

Berlin Septic Survey Final Report

A Water Quality Survey to Identify Sources of *E. coli* in
Three Mattabeset River Tributaries – 2002-2003

June 2003

Connecticut River Coastal Conservation District, Inc.
deKoven House, 27 Washington Street
Middletown, CT 06457
860.346.3282



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INTRODUCTION

The Connecticut River Coastal Conservation District (formerly Middlesex County Soil and Water Conservation District) conducted water quality surveys of several Mattabeset tributaries in Berlin in late 2002 and early 2003 under contractual agreement with the Town of Berlin. The surveys were conducted in areas where high levels of bacteria had been documented in previous studies to identify possible failing septic systems and other sources of bacterial contamination. Surveyed stream sections were located predominantly in residential areas on septic systems, as well as in some agricultural areas. Sections of Belcher Brook, John Hall Brook and Stocking Brook were surveyed during a total of six sampling rounds. Following each round, District staff reviewed results and consulted the Berlin Sanitarian and/or DEP Water Management Bureau staff to plan for subsequent sampling.

As part of the surveys, water samples were collected and analyzed for *E. coli* (*Escherichia coli*) bacteria. *E. coli* bacteria enter the environment in the feces of warm blooded animals (i.e. birds and mammals). Though not harmful themselves, *E. coli* are indicators of disease causing organisms (pathogens). Thus high concentrations of *E. coli* in surface waters (streams, rivers, ponds etc.) indicate an impaired habitat and a potential health risk to humans. *E. coli* is the indicator bacteria used by the State of Connecticut for freshwater to evaluate general sanitary conditions and determine whether bathing areas are safe for swimming. Sources include wastewater treatment plants, on-site septic systems, domestic and wild animal manure, and urban runoff.

Properly functioning septic system leaching fields filter out pathogens while failing septic systems allow bacteria and other substances to pass through, potentially contaminating nearby surface waters. Optical brighteners, synthetic additives in clothes washing detergents that make white cotton glow "whiter than white," pass through failing septic systems and can be detected in the environment. At specific locations, water samples were taken and fabric pads were submerged in streams for one week to absorb any optical brighteners. When analyzed in a lab, the pads yield qualitative data – presence, absence or inconclusive (i.e. retest). The presence of optical brighteners in surface water together with high levels of *E. coli* usually indicates failing septic systems nearby.¹

¹ Sargent, Dave and Wayne Castonguay. An Optical Brightener Handbook. 1998.
<http://www.naturecompass.org/8tb/sampling/index.html>

BACKGROUND

In 1999, the Connecticut River Coastal Conservation District formed the broad-based Mattabeset Stakeholders Group charged with developing a comprehensive, watershed-wide management plan. Their efforts culminated in *The Management Plan for the Mattabeset River Watershed*, which in September 2000 was overwhelmingly endorsed by the major watershed towns and a multitude of other watershed stakeholders. Since the signing, the town of Berlin has made notable progress in implementing the Plan through a formal implementation committee appointed by the Mayor, composed of members of the Town Council, town staff and various land use commissions. The Berlin Implementation Committee has developed a work plan based on the Management Plan, identified priority projects requiring funding, requested and received funding through the municipal budget process for specific projects, and initiated this survey and several other key projects.

This survey builds on water quality data for the Mattabeset River watershed collected by the Connecticut River Coastal Conservation District through its citizen monitoring program, the Connecticut River Watch Program (CRWP) and intensive water quality surveys carried out by staff. Long-term monitoring by citizen volunteers (1992-present) has documented high bacteria in watershed streams, among other water quality problems. More detailed investigations of water quality of Mattabeset River tributary streams were conducted in the summers of 2000 and 2001 to begin the process of identifying sources of water quality impairments documented by CRWP. Streams included John Hall/Stocking Brook, Belcher Brook, Little Brook, and Spruce Brook in Berlin. The surveys provided a great deal of information, useful in focusing future follow-up activities. Most notably, the results revealed several potential “hot spots” that should be investigated further, where bacteria, turbidity or nutrients were highest.²

The Connecticut River Watch Program

The Connecticut River Watch Program (CRWP) is a volunteer water quality monitoring, protection and improvement program for the Connecticut River and its tributaries. CRWP is sponsored by the Connecticut River Coastal Conservation District, and was initiated in 1992 in cooperation with River Watch Network, based in Vermont (now part of River Network). The program was developed, in part, to meet the water quality monitoring and public outreach and involvement needs of the Mattabeset River Watershed Management Project (see below). The goals of the program are to collect scientifically credible water quality information that can be used to identify and correct water quality problems, and to build public awareness of local river resources and water quality issues.

In the first eight years CRWP focused its monitoring activities on the lower Connecticut River main stem and two tributary watersheds, the Mattabeset and the Coginchaug. The program generated an extensive water quality database for these rivers, and raised local awareness of river resources and water quality issues through public involvement and outreach activities. Information collected through CRWP has been used by towns to investigate potential sources of pollution, and by the state for planning purposes. It has become a model program, with wide support from the local communities and state and federal environmental officials. Funding for CRWP has come primarily from the DEP through grants from the US EPA under Section 319 of the Clean Water Act.

² More detailed information can be found in two reports published by the Middlesex County Soil and Water Conservation District: *The Mattabeset River—A Study of Water Quality and Stream Health*, 2000; and *Mattabeset Regional Basin Intensive Water Quality Surveys—2000-2001:Discussion and Follow-Up Plan*, 2002.

In 1999, CRWP began expanding into new watersheds within the Connecticut River basin. The program is now a regional support service, whose focus is to initiate, support and coordinate community-based river monitoring, assessment and improvement programs in regional watersheds throughout the basin. Through the new program, CRWP continues to put water quality and physical survey information into the hands of local communities, and support efforts to use that information to direct river and other watershed protection and improvement efforts. Current project areas include the Mattabesset/Coginchaug, Eightmile, Salmon, Hockanum and Farmington River watersheds.

The Mattabesset River Study

Since 1992 the Connecticut River Watch Program has conducted a study of water quality and stream health in the Mattabesset River watershed. Located in Central Connecticut in a relatively urbanized area, the river is the target of efforts to improve its health. This study was undertaken to document the river's current water quality, and through public involvement, interest the local community in the river and its future.

As part of the study, water samples have been collected and analyzed for a number of indicators of water quality, both as part of a broad water quality survey of long-term sites and intensive water quality surveys of selected watershed streams; benthic macroinvertebrates (aquatic insects and other organisms) have been collected and identified; and physical characteristics of streams have been documented through visual surveys. All monitoring activities have been conducted with the help of trained volunteers. Strict quality control procedures, detailed in an EPA-approved Quality Assurance Project Plan, have ensured the scientific credibility of results.

The Mattabesset River Watershed Management Project

The Connecticut River Coastal Conservation District has been working on a long-term project to improve water quality conditions in the Mattabesset River with funding from the Federal EPA. In addition to ongoing water quality monitoring activities conducted by the Connecticut River Watch Program, activities have included restoration projects designed to demonstrate the use of Best Management Practices; technical assistance programs given on NPS pollution and storm water management for municipal staff and land use commissioners, developers and contractors; public outreach and involvement activities, including a major river clean up, storm drain stenciling projects and an annual watershed awareness week; and increasing opportunities for public access through development of a canoe/kayak launch area and on-river trail. In 1999-2000, the Conservation District worked with a diverse group of watershed stakeholders – including environmental advocates, conservation organizations, businesses, municipalities, and federal and state agencies – to develop a management plan for the Mattabesset watershed. The document was finalized in a signing ceremony in 2000, and efforts are now focused on implementing the recommendations in the plan.

METHODS

Water samples were collected in sterile polypropylene bottles by District staff and tested for *E. coli* at the State Lab in Hartford. The results are reported as the number of *E. coli* colonies per 100 milliliters of water. District staff placed optical brightener pads in streams for a period of one week. The optical brightener pads were analyzed under a UV light (blacklight) at the State Lab by DEP Water Management Bureau staff. Pads containing optical brighteners glowed under UV light. More information is available at <http://www.naturecompass.org/8tb/sampling/index.html>.

Quality assurance and control procedures included collection of duplicate samples and blanks for bacterial analysis, and placement and analysis of duplicate optical brightener pads.



Fabric pads, contained in metal cages, were placed in streams to absorb optical brighteners.

RESULTS

A summary of results and recommendations for follow-up are included for each section of stream surveyed. Sites are listed in tables upstream to downstream. Complete data tables are located in the Appendix.

E. coli results were generally well below the criterion listed in the State's Water Quality Standards,³ with some exceptions. It is important to note that due to time constraints, much of the sampling took place during the winter. Studies show that when released into cold surface waters, *E. coli* revert to a dormant-like state, referred to as "viable but nonculturable," in which they are not detected in standard lab tests.⁴ While *E. coli* levels did not exceed State Guidelines during the colder months of this survey, relatively high results were measured periodically, suggesting possible impacted areas.

While cold weather bacteria sampling is less reliable, significant bacteria inputs (e.g. total septic system failure) may still be detectable in nearby surface waters. Cold weather bacteria sampling was further justified when coupled with optical brightener monitoring, the presence of which does not vary with water temperatures.

³ According to the Water Quality Standards, for non-swimming uses, the single sample maximum is 576 colonies/100ml, and geometric mean should be less than 126 colonies/100ml.

⁴ Santo Domingo, Jorge W., Ph.D. US Environmental Protection Agency. NRMRL/WSWRD/Microbial Contaminants Control Branch. Personal communication, February 2003.

John Hall Brook

Site Location	Rationale
2 nd Edgewood Road crossing	Downstream of 2 residences
Downstream Edgewood Road crossing	Downstream of 4 residences
Orchard Road crossing	Downstream of ~5 residences
Penny Brook Lane crossing Orchard Road	Downstream of 4 residences
Penny Brook – outflow pipe in culvert	Potential illicit residential discharge
Unnamed tributary at Southington Road	Residential and golf course pond impacts
Southington Road crossing	Residential and agricultural impacts

Table 1. Bacteria Data Summary: *E. coli* reported as colonies/100mL

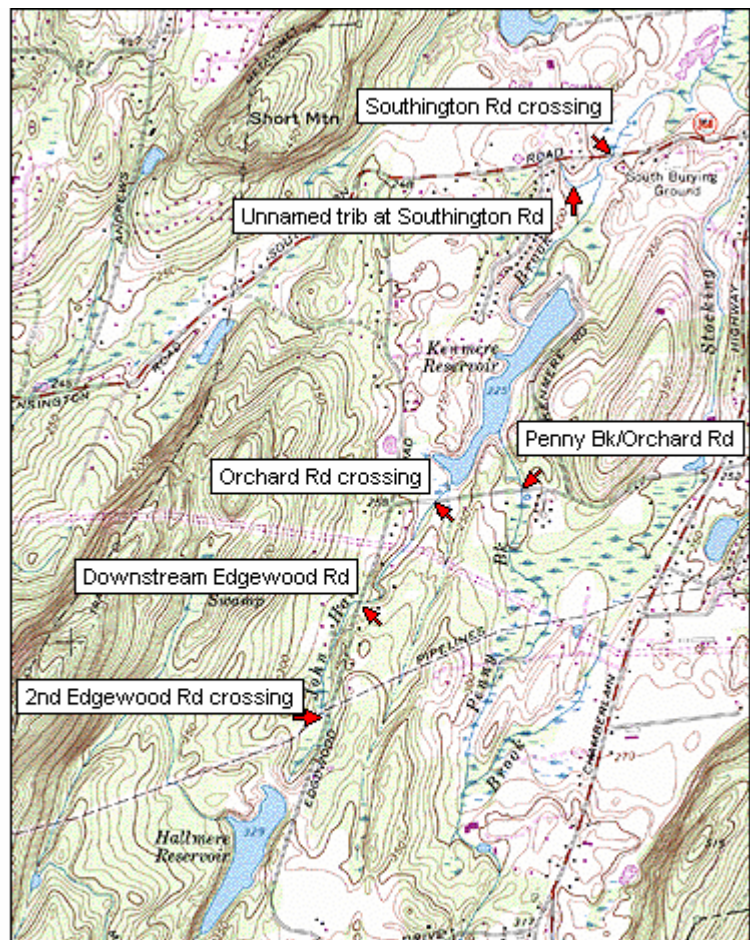
Site Location	11/25/02	12/2/02	1/7/03	1/14/03	4/1/03	4/9/03
2 nd Edgewood Rd crossing	10	<10	74	<10/<10	<10	10
Downstream Edgewood Rd crossing	110/30	30	31	150	<10	84/52
Orchard Rd crossing	20	20	72	74/20	10	52
Penny Brook crossing Orchard Rd	62	450	10/10	20	10	97
Unnamed tributary at Southington Rd	20	20	63	110	20	31
Southington Rd crossing	10	<10	20	31	20	10

Survey Results

John Hall Brook was surveyed in November-December, January and April. No optical brighteners were detected, and no significantly high *E. coli* levels were found. *E. coli* levels were generally low as is expected in cold weather with, however, subtle sporadic increases. The downstream Edgewood Road crossing showed higher bacteria levels on 11/25/02 and 1/14/03, particularly in comparison to upstream levels. Penny Brook at Orchard Road showed elevated bacteria levels on one occasion: 12/2/02. The unnamed tributary at Southington Road showed a relative increase in bacteria levels on 1/14/03.

Discussion and Recommendations

The slightly increased bacteria levels at the downstream Edgewood Road crossing and Penny Brook at Orchard Road warrants continued monitoring to further discern the impacts of nearby septic systems. Sampling in the warmer months would provide a more complete picture of *E. coli* presence.



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Stocking Brook

Site Location	Rationale
Heritage Drive	Some potential upstream impacts
Orchard Road crossing	Upstream of orchard and cow farm
1510 Chamberlain Highway	Agricultural impacts, possible residential impacts
Southington Road crossing	Upstream of golf course & confluence w/ John Hall Brook
Brooke Meadow Road	Recently sewered residential area, downstream of golf course
Reservoir Road	Integrator site for upstream impacts

Survey Results

(Data tables on following page.)

Stocking Brook showed impacts at three locations: Southington Road, 1510 Chamberlain Highway and Orchard Road. The first general survey (11/25/02 - 12/2/02) revealed high bacteria counts at 1510 Chamberlain Highway and high bacteria counts together with optical brighteners at the Southington Road crossing (Table 2).

A follow-up intensive survey and visual inspection (12/10/02 - 12/17/02) from Southington Road to 1510 Chamberlain Highway revealed optical brighteners only behind 1270 Chamberlain Highway but *E. coli* levels were high throughout the section (Table 3). With assistance from the Berlin Sanitarian, the residents discovered their washing machine was discharging directly to the brook. Once the washing machine was reconnected to the septic system, optical brighteners disappeared from the Southington Road site. Bacteria levels, however, remained high and were even higher upstream at 1510 Chamberlain Highway (Table 2 - 1/7/03, 1/14/03, 4/1/03, 4/9/03).

General surveys conducted in January and April showed optical brighteners further upstream at the Orchard Road crossing (Table 2). A follow-up intensive survey and visual inspection in April-May did not indicate optical brighteners (Table 4). A final follow-up survey in late May produced questionable optical brightener presence and showed bacteria levels far exceeding the State criterion (Table 5 - 5/20/03).

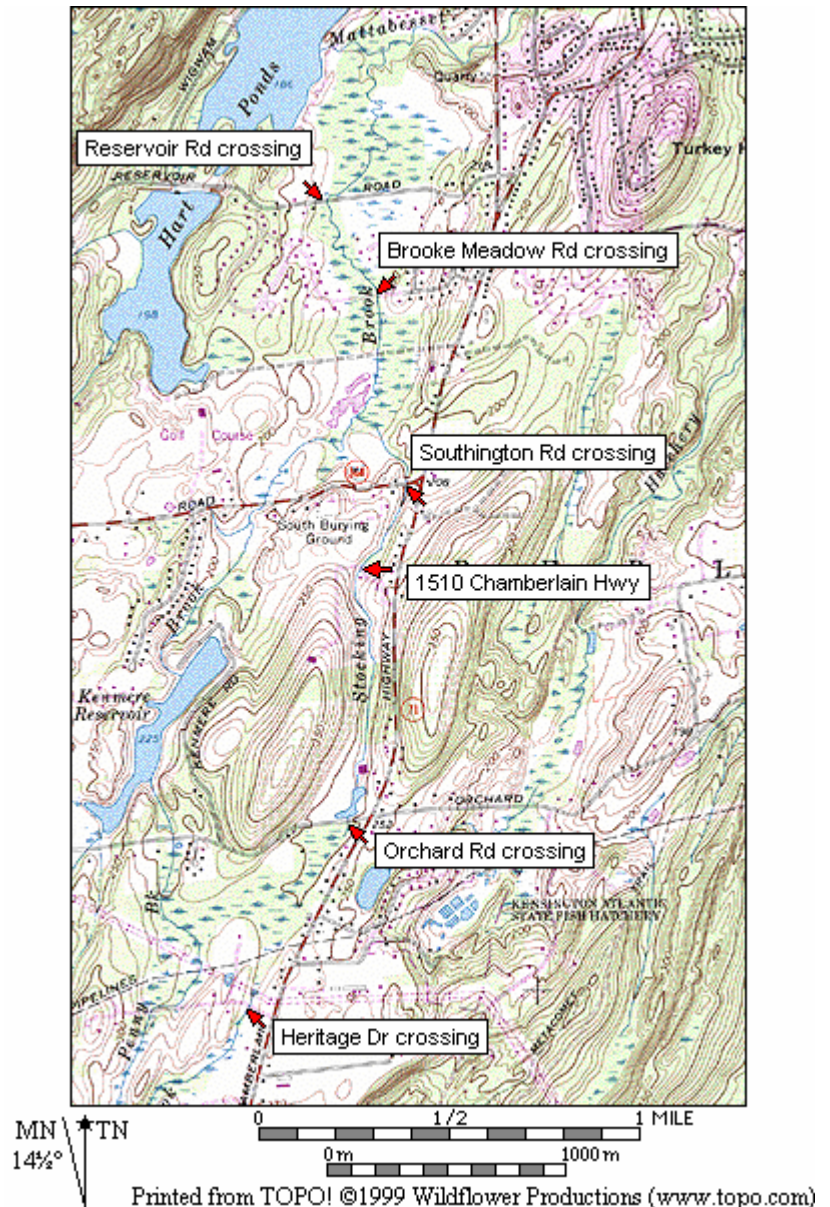


Table 2. General surveys. *E. coli* reported as colonies/100mL.

(+) optical brighteners present; (-) optical brighteners absent; (?) inconclusive.

Site Location	11/25/02	12/2/02		1/7/03	1/14/03		4/1/03	4/9/03	
	<i>E. coli</i>	<i>E. coli</i>	OB Pad	<i>E. coli</i>	<i>E. coli</i>	OB Pad	<i>E. coli</i>	<i>E. coli</i>	OB Pad
Heritage Drive crossing	41	52	-	<10/<10	31/41	-/-	<10/20	<10/<10	-
Orchard Road crossing	20	10	-	<10	<10	+	30/30	41/52	+/+
1510 Chamberlain Hwy	540	590	-	280	190	?	210	410	-
Southington Road crossing	110	220	+	270	120	-	120	140	?
Brooke Meadow Rd crossing	10	10/10	-	20	86	-	74	10	-
Reservoir Road crossing	20	20	-	63	74	-	210	20	-

Table 3. Intensive Survey and Visual Inspection upstream of Southington Rd crossing

E. coli reported as colonies/100mL. Exceedances of *E. coli* criterion are indicated in bold.

Site Location/Rationale	12/10/02	12/17/02	
	<i>E. coli</i>	<i>E. coli</i>	OB Pad
Upstream of nearest yards	220	570	-
Landscaped channel from yard	110	160/210	-
Culvert outfall	<10	63	-/-
Upstream of 1270 Chamberlain Highway	170	910	-
Upstream side of Southington Rd crossing	41/31	640	+/+
Downstream side of Southington Rd crossing	52	<10B/540	+

Table 4. Intensive Survey and Visual Inspection upstream of Orchard Rd crossing

E. coli reported as colonies/100mL.

Site Location/Rationale	4/30/03	5/7/03	
	<i>E. coli</i>	<i>E. coli</i>	OB Pad
Upstream of nearest yards	10/<10	500	-/-
At 1838 Chamberlain Highway	41	270	-
Downstream of 1838 Chamberlain Hwy	<10	200/240	-
Downstream of 1822 Chamberlain Hwy	<10	300	-
Downstream of 1800 Chamberlain Hwy	160	220	-
Orchard Road crossing	73	120	-

Table 5. Intensive Survey and Visual Inspection at Orchard Rd crossing

E. coli reported as colonies/100mL. Exceedances of *E. coli* criterion are indicated in bold.

Site Location/Rationale	5/20/03	5/28/03	
	<i>E. coli</i>	<i>E. coli</i>	OB Pad
Upstream of Orchard Rd crossing (dup)	7,300	350	?
Upstream of Orchard Rd crossing	6,100	310	-
Downstream of Orchard Rd crossing	5,800	490	-/-

Discussion and Recommendations

1510 Chamberlain Highway

Consistently high *E. coli* levels without optical brighteners present suggest bacterial impacts are not related to failing septic systems. The farm at 1510 Chamberlain highway allows cows to graze along the stream. Intensive surveys in 2001 revealed consistently high bacteria levels at 1510 Chamberlain Highway; it was recommended that a town-affiliated group approach the farm operator to address this issue. Data from this survey strongly suggest this still needs to be done.

Orchard Road

The intermittent presence of optical brighteners and increases in *E. coli* at the Orchard Road crossing suggest failing septic systems. On-site septic system inspections and education of residents regarding septic system maintenance and limitations is recommended here.

Belcher Brook

Site Location	Rationale
Norton Lane crossing	Silver Lake outflow, upstream control
Elizabeth Road	Residences on septic
Unnamed tributary at Angelli Ct	Tributary contributing substantial flow
Orchard Road	Sewered and non-sewered residences

Survey Results

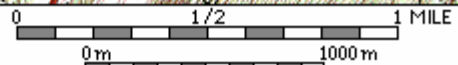
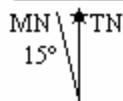
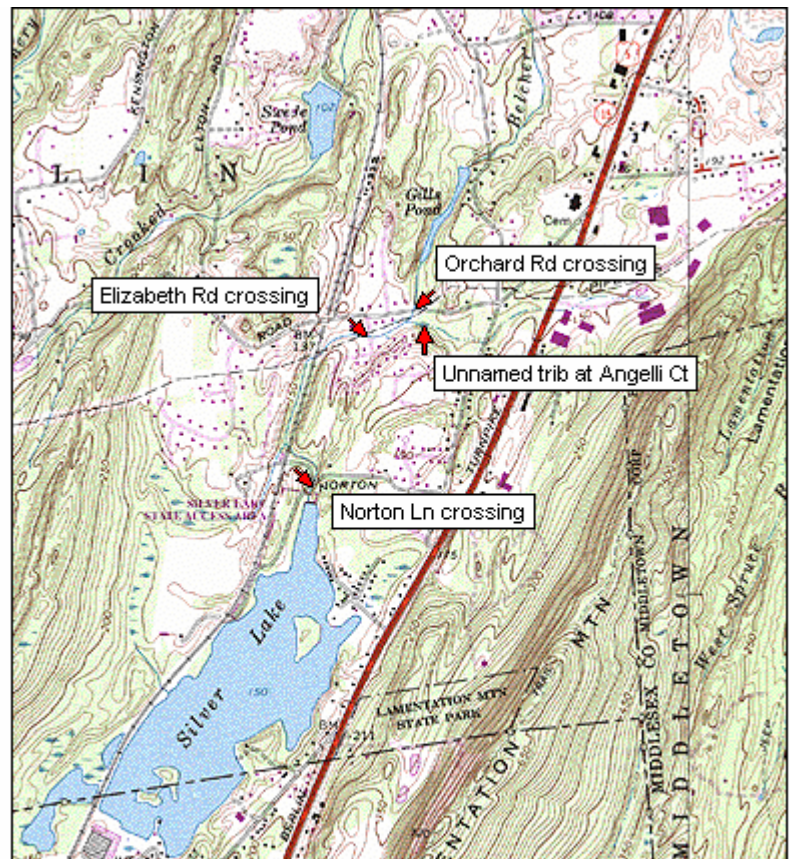
A targeted section of Belcher Brook was surveyed in November-December, January and April. Optical brighteners were not present. Bacteria levels were generally low throughout the survey with relatively minor increases at Elizabeth Road (12/2/02), Orchard Road (12/2/02) and Angelli Court (1/14/03 and 4/9/03).

Table 6. Bacteria Data Summary. *E. coli* reported as colonies/100mL.

Site Location	11/25/02	12/2/02	1/7/03	1/14/03	4/1/03	4/9/03
Norton Lane crossing	<10	<10	<10	<10	10	20
Elizabeth Road crossing	20	30/74	<10	20	10	20
Unnamed tributary at Angelli Court			20	110	20	74
Orchard Road crossing	<10	52	<10	<10	<10	30

Recommendations

Though Belcher Brook showed no signs of failing septic systems, sampling in warm months may provide a more complete picture. Sanitary sewers serve most residences in the area, though town maps indicate a few residences are still using septic systems.



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