Huntington River E.coli

A project of the Huntington Conservation Commission

2004 Project Report and Results

by Aaron Worthley, Project Coordinator
1/2005

Table of Contents:

Due to the volunteer nature of this project, this summary report is primarily a compilation of other materials that have been written for and about the project. All material was prepared by Aaron Worthley for the Huntington Conservation Commission, project volunteers and the citizens of Huntington. The intention of this report is to have a paper copy of these materials compiled and stored with other HCC materials for future reference.

Project Description

Description of Waters:

The Huntington River is a tributary of the Winooski River. Watershed origins include the towns of Huntington, Hinesburg, Starksboro, Fayston, Duxbury, Bolton, Richmond and Buels Gore, as such reaching three counties within the State of Vermont - Chittenden, Addison and Washington. The main branch of the Huntington River is approximately 18 miles long, from its headwaters in Buels Gore to its mouth at the Winooski River in the village of Jonesville (Richmond), VT. Approximately 10 miles of the river are located within the town of Huntington. The Huntington River is designated by the State of Vermont as Class B water. According to the Vermont Water Quality Standards (effective July 10, 2000) Class B waters should be suitable for, among other uses; aquatic habitat, boating, swimming and public water supply with filtration and disinfection. Escherichia Coli (E.Coli) bacteria level in Class B waters is not to exceed 77 organisms/100ml.

The Huntington River is recognized by the Huntington Town Plan (adopted January 2001) as the most notable surface water feature in the town and is considered by the Huntington Conservation Commission to be of critical importance to the residents and the natural resources of the Town of Huntington. The river is the centerpiece for town settlement and transportation, provides fishing, swimming, boating and scenic beauty to the residents of Huntington, and critical habitat to the wildlife of the town and greater region.

The Huntington River is host to at least eight swimming holes within the town of Huntington alone, frequented by the public during the summer months.

History

In July 2002, the Huntington Conservation Commission conducted limited water quality testing at two major swimming holes along the Huntington River. Results indicated E-Coli bacteria presence greater than 200 organisms/ml, prompting the Commission to continue testing for the remainder of the summer. The samples were analyzed by the Vt. Dept. of Health Lab in Burlington, Vt.

In 2003, the Conservation Commission received a VT DEC Water Quality Division Laboratory Services Grant and was able to expand sampling to include ongoing monitoring of the previously established upstream and downstream locations and add a range of “floating sites” along the river at both predetermined and field determined sites and times to establish a picture of E-Coli levels along the entire river stretch within the Town of Huntington. Results were compared to daily rainfall and charted for the testing period. The data confirm degradation of water quality in the Huntington River and suggest an inverse relationship between E. Coli levels and rainfall, a pattern that may be indicative of contamination from septic systems.

In 2004, again with DEC Laboratory grant funding, the sampling regimen was expanded to include 13 weekly test sites along the length of the river within Huntington. In addition, the mouths of all major tributaries were sampled at least once a month, and numerous floating

sites were used to bracket high readings or narrow down on potential sources of contamination. Sample results continued to be well above recommended levels at certain times. Correlation to rainfall was more difficult in 2004 presumably due to an unusually wet summer. One agricultural site was identified late in the season as a contributing source of e.coli contamination, though not suspected as a major source of season long problems. In that case, the landowner was approached, and measures were taken to exclude livestock from a tributary. Additional sampling in 2005 will hopefully indicate whether this mitigation strategy was successful.

Weekly sample results are distributed to interested citizens through an e-mail distribution list. Additionally, results are posted at the two stores in Huntington and a web site is maintained with all data and analysis (http://www.gmavt.net/~aaronw/e-coli/2004_home.htm). When high levels merit, postings are placed at popular swimming holes in order to warn the public of potential health risks. Additionally, informational articles are written to provide public education on the program and results and published in the local monthly newspaper- the Times Ink.

Funding

In 2002, funding of a limited number of samples was achieved through the HCC's general fund budget. In subsequent years- 2003 and 2004, funding for sample collection has been through a grant administered by the Vermont Department of Environmental Conservation (Agency of Natural Resources). The grant is specifically for laboratory services to be provided by the Larosa State Laboratory in Waterbury, VT for the purposes of Water Quality Monitoring by volunteer monitoring groups.

See Appendix E- 2004 Grant Application

Involved Parties

Project coordinator: Aaron Worthley, Huntington Conservation Commission
Grant Administrator: Neil Kamman, VT DEC
Huntington Conservation Commission Members
Huntington Health Officer: Dean Grover
QA /Sample Transport: Heather Pembrook (DEC employee & Huntington Resident)
Huntington Selectboard

Map of Sample Sites

See appendix A

Description of Sample sites:

Weekly Site Sampling:

Audubon- Hemlock Hole. Across road/ through field from Sugarhouse parking
Audubon- Horseshoe Bend. Off rock at swimming hole

Cemetery- Through field across road from cemetery- WALK ON MOWED PATH
Bridge Street Bridge. Below bridge
East Street Bridge. Below bridge

Spence Bridge. Below Bridge at Spence Road

Brace Bridge. Below Bridge just north of Brace Farm
Town Recreation Field. Behind Town Garage- near barbeque grills
Shaker Mountain Bridge. Below Bridge to Shaker Mtn Road (Miles Road)

Brent/Hardy Field. Corn fields just north of Alpaca Farm. Park at gate, walk along farm road to river.

Hanksville-Sheldrake Hole. Swimming hole just south of Moody Road
Carse Road Bridge. Below bridge at beginning of Carse Road
Seven Falls / Hanksville Gorge. Park near guardrail, follow trail to swimming hole

Monthly Brook Sampling:

Sherman Hollow Brook. Mouth of brook at Audubon- below beaver dam
Texas Brook. At Main Road bridge- Just North of Texas Hill Road
Fargo Brook. East Street- end of pavement. Park at edge of field across from Huntington woods- follow trail
Hollow Brook. Culvert under main road just south of Hollow Road
Bushy Brook- Under bridge over main road south of Jubilee Farm
Carpenter Brook- Across river south of Shaker Mtn. Road
Cobb Brook. Under bridge over Main Road south of Charlie Smith Road
Jones Brook. At end of meadow across Carse Bridge
Weaver Brook. Across from Bean Road fork

6 Site "floating" Sampling:

Sites To Be Determined as needed
These dates and sites will be determined by Aaron on an as needed basis. Access to these sites will likely require wading up or down river to collect multiple samples over a section of river.

Sample Protocols and Procedures

From Volunteer instruction package:

Procedure:
Pick up Sampling Container the week before
***7AM Monday**:* *Take Sample(s)*
*Deliver to Aaron at the Post Office by **7:20 AM***
Driver will deliver to Lab, drop off sample and log sheet
Driver will return with 2nd empty cooler

Timing is VERY important! You must have your sample(s) to Aaron by 7:20 AM so they don't miss their ride to Waterbury. If you cannot keep a scheduled date PLEASE call Wally at least 3 days in advance!

Sampling Guidelines:
Parking: Park off the traveled portion of the road, do not block traffic.
Please be respectful of private property- many of our sample sites are accessed across private property. We have permission to be on site for sample collection only. Walk to the sample site without disturbing the area, collect your sample and leave immediately.
It will be necessary to get your feet wet- so dress appropriately
LABEL YOUR SAMPLE! Write on the bottle label the site name, date and time. It helps to write on the label BEFORE GETTING THE BOTTLE WET.
Get away from shore to collect sample- at swimming holes, collect from swimming area
Collect your sample upstream from where you are standing to avoid contamination.
Do not touch the inside of the sample bottle at any time.
Do not uncover the sample bottle until just before filling.
FILL SAMPLE BOTTLE UP TO THE 100ml LINE.
Collect 2 bottles for duplicate sites- from the same spot.
Let people know what you are doing! Inform your friends and neighbors about this project and the water quality in the Huntington River.

Sign up for email notification of weekly results.

- Samples were collected by volunteers weekly, and transported to the laboratory. Sample dates range from the last week in June- last week in September – Approx. **14 weeks.**
- 13 regular weekly samples were collected at the 2004 weekly sample sites (13 sites x 14 weeks = **182 samples**).
- 7 Major tributaries were sampled at least once a month- Texas Brook, Fargo Brook, Hollow Brook, Bushy Brook, Carpenter Brook, Cobb Brook, Jones Brook (7 sites x 3 months = **21 samples**).
- An additional **+/- 50 samples** were used as Floating Sites throughout the sampling season. These will be used at the discretion of the project manager as conditions merit further investigation. In past years floating sites have been used successfully to narrow down areas of contamination and expand sampling locations.
- Duplicate samples were collected as required for quality control (1 duplicate/10 samples).
- Conductivity, water temperature, and rainfall data were recorded at multiple sites.
- Postings were maintained at swimming holes and public areas as needed.
- Informational articles were written to the local paper updating sample results.
- Work continued with the Huntington Health Officer and the State of Vermont DEC in identifying problem areas and working on mitigation solutions.

Quality Control

Quality assurance and control was primarily orchestrated by the Larosa Laboratory and DEC. An EPA approved QAPP was submitted to DEC prior to beginning of sampling. Duplicate samples were collected at a rate of approximately 1 dup/10 samples for quality assurance use in the laboratory. The local QA official and project coordinator reviewed results and data for consistency and accuracy.

Results

See Appendix B- 2003 and 2004 e.coli results
See Appendix C- discussion of Brushy Brook E.coli

Meetings with VT DEC

The HCC met with Neil Kamman of VT DEC on a couple of occasions during the calendar year 2004 to discuss sample results and next steps. The following points summarize the outcomes of these meetings:

- Additional data is necessary
- DEC will likely list the Huntington River as impaired during the next listing round (2006)- assuming another season of similar sample results.
- Ground water monitoring stations located in the Lower Village could be a helpful additional data source. This could help determine if contamination is traveling underground from failing septic systems.
- Surfactant and detergent testing could also be beneficial to identify contamination source.
- DNA analysis of e.coli was discussed. This has been successfully completed at other locations, and will be considered

for the future. Estimated cost around $10,000.
- Foundation for a Sustainable Future expressed interest in contributing to the E.coli project in Huntington.
- River volume will be measured through use of a permanent gauge stake starting in 2005.
- Dean Grover will research surfactant testing and detection.
- Neil Kamman will look into a state owned drill rig for ground water wells (none is available).

Data Analysis

See appendix D- Times Ink Article
and
Appendix B- Sample Results

At the time of this writing, analysis of the collected data is officially inconclusive. Further data collection will continue. Study of results by Vermont DEC scientists will hopefully take place in the next calendar year, with more conclusive analysis resulting.

The Project Coordinator and the Huntington Conservation Commission have developed the following hypothesis based on our review of the data:

There appears to be an inverse relationship between e.coli levels in the Huntington River and recorded precipitation (rain) in the area. This is to say that when rain levels are low the e.coli levels appear to rise, while during wet periods the e.coli levels decrease. Exceptions to this are during the early and late portions of the sample season when water temperature is lower.

It is assumed that when precipitation is high, contaminants are washed off the surface of the ground, into waterways that feed the Huntington River. Additionally, when rain increases, so does the amount of water carried by the River, resulting in dilution of contamination already in the river water. However, when precipitation is low, contamination is more likely to be entering surface water from constant groundwater sources such as septic systems that inadequately treat effluent prior to release. Low precipitation also results in lower water levels in the river and a likely greater concentration of contaminants.

Based on these assumptions and review of the data collected, we presume most of the high e.coli counts recorded are a result of sub-surface contamination reaching the river through groundwater infiltration. Failing septic systems are the obvious and most likely source.

Conclusions

Further study and data collection is warranted.

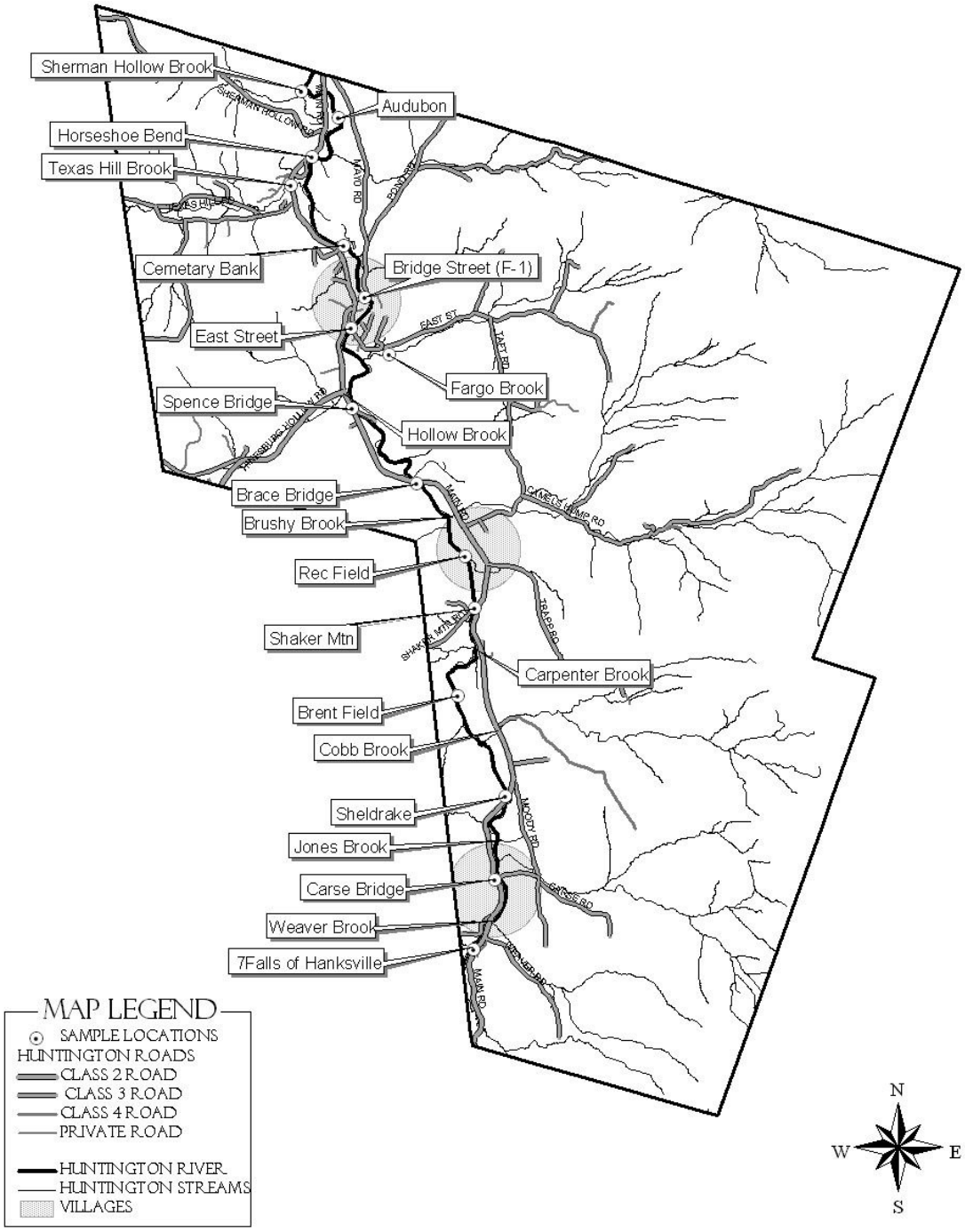
2005 Program

The HCC will apply for another Lab Services Grant from VT DEC in 2005. The sampling protocols and sites will follow much the same as 2004.

The HCC has purchased and will install a permanent stream gauge to measure relative water levels.

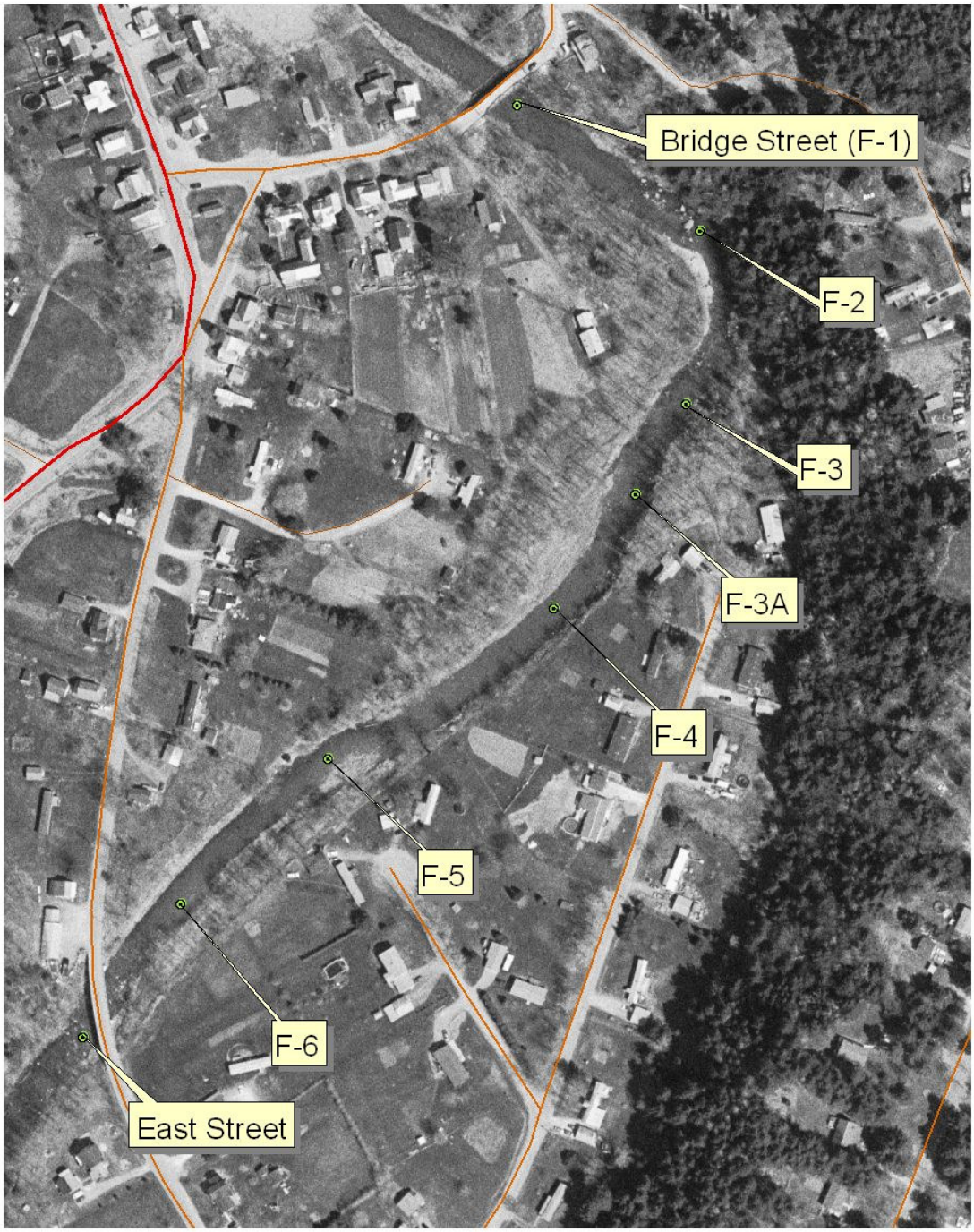
APPENDIX A:

2004 HUNTINGTON RIVER E-COLI SAMPLING LOCATIONS

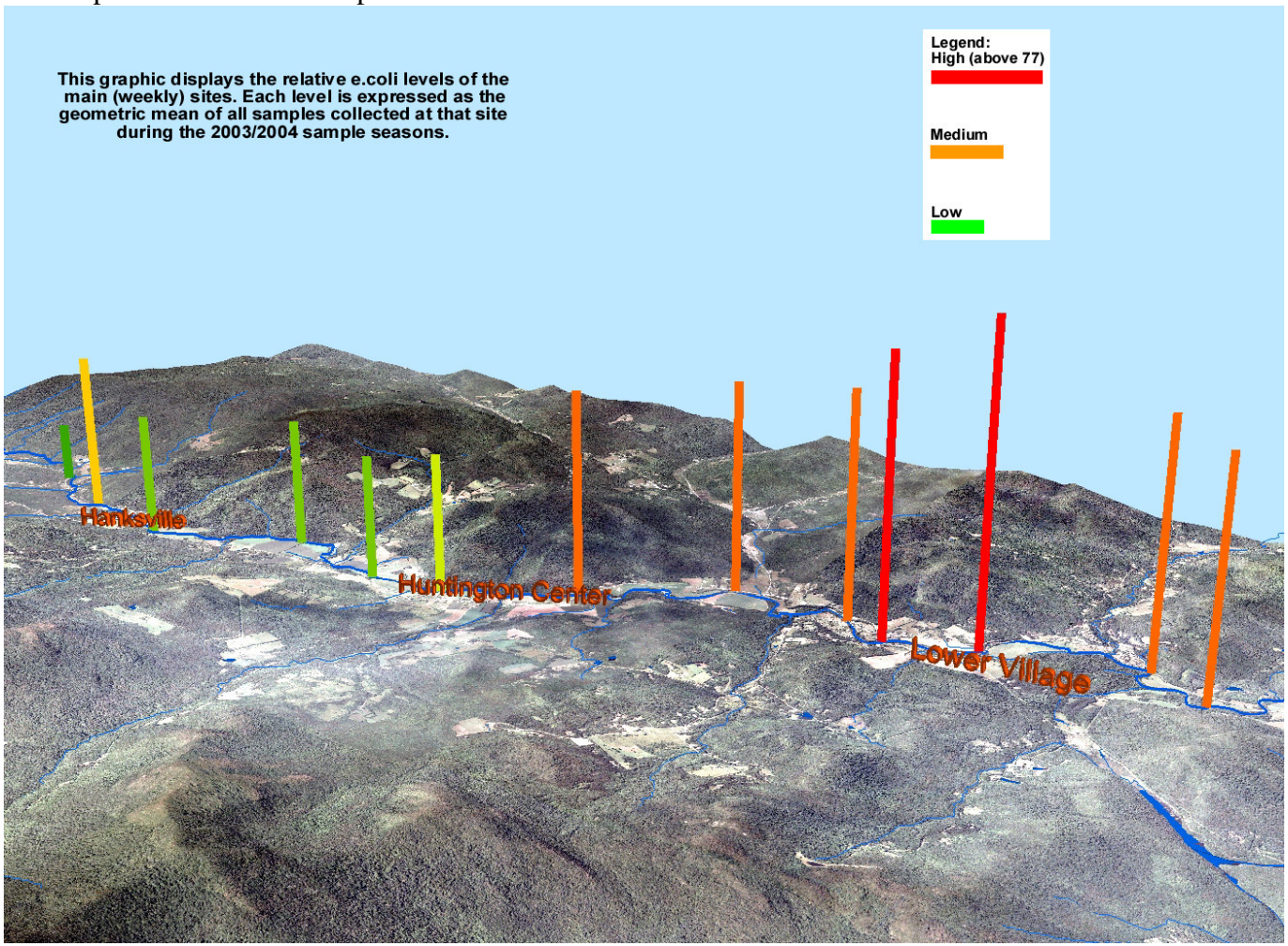


Appendix A (2)

Floating sites in Lower Village



Appendix B Sample Results/Data Compilations/Result Charts



2003 E.coli Sample Results- yellow cells are over state limit of 77

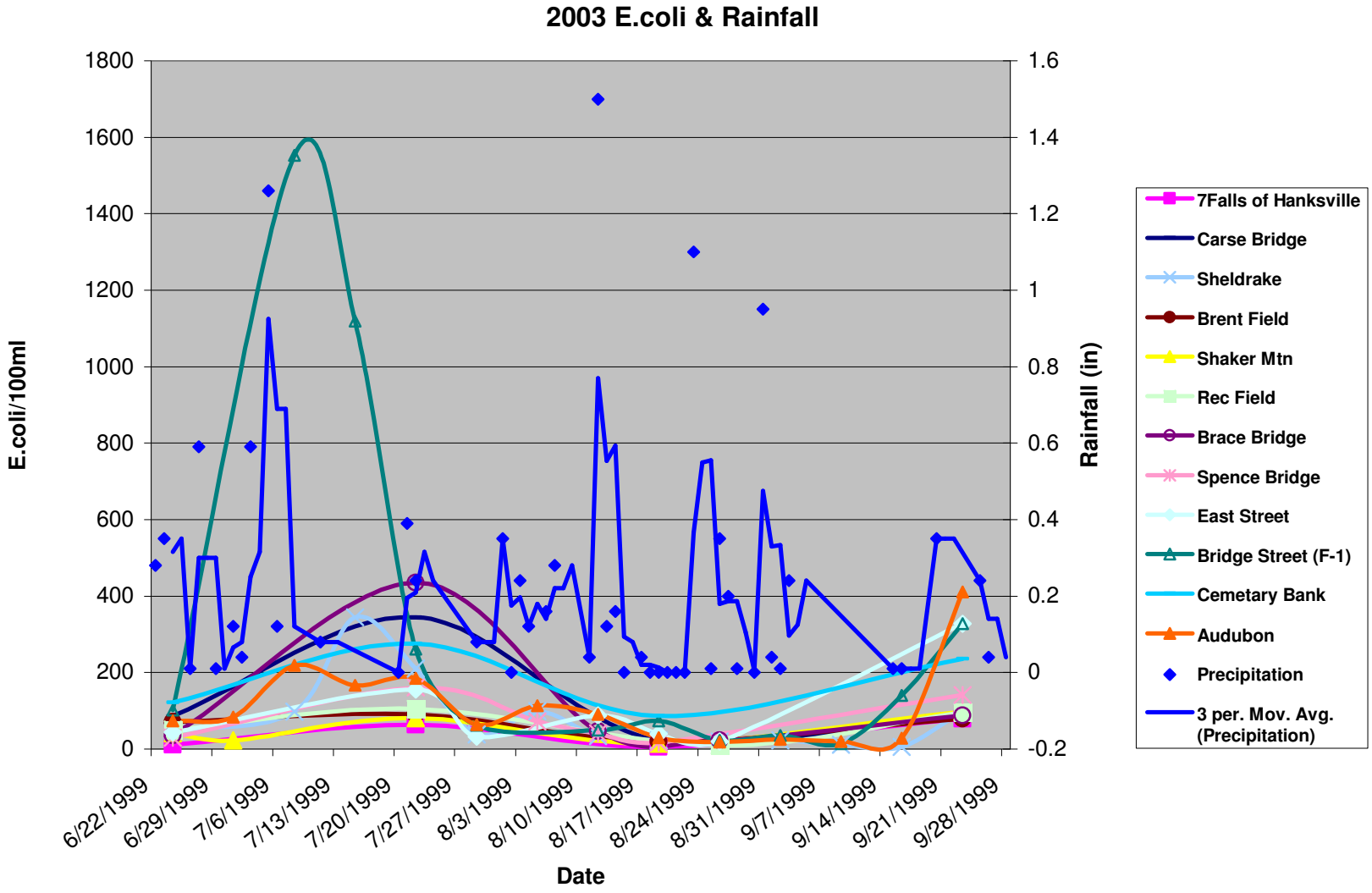
ID	LOCATION	6/25	7/2	7/9	7/16	7/23	7/30	8/6	8/13	8/20	8/27	9/3	9/10	9/17	9/24
1	7Falls of Hanksville	12				64				5					79
2	Carse Bridge	86				345				23					96
3	Sheldrake	47		98	345	210	38	99	34	23	20	23	12	6	99
4	Brent Field	70				91				20					79
5	Shaker Mtn	41	23			81				14					98
6	Rec Field	51				104					10				96
7	Brace Bridge	36				435			47		23				88
8	Spence Bridge	29				161		72	41	17					141
9	East Street	44				155	33		88	40	20				328
10	Bridge Street (F-1)	101		1553	1120	261	62		49	73	23	36	14	140	328
11	Cemetary Bank	122				276				86					236
12	Audubon	74	84	219	167	185	64	113	91	30	18	26	20	28	411
14	F-2			1046	1990		64								
15	F-3			579	1300		64								
16	F-4			613	866		56								
17	F-5			517	649		44								
18	F-6			387	517										
19	Horseshoe Bend				276	222			68		30		18		326
20	Sherman Hollow Brook				91										
21	Texas Hill Brook				649										
22	Fargo Brook														46
23	F-7						32								
24	F-8						28								
25	F-9						19								
26	F-10						39								
27	F-11						58								
28	F-3A						59								
29	F-18							96							
30	Smith Pond									236					
31	Hollow Brook									30					
32	Brushy Brook									12					
33	Cobb Brook									5					
34	Jones Brook										2				
35	Weaver Brook										1				
36	F-12										23				
37	F-13										28				
38	F-14										28				
39	F-15										37				
40	BB FEL											1			
41	BB 1											2			
42	BB 2											1			
43															
44															
45															

F2-F6= East St. to Bridge St.

F7-F11= East St. to Fargo Brook

F12-F15= Bridge St. to Cemetary

BB= Brushy Brook Upstream


2003 E.coli & Rainfall
E.coli/100ml
Rainfall (in)
Date
1800
1600
1400
1200
1000
800
600
400
200
0
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
6/22/1999
6/29/1999
7/6/1999
7/13/1999
7/20/1999
7/27/1999
8/3/1999
8/10/1999
8/17/1999
8/24/1999
8/31/1999
9/7/1999
9/14/1999
9/21/1999
9/28/1999
7Falls of Hanksville
Carse Bridge
Sheldrake
Brent Field
Shaker Mtn
Rec Field
Brace Bridge
Spence Bridge
East Street
Bridge Street (F-1)
Cemetary Bank
Audubon
Precipitation
3 per. Mov. Avg. (Precipitation)

2004 E.coli Sample Results

Huntington River E.coli 2004

Result over 235 (EPA swimming standard)
Result over 77 (State of Vermont swimming standard)

WEEKLY SITES

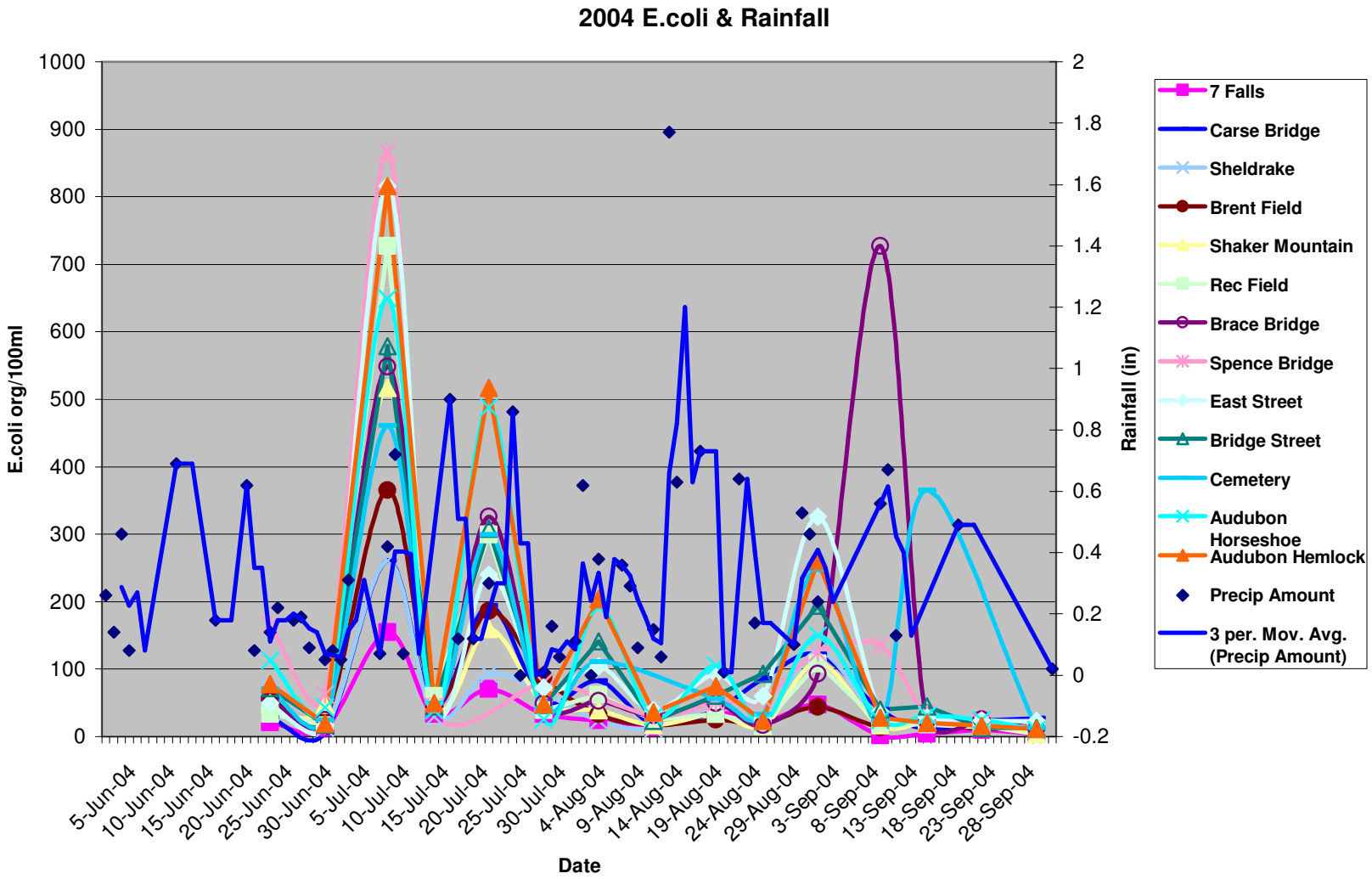
Site_Name	21-Jun-04	28-Jun-04	6-Jul-04	12-Jul-04	19-Jul-04	26-Jul-04	2-Aug-04	9-Aug-04	17-Aug-04	23-Aug-04	30-Aug-04	7-Sep-04	13-Sep-04	20-Sep-04	27-Sep-04	**Geometric Mean**
7 Falls	21	13	155	34	71	34	24	14	36	22	47	2	4	10	4	**18.889**
Audubon Hemlock	78	19	816	50	517	48	204	36	75	23	261	28	20	16	11	**60.157**
Audubon Horseshoe	113	43	649	39	488	26	192	30	105	22	150	24	31	25	10	**60.840**
Brace Bridge	55	25	548	46	326	49	53	31	50	17	93	727	23	26	11	**58.762**
Brent Field	57	26	365	56	186	88	33	17	25	19	44	14	20	11	14	**36.303**
Bridge Street	72	18	579	45	308	47	141	23	61	93	194	40	45	13	13	**60.486**
Carse Bridge	28	6	261	45	194	52	83	19	39	86	122	40	11	23	27	**43.286**
Cemetery	71	25	461	50	299	42	111		56	33	248	23	365		13	**76.063**
East Street	50	17	816	50	240	72	104	39	93	60	326	37	28	24	23	**67.121**
Rec Field	34	17	727	60	299	39	62	25	34	17	108	19	18	14	9	**40.355**
Shaker Mountain	36	47	517	52	160	50	39	17	34	16	109	17	21	15	4	**36.792**
Sheldrake	73	13	261	30	93	64	24	12	50	18	126	26	21	19	4	**33.000**
Spence Bridge	166	63	866	44		80		31	51	56	124	135	34	20	13	**65.613**

BROOK MOUTHS

Site_Name	28-Jun-04	6-Jul-04	12-Jul-04	26-Jul-04	2-Aug-04	17-Aug-04	30-Aug-04	7-Sep-04	13-Sep-04	20-Sep-04	27-Sep-04	
Brushy Brook					54		435	411	31	39	8	**67.356**
Carpenter Brook	42	201		517	46	45	127					**102.318**
Cobb Brook	1			16			34					**8.163**
Fargo Brook	9		36	44			248				14	**34.587**
Hollow Brook	162			77			82				18	**65.505**
Jones Brook	7			6			26				10	**10.222**
Sherman Hollow Brook		816		30							32	**92.184**
Texas Brook		58		35			34				7	**26.364**
Weaver Brook	11											**11.000**

FLOATING SITES

Site_Name	28-Jun-04	6-Jul-04	12-Jul-04	26-Jul-04	2-Aug-04	30-Aug-04	7-Sep-04	13-Sep-04	20-Sep-04	27-Sep-04	
Brushy Taft Bridge	15						14	7	3	8	**8.119**
Brushy Taft Culvert								1730	1410	98	**620.627**
Carpenter Brook Upstream					33	45					**38.536**
F2	22		60	70						16	**34.870**
F3	15		46	68						20	**31.124**
F4	12		84	60						28	**36.074**
F5	18		68	83						20	**37.755**
F6	16		55	79						14	**31.409**
Fargo Taft Road				38							**38.000**
Sherman Hollow Brook Upper		37		44							**40.348**
Worthley Pond								179			**179.000**


2004 E.coli & Rainfall
E.coli org/100ml
Rainfall (in)
Date
1000
900
800
700
600
500
400
300
200
100
0
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
5-Jun-04
10-Jun-04
15-Jun-04
20-Jun-04
25-Jun-04
30-Jun-04
5-Jul-04
10-Jul-04
15-Jul-04
20-Jul-04
25-Jul-04
30-Jul-04
4-Aug-04
9-Aug-04
14-Aug-04
19-Aug-04
24-Aug-04
29-Aug-04
3-Sep-04
8-Sep-04
13-Sep-04
18-Sep-04
23-Sep-04
28-Sep-04
7 Falls
Carse Bridge
Sheldrake
Brent Field
Shaker Mountain
Rec Field
Brace Bridge
Spence Bridge
East Street
Bridge Street
Cemetery
Audubon
Horseshoe Audubon Hemlock
Precip Amount
3 per. Mov. Avg. (Precip Amount)

2003 All Data – All Sites

Huntington River E.coli Data 2003-2004

Main Sites			25-Jun-03	2-Jul-03	9-Jul-03	16-Jul-03	23-Jul-03	30-Jul-03	6-Aug-03	13-Aug-03	20-Aug-03	27-Aug-03	3-Sep-03	10-Sep-03	17-Sep-03	24-Sep-03
	1	7 Falls	12				64				5					79
	2	Carse Bridge	86				345				23					96
	3	Sheldrake	47		98	345	210	38	99	34	23	20	23	12	6	99
	4	Brent Field	70				91				20					79
	5	Shaker Mountain	41	23			81				14					98
	6	Rec Field	51				104					10				96
	7	Brace Bridge	36				435			47		23				88
	8	Spence Bridge	29				161		72	41	17					141
	9	East Street	44				155	33		88	40	20				328
	10	Bridge Street	101		1553	1120	261	62		49	73	23	36	14	140	328
	11	Cemetery	122				276				86					236
	12	Audubon Horseshoe				276	222			68		30		18		326
	13	Audubon Hemlock	74	84	219	167	185	64	113	91	30	18	26	20	28	411
BROOK MOUTHS																
	105	Brushy Brook									12					
	104	Carpenter Brook														
	103	Cobb Brook									5					
	107	Fargo Brook														46
	106	Hollow Brook									30					
	102	Jones Brook										2				
	109	Sherman Hollow Brook				91										
	108	Texas Brook				649										
	101	Weaver Brook										1				
FLOATING SITES																
	209	Brushy Taft Bridge														
	210	Brushy Taft Culvert														
	208	Carpenter Brook Upstream														
	201	F2			1046	1990		64								
	202	F3			579	1300		64								
	203	F4			613	866		56								
	204	F5			517	649		44								
	205	F6			387	517										
	206	Fargo Taft Road														
	207	Sherman Hollow Brook Upper														
	211	Worthley Pond														
	212	Smith Pond									236					
	213	F-12										23				
	214	F-13										28				
	215	F-14										28				
	216	F-15										37				
	217	BB FEL											1			
	218	BB 1											2			
	219	BB 2											1			

Other Data

Water Temp- Sheldrake
Water Temp- Village
Water Temp- Horseshoe
Conductivity- Sheldrake
Conductivity- Village
Conductivity- Horseshoe

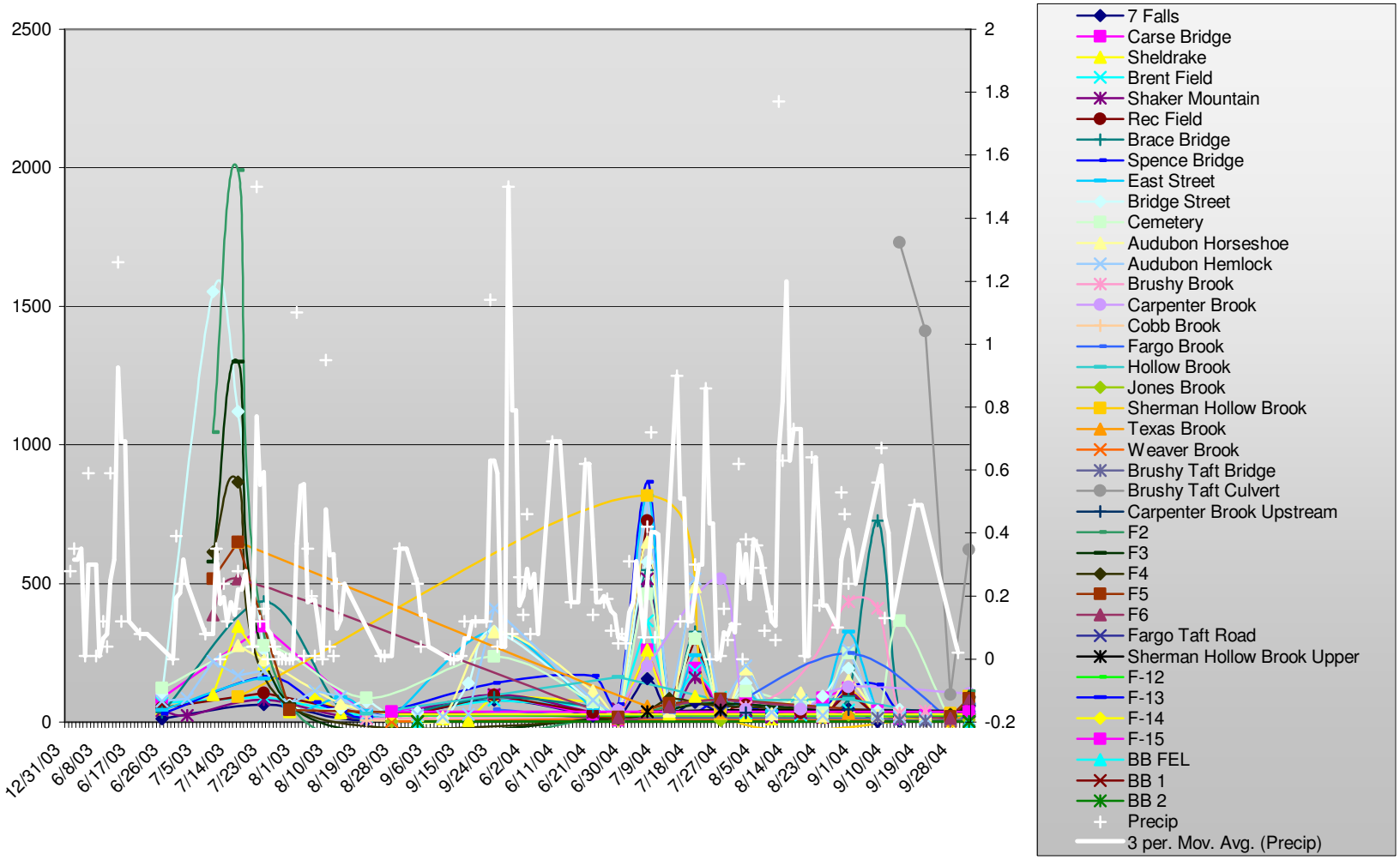
Water Temp-BrushyTaft
Conductivity-BrushyTaft
Water Temp-BrushyCulvert
Conductivity-BrushyCulvert
Water Temp-Brushy
Conductivity-Brushy

2004 All Data – All Sites

Huntington River E.coli Data 2003-2004

Main Sites		21-Jun-04	28-Jun-04	6-Jul-04	12-Jul-04	19-Jul-04	26-Jul-04	2-Aug-04	9-Aug-04	17-Aug-04	23-Aug-04	30-Aug-04	7-Sep-04	13-Sep-04	20-Sep-04	27-Sep-04
1	7 Falls	21	13	155	34	71	34	24	14	36	22	47	2	4	10	4
2	Carse Bridge	28	6	261	45	194	52	83	19	39	86	122	40	11	23	27
3	Sheldrake	73	13	261	30	93	64	24	12	50	18	126	26	21	19	4
4	Brent Field	57	26	365	56	186	88	33	17	25	19	44	14	20	11	14
5	Shaker Mountain	36	47	517	52	160	50	39	17	34	16	109	17	21	15	4
6	Rec Field	34	17	727	60	299	39	62	25	34	17	108	19	18	14	9
7	Brace Bridge	55	25	548	46	326	49	53	31	50	17	93	727	23	26	11
8	Spence Bridge	166	63	866	44		80		31	51	56	124	135	34	20	13
9	East Street	50	17	816	50	240	72	104	39	93	60	326	37	28	24	23
10	Bridge Street	72	18	579	45	308	47	141	23	61	93	194	40	45	13	13
11	Cemetery	71	25	461	50	299	42	111		56	33	248	23	365		13
12	Audubon Horseshoe	113	43	649	39	488	26	192	30	105	22	150	24	31	25	10
13	Audubon Hemlock	78	19	816	50	517	48	204	36	75	23	261	28	20	16	11
BROOK MOUTHS																
105	Brushy Brook							54				435	411	31	39	8
104	Carpenter Brook		42	201			517	46		45		127				
103	Cobb Brook		1				16					34				
107	Fargo Brook		9		36		44					248				14
106	Hollow Brook		162				77					82				18
102	Jones Brook		7				6					26				10
109	Sherman Hollow Brook			816			30									32
108	Texas Brook			58			35					34				7
101	Weaver Brook		11													
FLOATING SITES																
209	Brushy Taft Bridge		15										14	7	3	8
210	Brushy Taft Culvert													1730	1410	98
208	Carpenter Brook Upstream							33				45				
201	F2		22		60		70									16
202	F3		15		46		68									20
203	F4		12		84		60									28
204	F5		18		68		83									20
205	F6		16		55		79									14
206	Fargo Taft Road						38									
207	Sherman Hollow Brook Upper			37			44									
211	Worthley Pond													179		
212	Smith Pond															
213	F-12															
214	F-13															
215	F-14															
216	F-15															
217	BB FEL															
218	BB 1															
219	BB 2															
Other Data																
	Water Temp- Sheldrake		12.3		16.8	19							16.4			
	Water Temp- Village	11.4	13.6		17.5	18.6	16.5	18	13.6	15.2	12.6	18.5	15.5	15.2	8.4	9.5
	Water Temp- Horseshoe		12.9		17.3	17.8	15.8	18.2	14	15.5	13.8	18.5	16.1	13.8	7.4	11.1
	Conductivity- Sheldrake		114.7		107.5	76.5							91.4			
	Conductivity- Village	128.7	137.4		118	80	114.1	121	127.5	83.5	84.8	75.5	121	92.1	109.7	142.6
	Conductivity- Horseshoe		147		123	93.5	126.8	129.4	133.1	87.5	91.5	85.8	126.8	102	115.1	144.1
	Water Temp-BrushyTaft															10.2
	Conductivity-BrushyTaft															54.7
	Water Temp-BrushyCulvert															11.9
	Conductivity-BrushyCulvert															325
	Water Temp-Brushy															9.4
	Conductivity-Brushy															63.1

2003 and 2004 E.coli and Rainfall – All Sites



Precipitation- 2003 and 2004; Recorded by John Hadden, East Street, Huntington, VT

date	precip
5/31/03	0.28
6/1/03	0.35
6/2/03	
6/3/03	
6/4/03	0.01
6/5/03	0.59
6/6/03	
6/7/03	0.01
6/8/03	
6/9/03	0.12
6/10/03	0.04
6/11/03	0.59
6/12/03	
6/13/03	1.26
6/14/03	0.12
6/15/03	
6/16/03	
6/17/03	
6/18/03	
6/19/03	0.08
6/20/03	
6/21/03	
6/22/03	
6/23/03	
6/24/03	
6/25/03	
6/26/03	
6/27/03	
6/28/03	?
6/29/03	0.39
6/30/03	0.24
7/1/03	
7/2/03	
7/3/03	
7/4/03	
7/5/03	
7/6/03	
7/7/03	0.08
7/8/03	
7/9/03	
7/10/03	0.35
7/11/03	?
7/12/03	0.24
7/13/03	0.12
7/14/03	
7/15/03	0.16
7/16/03	0.28
7/17/03	
7/18/03	
7/19/03	
7/20/03	0.04
7/21/03	1.5
7/22/03	0.12
7/23/03	0.16
7/24/03	?
7/25/03	
7/26/03	0.04
7/27/03	?
7/28/03	?
7/29/03	?
7/30/03	?
7/31/03	?
8/1/03	1.1
8/2/03	
8/3/03	0.01
8/4/03	0.35
8/5/03	0.2
8/6/03	0.01
8/7/03	
8/8/03	?
8/9/03	0.95
8/10/03	0.04
8/11/03	0.01
8/12/03	0.24
8/13/03	
8/14/03	
8/15/03	
8/16/03	
8/17/03	
8/18/03	
8/19/03	
8/20/03	
8/21/03	
8/22/03	
8/23/03	
8/24/03	0.01
8/25/03	0.01
8/26/03	
8/27/03	
8/28/03	
8/29/03	0.35
8/30/03	
8/31/03	
9/1/03	
9/2/03	
9/3/03	0.24
9/4/03	0.04
9/5/03	
9/6/03	
9/7/03	
9/8/03	
9/9/03	
9/10/03	
9/11/03	
9/12/03	?
9/13/03	?
9/14/03	
9/15/03	0.01
9/16/03	0.12
9/17/03	
9/18/03	
9/19/03	0.12
9/20/03	
9/21/03	
9/22/03	0.12
9/23/03	1.14
9/24/03	
9/25/03	0.04
9/26/03	
9/27/03	
9/28/03	1.5
9/29/03	0.08
12/31/03	
5/30/04	
5/31/04	0.26
6/1/04	0.14
6/2/04	0.46
6/3/04	0.08
6/4/04	
6/5/04	
6/6/04	
6/7/04	
6/8/04	
6/9/04	0.69
6/10/04	
6/11/04	
6/12/04	
6/13/04	
6/14/04	0.18
6/15/04	
6/16/04	
6/17/04	
6/18/04	0.62
6/18/04	0.08
6/20/04	
6/21/04	0.14
6/22/04	0.22
6/23/04	
6/24/04	0.18
6/25/04	0.19
6/26/04	0.09
6/27/04	
6/28/04	0.05
6/29/04	0.08
6/30/04	0.05
7/1/04	0.31
7/2/04	
7/3/04	
7/4/04	
7/5/04	0.07
7/6/04	0.42
7/7/04	0.72
7/8/04	0.07
7/9/04	
7/10/04	
7/11/04	
7/12/04	
7/13/04	
7/14/04	0.9
7/15/04	0.12
7/16/04	
7/17/04	0.12
7/18/04	
7/19/04	0.3
7/20/04	
7/21/04	
7/22/04	0.86
7/23/04	0
7/24/04	
7/25/04	
7/26/04	0.01
7/27/04	0.16
7/28/04	0.06
7/29/04	
7/30/04	0.11
7/31/04	0.62
8/1/04	0
8/2/04	0.38
8/3/04	
8/4/04	
8/5/04	0.36
8/6/04	0.29
8/7/04	0.09
8/8/04	
8/9/04	0.15
8/10/04	0.06
8/11/04	1.77
8/12/04	0.63
8/13/04	
8/14/04	
8/15/04	0.73
8/16/04	
8/17/04	
8/18/04	0.01
8/19/04	
8/20/04	0.64
8/21/04	
8/22/04	0.17
8/23/04	
8/24/04	
8/25/04	
8/26/04	
8/27/04	0.1
8/28/04	0.53
8/29/04	0.46
8/30/04	0.24
8/31/04	
9/1/04	
9/2/04	
9/3/04	
9/4/04	
9/5/04	
9/6/04	
9/7/04	0.56
9/8/04	0.67
9/9/04	0.13
9/10/04	
9/11/04	
9/12/04	
9/13/04	
9/14/04	
9/15/04	
9/16/04	
9/17/04	0.49
9/18/04	
9/19/04	
9/20/04	
9/21/04	
9/22/04	
9/23/04	
9/24/04	
9/25/04	
9/26/04	
9/27/04	
9/28/04	
9/29/04	0.02
9/30/04	

Appendix C

From: Aaron Worthley [aaronw@gmavt.net]
Sent: Wednesday, September 29, 2004 8:29 AM
Subject: Brushy Brook e.coli
To: E.coli Information List Members
Re: recent E.coli in Brushy Brook & Tributary

Hello everybody,

I am getting a number of questions about the high e.coli numbers in the tributary to Brushy Brook. I thought I would send this out to the whole list to inform everybody at once.

The tributary we have been testing runs under the Camels Hump Road just below the Taft's Sugarhouse. It then skirts along the edge of their new barnyard, through a part of their pasture and under the road again just uphill from the "Taft" Bridge. The samples are taken at the outflow of the culvert just above the bridge.

As you may or may not know, Tim Taft is a member of the Huntington Conservation Commission. Both he and his wife Margaret have been very much a part of our e.coli investigation. Margaret is also one of our weekly sample volunteers.

I began testing the sites at Taft Bridge and at the tributary a few weeks ago. During our regular monthly sampling of stream mouths, the site at the Brushy Brook/Main Road bridge was running high. The following week I tested at the next bridge upstream (Taft) and again at the Main Road bridge. The Taft site was very low, and the Main Road was high. Assuming that the contamination source was between the two bridges, I took the next logical step and tested the tributary that runs through the pasture and enters Brushy Brook downstream from the Taft Bridge.

As we know, this site tested quite high. Through all this I have been in touch with Tim and Margaret. My first and most immediate concern was that I had seen cows standing in and along the banks of the tributary as it runs through the pasture. This situation was fixed right away- Tim put up a fence that keeps the cows away from the brook. He also added a water source at the other end of the pasture so they would not continue to hang out near the brook.

As part of their new barn construction, the Taft's have been installing a federally designed runoff management system. This system will handle rainwater runoff from the barn roofs, the barnyard area and the silage storage areas. The final components of this system are still under construction. It is possible that disturbance during construction of theses systems has contributed to the recent high e.coli counts. Tim invited me for a tour of the farm's runoff systems and it is quite impressive. As these systems continue to come on line, I expect we will see further improvement of the water quality in the area. I am pleased to say the Tafts have been very responsive and willing to make changes to eliminate potential sources of contamination that may originate on their farm.

For the last couple of weeks, the samples taken on Brushy Brook have been low, while the tributary continues to be high. There isn't much water in the little stream to dilute the contamination, and it appears not to be continually affecting downstream areas of Brushy Brook or the Huntington River.

IMPORTANT: Based on the data we have collected over the last 2 years, I **do not** believe this stream is a major contributor to the e.coli presence in the Huntington River. Our data still indicates to me that septic systems, particularly in the concentrated villages, will prove to be the single biggest piece of this puzzle.

Let me know if you have any further questions.

Aaron

Appendix D

E.coli Article, 2004
The Times Ink! Of Richmond and Huntington

by Aaron Worthley, Huntington Conservation Commission

The summer of 2004 has been much different than the past couple of years in many ways, most notably due to rain, rain and more rain. However, the Huntington Conservation Commission and a dedicated band of volunteers have continued data collection and study on the E.coli levels in the Huntington River.

E.coli is a type of bacteria that originates in the intestines of mammals and birds. While some strands of the E.coli bacteria can make humans sick, it is not always the case. E.coli is best used as an indicator of water pollution from fecal sources. Presence of E.coli in water tells us that fecal material from deer, beavers, geese, humans, livestock dogs or any other animal is entering the watercourse and there is potential for the water to contain any number of pathogens- organisms that might make you sick.

For the third year in a row, the Huntington Conservation Commission (HCC) has been sampling the Huntington River and having the samples analyzed for the presence of E.coli bacteria. The lab work this year and last is being paid for by a grant from the State of Vermont, Department of Environmental Conservation.

This year a more extensive sampling regimen has been adopted. The HCC has enlisted volunteers to take weekly samples at 13 sites along the River throughout the town of Huntington. Many of the sites are at popular swimming holes. In addition, the mouths of all major brooks are sampled monthly and other "floating sites" are used to narrow in on areas of higher pollution.

Last year many sites on the River were very contaminated, well above levels for swimming recommended by either the State of Vermont (77 organisms/100ml of water, the State of Vermont has the most stringent standard in the country) or the Federal Environmental Protection Agency (235 organisms/100ml of water). The data we collected led to the hypothesis that the main cause of the pollution in the River was failing or poorly performing septic systems. This suspicion was reached based on two factors. 1. The highest E.coli counts were centered in the populated village centers. 2. The E.coli levels went up with LOWER rainfall.

When the beaches in Burlington and Colchester are closed due to E.coli it is usually associated with HIGH rainfall events, not low. So what is different in Huntington? E.coli pollution can come from many sources, but it is always a result of fecal material reaching the waterway. During heavy rains pet, livestock and waterfowl waste is washed off the surface of the land and/or sewage disposal facilities overflow into the water. During dry periods, steady sources of contamination such as from leaking septic systems will build up in the water, increasing the concentration of E.coli. When it rains, this concentrated bacteria is diluted again, bringing the levels back down.

This year the E.coli levels seem to be a bit lower than last year. We haven't seen the sample results reach into the thousands, but they are still hitting 500 (organisms/100ml of water) on some days.
The correlation with rainfall has been a bit more difficult this year because, as we all know, it really hasn't stopped raining all summer. We will know more when the summer sampling season is complete and we have had a chance to analyze all the data.

The big question, of course, is "What do we do about it so we can all get back to swimming safely?" The HCC is working closely with the Huntington Health Officer and the Vermont Dept. of Environmental Conservation (DEC) on designing further studies and plans for what to do to clean up the River. The most important component is continued testing. The HCC intends to continue sampling the River and posting the results so river users can make informed decisions about swimming risks.

It is likely that with another year of similar data the Huntington River will be added to the listing of Impaired Waters for the State of Vermont. This will bring more attention to the cause and the State will be required to develop a plan for cleaning up the River. Federal EPA money could also become available through this listing. The list of impaired waters is long though, and it could be years before the Huntington River gets its turn in the DEC line up. Impaired water status will also give the health of the River more attention during the issuance of environmental permits for discharges that might affect the river's water quality. Meanwhile, the HCC will continue to collect data, educate river users and look for alternative ways to bring our river back to the clean, safe, high quality river we all expect it to be.

In addition to further E.coli sampling, other techniques being explored by the HCC and our partners include: drilling groundwater monitoring wells in the village, testing the river for phosphorus and nitrogen, looking for evidence of detergents in the water and DNA analysis of E.coli to distinguish the source animal.

Weekly E.coli results are distributed by email to anyone interested, send requests to aaronw@gmavt.net. Results and more information are also posted at the two stores in Huntington and online at: http://www.gmavt.net/~aaronw/e-coli/2004_home.htm. Further questions can be directed to: Aaron Worthley, aaronw@gmavt.net, 434-7012.

Appendix E:

2004 Grant Application

Huntington, Vermont Conservation Commission
Application for Laboratory Services Grant
for
Water Quality Monitoring
March 2004

Proposal respectfully submitted by:

Aaron Worthley
Project Contact and Chair, on behalf of the Huntington Conservation Commission

950 Bert White Road
Huntington, VT 05462

Tel. (802) 434-7012
Fax (802) 434-2102
E-mail aaronw@gmavt.net

INTRODUCTION

The Town of Huntington, through the Huntington Conservation Commission, submits this application to the Vermont Department of Environmental Conservation Water Quality Division for a 2004 Laboratory Services Grant to assist the Town in continuing and expanding E-Coli water quality testing in the Huntington River.

1. DESCRIPTION OF THE PROJECT WATERS

The Huntington River is a tributary of the Winooski River. Watershed origins include the towns of Huntington, Hinesburg, Starksboro, Fayston, Duxbury, Bolton, Richmond and Buels Gore, as such reaching three counties within the State of Vermont - Chittenden, Addison and Washington. The main branch of the Huntington River is approximately 18 miles long, from its headwaters in Buels Gore to its mouth at the Winooski River in the village of Jonesville (Richmond), VT. Approximately 10 miles of the river are located within the town of Huntington. The Huntington River is designated by the State of Vermont as Class B water. According to the Vermont Water Quality Standards (effective July 10, 2000) Class B waters should be suitable for, among other uses; aquatic habitat, boating, swimming and public water supply with filtration and disinfection. Escherichia Coli (E-Coli) bacteria level in Class B waters is not to exceed 77 organisms/100ml.

The Huntington River is recognized by the Huntington Town Plan (adopted January 2001) as the most notable surface water feature in the town and is considered by the Huntington Conservation Commission to be of critical importance to the residents and the natural resources of the Town of Huntington. The river is the centerpiece for town settlement and transportation, provides fishing, swimming, boating and scenic beauty to the residents of Huntington, and critical habitat to the wildlife of the town and greater region. The Huntington River is host to at least eight swimming holes within the town of Huntington alone, frequented by the public during the summer months.

2. DATA NEEDS AND USAGE

The Conservation Commission has conducted sampling programs along the Huntington River for two seasons – 2002 and 2003, last year documenting E-coli levels of 84 – 1990 organisms/ml at twenty different locations along the river, well in excess of the VT Water Quality and Department of Health Standards. Contaminated sites include well-used swimming areas for local residents. Additional sampling is needed to further document water quality problems and help determine the source(s) of contamination.

Previous Sampling History

In July 2002, the Huntington Conservation Commission conducted water quality testing at two major swimming holes along the Huntington River. Results indicated E-Coli bacteria presence greater than 200 organisms/ml, prompting the Commission to continue testing for the remainder of the summer. During most of the summer, results continued to be higher than those recommended by the VT Department of Health for swimmable water. In 2003, the Conservation Commission received a VT DEC Water Quality Division Laboratory Services Grant and was able to expand sampling to include ongoing monitoring of the previously established upstream and downstream locations, and add a range of "floating sites" along the river at both predetermined and field

determined times to establish a picture of E-Coli levels along the entire river stretch within the Town of Huntington (Attachments A and B). Results were compared to daily rainfall and charted for testing period (Attachment C). The data confirm degradation of water quality in the Huntington River and suggest an inverse relationship between E. Coli levels and rainfall, a pattern that may be indicative of contamination from septic systems. However, insufficient samples were collected to confirm this, or identify potential sources of contamination for mitigation.

Proposal:

The Huntington Conservation Commission, together with the Town Health Officer proposes a project to continue E-Coli monitoring in the Huntington River for the 2004 summer season. The proposed project builds upon the testing done during the 2002 and 2003 seasons and data will be used by the Commission to 1) provide reliable information for posting notices of E-Coli levels and warnings to swimmers in areas of higher-than-swimmable levels of E-Coli bacteria; and 2) narrow down areas of contamination, identify potential sources, and mitigate impacts.

The Town Heath Officer has the authority to test residential septic systems for compliance with state regulations if water quality problems are suspected. If a residential septic system is suspected as a source of high E-Coli levels in the river, the Huntington Selectboard will be asked to authorize the Health Officer to conduct a septic evaluation of the suspect system, and to request any required mitigation. If another source is identified, such as farm run-off or aquatic mammal populations, the Huntington Conservation Commission will work with landowners or the town government to identify and mitigate the source within the laws and regulations of the State of Vermont and the Town of Huntington.

3. SAMPLE COLLECTION METHODS AND PROGRAM

The Huntington Conservation Commission members, along with volunteers, will collect water samples at public or permitted access points along the Huntington River. All sampling, sample transport, data collection and management, data analysis and reporting will be coordinated by the Project Manager. The Huntington Town Health Officer will assist with sample site selection and mitigation efforts. The Project Manager will train all volunteers in sample collection methods in compliance with a standard EPA quality assurance plan .

The Conservation Commission proposes the following sampling regimen:

- Samples will be collected by volunteers every Wednesday morning, and transported to the laboratory by a Huntington resident (Heather Pembrook). Sample dates will range from the last Wednesday in June- last Wednesday in September – **14 weeks.**
- 10 regular weekly samples will be collected at approximately even intervals along the river within Huntington - corresponding to last years 10 monthly sites (10 sites x 14 weeks = **140 samples**).
- 7 Major tributaries will be sampled once a month- Texas Brook, Fargo Brook, Hollow Brook, Bushy Brook, Carpenter Brook, Cobb Brook, Jones Brook (7 sites x 3 months = **21 samples**).
- An additional **50 samples** will be used as Floating Sites throughout the sampling season. These will be used at the discretion of the project manager as conditions merit further investigation. Last year floating sites were used successfully to narrow down areas of contamination and expand sampling locations.
- Duplicate samples will be collected as required for quality control.
- Postings will be maintained at swimming holes and public areas as needed.
- Informational articles will be written to the local paper updating sample results (at least 2 articles were published during the 2003 season, see Attachment C).
- Daily temperature and rainfall will again be collected for analysis.

- Technical assistance will be sought in setting up a water volume measurement station on the river. This data will be recorded on sample days.
- Work will continue with the Huntington Health Officer and the State of Vermont DEC in identifying problem areas and working on mitigation solutions.

This sampling routine will result in a minimum of 161 samples and a maximum of 211 samples, plus quality control samples, throughout the sample season (Late June - Late September).

4. DESCRIPTION OF DATA REPORTING :

Data will be collected and compiled by the Project Manager. Data results for each sample will be entered into a Microsoft Excel format Spreadsheet. Data (Sampled E-Coli levels) will be recorded by site name and date. Additionally, rainfall totals, river volume and high temperatures will be entered for each day during the sample season as recorded by daily by a Huntington resident. An ESRI ArcView map will be prepared by the Project Manager which will detail sample locations with links established to the corresponding data in the Excel Spreadsheet. When and if necessary, postings will be placed at sample sites with a known history of recreational use warning of elevated levels of E-Coli bacteria presence. Postings will also be placed when and if necessary at public posting locations in town, including the two general stores. An internet web site (http://www.gmavt.net/~aaronw/e-coli/results.htm) and community e-mail list was developed in 2003 in order to efficiently inform interested persons of weekly sample results. This site and list will continue to be maintained on a weekly basis. If it is determined by the Conservation Commission, the Project Manager, or the Health Officer that further public notification is necessary, such information will be sent to the community newspaper The Times Ink, and potentially to the Burlington Free Press for posting.

Upon completion of the sampling season and final compilation of data, a full report will be made to the people of the Town of Huntington by the Conservation Commission and the Health Officer in the form of an article in The Times Ink, and a report in the Huntington Annual Town Report, 2004. Additionally, all data will be summarized in a paper report that will go on file with the Huntington Conservation Commission report materials in the Huntington Town Office.

5. ANTICIPATED OUTCOMES:

It is the intention of the Huntington Conservation Commission to implement the goal in the Huntington Town Plan to work to maintain the Class B Water Quality Status of the Huntington River. It is the mission of the Huntington Conservation Commission to protect and enhance the natural resources of the Town of Huntington. We believe that further rigorous testing of the Huntington River for levels of E-Coli Bacteria, and our plan to identify and mitigate sources of such contamination is consistent with both of these directives.

Additional anticipated outcomes of this project could include one or more of the following:

1. Residents of the Town of Huntington and other users of the recreational resources provided by the Huntington River are warned of potential health risks during periods of high E-Coli contamination.
2. Seasonal sampling results in the identification of one or more residential septic systems, agricultural operations and/or naturally occurring sources as contributing to a decrease in water quality in the Huntington River, and mitigation solutions are researched, discussed and implemented.
3. Seasonal sampling results indicate no cause for concern with normal and acceptable levels of

E-Coli bacteria detected. Residents of the Town of Huntington and other recreational users of the Huntington River are reassured as to the high water quality in the Huntington River.

4. Seasonal sampling is inconclusive for the cause or source of E-Coli bacteria in the Huntington River. 2004 data is recorded and a program of further sampling is implemented for the 2005 season.
5. Seasonal sampling results in suspected sources of contamination, mitigation is attempted with unknown results, and further sampling is implemented for the 2005 season to reassess water quality in the Huntington River.

6. PARTIES INVOLVED AND PROJECT CONTACT(S)

Project Sponsor: Huntington Conservation Commission

Project Manager: ***Aaron Worthley***, Chair Huntington Conservation Commission, GIS/field technician for Arrowwood Environmental, Huntington, VT.

Project Participants: Huntington Health Officer, Member of the Huntington Conservation Commission, Other Community Volunteers to sample and transport samples to testing facility. Huntington Resident and VT. State Employee, ***Heather Pembrook*** has volunteered to transport samples to the LaRosa Laboratory in Waterbury, VT. Wallace Jenkins, project volunteer coordinator; Heather Pembrook QAQC officer.

Contact: ***Aaron Worthley*** (see cover for complete contact information)
Tel (802) 434-7012

LIST OF ATTACHMENTS

A 2003 Huntington River E. Coli
B Sample Site Map
C Average E.coli with Daily Rainfall
D E.coli Report Published in the *Times Ink* (local paper)

Appendix F

E-COLI WARNING

Recent water tests of the Huntington River at this location by the Huntington Conservation Commission have shown E-Coli Bacteria counts above acceptable swimming levels set by the Vermont Department of Health.

The most recent test at this site shows E-Coli counts NOT suitable for swimming.

The State of Vermont warns against swimming in waters with a count of 77 or higher. At a count of 77, the health risk is six swimmers becoming ill per 1000. If the E. coli count is higher, the risk will be proportionately higher. Types of illness can include gastrointestinal and eye, ear, nose and throat infections. Symptoms of illness may be fever, upset stomach, sore throat, earache, chest cold, itchy or watery eyes.

Sample results for this and other Huntington River sites are available at Beaudry's and Jacques Stores, or at

http://www.gmavt.net/~aaronw/e-coli/2004_home.htm

Further testing is being conducted by the Huntington Conservation Commission. For more information contact Aaron Worthley at 434-7012

Appendix G Volunteer Calendar

Sample Site	6/21	6/28	7/6	7/12	7/19	7/26	8/2	8/9
green=duplicate sample (2 bottles)	*Yellow=volunteer sampler needed*							
7 Falls- Hanksville	Nirmegh	Rob Zimmerman	Wally Jenkins	Wally Jenkins	Wally Jenkins	Wally Jenkins	Wally Jenkins	Wally Jenkins
Carse Road Bridge	Nirmegh	Ryan Elliot	Wally Jenkins	Wally Jenkins	Wally Jenkins	Wally Jenkins	Wally Jenkins	Wally Jenkins
Sheldrake Swimming Hole	Nirmegh	Ryan Elliot	Wally Jenkins	Wally Jenkins	Wally Jenkins	Wally Jenkins	Wally Jenkins	Wally Jenkins
Brent Field	Amy Dohner	Rob Zimmerman	Amy Dohner	Amy Dohner	Amy Dohner	Amy Dohner	Amy Dohner	Amy Dohner
Shaker Mountain Bridge	Amy Dohner	Rob Zimmerman	Amy Dohner	Amy Dohner	Amy Dohner	Amy Dohner	Amy Dohner	Amy Dohner
Rec. Field	Alan Homans	Margaret Taft	Margaret Taft	Margaret Taft	Margaret Taft	Margaret Taft	Margaret Taft	Margaret Taft
Brace Bridge	Alan Homans	Margaret Taft	Margaret Taft	Margaret Taft	Margaret Taft	Margaret Taft	Margaret Taft	Margaret Taft
Spence Bridge	Robin Worn	Robin Worn	Robin Worn	Robin Worn	Robin Worn	Robin Worn	Robin Worn	Robin Worn
East Street Bridge	Heather Pembrook	Heather Pembrook	Mike Early	Mike Early	Nirmegh	Heather Pembrook	Heather Pembrook	Heather Pembrook
Bridge Street Bridge	Heather Pembrook	Heather Pembrook	Mike Early	Mike Early	Nirmegh	Heather Pembrook	Heather Pembrook	Heather Pembrook
Cemetary (Fecteau)	Dean Grover	David Brautigam	Mike Early	Mike Early	Nirmegh	Dean Grover	Mike Early	Mike Early
Horseshoe Bend	Audubon	Audubon	Audubon	Audubon	Audubon	Audubon	Audubon	Audubon
Audubon Hemlock	Audubon	Audubon	Audubon	Audubon	Audubon	Audubon	Audubon	Audubon
Sherman Hollow Brook		Audubon				Audubon		
Texas Brook		Alan Homans				Alan Homans		
Fargo Brook		David Brautigam				Peter Jenkins		
Hollow Brook		Alan Homans				Alan Homans		
Bushy Brook		Margaret Taft				Margaret Taft		
Carpenter Brook		Nirmegh				Nirmegh		
Cobb Brook		Nirmegh				Nirmegh		
Jones Brook		Ryan Elliot				Ryan Elliot		
Weaver Brook								
Floating #1		Aaron	Aaron	Aaron	Aaron	Aaron	Aaron	Aaron
Floating #2		Heather Pembrook				Heather Pembrook	Heather Pembrook	Heather Pembrook
Post Warnings		Linda Riscutto/Wally	Linda Riscutto/Wally	Linda Riscutto/Wally	Linda Riscutto/Wally	Linda Riscutto/Wally	Linda Riscutto/Wally	Linda Riscutto/Wally
DRIVE to Waterbury	Heather Pembrook	Heather Pembrook	Padraic Monks	Padraic Monks	Padraic Monks	Heather Pembrook	Heather Pembrook	Heather Pembrook

Sample Site	8/17	8/23	8/30	9/7	9/13	9/20	9/27
green=duplicate sample (2 bottles)							
7 Falls- Hanksville	Wally Jenkins	Wally Jenkins	Wally Jenkins	Wally Jenkins	Wally Jenkins	Wally Jenkins	Wally Jenkins
Carse Road Bridge	Wally Jenkins	Wally Jenkins	Wally Jenkins	Wally Jenkins	Wally Jenkins	Wally Jenkins	Wally Jenkins
Sheldrake Swimming Hole	Wally Jenkins	Wally Jenkins	Wally Jenkins	Wally Jenkins	Wally Jenkins	Wally Jenkins	Wally Jenkins
Brent Field	Amy Dohner	Amy Dohner	Amy Dohner	Amy Dohner	Amy Dohner	Amy Dohner	Amy Dohner
Shaker Mountain Bridge	Amy Dohner	Amy Dohner	Amy Dohner	Amy Dohner	Amy Dohner	Amy Dohner	Amy Dohner
Rec. Field	Margaret Taft	Margaret Taft	Margaret Taft	Margaret Taft	Margaret Taft	Margaret Taft	Margaret Taft
Brace Bridge	Margaret Taft	Margaret Taft	Margaret Taft	Margaret Taft	Margaret Taft	Margaret Taft	Margaret Taft
Spence Bridge	Robin Worn	Robin Worn	Robin Worn	Robin Worn	Robin Worn	Robin Worn	Robin Worn
East Street Bridge	Heather Pembrook	Dean Grover	Heather Pembrook	Heather Pembrook	Heather Pembrook	Heather Pembrook	Heather Pembrook
Bridge Street Bridge	Heather Pembrook	Dean Grover	Heather Pembrook	Heather Pembrook	Heather Pembrook	Heather Pembrook	Heather Pembrook
Cemetary (Fecteau)	Nirmegh	Nirmegh	Dean Grover	Mike Early	Mike Early	Mike Early	Mike Early
Horseshoe Bend	Audubon	Audubon	Audubon	Audubon	Audubon	Audubon	Audubon
Audubon Hemlock	Audubon	Audubon	Audubon	Audubon	Audubon	Audubon	Audubon
Sherman Hollow Brook			Audubon				Audubon
Texas Brook			Alan Homans				Mike Early
Fargo Brook			Peter Jenkins				Mike Early
Hollow Brook			Alan Homans				Alan Homans
Bushy Brook			Margaret Taft				Alan Homans
Carpenter Brook			Nirmegh				Nirmegh
Cobb Brook			Nirmegh				Nirmegh
Jones Brook			Ryan Elliot				Ryan Elliot
Weaver Brook							
Floating #1	Aaron	Aaron	Aaron	Aaron	Aaron	Aaron	Aaron
Floating #2	Heather Pembrook		Heather Pembrook	Heather Pembrook	Heather Pembrook	Heather Pembrook	Heather Pembrook
Post Warnings	Linda Riscutto/Wally	Linda Riscutto/Wally	Linda Riscutto/Wally	Linda Riscutto/Wally	Linda Riscutto/Wally	Linda Riscutto/Wally	Linda Riscutto/Wally
DRIVE to Waterbury	Heather Pembrook	Padraic Monks	Heather Pembrook	Heather Pembrook	Heather Pembrook	Heather Pembrook	Heather Pembrook