweed (*Lemna minor*) was also identified in both July and September, comprising 5.0% and 9.7% of the population.

In July the estimated biomass for reach 2 was 37,000 kg (wet weight). The aquatic vegetation was found to fill more of the stream area and filled the entire channel at one point. Filamentous green algae comprised 22% (8,100 kg wet weight) of the population. In July and September *Cladophora* sp. was the dominant taxa recorded in reach 2, comprising 48% (18,000 kg wet weight) and 57% (8,600 kg wet weight), respectively. Water chestnut and Eurasian milfoil were recorded in reach 2

during the July survey but during the September survey only Eurasian milfoil was identified. Duckweed was only identified in reach 2 during the September survey.

MDFW conducted fish population sampling at one station on this segment of the Concord River north of the Route 225 bridge in Carlisle/Bedford on 18 May 2001 using boat electroshocking equipment (Richards 2003a). One hundred seventy-six bluegill, 72 yellow perch, 46 pumpkinseed, 31 American eel, 26 black crappie, 25 largemouth bass, 11 golden shiner, seven common carp, six chain pickerel, six white perch, three brown bullhead, three redbfin pickerel, two northern pike, and one alewife were collected. The total number of fish collected was high and macrohabitat generalists dominated the sample. Only one species, white sucker, is considered a fluvial specialist. All species present are considered moderately tolerant or tolerant to pollution. This segment of the Concord River is predominantly a slow-moving, meandering river with large areas of contiguous wetlands (Great Meadows). Given the nature of this segment the dominance by a diverse mix of tolerant and moderately tolerant macrohabitat generalists is to be expected.

## Toxicity

### *Effluent*

Between 16 September 1996 and 8 March 2004 thirty whole effluent toxicity tests were conducted on the Town of Concord WWTP effluent using *Ceriodaphnia dubia* (water flea). The effluent was not acutely toxic to the water flea ( $LC_{50s} > 100\%$  effluent) in any of the tests conducted. Except for the 9 December 2003 test, the C-NOEC was 100% effluent. The C-NOEC for December 2003 was 50% effluent. Twenty whole effluent tests were also conducted on the Concord effluent between 16 September 1996 and 11 June 2001 using *Pimephales promelas* (fathead minnow). The effluent was not acutely toxic to the minnow ( $LC_{50s} > 100\%$  effluent) in any of those tests. The C-NOEC was 25% effluent on 19 September 2000 and 50% effluent on 8 December 1998; the remaining 18 tests had C-NOECs = 100% effluent, indicating that the effluent had no chronic toxic effects (survival, growth) on the minnows.

### *Ambient*

Between 13 March 2001 and 8 March 2004 the Town of Concord collected water from the Concord River from Flint's bridge on Monument Street for use as a site control in their *C. dubia* whole effluent toxicity tests (n=11). During these test events survival of *C. dubia* exposed (seven days) to the river water was good ( $\geq 90\%$ ).

## Chemistry – water

ENSR conducted *in situ* water quality monitoring at one station on this segment of the Concord River (CR01- Concord River downstream from the confluence with the Sudbury River) as part of the Sudbury River Water Quality Survey on three occasions in 2003. Parameters measured included temperature, pH, DO, and conductivity. Grab samples were also collected for ammonium-N, TSS, and total phosphorus (ENSR 2004).

The Town of Concord collected water at Flint's Bridge on Monument Street along this segment of the Concord River for use as a control in their whole effluent toxicity tests. The water was analyzed for pH, hardness, alkalinity, conductivity, ammonia, and suspended solids.

### *DO*

Dissolved oxygen concentrations in Concord River water, measured by ENSR in 2003 as part of the Sudbury survey, ranged between 4.8 and 7.8 mg/L, while percent saturations ranged between 58.4 and 94.5 % (n=3). These data do not represent worst-case conditions (i.e., pre-dawn).

### *pH*

pH of the Concord River during the ENSR Sudbury survey ranged between 6.1 and 7.1 SU (n=3). pH of Concord River water reported in the Concord toxicity tests ranged between 6.7 to 7.7 SU (n=11).

### *Temperature*

Data from the ENSR Sudbury study ranged from a low of 21.3°C in September to a high of 27.1°C in July (n=3).

### *Alkalinity*

Concord River water, as reported in the Concord toxicity tests, had alkalinities ranging between 30 and 60 mg/L (n=11).

### *Hardness*

Hardness ranged from 32 to 82 mg/L in the Concord toxicity tests (n=11).

### *Conductivity*

Conductivities of the Concord River during the ENSR Sudbury survey ranged from 378 to 450  $\mu\text{S}/\text{cm}$  (n=3). Conductivity of Concord River water, measured as part of the Concord toxicity tests, ranged between 330 and 670  $\mu\text{S}/\text{cm}$  (n=11).

### *Total Suspended Solids*

Total suspended solids concentrations measured during the ENSR Sudbury survey ranged from <1 to 7 mg/L (n=3). TSS concentrations, as reported in the Concord toxicity tests, ranged between <5 and 11 mg/L (n=9).

### *Total Phosphorus*

The concentration of total phosphorus measured during the ENSR Sudbury survey ranged from 0.03 to 0.04 mg/L (n=3).

### *Ammonia-nitrogen*

Ammonia-nitrogen data from the ENSR Sudbury survey ranged between <0.03 and 0.03 (n=3).

Concentrations of ammonia-nitrogen in the Concord River, as measured during the Concord toxicity tests, ranged between 0.07 and 0.56 mg/L (n=9).

### Chemistry-sediment

ENSR collected sediment samples from two sites in Bedford (Great Meadows and Rt. 225) along this segment of the Concord River. Samples were analyzed for nutrient concentrations and total organic carbon. Although the total phosphorus concentrations did not exceed the L-EL guidance of 600 ppm (both concentrations were less than 9.7 ppm), both sediment samples exceeded the S-EL guidance of 10 ppm for total organic carbon by a factor of 2,500 and 720 times, respectively (Persuad *et al.* 1993).

Based on the presence of the non-native macrophyte species, which compromise the native, naturally diverse community of aquatic flora, the *Aquatic Life Use* is assessed as impaired.

### **FISH CONSUMPTION**

DWM conducted fish toxics monitoring in the Concord River near Route 4 in Billerica in 1986 and 1988 (Maietta 1990). Because of elevated mercury in fish tissue MDPH issued a fish consumption advisory for the Concord River in the towns of Concord, Carlisle, Bedford, and Billerica (this encompasses this entire segment).

1. Children younger than 12 years, pregnant women, and nursing mothers should not eat any fish from this waterbody.
2. The general public should not consume any largemouth bass from this waterbody.
3. The general public should limit consumption of non-affected fish from this waterbody to two meals per month.

The *Fish Consumption Use* is assessed as impaired due to the MDPH site-specific fish consumption advisory associated with mercury contamination from the Nyanza Superfund Site. Other potential sources include atmospheric deposition.

### **PRIMARY CONTACT AND SECONDARY CONTACT RECREATION AND AESTHETICS**






As part of the Sudbury River water quality investigation ENSR collected samples from the Concord River for fecal coliform and *E. coli* analysis. The fecal coliform bacteria sample collected during dry

weather on 29 July 2003 had a concentration of 100 cfu/100mL while the sample collected during wet weather on 16 September 2003 had a concentration of 23,700 cfu/100mL (ENSR 2004).

The Concord River Environmental Stream Team (CREST) conducted a shoreline survey in this segment of the Concord River from Route 225 to Route 3A in Billerica on 15 May 1999. CREST noted trash/dumping in some areas, one sewage outfall pipe, storm drain overflows, and in the section between Route 4 and River Street, moderate water chestnut invasion and heavy purple loosestrife infestation (CREST 1999).

The *Recreational* and *Aesthetics* uses are currently not assessed due to the paucity of data. However, the *Recreational* uses are identified with an "Alert Status" due to the elevated bacteria count during wet weather.

Concord River (MA82A-07) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Causes: Non-native aquatic plants
Fish Consumption		IMPAIRED Causes: Mercury Sources: Nyanza Superfund Site (Suspected Sources: Atmospheric deposition)
Primary Contact		NOT ASSESSED*
Secondary Contact		NOT ASSESSED*
Aesthetics		NOT ASSESSED

\* Alert Status issues identified- see details in the use assessment section

## RECOMMENDATIONS

- A non-native aquatic macrophyte management plan should be developed for the Concord River aimed at controlling the populations and preventing the spread to waters downstream.
- Water quality monitoring should be conducted to better evaluate the status of the *Aquatic Life Use*. Particularly diurnal dissolved oxygen concentrations should be collected at additional stations throughout this segment and sampling of the benthic macroinvertebrate and fish communities should bracket the discharges to determine the effects, if any, on the aquatic life.
- Bacteria sampling should be conducted to assess the status of the *Primary* and *Secondary Contact Recreation* uses and to document the effectiveness of bacteria reduction activities associated with the implementation of the Phase II storm water program.
- Work with CREST to implement their action plan including establishing a volunteer water quality monitoring program and working to restore anadromous fish runs in cooperation with the US Fish & Wildlife Service and the Department of Fish and Game.
- Work with interested parties to protect the core habitats and critical supporting watershed identified in the *Living Waters* report (NHESP 2003) through land conservation measures and management practices.



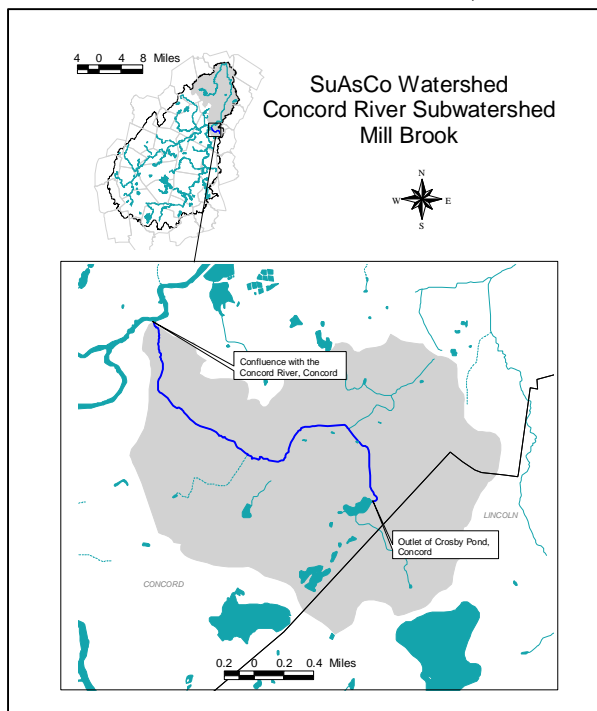
**MILL BROOK (SEGMENT MA82A-20)**

Description: From the outlet of Crosby Pond, Concord, to the confluence with the Concord River, Concord  
 Segment Length: 2.7 miles  
 Classification: Class B

Land-use estimates (top 3, excluding water) for the 3.3 mi<sup>2</sup> watershed (map inset, gray shaded area) are presented below. An estimate of the impervious area within this subwatershed is 0.26 mi<sup>2</sup> and the percentage of the imperviousness is 7.9%.

- Residential ..... 36%
- Forest..... 35%
- Agriculture..... 13%

Based on the last evaluation of water quality conditions Mill Brook is listed on the 2002 Integrated List of Waters in Category 4c. This segment was assessed as impaired or threatened due to other habitat alterations, which is not a pollutant requiring calculations of a TMDL (MA DEP 2003a).



**WMA WATER WITHDRAWAL SUMMARY (APPENDIX E, TABLE E5)**

Facility	WMA Permit Number	WMA Registration Number	Source (G = ground, S = surface)	Authorized Withdrawal (MGD)
Concord Water Department*	9P31460701	31406704	3067000-02G -07G	2.1 (reg) 0.42 (perm) 2.52*

\* Indicates a system-wide withdrawal, all sources not necessarily within this subwatershed.

**NPDES WASTEWATER DISCHARGE SUMMARY (APPENDIX E, TABLES E1-E4)**

Based on the available information there are no regulated NPDES surface water discharges to this subwatershed.

**LANDFILLS (APPENDIX K)**

The closed Concord Landfill and the active Concord Compost Site are located within this subwatershed.

**USE ASSESSMENT**

**AQUATIC LIFE**

Habitat and Flow

While too old for assessment purposes DWM conducted a habitat assessment as part of the benthic macroinvertebrate surveys in Mill Brook in 1996 at two stations: SAC01A, upstream from the Concord Police station, behind the Concord Ice Company, and SAC01B, upstream from Lowell Road, adjacent to the Star Market parking lot. Habitat quality degradation was noted at that time (Appendix H).

As part of the shoreline survey runoff and erosion from the Heywood Bridge, as well as channelization, were reported by the Mill Brook Task Force to the DPW (MBTF 2000). This was addressed in the spring of 2003 when the culvert and bridge were replaced (MBTF 2002).

Biology

MDFW conducted fish population sampling at one station in Mill Brook downstream of Haywood Road in Concord on 12 July 2001 using backpack electroshocking equipment (Richards 2003a). Six redfin pickerel, one white sucker, and one American eel were collected. The white sucker is considered a

fluvial dependent species that is tolerant of pollution. The redbfin pickerel and the American eel are both considered macrohabitat generalists.

MDFW also sampled an unnamed tributary to Mill Brook, upstream from Lexington Road, Concord, on 13 July 2001. Fifteen yellow perch, three redbfin pickerel, and one largemouth bass were collected.

DWM conducted RBP II surveys in Mill Brook in 1996 at two stations- SAC01A, upstream from the Concord Police station behind the Concord Ice Company, and SAC01B, upstream from Lowell Road, adjacent to the Star Market parking lot (Appendix H).

Due to the lack of current habitat quality, benthic macroinvertebrate, and physico-chemical data the *Aquatic Life Use* is currently not assessed for Mill Brook. The *Aquatic Life Use* is, however, identified with an Alert Status due to the low numbers of fish and because of the small drainage area of the watershed and the presence of water withdrawals. Whether or not habitat quality is improving or remains degraded is unknown.






**PRIMARY CONTACT AND SECONDARY CONTACT RECREATION AND AESTHETICS**

DWM collected three samples for bacteria analysis from Mill Brook on 18 July, 30 July and 11 September 2001 at Station MB01, upstream from Lowell Road bridge in Concord. Holding times were exceeded during the September survey so data from this sampling event were censored. The fecal coliform bacteria counts for the July dates were 300 and 70 cfu/100 mL (Appendix A).

The Mill Brook Task Force and Mill Brook Stream Team conducted a shoreline survey of Mill Brook in May 2000. With the exception of small localized areas of trash and debris the stream appeared to be of high aesthetic quality. Localized areas of erosion were noted at the Heywood Street bridge. Improper yard waste disposal practices near Old Bedford Road were also noted (MBTF 2000). In 2002 MBFT conducted a stream cleanup in Mill Brook to remove the localized trash and debris identified in the 2000 survey (MBTF 2002).

Due to the lack of additional data the *Primary* and *Secondary Contact Recreational* uses are currently not assessed. However, based on the high aesthetic quality noted in the Mill Brook Task Force Shoreline Survey the *Aesthetics Use* is assessed as support.

Mill Brook (MA82A-20) Use Summary Table

Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
				
NOT ASSESSED*	NOT ASSESSED	NOT ASSESSED	NOT ASSESSED	SUPPORT

\*Alert Status issues identified- see details in the use assessment section.

**RECOMMENDATIONS**

- During the next round of sampling (expected in 2006) DWM should conduct water quality sampling in Mill Brook to assess the *Aquatic Life Use*. The plan should also determine if water withdrawals are impacting habitat in the brook. Benthic macroinvertebrate sampling should be considered for this segment, but this could prove difficult since the 1996 Technical Memorandum indicated few sites suitable for sampling (Appendix H). At the very least, a habitat quality survey should be conducted to determine if habitat quality has improved or deteriorated. Additionally, bacteria samples from Mill Brook should also be collected to assess the recreational uses.
- Work with the Mill Brook Task Force to implement their action plan including continuing stream cleanups, catch basin tagging, and promoting educational awareness and good stewardship.

## CONCORD RIVER (SEGMENT MA82A-08)

Description: From the Billerica Water Supply Intake, Billerica, to Rogers Street bridge, Lowell

Segment Length: 5.1 miles

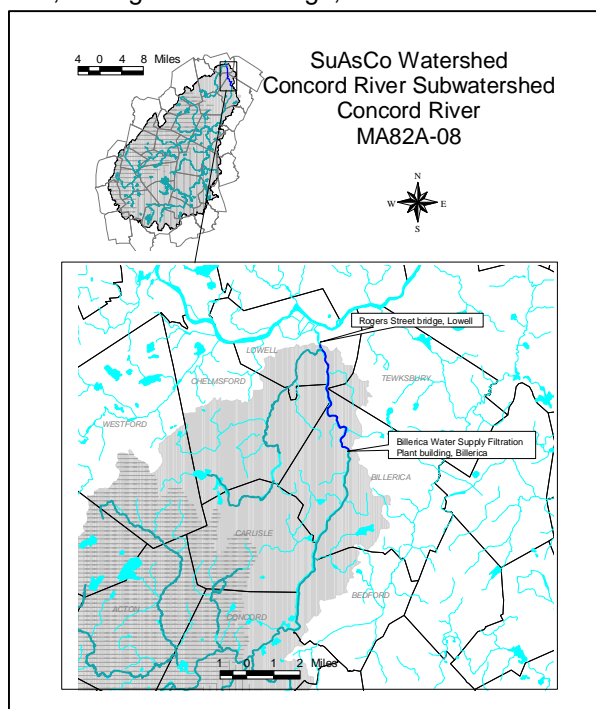
Classification: Class B, Warm Water Fishery

Land-use estimates (top 3, excluding water) for the 399.6 mi<sup>2</sup> watershed (map inset, gray shaded area, includes the entire Assabet and Sudbury subwatersheds) are presented below. An estimate of the impervious area within this subwatershed is 48.4 mi<sup>2</sup> and the percentage of the imperviousness is 12.1%.

Forest.....	44%
Residential .....	31%
Open land .....	7%

Based on the last evaluation of water quality conditions this segment of the Concord River is listed on the 2002 Integrated List of Waters in Category 5. This segment was assessed as impaired and requires a TMDL for metals and nutrients (MA DEP 2003a).

The history of the 27-mile long Middlesex Canal, completed in December of 1803 as a means of transporting freight from Boston to Merrimack, and Faulkner/Talbot's Dam in Billerica is available in the Middlesex Canal Association's September 2000 Towpath Topics newsletter (Middlesex Canal Association 2000). Additional information on the canal can be also obtained from the association's websites at <http://www.middlesexcanal.org/>.



## WMA WATER WITHDRAWAL SUMMARY

Based on the available information there are no registered or permitted WMA withdrawals from this subwatershed.

## NPDES WASTEWATER DISCHARGE SUMMARY (APPENDIX E, TABLE E1-E4)

The Town of Billerica (MA0101711) is permitted (2 November 2001) to discharge 5.4 MGD (annual average, not monthly average) of treated sanitary wastewater via outfall 001 to the Concord River. The permit expired in 2003. A new permit is being developed. The facility's whole effluent toxicity limit is C-NOEC  $\geq$ 24% effluent and LC<sub>50</sub>  $\geq$  100% effluent. There are seasonal limits for phosphorus (May 1- October 31 = 0.75 and November 1- April 31 = report) and ammonia-nitrogen (June 1 to September 30 = 6 mg/L and October 1 – May 31 = report). Ammonia-nitrogen concentrations in the effluent ranged from a low of <0.05 to a high of 17 mg/L. The facility's TRC limit is 0.045 mg/L. TRC concentrations in the effluent ranged between <0.02 and 0.08 mg/L and of the 27 measurements only one exceeded the limit. The Billerica WWTP is a secondary WWTP that serves 37,000 people and receives wastewater from approximately 19 industrial users. The facility has requested an increase in flow rate due to the planned tie-in of the Billerica House of Corrections (MCI-Billerica). Following the tie-in the Town plans to take over the MCI-Billerica WWTP, rehabilitate it, and resume treating flow from the facility and a planned industrial park. The NPDES Permit for any future facility will be issued such that it is consistent with all other NPDES Permits issued in this segment of the Concord River (Casella 2005).

Baker Commodities, Incorporated (MAG250026) is permitted (4 June 2003) to discharge 0.1 MGD of NCCW to a tributary to this segment of the Concord River. Baker Commodities (MAR05C532) is also permitted to discharge storm water. The facility's individual permit (MA0031585) was closed.

## FERC

In September of 1981 the Mass Bay Power Company was issued a FERC- exemption (Project No. 2998) to operate the Centennial Island Hydroelectric Project. The project consists of a 320-foot long masonry

and concrete dam with 8-inch high flashboards, a headpond, and a 2,300-foot long, 36-foot wide, and 8-foot deep canal that transports water to the powerhouse. The project is required to release a continuous minimum flow of 57 cfs, or inflow, into the bypass reach, between the dam and the tailrace (Grader 2004). The 57 cfs is released, in part, over the dam and thru the fishways (upstream and downstream - although only one may be operational at any particular point in time). The Denil fishway would normally be passing about 12 cfs (Quinn 2004). They also must always release a minimum below-project flow of 142 cfs (Grader 2004). However, the owner operates the project as true run-of-river (inflow = outflow, maintaining a stable headpond at the top of the flashboards) (Grader 2004). In 1994 the exemptee was required to install streamflow monitoring equipment that records minimum flow discharged to the bypass reach after a site visit by FERC, which was prompted by reports that showed that the minimum flows were not met (as low as 5 cfs in Nov 93 and June 94 completely dewatered). The fishway is adjacent to the dam and includes an upstream fish ladder and downstream chute for fish migration. The fishway also operates as the structure for the release of minimum flow. Depending on the upstream or downstream migration season flows are regulated or controlled by stoplogs (FERC undated). The upstream fish ladder typically begins operating one week after clupeids pass the Lawrence fish lift and closes July 31. The downstream ladder is opened for spent adults two weeks after the upstream passage begins and closes July 31. For juveniles the bypass operates from September 1 through November 15.

## **LANDFILLS (APPENDIX K)**

The Corenco Industrial Landfill is located within this subwatershed.

## **USE ASSESSMENT**

### **AQUATIC LIFE**

#### Habitat and Flow

The estimated 7Q10 at the USGS streamflow gage (01099500) located downstream from this segment (300 feet downstream from Rogers Street in Lowell) is estimated to be 32.2 cfs (Wandell and Fontaine 1984). The USGS remarks that the discharge includes water released from the Sudbury River basin and Lake Cochituate and that low flow is regulated by mills in Lowell. Evidence of regulation at this stream gaging location can be observed using on-line real-time USGS gaging data (USGS 2004).

On 23 July 2001, ENSR measured streamflow in the Concord River at Station CR03, upstream from the Faulkner Dam in Billerica, to be 143.2 cfs (ENSR 2003). Additionally, on 23 August 2001 ENSR conducted a time-of-travel survey through five miles of the Concord River, beginning in Bedford, downstream from Ball Hill Road at river mile 13, and ending at River Street in Billerica at river mile 8. The estimated mean time-of-travel was 3.8 days (90 hours and 48 minutes) and the average velocity was estimated to be 0.08 ft/sec. On 10 September 2001 another time-of-travel study was again conducted using Rhodomine dye through the same five-mile reach. The estimated time-of-travel was 3.6 days (86 hours and 40 minutes) and the average velocity was estimated to be 0.09 ft/sec (ENSR 2003). The average streamflow at the USGS gage over the time-of-travel study in August was 97 cfs (3 times the 7Q10) and in September was 40 cfs (1.2 times the 7Q10).

Although the Concord River is not specifically mentioned in the *Strategic Plan for the Restoration of Atlantic Salmon for the Merrimack River 1990 through 2004* (Merrimack River Policy and Technical Committee 1990) it is mentioned in the Merrimack River Basin Fish Passage Action Plan for Anadromous Fish (Merrimack River Policy Committee 1988). The latter plan specifically identifies two dams on this segment of the Concord River requiring fish passage- Centennial Island in Lowell and Faulkner Dam (also referred to as the Talbot Mills or Billerica Dam) in East Billerica. The plan further states that "Construction of the Centennial Island and East Billerica fish passage facilities will provide anadromous fish access to the base of the Saxonville dam on the Sudbury River and to the base of the Damondale dam on the Assabet River". The fish passage facility at Faulkner Dam was to be operational five years following the passage of 500 shad at Centennial Island (Merrimack River Policy and Technical Committee 1990). At this time there are no functional plans for any upstream or downstream fishway at the Talbot/Billerica dam (Quinn 2004).

Mass Bay Power Company owns and operates the FERC exempt Centennial Island Hydroelectric Project No. 2998. The project is supposed to release a continuous minimum flow of 57 cfs, or inflow, into the bypass reach. The bypass reach extends from the dam to the confluence with the tailrace (approximately

0.4 river miles). FERC has received reports that flows in the bypass reach have been below the required minimum 57 cfs. In May 2002 a compliance investigation of Centennial Island was requested by a third party. During the spring of 2002 flashboards, approximately 16 inches high, were noted along the top of the falls and an adjacent fish ladder diverting water to the supply canal. The US Fish & Wildlife Service noted deficiencies at the fish ladder during a site visit in the summer of 1999. The fish ladder is to begin operating one week after clupeids pass the Lawrence fish lift and closes 31 July. For spent adults the bypass channel is opened two weeks after upstream passage begins and closes 31 July. For juveniles the bypass operates 1 September through 15 November. The USF&W Service initiated an alewife stocking program in 2000 above the Faulkner Dam (Talbot Mill Dam/Billerica Dam) in Billerica that was expected to last at least three years. As such the downstream bypass sluice should be opened earlier than in the past, around April 7 (FERC undated).

On 24 March 2004 DWM staff toured the Centennial Island Dam and fish ladder in Lowell. The eight foot high dam, located downstream from Lawrence Street, seemed to be in need of maintenance; logs and branches accumulated against the flash boards and some rooted shrubs appeared to be growing out of the dam. There were also three large deciduous trees growing out of the center of the stream below the dam. Water flows under the Flotsam Bridge and then encounters the Centennial Dam Project. Water may flow by the project in any of three courses. Water may pour over the dam and then travel down the right side of the island. Or, water may flow through the fish ladder and then mix with the water that has poured over the dam. Or, water may enter the canal that flows down the left side of the island.

It did not appear that the hydroelectric facility was operating. The fish ladder did not appear to be operating as water levels were insufficient to allow upstream migration. Instream cover downstream from the dam was good with the substrate in the main river channel consisting primarily of boulders and cobble. Less than 10% of the reach had submerged snags or logs. The bank on the left bank (facing downstream) was a cement wall. The right bank consisted mostly of large boulders. Undercut banks for habitat were minimal. Filamentous green algae were attached to the boulders and cobble. Current velocities were greater than 5 feet per second and water reached both banks. The width of the riparian zone on the right bank was less than six meters, with obvious human impacts (old warehouse and hydro facility), while on the right the riparian zone is 6-12 meters.

### Biology

In July and September of 2001 ENSR conducted aquatic weed mapping along one reach of this segment of the Concord River upstream of the Faulkner Mills Dam in Billerica. These studies were conducted as part of the Phase I assessment for the Concord River nutrient TMDL development (ENSR 2003).

In July the estimated biomass was 110,000 kg, while in September the estimated biomass was 140,000 kg. It should be noted that ENSR believes that the estimated biomass is artificially inflated due to the presence of high-density plants. Aquatic vegetation was limited to the areas along the stream banks in the main river. However, the impounded area behind the dam was 75-95% covered with dense to very dense aquatic vegetation. The non-native *Trapa natans* (water chestnut) dominated the aquatic vegetation (27%, 31,000 kg) in July. Filamentous green algae (22% and 3.7%), *Cladophora* sp. (23% and 14%), the non-native *Cabomba caroliniana* (0.4% in July), and *Myriophyllum spicatum* (1.3% in September) were also identified. Duckweed (*Lemna minor*) was also identified in July (2.4%, 2,800kg) and was the dominant species identified during the September survey (37%, 52,000 kg).

As part of the USFWS river herring/alewife restoration program the Lowell Parks and Conservation Trust started a volunteer fish counting program at Wamesit Falls and Centennial Island Fish Ladder in Lowell in 2002. As of 2004 USFWS was not aware of any fish counted at Centennial Island by the Lowell volunteers (Quinn 2004).

MDFW conducted fish population sampling at one station on this segment of the Concord River, behind the fire station off of Lowell Street in Billerica, on 21 May 2001 using boat electroshocking equipment (Richards 2003a). One hundred thirty-eight bluegill, 71 pumpkinseed, 63 white perch, 56 common carp, 29 yellow perch, 30 black crappie, 21 largemouth bass, 16 white sucker, nine golden shiner, nine chain pickerel, eight brown bullhead, five alewife, four redbfin pickerel, three American eel, two green sunfish, two smallmouth bass, one northern pike, and one yellow bullhead were collected. The total number of

fish collected was high. Macrohabitat generalists dominated the sample. Only one species, white sucker, is considered a fluvial specialist. All species present are considered moderately tolerant or tolerant to pollution. This segment of the Concord River is predominantly slow-moving and meandering. Given the nature of this segment the dominance by a diverse mix of tolerant and moderately tolerant macrohabitat generalists is to be expected. Few anadromous fish (alewife) and catadromous fish (American eel) were found.

## Toxicity

### *Effluent*

Between 14 July 1997 and 15 March 2004 the Town of Billerica conducted 23 whole effluent toxicity tests using the water flea (*Ceriodaphnia dubia*) and 25 tests using the fathead minnow (*Pimephales promelas*). The effluent was acutely toxic to the water flea on only two occasions, once in February 2000 (LC<sub>50</sub> =58.8% effluent) and once in March 2002 (LC<sub>50</sub> = 70.7% effluent). The effluent was never acutely toxic to the minnow (LC<sub>50</sub> >100% effluent). The C-NOEC ranged from 12.5% effluent to 100% effluent for the *Ceriodaphnia* tests and from 24 to 100% effluent for the *Pimephales* tests. Of the tests conducted *C. dubia* was generally the more sensitive test species.

### *Ambient*

The Town of Billerica collected water from the Concord River at the Pollard Street bridge (~one mile upstream from the discharge) for use as diluent in their whole effluent toxicity tests. Survival of *Ceriodaphnia* exposed to river water for seven days was good ( $\geq 80\%$ ). Survival of *Pimephales* was fair and ranged between 38 and 100% survival and was less than 75% in seven of the 25 tests conducted. It should be noted that survival of the minnows from July 2001 to present has not been less than 75%.

## Chemistry – water

As part of their whole effluent toxicity tests the Town of Billerica collected water from the Concord River. The water was analyzed for hardness, alkalinity, conductivity, ammonia-nitrogen, pH, and suspended solids.

### *pH*

pH in the Concord River as measured in the Billerica toxicity tests ranged between 6.6 and 7.75 SU (n=27).

### *Hardness*

Hardness in Concord River water as measured in the Billerica toxicity tests ranged between 27 and 100 mg/L (n=27).

### *Alkalinity*

The Billerica toxicity tests reported alkalinity of the Concord River between <10 and 80 mg/L (n=25).

### *Conductivity*

Concord River conductivities, as reported in the Billerica toxicity tests, ranged between 254 and 587  $\mu\text{S}/\text{cm}$  (n=27).

### *Total Suspended solids*

TSS concentrations, according to the Billerica toxicity tests, ranged between <5 and 23 mg/L (n=24).

### *Ammonia-nitrogen*

Concentrations of ammonia-nitrogen in Concord River water ranged between <0.05 and 0.580 mg/L (n=25).

### *Total Residual Chlorine*

With the exception of one elevated TRC measurement (July 1997) of 0.12 mg/L, all TRC measurements were less than the minimum quantification level of 0.05 mg/L.

### Chemistry-sediment

ENSR collected sediment samples from the Concord River at the Faulkner Dam forebay. Samples were analyzed for nutrient concentrations, total carbon, and Toxicity Characteristic Leaching Procedure (TCLP) metal analysis. Although the total phosphorus concentration did not exceed the L-EL guidance of 600 ppm (32.2 ppm) the sediment sample exceeded the S-EL guidance of 10 ppm for TOC by a factor of 2,500 (Persuad *et al.* 1993). TCLP analysis did not detect concentrations of arsenic, barium, cadmium, chromium, mercury, lead, selenium, or silver in the sediments from the Faulkner Dam forebay (ENSR 2003).

Based on the presence of the non-native macrophyte species, which compromise the native, naturally diverse community of aquatic flora, the *Aquatic Life Use* is assessed as impaired. It should also be noted that the Concord River is specifically listed in Table 1 (*Upstream Fish Passage Requirements For Anadromous Fish in The Merrimack River Basin, 1988-2005*) of Appendix III (*Merrimack River Basin Fish Passage Action Plan for Anadromous Fish*) within the *Strategic Plan for the Restoration of Atlantic Salmon for the Merrimack River 1990 through 2004* (Policy Committee for Anadromous Fishery Management of the Merrimack River 1990). Goals include an operational fish passage facility coincident with completion of hydroelectric facility at Centennial Island and an operational fish passage facility at East Billerica within five years of the passage of 500 shad at the Centennial Island ladder. According to the Strategic Plan fish passage facilities at these locations would "provide anadromous fish access to the base of the Saxonville dam on the Sudbury River and to the base of the Damondale dam on the Assabet River." The current lack of passage at Faulkner Dam also contributes to the impairment noted above. The USFWS is currently working with the owners of both the Centennial Island and Faulkner Dam to either improve (Centennial) or establish (Faulkner) fish passage facilities at these locations. There may also be issues with the hydropower project (e.g., lack of water in the bypass reach, evidence of stream flow fluctuations). Poor survival of minnows exposed to river water collected near the Pollard Street bridge prior to July 2001 was also documented.

### **FISH CONSUMPTION**

Because of elevated mercury in fish tissue documented in the Concord and Sudbury rivers MDPH issued a fish consumption advisory for the Concord River in the towns of Concord, Carlisle, Bedford, and Billerica.

1. Children younger than 12 years, pregnant women, and nursing mothers should not eat any fish from this waterbody.
2. The general public should not consume any largemouth bass from this waterbody.
3. The general public should limit consumption of non-affected fish from this waterbody to two meals per month.






Currently, the MDPH advisory does not include the portion of the Concord River through the towns of Chelmsford and Lowell so the *Fish Consumption Use* is assessed as impaired for the upper 3.2 miles and not assessed for the lower 1.8 miles. Mercury contamination from the Nyanza Superfund Site is considered the primary cause of impairment but other potential sources include atmospheric deposition.

### **PRIMARY CONTACT AND SECONDARY CONTACT RECREATION AND AESTHETICS**

As part of a reconnaissance of this segment downstream from the Lawrence Street bridge on 24 March 2004 DWM staff noted that there were very small amounts of trash and debris actually in the watercourse. However, the potential exists for large amounts of discarded materials (roof shingles, pipes, glass, wood, etc) from the abandoned factory buildings on the left bank to end up in the water. These materials were lying atop the cement retaining wall and could easily blow into the stream. There was also a footpath along this wall that provides potential access to the stream for recreation. The Massachusetts Community Water Watch conducted a shoreline survey on two miles of this segment of the Concord River upstream from the Lowell Cemetery on Lawrence Street. They noted improper disposal of yard waste, lack of erosion and sediment controls at the site of new dock construction, and concerns over the storage of trains over the river. With the exception of sporadic trash on the stream banks this section of the Concord River was aesthetically pleasing (Cornwell 2004).

Due to the lack of quality assured bacteria data the *Recreational* uses are currently not assessed. The *Aesthetics Use* is assessed as support. However, the *Aesthetics Use* is identified with an “Alert Status” due to the isolated areas of trash and debris along the streambanks and the urbanized nature of this segment.

Concord River (MA82A-08) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Causes: Non-native aquatic plants (Suspected Causes: Fish barriers) (Suspected Sources: Hydrostructure impacts on fish passage, impacts from hydrostructure flow regulation/ modification)
Fish Consumption		IMPAIRED upper 3.2 miles NOT ASSESSED lower 1.9 miles Causes: Mercury Sources: Nyanza Superfund Site (Suspected Sources: Atmospheric deposition)
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		SUPPORT*

\* Alert Status issues identified—see details in use assessment section.

## RECOMMENDATIONS

- Water quality and biological monitoring should be conducted to better evaluate the status of the *Aquatic Life Use*. Monitor the fish community along this segment of the Concord River to evaluate any changes resulting from efforts to improve/mimic natural flow regimes.
- Instream flow regimes along this segment of the Concord River (as affected by operation of the FERC-exempt hydropower projects) should be documented and attempts should be made to mimic natural flow regimes to the extent possible. Investigate the operating conditions at the Centennial Island Dam during periods of low flow. Determine if this project releases its required minimum flows. Evaluate and monitor operations for compliance with run-of-river requirements.
- A habitat assessment for anadromous fish should be conducted upstream and downstream from the Talbot/Billerica dam. An anadromous fish target species should be selected. Depending on the target species and returns expected a Denil fishway or a steppass fishway would be appropriate. Funding sources should be explored to install and maintain the fishway. The possibility/feasibility of dam removal should also be explored
- A non-native aquatic macrophyte management plan should be developed for the Concord River aimed at controlling the populations and preventing the spread to waters downstream.
- The Town of Billerica WWTP NPDES permit should be renewed with appropriate limits and monitoring requirements. The toxicity testing requirements should be reduced to testing with *C. dubia* only since it has been the more sensitive test organism.
- Additional instream studies (ambient toxicity testing, benthic macroinvertebrate sampling bracketing the discharge, fish population sampling, habitat assessment) should be conducted due to the frequency of reduced survival of *P. promelas* in the Concord River upstream from the Billerica WWTP. If significant toxicity is detected determine cause(s) and source(s).
- MDPH should re-evaluate the fish consumption advisory for the Concord River to include all towns from the confluence with the Assabet and Sudbury rivers to the confluence with the Merrimack River.
- Bacteria monitoring should be conducted at multiple stations along this five-mile segment to assess status of the *Recreational* uses.
- Work with Massachusetts Community Water Watch to conduct a stream cleanup along this segment of the Concord River and continue performing shoreline surveys to document the aesthetic quality of this segment for use in assessing the *Aesthetics Use*.



**UNNAMED TRIBUTARY (SEGMENT MA82A-21)**

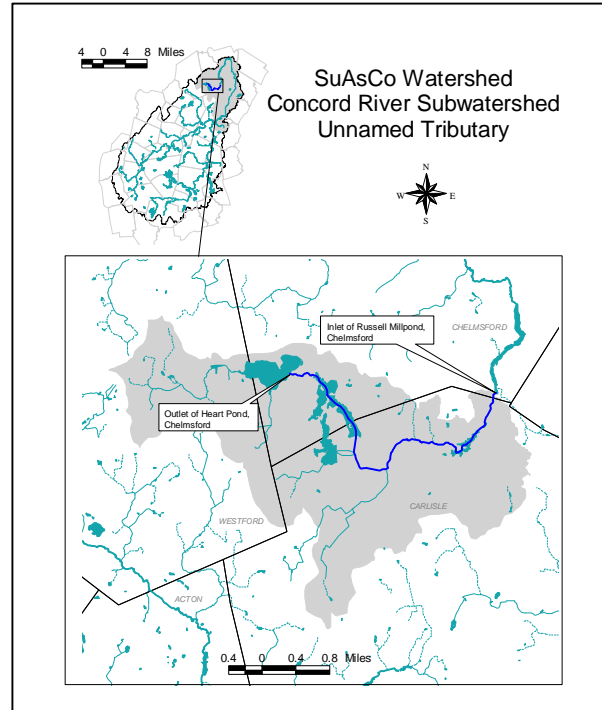
Description: From the outlet of Heart Pond, Chelmsford, to the inlet of Russell Millpond, Chelmsford  
 Segment Length: 4.1 miles  
 Classification: Class B

Land-use estimates (top 3, excluding water) for the 7.6 mi<sup>2</sup> watershed (map inset, gray shaded area) are presented below. An estimate of the impervious area within this subwatershed is 0.38 mi<sup>2</sup> and the percentage of the imperviousness is 5.0%.

- Forest..... 53%
- Residential ..... 29%
- Agriculture..... 7%

Based on the last evaluation of water quality conditions this unnamed tributary is listed on the 2002 Integrated List of Waters in Category 3. This segment was not assessed for any of the designated uses (MA DEP 2003a).

Approximately 310 acres in Carlisle and Chelmsford are preserved for open space and cranberry agriculture. In Carlisle about 40 acres are actual cranberry bog. This is the site of the last continuously working cranberry bog in Middlesex County, Massachusetts. The Nickles brothers of Carlisle began the bog in the late 1800's. Chelmsford and Carlisle bought the 300+ acre bog and adjoining lands for almost 2 million dollars to protect it from development in 1986. Adjacent to the bog is the Great Brook Farm State Park, which was created in the 1970s and encompasses 934 acres (Carlisle 2005).



**WMA WATER WITHDRAWAL SUMMARY (APPENDIX E, TABLE E5)**

In Dec. 1999 the Chelmsford Water District proposed to develop a well field (3056000-0AG) within the Cranberry Bog Reservation property in Carlisle/Chelmsford. The well field proposal included the construction of six wells, 650 linear feet of gravel roadway, and a 30'x30' control building and sought a withdrawal of 360,000 GPD. The proposal was retracted in 2000 when concerns were raised regarding the impacts that the withdrawal would have on surface waters in the vicinity of the wells (O'Keefe 2005).

Facility	WMA Permit Number	WMA Registration Number	Source (G = ground, S = surface)	Authorized Withdrawal (MGD)
Carlisle Water Department		31405101	Martin & Fiske St Pond	0.36

**NPDES WASTEWATER DISCHARGE SUMMARY**

Based on the available information there are no regulated surface water NPDES discharges to this subwatershed.

**LANDFILLS (APPENDIX K)**

The Carlisle Landfill and Carlisle Transfer Station are located within this subwatershed.

## **USE ASSESSMENT**

### **AQUATIC LIFE**

#### Habitat and Flow

In 1996 DWM conducted a habitat assessment of River Meadow Brook at one station- SAC04, upstream from Lowell Street, Carlisle (Appendix H). The sampling reach received the highest score for the SuAsCo Watershed (186 out of 200).

Five water control structures are operated on this segment to accommodate the cranberry agriculture in Carlisle. The River Meadow Brook Association has raised concerns regarding frequent drawdowns and the impacts from siltation on conservation wetlands and downstream habitat. The River Meadow Brook Association documented a four-foot drawdown of this unnamed tributary/Russell Millpond/River Meadow Brook on 24 August 2003. In the late 1990's Elm Street Pond was documented by the Association to be completely dry, except for a few muddy channels, resulting in fish kills. The association also noted that the dam at the Cranberry Bog reservation is being repaired (Wilson 2004).

DWM personnel conducted a field reconnaissance of the River Meadow Brook subwatershed including Elm Street Pond, this unnamed tributary, Russell Millpond, and River Meadow Brook on 24 March 2004. Water flows from the control structure on Fiske Street Pond into the cranberry bog and out into this unnamed tributary. The water is conveyed from the cranberry bog under an earthen dike via two new eight-foot culverts, channeled around the perimeter of a bog undergoing renovations, into a culvert under North Street, and back into the unnamed tributary.

Rare and endangered species (wood turtles and rare mussels) have been documented in the River Meadow Brook Subwatershed by the River Meadow Brook Association and led to the mapping of a priority habitat by the MA Natural Heritage and Endangered Species Program (Wilson 2004).

#### Biology

In 1996 DWM conducted a benthic macroinvertebrate (RBP II) survey at Station SAC04 in River Meadow Brook (Appendix H).

MDFW conducted fish population sampling at two stations in this unnamed tributary in Carlisle on 12 July 2001 using backpack electroshocking equipment. The brook was sampled downstream from a cranberry bog and at Mill Pond Lane and Curve Lane (Richards 2003a). One redbfin pickerel, one brown bullhead, and three banded sunfish were collected (five fish total). All of these species can be classified as macrohabitat generalists. The banded sunfish has not been classified while the redbfin pickerel is considered to be moderately pollution tolerant species and the brown bullhead is a pollution tolerant species.






Too limited data are available so the Aquatic Life Use is not assessed. However, this use is identified with an Alert Status because of the flow fluctuations/modifications associated with the cranberry bog operations.

### **PRIMARY CONTACT AND SECONDARY CONTACT RECREATION AND AESTHETICS**

A large portion of this tributary is protected open space. Additionally, the River Meadow Brook Association, in conjunction with the Mass WaterWatch Partnership, has conducted stream cleanups along this tributary. No objectionable conditions were noted by DWM staff during field reconnaissance along this tributary in March 2004 (O'Brien-Clayton 2004).

The *Primary* and *Secondary Contact Recreational* uses are not assessed because of a lack of bacteria data. The *Aesthetics Use*, however, is assessed as support.

Unnamed Tributary (MA82A-21) Use Summary Table

Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
				
NOT ASSESSED*	NOT ASSESSED	NOT ASSESSED	NOT ASSESSED	SUPPORT

\* Alert Status issues identified, see details in use assessment section

## RECOMMENDATIONS

- Work with the River Meadow Brook Association and the Massachusetts Community Water Watch to conduct a shoreline survey and conduct quality assured water quality monitoring to assess the *Aesthetics* and *Aquatic Life* uses.
- Work with the Town of Carlisle and the lessees of the cranberry bog to implement environmentally friendly practices at the cranberry bog. Care should be taken to mitigate sedimentation spreading downstream of the bogs and water management practices (e.g., minimum release, stop log activities) should be employed to protect the aquatic life downstream from the bogs in River Meadow Brook. Encourage the owners to seek assistance from the United States Department of Agriculture National Resources Conservation Service and Cape Cod Cranberry Growers Association.
- DWM biologists suggested follow up sampling (habitat assessment, streamflow monitoring, benthic macroinvertebrates and fish population) in River Meadow Brook to examine the effects, if any, of pesticide residues and nutrient enrichment associated with the cranberry bog operations.
- The River Meadow Brook Association, Massachusetts Community Water Watch, and OAR should work with the Riverways RIFLS (River Instream Flow Stewards) Program to install a staff gage(s) along River Meadow Brook to monitor streamflows.

**RIVER MEADOW BROOK (SEGMENT MA82A-10)**

Description: From the outlet of Russell Mill Pond, Chelmsford, to the confluence with the Concord River, Lowell

Segment Length: 6.4 miles

Classification: Class B

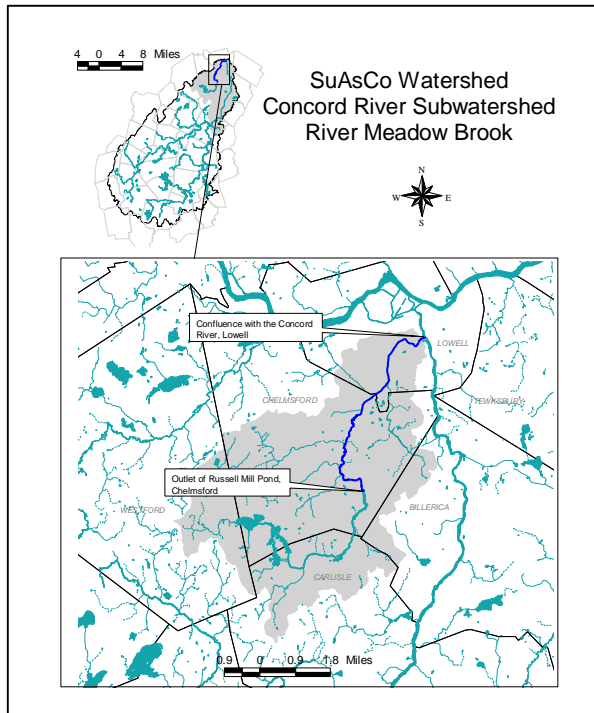
Land-use estimates (top 3, excluding water) for the 26.9 mi<sup>2</sup> watershed (map inset, gray shaded area) are presented below. An estimate of the impervious area within this subwatershed is 4.6 mi<sup>2</sup> and the percentage of the imperviousness is 17.3%.

- Residential ..... 40%
- Forest..... 35%
- Open land ..... 6%

Based on the last evaluation of water quality conditions River Meadow Brook is listed on the 2002 Integrated List of Waters in Category 5. This segment was assessed as impaired and requires a TMDL for pathogens (MA DEP 2003a).

The following description of River Meadow Brook was excerpted from the Stoss Landscape Urbanism of Boston (Stoss 2002) proposal for the Tanner Street Initiative/Silresim Superfund Site.

River Meadow Brook flows in a south-to-north direction from southwestern Lowell to the Concord River, passing along the entire western edge of the Tanner Street Initiative site. River Meadow Brook's headwaters are comprised of a few small tributaries and a nutrient-rich wetland. The banks of the upper portion of the Brook are nicely vegetated, and wildlife habitat within and around the Brook seems to be intact. A straight and relatively deep channel characterizes the middle reaches of River Meadow Brook. The absence of riffle/pool sequences and meandering characteristics is likely a result of river channelization that occurred during construction of the Lowell Connector during the late 1950s and early 1960s. Immediately downstream of the study site (past Howard Street), the Brook enters a culvert as it travels under the railroad tracks, reemerges as a well vegetated stretch of river, discharges over a grade control structure then travels under Route 3A. Just downstream of Route 3A, River Meadow Brook narrows and becomes more sinuous as it flows through a residential area. The final section of River Meadow Brook flows through an industrial complex and passes under a couple of large brick buildings, then reemerges into a vegetated area with overhanging trees. The area where the Brook enters the Concord River appears to be a popular fishing area.



**WMA WATER WITHDRAWAL SUMMARY (APPENDIX E, TABLE E5)**

Facility	WMA Permit Number	WMA Registration Number	Source (G = ground, S = surface)	Authorized Withdrawal (MGD)
Chelmsford Water District	9P31405601	31405602	3056000-02G -05G -09G -11G -15G -16G -18G -19G	1.8 (reg) <u>0.22 (perm)</u> 2.02
East Chelmsford Water District	9P421405602	31405601	3056001-01G -02G -03G	0.13 (reg) <u>0.1 (perm)</u> 0.23

**NPDES WASTEWATER DISCHARGE SUMMARY (APPENDIX E, TABLES E1-E4)**

UAE Lowell Power LLC (MA0033201) is permitted (25 June 1992) to discharge storm water runoff from a detention basin via outfall 001 to River Meadow Brook (former permit holder L'Energia Limited

Partnership). This permit expired 25 June 1997. The permit requires monitoring for flow, oil & grease, BOD, TSS, COD, total phosphorus, total Kjeldahl nitrogen, nitrate plus nitrite-nitrogen, and pH.

Majilite Manufacturing Incorporated (MAG250011) is permitted (23 February 2001) to discharge 0.028 MGD of NCCW to River Meadow Brook. This permit will expire in 2006. The facility's individual permit (MA0032506) was closed.

Four-In-One Co. Inc., formerly known as Stickney & Poor Company, (MAG250954) is permitted (8 September 2000) to discharge 0.01 MGD of NCCW to an unnamed tributary to River Meadow Brook. This permit will expire in 2005.

The East Chelmsford Water District (MAG640057) is permitted (20 July 2001) to discharge filter backwash from a water treatment plant to an unnamed tributary to River Meadow Brook. This permit expires in 2006. The facility began operation in the fall of 2001. The monthly average discharge is approximately 0.3 MGD. The facility has reported monthly and daily maximum TRC concentrations of 0.8 to 1.3 mg/L, respectively and the effluent pH is almost always < 6.5 SU. The permit required a toxicity test using *Ceriodaphnia dubia* due to the low dilution factor. The test was required in June 2002 but was to be conducted in June 2004.

## **SUPERFUND SITES**

The Silresim Chemical Corporation site is located at 86 Tanner Street in Lowell and covers approximately 5 acres in an industrial area. Starting in 1971, Silresim began reclaiming a variety of chemical wastes, waste oil, solvents, and sludges containing heavy metals. In 1977, Silresim declared bankruptcy and abandoned the site, leaving behind 30,000 decaying drums and several large storage tanks. The groundwater is contaminated with volatile organic compounds (VOCs), semi-volatile organic compounds, pesticides, polychlorinated biphenyls (PCBs), and heavy metals. The soil is polluted with VOCs, semi-volatile organic compounds, pesticides, and PCBs. Low levels of dioxin also are present in the soil. Additional investigations were completed in the summer of 2001 and a report entitled "Final Additional Site Investigation and Revision of Site Clean-up Goals" was issued in January 2002. EPA is currently conducting a pilot study to evaluate the effectiveness of electrical resistive heating for removing VOC contamination from the soil and groundwater. Evaluation of the technology and preparations for soil excavation, consolidation, and capping activities will continue through 2003 and into 2004. A Reuse Assessment, which identifies potential reuse options for the site based on the clean-up plan and the current and future land use, was also completed in September 2003 (EPA 2004c). Additional information is available in the Summary of Existing Conditions and Perceived Problems section of this report and from the EPA website.

The Tanner Street Initiative is a study of the Silresim Superfund Site aimed at examining the impact this site has had on an entire district within the City of Lowell. The City formed a Community Advisory Board to help guide the planning process in determining the future of the area. They received an EPA grant to hire Stoss Landscape Urbanism of Boston to complete a reuse and redevelopment study for the district (Stoss 2002). Additional information about the Initiative is available from the City of Lowell's website at <http://www.lowellma.gov/depts/dpd/services/econdev/brownfield/tanner/>.

## **USE ASSESSMENT**

### **AQUATIC LIFE**

#### Habitat and Flow

DWM personnel conducted a field reconnaissance near the Russell Millpond Dam on River Meadow Brook on 24 March 2004. River Meadow Brook cascades over the falls at the former sawmill (see note below) and is then channelized by concrete pavers through the property. Canopy cover was sparse as was overhanging bank vegetation. The riparian zone was less than 6 meters on both banks and green lawns run right to the edge of the concrete pavers. Large amounts of what appeared to be naturally occurring foam accumulated at the Mill Road culvert. A small eddy was also created at the culvert.

Note: The Russell Mill Pond hydroelectric dam is located just off Mill Road in Chelmsford. This dam powered the "first saw mill", built in 1656 by a Samuel Adams.

'Mr. Adams is granted Libberty to sett Flood gates for the advantage of his Mill pond at the Mouth of Hart pond this was granted by the Town for the use of his Mill to him and his heirs forever.' This mill was upon Great, or River Meadow brook, about two miles, a little east of south, from the center of the town. A saw and gristmill was maintained there by five successive generations of the Adams family. It then passed by purchase to Mr. Abbot Russell, who was followed by his son, the late Lincoln H. Russell, since whose death in 1899, the mill has not been used (USIGS undated).

The River Meadow Brook Association has described water levels in this segment as perilously low, although it was possible that dam repairs at Russell Millpond may have contributed to this low flow situation. Operations of the dam are still conducted under the "King's Grant" of 1656 (Wilson 2004). The Association documented a four-foot drawdown of this unnamed tributary/Russell Millpond/River Meadow Brook on 24 August 2003. (Wilson 2004).

As part of the data collection and assessment phase for the development of the Concord River nutrient TMDL ENSR conducted stream flow monitoring in River Meadow Brook on four occasions in June, July, August, and September 2001. Flows ranged between 24.56 cfs in June to 2.02 cfs in September (ENSR 2003). The estimated 7Q10 of River Meadow Brook is 0.99 cfs (USGS 2002).

Rare and endangered species (wood turtles and rare mussels) have been documented in the River Meadow Brook Subwatershed by the River Meadow Brook Association and led to the mapping of a priority habitat by the MA Natural Heritage and Endangered Species Program (Wilson 2004).

The Lowell Connector was constructed in the 1950s, joining central Lowell with the new interstate highway system. As a result of the construction River Meadow Brook was straightened and channelized to run immediately parallel with the highway. The new channel is characterized by steep banks, designed to contain the 100-year flood, and the elimination of buffer and wetland zones that might help to filter stormwater entering the brook (Stoss 2002).

#### Biology

The non-native aquatic macrophyte *Trapa natans* (water chestnut) was documented in Russell Millpond by DWM during the 1996 synoptic survey (See lakes section and Appendix B). The River Meadow Brook Association has documented that the infestation has spread downstream throughout the brook (Wilson 2004).

Too limited water quality data are available so the *Aquatic Life Use* is not assessed. However, this use is identified with an Alert Status because of reportedly low flow conditions and infestation of the non-native aquatic macrophyte *Trapa natans*. The effects, if any, of the discharges in this subwatershed are currently unknown.

#### **PRIMARY CONTACT AND SECONDARY CONTACT RECREATION AND AESTHETICS**






The River Meadow Brook Association noted shopping carts and other trash in the brook near Glenn Avenue. The section of River Meadow Brook along the Lowell Connector and Tanner Street was most impacted. Crushed cars from an auto salvage company were documented to be overhanging the brook (Wilson 2004).

The Massachusetts Community Water Watch surveyed River Meadow Brook near the confluence with the Concord River at Centennial Isle Mills Condos off Lawrence Street. The water was noted to have an orange color, perhaps from sand or iron runoff. Trash was noted in the water and erosion was also noted to be taking place (Cornwell 2004).

The Tanner Street Initiative report (Stoss 2002) noted that adjacent landowners in the middle section of River Meadow Brook have cleared vegetation from the bank and have either left the soil exposed or covered it with bark mulch. Storm water runoff and direct dumping of waste negatively impact the stream. Large amounts of debris (i.e. tires, shopping carts, wood pallets) are scattered throughout the brook, particularly shopping carts, tires, and other debris litter the portion of the brook below Howard Street. The area where the Brook enters the Concord River appears to be a popular fishing area. The report also noted that piles of scrap automobiles hang "precipitously over the edge of the bank".

Based on the abundance of trash and debris throughout this segment River Meadow Brook is assessed as impaired for the *Primary Contact Recreation*, *Secondary Contact Recreation*, and *Aesthetics* uses.

River Meadow Brook (MA82A-10) Use Summary Table

Designated Uses		Status
Aquatic Life		NOT ASSESSED*
Fish Consumption		NOT ASSESSED
Primary Contact		<b>IMPAIRED</b> Causes: Trash and debris Sources: Municipal urbanized high density areas
Secondary Contact		
Aesthetics		

\* Alert Status issues identified – see details in use assessment section

## RECOMMENDATIONS

- Interested parties including the Massachusetts Community Water Watch, River Meadow Brook Association, and the Tanner Street Initiative should organize a shoreline survey of River Meadow Brook and conduct a river cleanup to remove the trash and debris.
- Water quality monitoring should be conducted in River Meadow Brook. The monitoring plan should be designed to examine the impacts from storm water, NPDES point source discharges, instream impacts from the Silresim Superfund Site (if any), and flow manipulations associated with upstream cranberry bog operations/dam operations. Limited surface water and sediment sampling was conducted in River Meadow Brook as part of the Record of Decision (ROD) and found low levels of VOCs, SVOCs, and PCBs. It was unclear as to the source of the PCBs (Stoss 2002).
- As it appears that the lowest section of River Meadow Brook is a popular fishing spot and the sediments contain at least trace amounts of contaminants, fish toxics monitoring should be conducted in River Meadow Brook in the vicinity of Tanner Street.
- Bacteria monitoring should be conducted in River Meadow Brook to evaluate the *Primary* and *Secondary Contact Recreational* uses.
- The expired UAE Lowell LLC NPDES permit should be reviewed and reissued with appropriate limits. It should be determined if this facility is eligible to apply for coverage under the storm water general permit and the individual permit closed.
- Continue to monitor the DMRs for the East Chelmsford Water District, as it appears the facility is having problems with TRC and pH. When complete, the toxicity test report should be reviewed. If warranted, biological sampling should be conducted to bracket the discharge.
- Evaluate the recommendations of the Tanner Street Initiative Report prepared by Stoss Landscape Urbanism of Boston (Stoss 2002). If appropriate, implement the recommendations relative to improving water quality. Prior to implementation additional water quality sampling should be conducted to document baseline conditions (especially the recommendation to treat stormwater).

## CONCORD RIVER (SEGMENT MA82A-09)

Description: From the Rogers Street Bridge, Lowell, to the confluence with the Merrimack River, Lowell

Segment Length: 0.9 miles

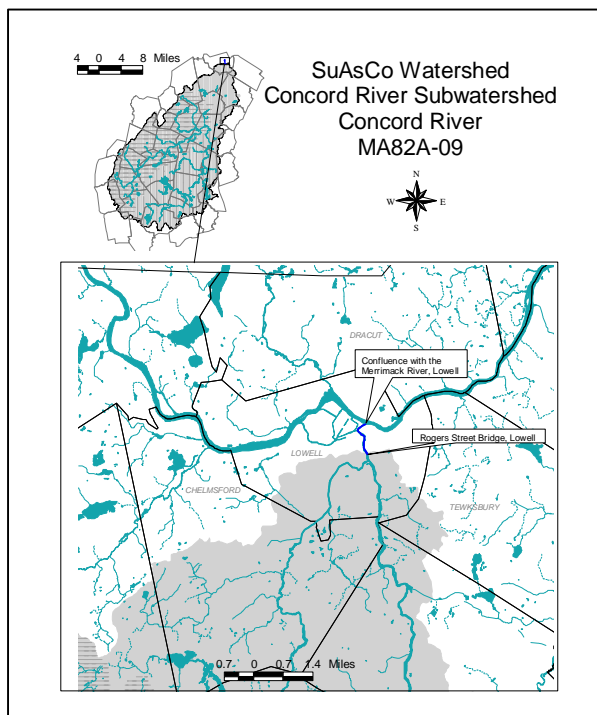
Classification: Class B, Warm Water Fishery, CSO

Land-use estimates (top 3, excluding water) for the 400.0 mi<sup>2</sup> watershed are presented below (map inset, gray shaded area, calculated at the confluence with the Pawtucket Canal, includes entire Assabet and Sudbury subwatersheds). An estimate of the impervious area within this subwatershed is 48.6 mi<sup>2</sup> and the percentage of the imperviousness is 12.1%.

Forest.....	43%
Residential .....	31%
Open land .....	7%

Based on the last evaluation of water quality conditions this segment of the Concord River is listed on the 2002 Integrated List of Waters in Category 5. This segment was assessed as impaired and requires a TMDL for metals, nutrients, and pathogens (MA DEP 2003a).

The Pawtucket Canal was constructed in 1796 as a means to transport timber from New Hampshire to Newburyport, MA, circumventing Pawtucket Falls in what is now the City of Lowell. Water moves from the Merrimack River through four sets of locks, through a 30-foot drop, to the Concord River. The canal system evolved to channel water for powering mills. The Northern Canal was added in 1847, bringing the length of the canals to over 6 miles, operating on two level, and powering 10 major mill complexes. Since the mills have gone out of business the buildings have been transformed into apartments and office space, as well as various sites of Lowell National Historical Park. Lowell Parks and Conservation Trust use the lower locks for their whitewater rafting tours. Additional information is available from the Lowell National Historic Park [http://www.nps.gov/lowe/loweweb/Lowell\\_History/Lowell\\_Canal\\_System.htm](http://www.nps.gov/lowe/loweweb/Lowell_History/Lowell_Canal_System.htm) or from the Lowell Parks and Conservation Trust <http://www.lowellandtrust.org>.



## WMA WATER WITHDRAWAL SUMMARY

Based on the available information there are no regulated water withdrawals from this subwatershed.

## NPDES WASTEWATER DISCHARGE SUMMARY (APPENDIX E, TABLES E1-E4)

Lowell Regional Water and Wastewater Utility (LRWWU) is permitted (MA0100633, 14 September 1997) to discharge via Outfall Number 020-SDS#6 (Warren Street parking lot) combined sewer overflow to this segment of the Concord River. The permit expired in 2002 and EPA is currently drafting this permit with input from MA DEP (Brander 2003). According to Camp Dresser and McKee's June 2001 draft LRWWU Long-term CSO Control Plan "...the Warren Street CSO Structure to the lower Concord River has been shown to contribute the largest volume of CSO discharges per year at 202 MG, which represents 57 percent of the total average annual volume for the collection system. LRWWU is presently under an Administrative Order from EPA to implement CSO projects that mitigate CSO discharges throughout their system, including at the Warren Street CSO. These Phase I projects will reduce the annual CSO volume from 202 MG to approximately 65 MG annually on average at Warren Street.

## HAZARDOUS WASTE SITES AWAITING NATIONAL PRIORITY LISTING DECISION

The former Costa's Landfill is located at 89 to 103 Billerica Street in Lowell. The sources on the property are a former landfill, which received municipal waste, tannery waste, and other industrial waste (including waste from the coal gasification process), and a hazardous waste landfill, constructed between 1994 and 1995 to hold waste removed from the former landfill. The waste that was disposed of at Costa's Landfill can be characterized as containing coal gasification process by-products, railroad debris, leather scraps,



ceramic insulators from telephone and electrical poles, hospital bandages, bottles, light bulbs, drums, metal paint cans, ash, ceramic plates, waste paint or dye, rubber shoe scraps, and possibly electrical transformers. Surface water and sediment samples collected in 1988 downstream along the Concord River documented two organic and four inorganic substances (methylene chloride, phenol, chromium, lead, mercury, and silver) significantly above reference concentrations. The property is currently in Phase V of the five phase MCP process and is listed as a Tier 1A site (EPA 2002f).

The Raytheon property is a missile production facility located in Lowell, Tewksbury, and Billerica at the intersection of the three municipalities. The 30-acre property is located in a mixed industrial, commercial, and residential area and is bordered to the north by Interstate 495, to the east by Boston and Maine Railroad, to the west by the Concord River, and to the south by Corenco Corporation (an animal by-product processing facility). Groundwater investigations conducted in 1985 revealed the presence of numerous VOCs which included 1,1,1-trichloroethane (TCA) and 1,1,1-trichloroethylene (TCE). Subsequent groundwater investigations conducted in 1993 confirmed groundwater VOC contamination in the vicinity of the main building on the property. Groundwater investigations determined that a two-aquifer system exists beneath the property. A silt-layer, acting as an aquitard, limits hydraulic communication between the upper and lower aquifers. Water-level monitoring data suggest that groundwater in both the upper and lower aquifers flows in a westerly to northwesterly direction towards the Concord River. A study of the Concord River, adjacent to the property, was conducted in 1988 and 1989. Sediment and surface water samples were collected from four river transect lines. VOCs were detected in both surface water and sediment samples, indicating the groundwater plume below the property has impacted the Concord River. The property is currently a Tier 1C site and is in Phase II of the five phase MCP process (EPA 2002g).

## **USE ASSESSMENT**

### **AQUATIC LIFE**

#### Habitat and Flow

Stream gaging data for the Concord River are available from the USGS gage 01099500, located downstream from the Rogers Street Bridge in Lowell, from 1936 to the present. The drainage area at this gage is 400 mi<sup>2</sup> (net 307 mi<sup>2</sup> diversion as needed from 92.6 mi<sup>2</sup> for use by the Boston metropolitan district) and the average annual discharge over the period of record is 647 cfs (Socolow 2004).

According to USGS low flows are regulated by mills upstream. Daily discharge includes undiverted water from 92.6 mi<sup>2</sup> in the Sudbury River and Lake Cochituate basins (Socolow *et al.* 2003). The 7Q10 for the Concord River at this gage is 32.2 cfs (Wandle and Fontaine 1984 and USGS 2002). Evidence of regulation at this stream gaging location can be observed using on-line real-time USGS gaging data (USGS 2004).

The Middlesex Dam was breached in the early 1980s. The remnants include only the concrete abutments and the site consists of an island and major and minor channels surrounding the abutments. A hydraulic assessment indicated that fish passage would be impeded during low flow conditions (650 cfs). Therefore, the USFWS has undertaken the Middlesex Dam Breach Stabilization Project to maintain and improve fish passage. The project will create an eight-foot-wide channel of smooth laminar flow along the island side of the main channel. It is expected that sections of ledge in the river channel will be removed to reduce the turbulence. The project fact sheet indicated that stabilization of the dam, adequate operation of the Centennial Island project, and installation of a fish ladder at Talbot/Billerica Dam would provide access to 12.1 miles of the Concord River, 17.5 miles of the Sudbury River, and 9.0 miles of the Assabet River. The project was scheduled to be completed in 2002 (USFWS undated).

#### Chemistry – water

As part of the SMART monitoring program, water quality sampling was conducted on five occasions between March and November of 2000 in the Concord River (Station C07) approximately 100 meters downstream/north from Rogers Street, Lowell (Appendix I).

#### *DO*

DO measurements ranged from a low of 8.5 mg/L in August to a high of 12.7 mg/L in March. Percent saturation ranged from 93% (August) to 107% (March). It should be noted that these data do not represent the worst-case, pre-dawn conditions.

#### *Temperature*

The temperature in this segment of the Concord River ranged from a high of 24.1°C during the summer month of July to a low of 6.0°C in March.

#### *pH*

Instream pH ranged between 6.7 and 7.4 SU.

#### *Alkalinity*

Alkalinity in this segment of the Concord River ranged between 13 and 30 mg/L.

#### *Hardness*

Hardness data ranged from 35 to 60 mg/L.

#### *Conductivity*

Measurements of specific conductance at 25°C ranged from a low of 270 to a high of 412 µS/cm.

#### *Turbidity*

Turbidity ranged from 0.2 to 5.1 NTU.

#### *Total Suspended Solids*

TSS concentrations ranged between 3.7 and 11 mg/L.

#### *Total Phosphorus*

The concentration of total phosphorus in the Concord River downstream from Rogers Street ranged from 0.067 to 0.18 mg/L.

#### *Ammonia-nitrogen*

Ammonia-nitrogen concentrations ranged from <0.02 to 0.06 mg/l (which do not exceed the chronic criterion for ammonia-nitrogen).

The *Aquatic Life Use* is currently not assessed for this segment of the Concord River due to the lack of biological and worst-case, pre-dawn dissolved oxygen data. This use is, however, identified with an Alert Status due to the elevated total phosphorus concentrations.

### **FISH CONSUMPTION**

In June 2004 fish were collected from this segment of the Concord River (as part of a public request for fish toxics monitoring in the Lowell Canal System) and were analyzed for select metals, organochlorine pesticides, and PCBs. These data are not yet available.

Due to mercury contamination associated with the Nyanza Superfund Site MDPH issued a fish consumption advisory for the Concord River in the towns of Concord, Carlisle, Bedford, and Billerica that states:

1. Children younger than 12 years, pregnant women, and nursing mothers should not eat any fish from this waterbody.
2. The general public should not consume any largemouth bass from this waterbody.
3. The general public should limit consumption of non-affected fish from this waterbody to two meals per month.

It is unclear why the advisory does not include the towns of Chelmsford and Lowell. The *Fish Consumption Use* is currently not assessed for this segment of the Concord River due to the lack of a site-specific advisory for the Town of Lowell.

**PRIMARY CONTACT AND SECONDARY CONTACT RECREATION AND AESTHETICS**






As noted in the NPDES section, Lowell Regional Water and Wastewater Utility discharges 202 million gallons per year of CSO via the Warren Street outfall to this section of the Concord River. Under the Utility’s long-term CSO control plan, CSO discharges via the Warren Street outfall will be reduced to 65 million gallons per year (Brander 2003).

In June 2004 DWM biologists noted that the lower portion of this segment had objectionable odors, trash and debris, and algae (Maietta 2004). The Massachusetts Community Water Watch conducted shoreline surveys of the Concord River in 2003 and 2004. Massachusetts Community Water Watch found high levels of illegal dumping including broken bottles, household products, yard clippings, and shopping carts in the Concord River at Rogers Street (Cornwell 2004).

The SMART field crews did not note any objectionable conditions (trash/debris, scum, sheens). The water did have a musty basement smell on two occasions (MA DEP 2001b).

Although there is no current bacteria data for this segment based on best professional judgment, this segment of the Concord River is assessed as impaired for the lower 0.5 miles due to the volume of CSO discharge. The upper 0.4 miles are assessed as impaired for the *Recreational* and *Aesthetics* uses due to objectionable conditions (odors, trash, debris, algae).

Concord River (MA82A-09) Use Summary Table

Designated Uses		Status
Aquatic Life		NOT ASSESSED*
Fish Consumption		NOT ASSESSED
Primary Contact		IMPAIRED Causes: Fecal coliform bacteria, trash and debris, excess algal growth Sources: CSOs (Suspected Sources: Municipal urbanized high density areas, discharges from municipal separate storm sewers (MS4s))
Secondary Contact		
Aesthetics		IMPAIRED Causes: Trash and debris (181), excess algal growth (Suspected Sources: Municipal urbanized high density areas (84), Municipal storm sewers (MS4s))

\* Alert Status issues identified—see details in the use assessment section

**RECOMMENDATIONS**

- Pre-dawn dissolved oxygen monitoring and biological monitoring (benthic macroinvertebrate, habitat assessment, fish population) should be conducted to assess the status of the *Aquatic Life Use*.
- When available, review the results of the 2004 fish toxics sampling. MDPH should re-evaluate the fish consumption advisory for the Concord River and include all towns from the confluence with the Assabet and Sudbury rivers to the confluence with the Merrimack River, if appropriate.
- Conduct bacteria sampling throughout this segment of the river to document the effectiveness of source reduction activities (elimination of the Warren Street CSO, Phase II) and to better evaluate the status of the *Recreational* uses.
- The Massachusetts Community Water Watch should continue to conduct shoreline surveys of this segment of the Concord River as well as conduct a stream cleanup and work to educate the public on good stewardship practices.