Fitzgerald Environmental Associates, LLC.

Applied Watershed Science & Ecology

Town of Colchester Phase I
Stream Geomorphic Assessment Report

July 29, 2007

Prepared for:

Chittenden County Regional Planning Commission
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1.0 Executive Summary

This report summarizes data collected by Fitzgerald Environmental Associates, LLC. for the Pond Brook and Smith Creek watersheds in the Town of Colchester, Vermont. The Pond Brook and Smith Creek watersheds both outlet to Malletts Bay and have drainage areas of 4.7 and 1.4 square miles, respectively. The two watersheds were identified for assessment by the Town of Colchester and the Chittenden County Regional Planning Commission, and the Phase 1 approach of the VTANR Stream Geomorphic Assessment (SGA) Protocol (VTDEC, 2006) was utilized for data collection and analysis.

The Pond Brook watershed contains a mix of agricultural, forested, and low to medium density residential land use with a low degree of urbanization (3.2% impervious cover). The channel network is largely characterized by low-gradient reaches with sand substrate and many areas of beaver activity. The primary stressors to geomorphic stability and habitat conditions in the Pond Brook watershed include historic impacts to the channel boundary conditions (e.g., straightening) and the subsequent recover of a meandering planform occurring today, as well as specific undersized culverts found in the lower and middle sections of the watershed. Based on the results of the Phase 1 analysis, a total of 8 reaches have been identified for future assessment using the SGA Phase 2 approach.

The Smith Creek watershed contains a mix of agricultural, forested, and low to medium density residential land use with a moderate degree of urbanization (10.5% impervious cover). The channel network is also characterized by low-gradient reaches with sand substrate and steep valley side slopes. The primary stressors to geomorphic stability and habitat conditions in the Smith Creek watershed include stormwater inputs and the alteration of the watershed's hydrologic regime, as well as historic impacts to the channel boundary conditions (e.g., straightening). Based on the results of the Phase 1 analysis, a total of 4 reaches have been identified for future assessment using the SGA Phase 2 approach.

Additional recommendations for data analysis beyond the SGA Phase 2 approach include the development of rainfall-runoff models for those reaches where culverts have been identified as problematic and potentially undersized. Little additional effort would be required to develop the data needed to run the rainfall-runoff models (much of the data has been generated through the Phase 1 analysis), and the resulting discharge data would provide a sound basis for prioritizing structures for replacement for the Town of Colchester. This approach is described in further detail in the conclusions in Section 5.

2.0 Introduction:

The Town of Colchester and the Chittenden County Regional Planning Commission (CCRPC) identified two small watersheds within Colchester for assessment of fluvial geomorphic condition and erosion hazards: Pond Brook and Smith Creek. Both watersheds experienced flooding and erosion damage resulting from heavy rainfall events during the summer and fall of 2004, caused primarily by increased residential land use and improperly sized road culverts. Fitzgerald Environmental Associates, LLC. (FEA) was retained by CCRPC to carry out a Phase 1 assessment following the Stream Geomorphic Assessment (SGA) Protocols developed by VTANR. The Phase 1 SGA approach results in watershed-scale data about the landscape (e.g., soils and land cover) and the stream channel (e.g., slope and form), providing a basis for understanding the natural and human-impacted conditions within the watershed. The SGA data also aids in the identification of specific stressors affecting the physical conditions of the stream channels and structures (e.g., bridges and culverts) within watersheds.

Separate summaries of the watershed data are provided below for Pond Brook and Smith Creek. These summaries include descriptions of the watershed zones and specific reaches where land cover and soils characteristics indicate potential areas for fluvial erosion hazards. Following these descriptions are recommendations for future monitoring and data collection that would aid in the identification of projects that that could protect, sustain, or restore fluvial geomorphic equilibrium conditions, through the implementation of either passive or active stream corridor management strategies.

Tables summarizing the data compiled through the Phase 1 analysis are found in Appendix B. These tables include summaries of the physical conditions and reference stream types in the watershed (Tables 1 and 4), impact ratings and priorities for future assessment (Tables 2 and 5), and predicted stream channel adjustment processes (Tables 3 and 6). The relative reach impact score within each watershed was evaluated to determine the priority for future Phase 2 assessment. Generally, reaches with higher impact scores received a higher priority ranking. However some reaches with low impact scores were considered high priorities for future assessment if they contain problematic bridges or culverts, or had channel adjustment processes observed during the windshield surveys that warrant further investigation. Data specific to each reach are summarized in the reach summary sheets in Appendix C. These data form the basis for the impact ratings and prioritization as described above.

3.0 Pond Brook Watershed

The Pond Brook watershed is found in the northeastern part of the Colchester from the headwaters at Colchester Pond to the outlet at Malletts Creek approximately one mile east of Malletts Bay (see map in Appendix A). The watershed encompasses an area of 4.7 square miles, with 6 miles of stream channel along the mainstem from the headwaters to the outlet. The overall slope of the mainstem and tributary channels is 1.2%, reflecting the low gradient nature of the majority of the reaches in the watershed. The surface waters of the watershed were divided into two branches for the Phase 1 analysis. In addition to the Pond Brook mainstem (reaches M01 through M08), an additional tributary that is found along Route 2A and referred to as the "Southern Tributary" (reaches T1.01 through T1.05) was analyzed due to the size of the contributing drainage area.

The land use within the Pond Brook watershed is dominated by open agricultural and forested areas, with a mix of low and medium-density residential and commercial land along Route 2A in the village. Currently the impervious cover of the Pond Brook watershed is 3.2%, below levels (5-10%) associated with decline of channel stability and biotic integrity in small watersheds in Chittenden County (Fitzgerald, 2007).

The surficial geology of the watershed is dominated by lacustrine clays deposited during the early Holocene when Lake Vermont occupied much of the Champlain Valley (Wright, 2003). Some areas of glacial till and alluvial substrates are also found in the headwaters zone and near the mouth of Pond Brook, respectively. In the lower part of the watershed, the highly erosive properties of the soils have led to the development of steep valley side walls in many of the low-gradient reaches. These areas are characterized by narrow, meandering sand-bottomed channels found within unconfined valleys. Much of the bank and riparian vegetation along these reaches are dominated by herbaceous plants as a result of recurring beaver ponding. In the upper reaches of the watershed where glacial till is present and the channel slopes are greater, coarse-bottomed (e.g., gravel and cobble) channels are found in confined settings in the absence of historic beaver activity.

Below are narrative summaries of three zones of the Pond Brook watershed.

Upper Watershed Zone (M07 & M08; T1.03 to T1.05)

The upper headwaters area of the Pond Brook watershed in the vicinity of Colchester Pond (Figure 1) is occupied by forested terrain that has been minimally impacted by development. In the steeper areas of this watershed

Figure 1. View east over Colchester Pond and headwaters of Pond Brook

zone, B and C-type channels (Rosgen, 1994) are found where the valley setting is more confined and substrates are coarser. Downslope of these areas in the middle watershed zone, depositional (sand-bottomed) E-type channels are found where the channel slopes are less than 1% (Appendix B; Table 1). To the west and south of the pond, residential and commercial land uses (and associated road crossings) are found that may be impacting the channel stability in these depositional reaches. From Phase 1 analysis, one reach has been identified that has a high impact rating and high priority for further assessment.

- **T1.04:** This reach is found on the southern tributary beginning at the road crossing associated with the industrial park (located across from Canyon Estates Rd; see map in Appendix A) and extending upstream to the crossing at Gentes Road. Under reference conditions we would expect to see a C-type channel with gravel substrate and a meandering planform. The lower section of the reach has been straightened and culverted (~25 % of entire reach length) beneath the industrial park, and nearly all of the natural channel sinuosity has been lost. Downstream of this area the channel shows some signs of historic incision (Figure 2). In addition, the high degree of urbanization in the immediate drainage area to the channel has likely altered the reach hydrology. Direct observations of the middle portion of the reach were not possible during the windshield survey due to limited property access. This reach is predicted to have significant changes in planform and a poor geomorphic condition (Appendix B; Table 3).

Figure 2. Channel immediately downstream of industrial park in T1.04

Middle Watershed Zone (M04 to M06; T1.01 & T1.02)

Throughout the middle section of the watershed most of the reaches are characterized by meandering, low-gradient channels with frequent flooding caused by beaver activity. One short, high-gradient reach (M04) is found at the lower end of this zone where the channel descends over a limestone escarpment through a 40 foot waterfall. Areas of low density residential development are found upslope of reach T1.03, however field observations indicate that the channel is not adjusting due to this stressor. Throughout reaches M05 and M06, numerous channel meanders and potential neck cutoffs can be observed from current and historic aerial photography. However these changes in planform may be influenced more by beaver activity than by disequilibrium conditions caused by human impacts. From Phase 1 analysis, one reach has been identified that has a high impact rating and high priority for further assessment.

- **M06:** This mainstem reach is found from the confluence with the southern tributary up to a break in slope approximately 0.5 miles upstream of the East Road crossing. The channel is characterized by a low-gradient, sinuous form with many areas of meander migration resulting from beaver impacts to the floodplain. This reach has received a high impact rating due to the observed changes in planform, as well as the ice and debris jam potential at the East Road crossing. During an August 2004 runoff event, flooding occurred upstream of this road crossing, causing the road to be

temporarily closed. Debris and ice jams and future flooding will likely recur at this road crossing due to a combination of the following factors: 1) an undersized culvert (Figure 3); 2) limited relief of road from floodplain (less than 10 feet); 3) frequent beaver ponding above and below crossing.

Figure 3. 36" culvert constricting flow and debris beneath East Road

Lower Watershed Zone (M01 through M03)

In the lower section of the watershed below Middle Road the channel maintains a highly sinuous planform with E-type channel geometry. No beaver activity was observed during the windshield surveys in this watershed zone. Lack of property access limited direct observations of reach M01, however review of aerial photography indicates that this reach has been straightened and has limited vegetative buffer throughout. Numerous meander migrations in reaches M02 and M03 suggest that the channels in this zone are active in their lateral migration, perhaps in partial response to beaver influences. From Phase 1 analysis, two reaches have been identified that have a high impact rating and high priority for further assessment.

- **M01:** This mainstem reach is found from the confluence with Malletts Creek up to the end of the property associated with the surrounding farm. This reach has had severe historic impacts to the planform (greater than 90% of the channel length has been straightened). In addition, much of the reach lacks a vegetative buffer greater than 25 feet, which likely contributes to the direct input of sediment and nutrients from the adjacent agricultural fields, and also elevates surface water temperatures during the summer months due to lack of canopy cover. This reach is predicted to

have significant changes in planform and a poor geomorphic condition (Appendix B; Table 3).

- **M03:** This reach is found from approximately 1000 feet below the Route 7 crossing up to a change in slope and confinement at the reach break with M04. Although this reach has had limited direct impacts to the channel boundary conditions (e.g., channel straightening), its changes of planform indicate that it is undergoing significant lateral migration. In addition, the culvert beneath Route 7 represents a potential for ice and debris jams (although upstream flooding would not impacts any structures or property). Some scour and incision was noted below this culvert, indicating that it constricts flow during channel forming events. This reach is predicted to have significant changes in planform and a poor geomorphic condition (Appendix B; Table 3).

3.1 Pond Brook Assessment Recommendations

Based on the results of the Phase 1 analysis, 6 mainstem reaches and 2 tributary reaches have been selected for recommendation for further assessment (see priority rankings in Appendix B; Table 2) using the Phase 2 approach of the SGA protocols (including bridge and culvert assessments).

- **Mainstem:** Reaches **M01 through M06** are recommended for further Phase 2 assessment.
  - **Reach M01 (high priority)** should be investigated in further detail to determine the impacts of historic straightening and lack of vegetative buffer, and to evaluate the potential for stream corridor protection within the farm surrounding the channel. This effort would also involve landowner outreach to assess the social constraints to stream restoration.
  - **Reaches M02 and M03 (medium and high priority)** should also be assessed to determine the connectivity of adjustments along the channel network, as a high degree of channel migration was observed in both reaches. The Route 7 culvert (M03) should also be evaluated for impacts to fish passage and channel adjustments downstream of the structure.
  - **Reach M04 (medium priority)** contains a culvert beneath Middle Road which appears to be undersized. This reach and culvert should be assessed to determine whether it could be a priority for the replacement by the

Town of Colchester, given the known flooding hazard in the upstream culvert under East Road with similar dimensions and profile.

- **Reaches M05 and M06 (medium and high priority)** are priority reaches for assessment due to the high degree of lateral migration observed in both. In addition, the culvert beneath East Road should be evaluated in more detail to develop baseline information for the future replacement of this structure to reduce the risk of flooding along the road.

- **Southern Tributary:** Reaches **T1.01 and T1.04** are recommended for further Phase 2 assessment.
  - **Reach T1.01 (medium priority)** should be investigated in further detail to determine the impacts of runoff associated with the surrounding low-density residential development. The windshield survey was limited to the East Road crossing and did not encompass the middle or lower section of the reach.
  - **Reaches T1.04 (high priority)** should also be assessed to determine the impacts of runoff associated with the surrounding industrial development.

4.0 Smith Creek Watershed

The Smith Creek watershed is found in the center of the Colchester from the source at Severence Corners to the outlet at Malletts Bay along East Lakeshore Drive (see map in Appendix A). The watershed encompasses an area of 1.4 square miles, with 3 miles of stream channel along the mainstem from the headwaters to the outlet. The overall channel slope of the mainstem channel is 1.2%, reflecting the low-gradient nature of the majority of the reaches in the watershed (Appendix B; Table 4).

The land use within the Smith Creek watershed has become increasingly urbanized over the past 20 years, and includes a mix of low and medium-density residential and commercial land, as well as large areas of agriculture and forest. Currently the impervious cover of the Smith Creek watershed is 10.5%, a level associated with decline of channel stability and biotic integrity within other small watersheds in Chittenden County (Fitzgerald, 2007).

The surficial geology of the watershed is similar that found in the Pond Brook watershed, with lacustrine clays dominating throughout. In the lower part of the watershed, the presence of these soils has led to the development of steep valley side walls in many of the low gradient reaches. These areas are characterized by narrow, meandering sand-bottomed channels found within unconfined to narrow valleys.

Below are narrative summaries of two zones of the Smith Creek watershed.

Upper Watershed Zone (M04, M05, & Tributary Reaches)

Above Interstate 89 the small contributing drainage area to the upper reaches results in small, sand and gravel-bottomed reaches with limited stream power to cause flooding or fluvial erosion hazards. The channels in the watershed zone are found in very broad valleys (relative to the channel size) with abundant wetlands (Figure 4). Although high impact ratings have been assigned to some of the reaches in this zone, the physical conditions of these channels and watersheds would be best protected through the implementation of buffer setbacks and best management practices to control stormwater runoff, rather than the traditional SGA approach to assessing and controlling fluvial erosion hazards.

Figure 4. Small channel with adjacent wetlands in reach T2.01

Lower Watershed Zone (M01 through M04)

Below Interstate 89 the contributing drainage area becomes large enough to form typical alluvial channels that have historically carved valleys with steep side slopes through the lacustrine clays. Most of the reaches found within this zone are sand-bottomed channels with E-type geometry. The exception to this is the lowermost reach, where a wide channel is found within a narrow valley. Numerous stormwater outfalls were observed in this watershed zone that appear to be negatively impacting the hydrologic regime. Many of the stream channel

adjustments in the lower reaches are likely occurring as a result of the increased frequency of channel and bank scouring events due to runoff from impervious surfaces. From Phase 1 analysis, two reaches have been identified that have a high impact rating and high priority for further assessment.

- **M01:** This reach is found from the outlet at Malletts Bay up to a change in valley confinement just east of the Colchester Junior High School recreation fields. This reach appears to have B-type geometry with a sand-bottomed channel (Figure 5). This reach has had severe impacts to the vertical stability due to impacts from upslope impervious cover. In a heavy rainfall event in August 2004, the culvert beneath East Lakeshore Drive was undermined and washed out, and has since been replaced. This reach is predicted to have significant channel aggradation (e.g., sediment deposition) and degradation (e.g., downcutting) and a fair geomorphic condition (Appendix B; Table 6).

Figure 5. Sand-bottomed channel in lower reach M01

- **M02:** This reach is found from the reach break with M01 up to the Williams Road crossing. Many stormwater outfalls were noted along this reach, resulting in incision in the areas upstream of the bike path crossing (Figure 6). In addition, some scour and lateral migration was observed immediately below the Williams Road culvert. This reach is also predicted to have significant channel aggradation and degradation and a fair geomorphic condition (Appendix B; Table 6).

Figure 6. Incised channel in middle of reach M02

4.1 Smith Creek Monitoring Recommendations

Based on the results of the Phase 1 analysis, 4 mainstem reaches reaches have been selected for recommendation for further assessment using the Phase 2 approach of the SGA protocols (including bridge and culvert assessments). Although the impact rating and subsequent priority ranking (Appendix 2; Table 5) for tributary reach T1.02 indicate the importance for further assessment, the small size of the channel within this reach makes it inappropriate for a Phase 2 approach. Important information could be gained, however, through a cursory Phase 2 approach of channel and adjacent wetland assessment within this reach if desired by CCRPC or the Town of Colchester.

- **Mainstem:** Reaches **M01 through M04** are recommended for further Phase 2 assessment.
    - **Reaches M01 and M02 (high priority)** should be investigated in further detail to determine the impacts of upslope runoff from impervious surfaces. Given the erosion hazard noted with the washout of the culvert beneath East Lakeshore Drive in reach M01 (and the incision noted during the windshield surveys), further assessment of the upstream area is recommended. In addition, low-density development has recently been added to the area that drains directly to reach M02, and the impacts of this development are unknown.

- **Reach M03 (medium priority)** should also be assessed to determine the connectivity of adjustments along the channel network, as a moderate degree of channel straightening (~15% of channel length) was observed in this reach. Like in M02, additional low-density development has recently been added to the area that drains directly to M03, the impacts of which are unknown.
- **Reach M04 (medium priority)** also has been impacted by historic channel straightening (~25% of channel length), and may currently be impacted by the impervious cover associated with the Edgewood Drive neighborhood. Although this reach received a high impact rating (Appendix 2; Table 5), the relatively small drainage area and channel size makes it unlikely that significant erosion hazards will develop in this reach. Therefore, this reach has been given a medium priority for further assessment.

5.0 Conclusions

The Phase 1 approach for the Pond Brook and Smith Creek watersheds has provided initial data to describe the topographic, geologic and anthropogenic settings within the Town of Colchester. The overall conditions within the Pond Brook watershed vary significantly depending on the adjacent land use (historic and current) and the presence or absence of undersized culverts. Many reaches in the Pond Brook watershed are predicted to have significant channel adjustment processes with fair to poor geomorphic conditions. As a result, a total of 8 reaches have been recommended for future Phase 2 assessment. The overall conditions within Smith Creek are being strongly influenced by the moderate degree of urbanization within the watershed. Many reaches in the Smith Creek watershed are also predicted to have significant channel adjustment processes with fair to poor geomorphic conditions, and a total of 4 reaches have been recommended for future Phase 2 assessment.

For reaches where the dominant stressor is an undersized culvert, or where culverts have been identified for possible replacement by the Town of Colchester, additional data describing the hydrologic regime (e.g., magnitude and frequency of discharge events) would be required to further identify and prioritize these structures. The Phase 1 data generated by this study provide a convenient basis for developing rainfall-runoff models (using the NRCS approach with the TR20 model) that can determine the peak flow rates through these structures during larger storm events. Much of the data required to develop these models is inherent in the Phase 1 results (including watershed areas, soils data, and land use), and little additional effort using GIS would be needed. It is recommended that

discharge data for a spectrum of large storm events (10, 25 and 100 year return) be generated for those stream crossings that have been identified as problematic in this study, including a total of three crossings in the Pond Brook watershed (reaches M03, M04 and M06) and one in the Smith Creek watershed (M02).

6.0 References

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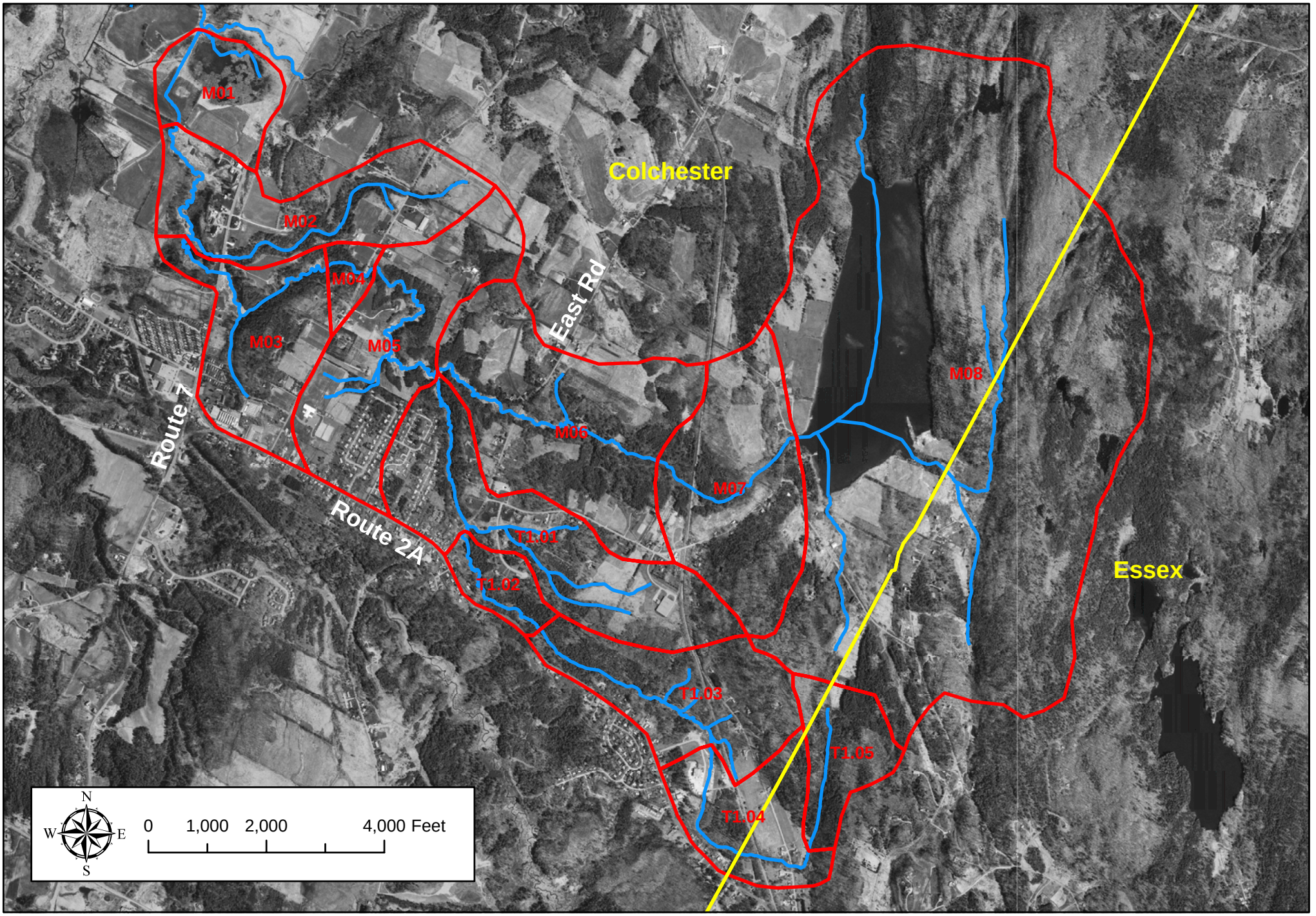
APPENDIX A

SUBWATERSHED MAPPING



Town Boundaries

Pond Brook Subwatersheds

Pond Brook Surface Waters

Pond Brook Subwatershed Map

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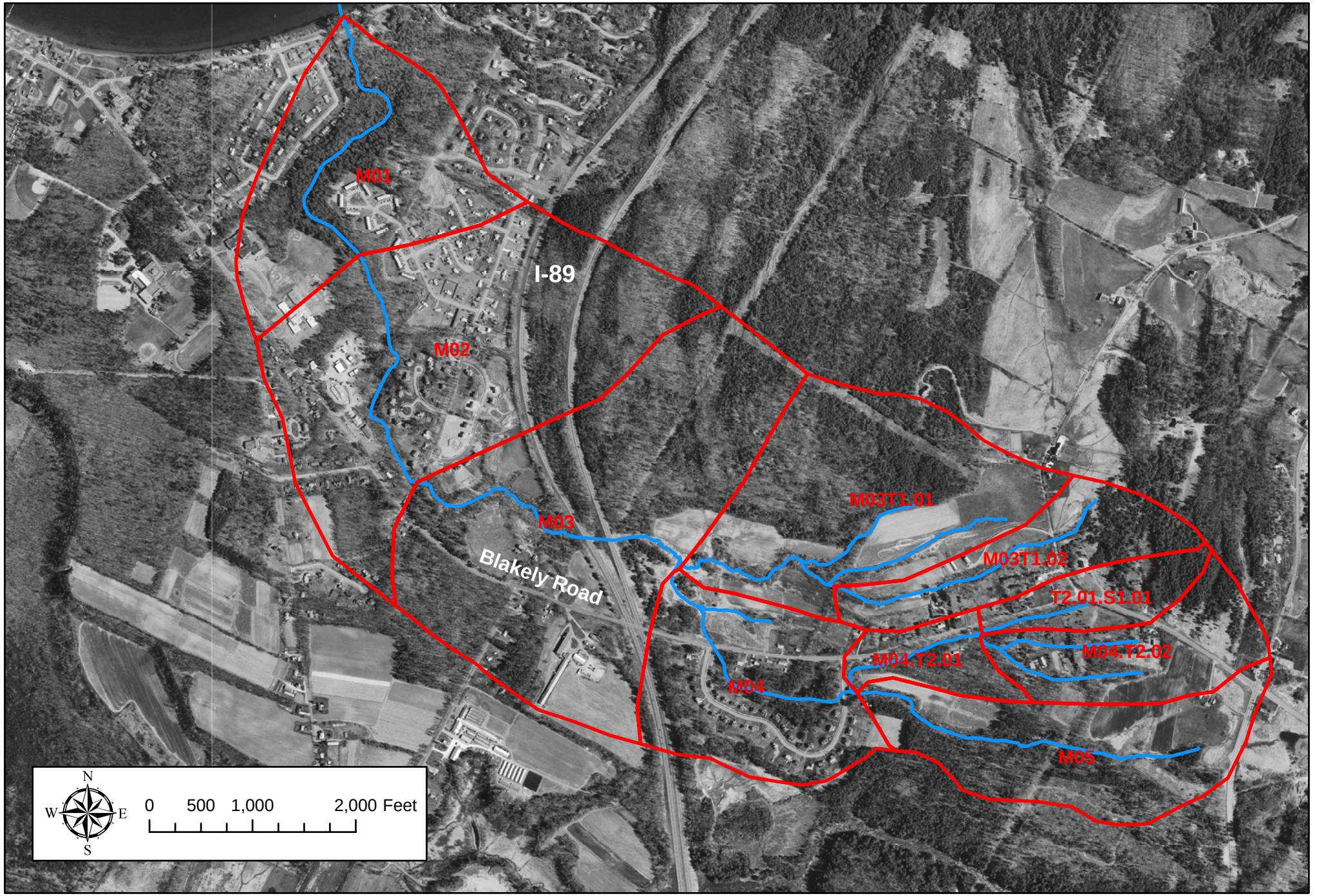

Smith Creek Subwatersheds

Smith Creek Surface Waters

Smith Creek Subwatershed Map

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APPENDIX B

WATERSHED SUMMARY DATA

Table 1. Pond Brook Preliminary Stream Types (Step 2)

Reach ID	Elevation Up (ft.)	Elevation Down (ft.)	Valley Length (ft.)	Valley Slope (%)	Channel Length (ft.)	Channel Slope (%)	Sinuosity	Watershed Area (sq. mi.)	Channel Width (ft.)	Valley Width (ft.)	Confinement Ratio	Confinement Type*	Reference Stream Type	Bedform	Bed Subsrate
M01	103	100	1682	0.18	1920	0.16	1.14	4.65	25.8	603	23.4	VB	E	Dune-Ripple	Sand
M02	112	103	2210	0.41	3179	0.28	1.44	4.53	25.5	294	11.5	VB	E	Dune-Ripple	Sand
M03	130	112	3418	0.53	4289	0.42	1.25	4.24	24.7	193	7.8	BD	E	Dune-Ripple	Sand
M04	187	130	964	5.91	1018	5.6	1.06	4.02	24.2	50	2.1	SC	A	Cascade	Bedrock
M05	195	187	2937	0.27	4343	0.18	1.48	3.99	24.1	260	10.8	VB	E	Dune-Ripple	Sand
M06	235	195	4276	0.94	5055	0.79	1.18	2.75	20.5	191	9.3	BD	E	Dune-Ripple	Sand
M07	380	235	3052	4.75	3201	4.53	1.05	2.34	19	50	2.6	SC	B	Step-Pool	Boulder
M08	480	380	8327	1.2	8611	1.16	1.03	2.02	17.8	120	6.7	BD	C	Riffle-Pool	Gravel
T1.01	215	195	2732	0.73	3056	0.65	1.12	0.92	12.6	147	11.6	VB	E	Dune-Ripple	Sand
T1.02	237	215	2302	0.96	2731	0.81	1.19	0.58	10.3	136	13.2	VB	E	Dune-Ripple	Sand
T1.03	298	237	3730	1.64	3963	1.54	1.06	0.52	9.8	133	13.5	VB	E	Dune-Ripple	Sand
T1.04	340	298	3608	1.16	3795	1.11	1.05	0.28	7.5	156	20.8	VB	C	Riffle-Pool	Gravel
T1.05	440	340	2460	4.07	2496	4.01	1.01	0.11	5	30	6	NW	B	Step-Pool	Cobble

* NW = Narrow; SC = Semi-confined; BD = Broad; VB = Very Broad

Table 2. Pond Brook Impact Ratings (Step 8)

	Step Number† with Impact Score*																Total	Priority
Reach ID	**4.1**	**4.2**	**4.3**	**5.1**	**5.2**	**5.3**	**5.4**	**5.5**	**6.1**	**6.2**	**6.3**	**6.4**	**6.5**	**6.6**	**7.2**	**7.3**	**Score**	**Ranking**
M01	2	0	2	0	0	0	2	0	0	0	0	1	2	2	0	1	12	High
M02	2	2	0	0	0	0	2	0	0	0	0	1	1	1	0	0	9	Medium
M03	2	1	0	0	0	0	1	0	0	0	1	2	1	2	0	1	11	High
M04	2	2	0	0	0	0	1	0	0	0	0	0	0	0	0	2	7	Medium
M05	2	1	0	0	0	0	1	0	0	0	1	2	1	1	0	0	9	Medium
M06	2	1	0	1	0	0	1	0	0	0	1	2	1	1	0	2	12	High
M07	2	2	0	1	0	0	1	0	0	0	0	0	0	0	0	0	6	Low
M08	2	2	0	1	0	0	0	0	0	0	0	0	2	2	0	0	9	Low
T1.01	2	2	0	0	0	0	1	0	0	0	0	0	1	1	0	0	7	Medium
T1.02	2	2	0	0	0	0	0	0	0	0	0	0	0	1	0	0	5	Low
T1.03	2	1	0	0	0	0	0	0	0	0	0	2	0	1	0	0	6	Low
T1.04	2	2	1	0	0	0	2	0	0	2	0	0	1	0	0	0	10	High
T1.05	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	Low

* 0 = Not Significant or No Data; 1 = Low; 2 = High

† Step 4: Land Cover and Reach Hydrology
Step 5: Channel Modifications
Step 6: Floodplain Modifications and Planform Changes
Step 7: Bed and Bank Condition

Table 3. Pond Brook Predicted Channel Adjustment Processes (Step 9)

	9.1 Predicted Adjustment Scores				Total	9.2 Reach Condition		9.3 Reach
Reach ID	**Degradation**	**Aggradation**	**Widening**	**Planform**	**Impact**	**Project***	**Statewide***	**Sensitivity**
M01	6	6	7	**8**	12	Poor	Good	High
M02	4	4	2	2	9	Fair	Reference	High
M03	5	5	5	**7**	11	Poor	Good	High
M04	5	**8**	5	2	7	Fair	Good	Very Low
M05	3	3	2	3	9	Good	Reference	High
M06	3	5	4	5	12	Fair	Good	High
M07	5	**6**	5	2	6	Fair	Good	Very Low
M08	4	4	2	0	9	Good	Reference	High
T1.01	3	4	2	1	7	Good	Reference	High
T1.02	2	4	2	0	5	Good	Reference	High
T1.03	2	3	2	2	6	Good	Reference	High
T1.04	6	7	5	**8**	10	Poor	Good	High
T1.05	2	1	0	0	1	Reference	Reference	Moderate

* Conditions relative to the Pond Brook watershed ("project") versus overall Vermont ("statewide")

Note: **Bold** values indicate the dominant adjustment processes (when moderate to severe; value > 5)

Table 4. Smith Creek Preliminary Stream Types (Step 2)

Reach ID	Elevation Up (ft.)	Elevation Down (ft.)	Valley Length (ft.)	Valley Slope (%)	Channel Length (ft.)	Channel Slope (%)	Sinuosity	Watershed Area (sq. mi.)	Channel Width (ft.)	Valley Width (ft.)	Confinement Ratio	Confinement Type*	Reference Stream Type	Bedform	Bed Substrate
M01	165	95	3151	2.22	3189	2.2	1.01	1.4	15.2	50	3.3	SC	B	Dune-Ripple	Sand
M02	175	165	2516	0.4	2577	0.39	1.02	1.24	14.4	140	9.7	BD	E	Dune-Ripple	Sand
M03	190	175	2855	0.53	3194	0.47	1.12	0.95	12.8	130	10.1	VB	E	Dune-Ripple	Sand
M04	210	190	2487	0.8	2604	0.77	1.05	0.4	8.7	231	26.5	VB	E	Dune-Ripple	Sand
M05	280	210	3508	2	3582	1.95	1.02	0.13	5.3	100	18.9	VB	B	Riffle-Pool	Gravel
T1.01	200	190	1646	0.61	1840	0.54	1.12	0.25	7.1	206	28.9	VB	E	Dune-Ripple	Sand
T1.02	280	200	2875	2.78	2934	2.73	1.02	0.07	4.2	75	18	VB	B	Riffle-Pool	Gravel
T2.01	220	210	1408	0.71	1458	0.69	1.04	0.15	5.6	75	13.4	VB	E	Dune-Ripple	Sand
T2.01.S1.01	270	220	1065	4.69	1074	4.66	1.01	0.04	3.1	45	14.4	VB	B	Riffle-Pool	Gravel
T2.02	280	220	1700	3.53	1712	3.5	1.01	0.07	4.2	145	34.6	VB	B	Riffle-Pool	Gravel

* SC = Semi-confined; BD = Broad; VB = Very Broad

Table 5. Smith Creek Impact Ratings (Step 8)

	Step Number† with Impact Score*																Total	Priority
Reach ID	**4.1**	**4.2**	**4.3**	**5.1**	**5.2**	**5.3**	**5.4**	**5.5**	**6.1**	**6.2**	**6.3**	**6.4**	**6.5**	**6.6**	**7.2**	**7.3**	**Score**	**Ranking**
M01	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	5	High
M02	2	2	0	0	0	0	0	0	0	2	0	0	0	1	0	1	8	High
M03	2	2	0	0	0	0	1	0	0	0	0	1	0	2	0	1	9	Medium
M04	2	2	0	0	0	0	2	0	0	1	0	0	2	2	0	1	12	Medium
M05	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	Low
T1.01	2	2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	5	Low
T1.02	2	2	1	1	0	0	2	0	0	1	0	0	0	2	0	0	11	High
T2.01	2	2	0	0	0	0	0	0	0	2	0	0	0	0	0	0	6	Low
T2.01.S1.01	2	2	0	0	0	0	0	0	2	0	0	0	0	0	0	0	6	Low
T2.02	2	2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	5	Low

* 0 = Not Significant or No Data; 1 = Low; 2 = High

† Step 4: Land Cover and Reach Hydrology
Step 5: Channel Modifications
Step 6: Floodplain Modifications and Planform Changes
Step 7: Bed and Bank Condition

Table 6. Smith Creek Predicted Channel Adjustment Processes (Step 9)

	9.1 Predicted Adjustment Scores				Total	9.2 Reach Condition		9.3 Reach
Reach ID	**Degradation**	**Aggradation**	**Widening**	**Planform**	**Impact**	**Project***	**Statewide***	**Sensitivity**
M01	4	4	2	0	5	Fair	Reference	Moderate
M02	4	4	2	2	8	Fair	Reference	High
M03	3	4	2	1	9	Fair	Reference	High
M04	**6**	**6**	5	**6**	12	Poor	Good	High
M05	4	4	2	0	4	Fair	Reference	Moderate
T1.01	2	4	2	0	5	Good	Reference	High
T1.02	6	**7**	5	6	11	Poor	Good	Moderate
T2.01	**6**	**6**	5	**6**	6	Poor	Good	High
T2.01.S1.01	**6**	**6**	5	4	6	Poor	Good	Moderate
T2.02	4	4	2	0	5	Fair	Reference	Moderate

* Conditions relative to the Smith Creek watershed ("project") versus overall Vermont ("statewide")

Note: **Bold** values indicate the dominant adjustment processes (when moderate to severe; value > 5)

APPENDIX C

PHASE 1 REACH REPORTS

Pond Brook

Phase 1 - Reach Summary Report

Basin: **Northern Champlain**
Stream Name: **Pond Brook** Reach **M01**
Topo Maps: **COLCHESTER**
Date Last Edited: **Thu, July 26, 2007**
Watershed: **Lewis Creek, Little Otter, Lake Champlain**
Sub-watershed: **Malletts Bay**
Is Reach an Impoundment? **No**

Step 1. Reach Location

1.1 Reach Description: **From confluence with Malletts Creek up to the end of channel**
1.2 Towns: **Colchester**
1.3 Downstream Latitude: **44.57**
1.3 Downstream Longitude: **-73.16**

Step 2. Stream Type

2.1 Elevation Upstream: **103**
2.1 Elevation Downstream: **100**
2.1 Is Gradient Gentle? **No**
2.2 Valley Length: **1682** feet. **0.32** Miles.
2.3 Valley Slope: **0.18** %
2.4.Channel Length: **1920** feet. **0.36** Miles.
2.5 Channel Slope: **0.16** %
2.6 Sinuosity: **1.14**
2.7 Watershed Area: **5** Square Miles
2.8 Channel Width: **26** feet.
2.9 Valley Width: **603** feet.
2.10 Confinement Ratio: **23.4**
2.10 Confinement Type: **Very Broad**
2.11 Reference Stream Type: **E**
Bedform: **Dune-Ripple**
Sub-class Slope: **None**
Bed Material: **Sand**

Step 3. Basin Characteristics:

3.1 Alluvial Fan: **None**
3.2 Grade Control: **None**
3.3 Dominant Geologic Mat.: **Alluvial** **100.** %
3.3 Sub-dominant Geological Mat.:
3.4 Left Valley Side **Flat**
3.4 Right Valley Side **Flat**
3.5 Soils

Hydrologic Group:	**C**	**100.** %
Flooding:	**Frequent**	**100.** %
Water Table Deep:	**1.5**	**100.** %
Water Table Shallow:	**0.0**	**100.** %
Erodibility:		%

7.4 Comments:

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Field**
Current Dominant land Cover: **Forest** **39.0** %
Current Sub-Dominant Land Cover:
4.2 Corridor
Historic Land Cover: **Field**
Current Dominant land Cover: **Forest** **53.0** %
Current Sub-Dominant Land Cover: **Field**
4.3 Riparian Buffer - Left Bank: **0-25**
4.3 Riparian Buffer - Right Bank: **0-25**
4.4 Ground Water Inputs: **Abundant**

Step 5. Instream Channel Modifications

5.1 Flow Regulation: **None**
5.2 Bridges and Culverts: **1** **0** %
5.3 Bank Armoring: **None** **None**
5.4 Channel Straightening: **1750** **91 %**
5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms and Roads: **0** **0**
6.2 Floodplain Development: **0** **0**
6.3 Channel Bars: **None**
6.4 Meander Migration: **Migration**
6.5 Meander Width: **16** Ratio: **0.6**
6.6 Wavelength: **110** Ratio: **4.3**

Step 7. Windshield Survey

7.2 Bank Erosion: **None**
7.2 Bank Height: **No Data**
7.3 Ice/Debris Jam Potential: **Bridge**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.2	7.3	Total
2 High	0 N.S.	2 High	0 N.S.	0 N.S.	0 N.S.	2 High	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	2 High	2 High	0 N.S.	0 N.S.	10

Pond Brook

Phase 1 - Reach Summary Report

Basin: **Northern Champlain**
Stream Name: **Pond Brook** Reach **M02**
Topo Maps: **COLCHESTER**
Date Last Edited: **Thu, July 26, 2007**
Watershed: **Lewis Creek, Little Otter, Lake Champlain**
Sub-watershed: **Malletts Bay**
Is Reach an Impoundment? **No**

Step 1. Reach Location

1.1 Reach Description: **From the farm bridge crossing up to approximately 1000 feet**
1.2 Towns: **Colchester**
1.3 Downstream Latitude: **44.56**
1.3 Downstream Longitude: **-73.17**

Step 2. Stream Type

2.1 Elevation Upstream: **112**
2.1 Elevation Downstream: **103**
2.1 Is Gradient Gentle? **No**
2.2 Valley Length: **2210** feet. **0.42** Miles.
2.3 Valley Slope: **0.41** %
2.4.Channel Length: **3179** feet. **0.60** Miles.
2.5 Channel Slope: **0.28** %
2.6 Sinuosity: **1.44**
2.7 Watershed Area: **5** Square Miles
2.8 Channel Width: **25** feet.
2.9 Valley Width: **294** feet.
2.10 Confinement Ratio: **11.5**
2.10 Confinement Type: **Very Broad**
2.11 Reference Stream Type: **E**
Bedform: **Dune-Ripple**
Sub-class Slope: **None**
Bed Material: **Sand**

Step 3. Basin Characteristics:

3.1 Alluvial Fan: **None**
3.2 Grade Control: **None**
3.3 Dominant Geologic Mat.: **Alluvial** **58.0** %
3.3 Sub-dominant Geological Mat.: **Glacial Lake**
3.4 Left Valley Side **Hilly**
3.4 Right Valley Side **Steep**
3.5 Soils

Hydrologic Group:	**C**	**58.0** %
Flooding:	**Frequent**	**58.0** %
Water Table Deep:	**1.5**	**58.0** %
Water Table Shallow:	**0.0**	**58.0** %
Erodibility:	**High -**	**1.0** %

7.4 Comments:

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Field**
Current Dominant land Cover: **Forest** **38.0** %
Current Sub-Dominant Land Cover:
4.2 Corridor
Historic Land Cover: **Field**
Current Dominant land Cover: **Field** **21.0** %
Current Sub-Dominant Land Cover: **Crop**
4.3 Riparian Buffer - Left Bank: **>100**
4.3 Riparian Buffer - Right Bank: **>100**
4.4 Ground Water Inputs: **Abundant**

Step 5. Instream Channel Modifications

5.1 Flow Regulation: **None**
5.2 Bridges and Culverts: **0** **0** %
5.3 Bank Armoring: **None** **None**
5.4 Channel Straightening: **809** **25 %**
5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms and Roads: **0** **0**
6.2 Floodplain Development: **0** **0**
6.3 Channel Bars: **None**
6.4 Meander Migration: **Migration**
6.5 Meander Width: **110** Ratio: **4.3**
6.6 Wavelength: **175** Ratio: **6.9**

Step 7. Windshield Survey

7.2 Bank Erosion: **None**
7.2 Bank Height: **No Data**
7.3 Ice/Debris Jam Potential: **None**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.2	7.3	Total
2 High	2 High	0 N.S.	0 N.S.	0 N.S.	0 N.S.	2 High	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	1 Low	1 Low	0 N.S.	0 N.S.	8

Pond Brook

Phase 1 - Reach Summary Report

Basin: **Northern Champlain**
Stream Name: **Pond Brook** Reach **M03**
Topo Maps: **COLCHESTER**
Date Last Edited: **Thu, July 26, 2007**
Watershed: **Lewis Creek, Little Otter, Lake Champlain**
Sub-watershed: **Malletts Bay**
Is Reach an Impoundment? **No**

Step 1. Reach Location

1.1 Reach Description: **From approx. 1000 feet downstream of Rt. 7 crossing up to approx.**
1.2 Towns: **Colchester**
1.3 Downstream Latitude: **44.56**
1.3 Downstream Longitude: **-73.16**

Step 2. Stream Type

2.1 Elevation Upstream: **130**
2.1 Elevation Downstream: **112**
2.1 Is Gradient Gentle? **No**
2.2 Valley Length: **3418** feet. **0.65** Miles.
2.3 Valley Slope: **0.53** %
2.4.Channel Length: **4289** feet. **0.81** Miles.
2.5 Channel Slope: **0.42** %
2.6 Sinuosity: **1.25**
2.7 Watershed Area: **4** Square Miles
2.8 Channel Width: **25** feet.
2.9 Valley Width: **193** feet.
2.10 Confinement Ratio: **7.8**
2.10 Confinement Type: **Broad**
2.11 Reference Stream Type: **E**
Bedform: **Dune-Ripple**
Sub-class Slope: **None**
Bed Material: **Sand**

Step 3. Basin Characteristics:

3.1 Alluvial Fan: **None**
3.2 Grade Control: **None**
3.3 Dominant Geologic Mat.: **Glacial Lake 42.0** %
3.3 Sub-dominant Geological Mat.: **Alluvial**
3.4 Left Valley Side **Steep**
3.4 Right Valley Side **Very Steep**
3.5 Soils

Hydrologic Group:	**Not Rated**	**42.0** %
Flooding:	**None/Rare**	**62.0** %
Water Table Deep:	**1.5**	**37.0** %
Water Table Shallow:	**0.0**	**37.0** %
Erodibility:	**High -**	**12.0** %

7.4 Comments:

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Field**
Current Dominant land Cover: **Forest** **39.0** %
Current Sub-Dominant Land Cover:
4.2 Corridor
Historic Land Cover: **Field**
Current Dominant land Cover: **Forest** **53.0** %
Current Sub-Dominant Land Cover: **Urban**
4.3 Riparian Buffer - Left Bank: **>100**
4.3 Riparian Buffer - Right Bank: **>100**
4.4 Ground Water Inputs: **Abundant**

Step 5. Instream Channel Modifications

5.1 Flow Regulation: **None**
5.2 Bridges and Culverts: **1** **0** %
5.3 Bank Armoring: **None** **None**
5.4 Channel Straightening: **292** **6 %**
5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms and Roads: **0** **0**
6.2 Floodplain Development: **0** **0**
6.3 Channel Bars: **Mid-channel**
6.4 Meander Migration: **Migration**
6.5 Meander Width: **85** Ratio: **3.4**
6.6 Wavelength: **110** Ratio: **4.4**

Step 7. Windshield Survey

7.2 Bank Erosion: **None**
7.2 Bank Height: **No Data**
7.3 Ice/Debris Jam Potential: **Culvert**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.2	7.3	Total
2 High	1 Low	0 N.S.	0 N.S.	0 N.S.	0 N.S.	2 High	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	1 Low	2 High	0 N.S.	0 N.S.	8

Pond Brook

Phase 1 - Reach Summary Report

Basin: **Northern Champlain**
Stream Name: **Pond Brook** Reach **M04**
Topo Maps: **COLCHESTER**
Date Last Edited: **Thu, July 26, 2007**
Watershed: **Lewis Creek, Little Otter, Lake Champlain**
Sub-watershed: **Malletts Bay**
Is Reach an Impoundment? **No**

Step 1. Reach Location

1.1 Reach Description: **From approx. 700 ft below Middle Road to immediately above the Colchester**
1.2 Towns:
1.3 Downstream Latitude: **44.56**
1.3 Downstream Longitude: **-73.16**

Step 2. Stream Type

2.1 Elevation Upstream: **187**
2.1 Elevation Downstream: **130**
2.1 Is Gradient Gentle? **No**
2.2 Valley Length: **964** feet. **0.18** Miles.
2.3 Valley Slope: **5.91** %
2.4.Channel Length: **1018** feet. **0.19** Miles.
2.5 Channel Slope: **5.60** %
2.6 Sinuosity: **1.06**
2.7 Watershed Area: **4** Square Miles
2.8 Channel Width: **24** feet.
2.9 Valley Width: **50** feet.
2.10 Confinement Ratio: **2.1**
2.10 Confinement Type: **Semi-confined**
2.11 Reference Stream Type: **A**
Bedform: **Cascade**
Sub-class Slope: **None**
Bed Material: **Bedrock**

Step 3. Basin Characteristics:

3.1 Alluvial Fan: **None**
3.2 Grade Control: **Waterfall**
3.3 Dominant Geologic Mat.: **Ice-Contact** **49.0** %
3.3 Sub-dominant Geological Mat.: **Glacial Lake**
3.4 Left Valley Side **Extremely Steep**
3.4 Right Valley Side **Extremely Steep**
3.5 Soils

Hydrologic Group:	**A**	**49.0** %
Flooding:	**None/Rare**	**94.0** %
Water Table Deep:	**6.0**	**49.0** %
Water Table Shallow:	**6.0**	**49.0** %
Erodibility:	**High -**	**94.0** %

7.4 Comments:

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Field**
Current Dominant land Cover: **Forest** **39.0** %
Current Sub-Dominant Land Cover:
4.2 Corridor
Historic Land Cover: **Forest**
Current Dominant land Cover: **Urban** **36.0** %
Current Sub-Dominant Land Cover: **Forest**
4.3 Riparian Buffer - Left Bank: **>100**
4.3 Riparian Buffer - Right Bank: **>100**
4.4 Ground Water Inputs: **None**

Step 5. Instream Channel Modifications

5.1 Flow Regulation: **None**
5.2 Bridges and Culverts: **1** **0** %
5.3 Bank Armoring: **None** **None**
5.4 Channel Straightening: **123** **12 %**
5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms and Roads: **0** **0**
6.2 Floodplain Development: **0** **0**
6.3 Channel Bars: **Not Evaluated**
6.4 Meander Migration: **Not Evaluated**
6.5 Meander Width: **Not** Ratio: **0.0**
6.6 Wavelength: **Not** Ratio: **0.0**

Step 7. Windshield Survey

7.2 Bank Erosion: **None**
7.2 Bank Height: **No Data**
7.3 Ice/Debris Jam Potential: **Culvert**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.2	7.3	Total
2 High	2 High	0 N.S.	0 N.S.	0 N.S.	0 N.S.	2 High	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	6

Pond Brook

Phase 1 - Reach Summary Report

Basin: **Northern Champlain**
Stream Name: **Pond Brook** Reach **M05**
Topo Maps: **COLCHESTER**
Date Last Edited: **Thu, July 26, 2007**
Watershed: **Lewis Creek, Little Otter, Lake Champlain**
Sub-watershed: **Malletts Bay**
Is Reach an Impoundment? **No**

Step 1. Reach Location

1.1 Reach Description: **From Middle Road upstream to confluence with Southern Trib**
1.2 Towns: **Colchester**
1.3 Downstream Latitude: **44.56**
1.3 Downstream Longitude: **-73.15**

Step 2. Stream Type

2.1 Elevation Upstream: **195**
2.1 Elevation Downstream: **187**
2.1 Is Gradient Gentle? **No**
2.2 Valley Length: **2937** feet. **0.56** Miles.
2.3 Valley Slope: **0.27** %
2.4.Channel Length: **4343** feet. **0.82** Miles.
2.5 Channel Slope: **0.18** %
2.6 Sinuosity: **1.48**
2.7 Watershed Area: **4** Square Miles
2.8 Channel Width: **24** feet.
2.9 Valley Width: **260** feet.
2.10 Confinement Ratio: **10.8**
2.10 Confinement Type: **Very Broad**
2.11 Reference Stream Type: **E**
Bedform: **Dune-Ripple**
Sub-class Slope: **None**
Bed Material: **Sand**

Step 3. Basin Characteristics:

3.1 Alluvial Fan: **None**
3.2 Grade Control: **None**
3.3 Dominant Geologic Mat.: **Glacial Lake 57.0** %
3.3 Sub-dominant Geological Mat.: **Alluvial**
3.4 Left Valley Side **Hilly**
3.4 Right Valley Side **Steep**
3.5 Soils

Hydrologic Group:	**D**	**37.0** %
Flooding:	**None/Rare**	**57.0** %
Water Table Deep:	**2.0**	**37.0** %
Water Table Shallow:	**0.5**	**37.0** %
Erodibility:	**High -**	**37.0** %

7.4 Comments:

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Field**
Current Dominant land Cover: **Forest** **39.0** %
Current Sub-Dominant Land Cover:
4.2 Corridor
Historic Land Cover: **Field**
Current Dominant land Cover: **Forest** **67.0** %
Current Sub-Dominant Land Cover: **Crop**
4.3 Riparian Buffer - Left Bank: **>100**
4.3 Riparian Buffer - Right Bank: **>100**
4.4 Ground Water Inputs: **Abundant**

Step 5. Instream Channel Modifications

5.1 Flow Regulation: **None**
5.2 Bridges and Culverts: **0** **0** %
5.3 Bank Armoring: **None** **None**
5.4 Channel Straightening: **319.4** **7 %**
5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms and Roads: **0** **0**
6.2 Floodplain Development: **0** **0**
6.3 Channel Bars: **Mid-channel**
6.4 Meander Migration: **Migration**
6.5 Meander Width: **100** Ratio: **4.2**
6.6 Wavelength: **150** Ratio: **6.2**

Step 7. Windshield Survey

7.2 Bank Erosion: **None**
7.2 Bank Height: **No Data**
7.3 Ice/Debris Jam Potential: **None**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.2	7.3	Total
2 High	1 Low	0 N.S.	0 N.S.	0 N.S.	0 N.S.	2 High	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	1 Low	1 Low	0 N.S.	0 N.S.	7

Pond Brook

Phase 1 - Reach Summary Report

Basin: **Northern Champlain**
Stream Name: **Pond Brook** Reach **M06**
Topo Maps: **COLCHESTER**
Date Last Edited: **Thu, July 26, 2007**
Watershed: **Lewis Creek, Little Otter, Lake Champlain**
Sub-watershed: **Malletts Bay**
Is Reach an Impoundment? **No**

Step 1. Reach Location

1.1 Reach Description: **From confluence with Southern Trib upstream, under East Rd,**
1.2 Towns: **Colchester**
1.3 Downstream Latitude: **44.55**
1.3 Downstream Longitude: **-73.15**

Step 2. Stream Type

2.1 Elevation Upstream: **235**
2.1 Elevation Downstream: **195**
2.1 Is Gradient Gentle? **No**
2.2 Valley Length: **4276** feet. **0.81** Miles.
2.3 Valley Slope: **0.94** %
2.4.Channel Length: **5055** feet. **0.96** Miles.
2.5 Channel Slope: **0.79** %
2.6 Sinuosity: **1.18**
2.7 Watershed Area: **3** Square Miles
2.8 Channel Width: **20** feet.
2.9 Valley Width: **191** feet.
2.10 Confinement Ratio: **9.3**
2.10 Confinement Type: **Broad**
2.11 Reference Stream Type: **E**
Bedform: **Dune-Ripple**
Sub-class Slope: **None**
Bed Material: **Sand**

Step 3. Basin Characteristics:

3.1 Alluvial Fan: **None**
3.2 Grade Control: **None**
3.3 Dominant Geologic Mat.: **Glacial Lake 54.0** %
3.3 Sub-dominant Geological Mat.: **Alluvial**
3.4 Left Valley Side **Hilly**
3.4 Right Valley Side **Hilly**
3.5 Soils

Hydrologic Group:	**D**	**52.0** %
Flooding:	**None/Rare**	**58.0** %
Water Table Deep:	**1.0**	**45.0** %
Water Table Shallow:	**0.0**	**90.0** %
Erodibility:	**High -**	**29.0** %

7.4 Comments:

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Field**
Current Dominant land Cover: **Forest** **37.0** %
Current Sub-Dominant Land Cover:
4.2 Corridor
Historic Land Cover: **Field**
Current Dominant land Cover: **Forest** **76.0** %
Current Sub-Dominant Land Cover: **Wetland**
4.3 Riparian Buffer - Left Bank: **>100**
4.3 Riparian Buffer - Right Bank: **>100**
4.4 Ground Water Inputs: **Abundant**

Step 5. Instream Channel Modifications

5.1 Flow Regulation: **None**
5.2 Bridges and Culverts: **1** **0** %
5.3 Bank Armoring: **None** **None**
5.4 Channel Straightening: **88** **1 %**
5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms and Roads: **0** **0**
6.2 Floodplain Development: **0** **0**
6.3 Channel Bars: **Mid-channel**
6.4 Meander Migration: **Neck Cut-Off**
6.5 Meander Width: **100** Ratio: **4.9**
6.6 Wavelength: **150** Ratio: **7.3**

Step 7. Windshield Survey

7.2 Bank Erosion: **None**
7.2 Bank Height: **No Data**
7.3 Ice/Debris Jam Potential: **Culvert**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.2	7.3	Total
2	1	0	0	0	0	1	0	0	0	0	0	1	1	0	0	6
High	Low	N.S.	N.S.	N.S.	N.S.	Low	N.S.	N.S.	N.S.	N.S.	N.S.	Low	Low	N.S.	N.S.	

Pond Brook

Phase 1 - Reach Summary Report

Basin: **Northern Champlain**
Stream Name: **Pond Brook** Reach **M07**
Topo Maps: **COLCHESTER, ESSEX CENTER**
Date Last Edited: **Thu, July 26, 2007**
Watershed: **Lewis Creek, Little Otter, Lake Champlain**
Sub-watershed: **Malletts Bay**
Is Reach an Impoundment? **No**

Step 1. Reach Location

1.1 Reach Description: **From approx. 850 ft below railroad crossing up to the outlet of Colchester**
1.2 Towns:
1.3 Downstream Latitude: **44.55**
1.3 Downstream Longitude: **-73.13**

Step 2. Stream Type

2.1 Elevation Upstream: **380**
2.1 Elevation Downstream: **235**
2.1 Is Gradient Gentle? **No**
2.2 Valley Length: **3052** feet. **0.58** Miles.
2.3 Valley Slope: **4.75** %
2.4.Channel Length: **3201** feet. **0.61** Miles.
2.5 Channel Slope: **4.53** %
2.6 Sinuosity: **1.05**
2.7 Watershed Area: **2** Square Miles
2.8 Channel Width: **19** feet.
2.9 Valley Width: **50** feet.
2.10 Confinement Ratio: **2.6**
2.10 Confinement Type: **Semi-confined**
2.11 Reference Stream Type: **B**
Bedform: **Step-Pool**
Sub-class Slope: **None**
Bed Material: **Boulder**

Step 3. Basin Characteristics:

3.1 Alluvial Fan: **None**
3.2 Grade Control: **Dam**
3.3 Dominant Geologic Mat.: **Glacial Lake 35.0** %
3.3 Sub-dominant Geological Mat.: **Ice-Contact**
3.4 Left Valley Side **Extremely Steep**
3.4 Right Valley Side **Extremely Steep**

3.5 Soils

Hydrologic Group:	**D**	**58.0** %
Flooding:	**None/Rare**	**91.0** %
Water Table Deep:	**6.0**	**55.0** %
Water Table Shallow:	**2.0**	**35.0** %
Erodibility:	**High -**	**78.0** %

7.4 Comments:

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Field**
Current Dominant land Cover: **Forest** **36.0** %
Current Sub-Dominant Land Cover:

4.2 Corridor
Historic Land Cover: **Forest**
Current Dominant land Cover: **Forest** **49.0** %
Current Sub-Dominant Land Cover: **Urban**
4.3 Riparian Buffer - Left Bank: **>100**
4.3 Riparian Buffer - Right Bank: **>100**
4.4 Ground Water Inputs: **Minimal**

Step 5. Instream Channel Modifications

5.1 Flow Regulation: **None**
5.2 Bridges and Culverts: **2** **0** %
5.3 Bank Armoring: **None** **None**
5.4 Channel Straightening: **221** **6 %**
5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms and Roads: **0** **0**
6.2 Floodplain Development: **0** **0**
6.3 Channel Bars: **Not Evaluated**
6.4 Meander Migration: **Not Evaluated**
6.5 Meander Width: **Not** Ratio: **0.0**
6.6 Wavelength: **Not** Ratio: **0.0**

Step 7. Windshield Survey

7.2 Bank Erosion: **None**
7.2 Bank Height: **No Data**
7.3 Ice/Debris Jam Potential: **Bridge**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.2	7.3	Total
2 High	2 High	0 N.S.	0 N.S.	0 N.S.	0 N.S.	2 High	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	6

Pond Brook

Phase 1 - Reach Summary Report

Basin: **Northern Champlain**
Stream Name: **Pond Brook** Reach **M08**
Topo Maps: **ESSEX CENTER**
Date Last Edited: **Thu, July 26, 2007**
Watershed: **Lewis Creek, Little Otter, Lake Champlain**
Sub-watershed: **Malletts Bay**
Is Reach an Impoundment? **No**

Step 1. Reach Location

1.1 Reach Description: **Includes Colchester Pond and tributary draining to Pond which stems**
1.2 Towns: **Colchester, Essex**
1.3 Downstream Latitude: **44.55**
1.3 Downstream Longitude: **-73.12**

Step 2. Stream Type

2.1 Elevation Upstream: **480**
2.1 Elevation Downstream: **380**
2.1 Is Gradient Gentle? **No**
2.2 Valley Length: **8327** feet. **1.58** Miles.
2.3 Valley Slope: **1.20** %
2.4.Channel Length: **8611** feet. **1.63** Miles.
2.5 Channel Slope: **1.16** %
2.6 Sinuosity: **1.03**
2.7 Watershed Area: **2** Square Miles
2.8 Channel Width: **18** feet.
2.9 Valley Width: **120** feet.
2.10 Confinement Ratio: **6.7**
2.10 Confinement Type: **Broad**
2.11 Reference Stream Type: **C**
Bedform: **Riffle-Pool**
Sub-class Slope: **None**
Bed Material: **Gravel**

Step 3. Basin Characteristics:

3.1 Alluvial Fan: **None**
3.2 Grade Control: **None**
3.3 Dominant Geologic Mat.: **Till** **77.0** %
3.3 Sub-dominant Geological Mat.: **Glacial Lake**
3.4 Left Valley Side **Very Steep**
3.4 Right Valley Side **Very Steep**
3.5 Soils

Hydrologic Group:	**D**	**88.0** %
Flooding:	**None/Rare**	**100.** %
Water Table Deep:	**6.0**	**71.0** %
Water Table Shallow:	**2.0**	**68.0** %
Erodibility:	**High -**	**94.0** %

7.4 Comments:

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Forest**
Current Dominant land Cover: **Urban** **38.0** %
Current Sub-Dominant Land Cover:
4.2 Corridor
Historic Land Cover: **Forest**
Current Dominant land Cover: **Forest** **31.0** %
Current Sub-Dominant Land Cover: **Urban**
4.3 Riparian Buffer - Left Bank: **>100**
4.3 Riparian Buffer - Right Bank: **>100**
4.4 Ground Water Inputs: **Abundant**

Step 5. Instream Channel Modifications

5.1 Flow Regulation: **Impoundment**
5.2 Bridges and Culverts: **None** **0** %
5.3 Bank Armoring: **None** **None**
5.4 Channel Straightening: **None** **None**
5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms and Roads: **0** **0**
6.2 Floodplain Development: **0** **0**
6.3 Channel Bars: **None**
6.4 Meander Migration: **None**
6.5 Meander Width: **21** Ratio: **1.2**
6.6 Wavelength: **50** Ratio: **2.8**

Step 7. Windshield Survey

7.2 Bank Erosion: **None**
7.2 Bank Height: **No Data**
7.3 Ice/Debris Jam Potential: **None**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.2	7.3	Total
2 High	2 High	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	2 High	2 High	0 N.S.	0 N.S.	8

Pond Brook

Phase 1 - Reach Summary Report

Basin: **Northern Champlain**
Stream Name: **Southern Tributary** Reach **T1.01**
Topo Maps: **COLCHESTER**
Date Last Edited: **Thu, July 26, 2007**
Watershed: **Lewis Creek, Little Otter, Lake Champlain**
Sub-watershed: **Malletts Bay**
Is Reach an Impoundment? **No**

Step 1. Reach Location

1.1 Reach Description: **From confluence with main stem up to approx 150 ft above East Road**
1.2 Towns: **Colchester**
1.3 Downstream Latitude: **44.55**
1.3 Downstream Longitude: **-73.15**

Step 2. Stream Type

2.1 Elevation Upstream: **215**
2.1 Elevation Downstream: **195**
2.1 Is Gradient Gentle? **No**
2.2 Valley Length: **2732** feet. **0.52** Miles.
2.3 Valley Slope: **0.73** %
2.4.Channel Length: **3056** feet. **0.58** Miles.
2.5 Channel Slope: **0.65** %
2.6 Sinuosity: **1.12**
2.7 Watershed Area: **1** Square Miles
2.8 Channel Width: **13** feet.
2.9 Valley Width: **147** feet.
2.10 Confinement Ratio: **11.6**
2.10 Confinement Type: **Very Broad**
2.11 Reference Stream Type: **E**
Bedform: **Dune-Ripple**
Sub-class Slope: **None**
Bed Material: **Sand**

Step 3. Basin Characteristics:

3.1 Alluvial Fan: **None**
3.2 Grade Control: **None**
3.3 Dominant Geologic Mat.: **Glacial Lake 76.0** %
3.3 Sub-dominant Geological Mat.: **Ice-Contact**
3.4 Left Valley Side **Very Steep**
3.4 Right Valley Side **Very Steep**
3.5 Soils

Hydrologic Group:	**Not Rated**	**55.0** %
Flooding:	**None/Rare**	**99.0** %
Water Table Deep:	**6.0**	**22.0** %
Water Table Shallow:	**6.0**	**22.0** %
Erodibility:	**High -**	**31.0** %

7.4 Comments:

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Field**
Current Dominant land Cover: **Forest** **44.0** %
Current Sub-Dominant Land Cover:
4.2 Corridor
Historic Land Cover: **Forest**
Current Dominant land Cover: **Urban** **49.0** %
Current Sub-Dominant Land Cover: **Forest**
4.3 Riparian Buffer - Left Bank: **>100**
4.3 Riparian Buffer - Right Bank: **>100**
4.4 Ground Water Inputs: **Abundant**

Step 5. Instream Channel Modifications

5.1 Flow Regulation: **None**
5.2 Bridges and Culverts: **1** **0** %
5.3 Bank Armoring: **None** **None**
5.4 Channel Straightening: **91** **2 %**
5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms and Roads: **0** **0**
6.2 Floodplain Development: **140** **2 %**
6.3 Channel Bars: **None**
6.4 Meander Migration: **Not Evaluated**
6.5 Meander Width: **61** Ratio: **4.8**
6.6 Wavelength: **100** Ratio: **7.9**

Step 7. Windshield Survey

7.2 Bank Erosion: **None**
7.2 Bank Height: **No Data**
7.3 Ice/Debris Jam Potential: **Culvert**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.2	7.3	Total
2 High	2 High	0 N.S.	0 N.S.	0 N.S.	0 N.S.	2 High	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	1 Low	1 Low	0 N.S.	0 N.S.	8

Pond Brook

Phase 1 - Reach Summary Report

Basin: **Northern Champlain**
Stream Name: **Southern Tributary** Reach **T1.02**
Topo Maps: **COLCHESTER**
Date Last Edited: **Mon, July 16, 2007**
Watershed: **Lewis Creek, Little Otter, Lake Champlain**
Sub-watershed: **Malletts Bay**
Is Reach an Impoundment? **No**

Step 1. Reach Location

1.1 Reach Description: **From the East Rd crossing up to a change in sinuosity. Reach runs**
1.2 Towns: **Colchester**
1.3 Downstream Latitude: **44.54**
1.3 Downstream Longitude: **-73.15**

Step 2. Stream Type

2.1 Elevation Upstream: **237**
2.1 Elevation Downstream: **215**
2.1 Is Gradient Gentle? **No**
2.2 Valley Length: **2302** feet. **0.44** Miles.
2.3 Valley Slope: **0.96** %
2.4.Channel Length: **2731** feet. **0.52** Miles.
2.5 Channel Slope: **0.81** %
2.6 Sinuosity: **1.19**
2.7 Watershed Area: **1** Square Miles
2.8 Channel Width: **10** feet.
2.9 Valley Width: **136** feet.
2.10 Confinement Ratio: **13.2**
2.10 Confinement Type: **Very Broad**
2.11 Reference Stream Type: **E**
Bedform: **Dune-Ripple**
Sub-class Slope: **None**
Bed Material: **Sand**

Step 3. Basin Characteristics:

3.1 Alluvial Fan: **None**
3.2 Grade Control: **None**
3.3 Dominant Geologic Mat.: **Glacial Lake 88.0** %
3.3 Sub-dominant Geological Mat.: **Ice-Contact**
3.4 Left Valley Side **Extremely Steep**
3.4 Right Valley Side **Extremely Steep**
3.5 Soils

Hydrologic Group:	**D**	**49.0** %
Flooding:	**None/Rare**	**100.** %
Water Table Deep:	**2.0**	**49.0** %
Water Table Shallow:	**0.5**	**49.0** %
Erodibility:	**High -**	**99.0** %

7.4 Comments:

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Field**
Current Dominant land Cover: **Forest** **54.0** %
Current Sub-Dominant Land Cover:
4.2 Corridor
Historic Land Cover: **Forest**
Current Dominant land Cover: **Forest** **37.0** %
Current Sub-Dominant Land Cover: **Urban**
4.3 Riparian Buffer - Left Bank: **>100**
4.3 Riparian Buffer - Right Bank: **>100**
4.4 Ground Water Inputs: **Abundant**

Step 5. Instream Channel Modifications

5.1 Flow Regulation: **None**
5.2 Bridges and Culverts: **None** **0** %
5.3 Bank Armoring: **None** **None**
5.4 Channel Straightening: **None** **None**
5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms and Roads: **0** **0**
6.2 Floodplain Development: **0** **0**
6.3 Channel Bars: **None**
6.4 Meander Migration: **Not Evaluated**
6.5 Meander Width: **71** Ratio: **6.9**
6.6 Wavelength: **75** Ratio: **7.3**

Step 7. Windshield Survey

7.2 Bank Erosion: **None**
7.2 Bank Height: **No Data**
7.3 Ice/Debris Jam Potential: **None**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.2	7.3	Total
2	2	0	0	0	0	0	0	0	0	0	0	0	1	0	0	5
High	High	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	Low	N.S.	N.S.	

Pond Brook

Phase 1 - Reach Summary Report

Basin: **Northern Champlain**
Stream Name: **Southern Tributary** Reach **T1.03**
Topo Maps: **COLCHESTER**
Date Last Edited: **Thu, July 26, 2007**
Watershed: **Lewis Creek, Little Otter, Lake Champlain**
Sub-watershed: **Malletts Bay**
Is Reach an Impoundment? **No**

Step 1. Reach Location

1.1 Reach Description: **Along Rt 2A up to industrial property just above the confluence of a**
1.2 Towns: **Colchester**
1.3 Downstream Latitude: **44.54**
1.3 Downstream Longitude: **-73.14**

Step 2. Stream Type

2.1 Elevation Upstream: **298**
2.1 Elevation Downstream: **237**
2.1 Is Gradient Gentle? **No**
2.2 Valley Length: **3730** feet. **0.71** Miles.
2.3 Valley Slope: **1.64** %
2.4.Channel Length: **3963** feet. **0.75** Miles.
2.5 Channel Slope: **1.54** %
2.6 Sinuosity: **1.06**
2.7 Watershed Area: **1** Square Miles
2.8 Channel Width: **10** feet.
2.9 Valley Width: **133** feet.
2.10 Confinement Ratio: **13.5**
2.10 Confinement Type: **Very Broad**
2.11 Reference Stream Type: **E**
Bedform: **Dune-Ripple**
Sub-class Slope: **None**
Bed Material: **Sand**

Step 3. Basin Characteristics:

3.1 Alluvial Fan: **None**
3.2 Grade Control: **None**
3.3 Dominant Geologic Mat.: **Ice-Contact** **58.0** %
3.3 Sub-dominant Geological Mat.: **Glacial Lake**
3.4 Left Valley Side **Steep**
3.4 Right Valley Side **Steep**
3.5 Soils

Hydrologic Group:	**A**	**58.0** %
Flooding:	**None/Rare**	**100.** %
Water Table Deep:	**6.0**	**58.0** %
Water Table Shallow:	**6.0**	**58.0** %
Erodibility:	**High -**	**96.0** %

7.4 Comments:

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Field**
Current Dominant land Cover: **Forest** **57.0** %
Current Sub-Dominant Land Cover:
4.2 Corridor
Historic Land Cover: **Shrub**
Current Dominant land Cover: **Forest** **46.0** %
Current Sub-Dominant Land Cover: **Crop**
4.3 Riparian Buffer - Left Bank: **>100**
4.3 Riparian Buffer - Right Bank: **>100**
4.4 Ground Water Inputs: **Abundant**

Step 5. Instream Channel Modifications

5.1 Flow Regulation: **None**
5.2 Bridges and Culverts: **1** **0** %
5.3 Bank Armoring: **None** **None**
5.4 Channel Straightening: **None** **None**
5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms and Roads: **0** **0**
6.2 Floodplain Development: **0** **0**
6.3 Channel Bars: **None**
6.4 Meander Migration: **Migration**
6.5 Meander Width: **65** Ratio: **6.6**
6.6 Wavelength: **70** Ratio: **7.1**

Step 7. Windshield Survey

7.2 Bank Erosion: **None**
7.2 Bank Height: **No Data**
7.3 Ice/Debris Jam Potential: **Culvert**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.2	7.3	Total
2	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	4
High	Low	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	Low	N.S.	N.S.	

Pond Brook

Phase 1 - Reach Summary Report

Basin: **Northern Champlain**
Stream Name: **Southern Tributary** Reach **T1.04**
Topo Maps: **COLCHESTER, ESSEX CENTER**
Date Last Edited: **Thu, July 26, 2007**
Watershed: **Lewis Creek, Little Otter, Lake Champlain**
Sub-watershed: **Malletts Bay**
Is Reach an Impoundment? **No**

Step 1. Reach Location

1.1 Reach Description: **Through industrial property and along Rt. 2A beneath railroad and up**
1.2 Towns: **Colchester, Essex**
1.3 Downstream Latitude: **44.53**
1.3 Downstream Longitude: **-73.13**

Step 2. Stream Type

2.1 Elevation Upstream: **340**
2.1 Elevation Downstream: **298**
2.1 Is Gradient Gentle? **No**
2.2 Valley Length: **3608** feet. **0.68** Miles.
2.3 Valley Slope: **1.16** %
2.4.Channel Length: **3795** feet. **0.72** Miles.
2.5 Channel Slope: **1.11** %
2.6 Sinuosity: **1.05**
2.7 Watershed Area: **0** Square Miles
2.8 Channel Width: **7** feet.
2.9 Valley Width: **156** feet.
2.10 Confinement Ratio: **20.8**
2.10 Confinement Type: **Very Broad**
2.11 Reference Stream Type: **C**
Bedform: **Riffle-Pool**
Sub-class Slope: **None**
Bed Material: **Gravel**

Step 3. Basin Characteristics:

3.1 Alluvial Fan: **None**
3.2 Grade Control: **None**
3.3 Dominant Geologic Mat.: **Ice-Contact** **99.0** %
3.3 Sub-dominant Geological Mat.: **Till**
3.4 Left Valley Side **Hilly**
3.4 Right Valley Side **Hilly**

3.5 Soils

Hydrologic Group:	**A**	**86.0** %
Flooding:	**None/Rare**	**100.** %
Water Table Deep:	**6.0**	**100.** %
Water Table Shallow:	**6.0**	**100.** %
Erodibility:	**High -**	**76.0** %

7.4 Comments:

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Shrub**
Current Dominant land Cover: **Forest** **55.0** %
Current Sub-Dominant Land Cover:

4.2 Corridor
Historic Land Cover: **Forest**
Current Dominant land Cover: **Urban** **36.0** %
Current Sub-Dominant Land Cover: **Forest**
4.3 Riparian Buffer - Left Bank: **>100**
4.3 Riparian Buffer - Right Bank: **>100**
4.4 Ground Water Inputs: **Minimal**

Step 5. Instream Channel Modifications

5.1 Flow Regulation: **None**
5.2 Bridges and Culverts: **4** **0** %
5.3 Bank Armoring: **None** **None**
5.4 Channel Straightening: **1004** **26 %**
5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms and Roads: **0** **0**
6.2 Floodplain Development: **1245** **27 %**
6.3 Channel Bars: **None**
6.4 Meander Migration: **Not Evaluated**
6.5 Meander Width: **35** Ratio: **4.7**
6.6 Wavelength: **60** Ratio: **8.0**

Step 7. Windshield Survey

7.2 Bank Erosion: **None**
7.2 Bank Height: **No Data**
7.3 Ice/Debris Jam Potential: **Culvert**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.2	7.3	Total
2 High	2 High	1 Low	0 N.S.	0 N.S.	0 N.S.	2 High	0 N.S.	0 N.S.	2 High	0 N.S.	0 N.S.	1 Low	0 N.S.	0 N.S.	0 N.S.	10

Pond Brook

Phase 1 - Reach Summary Report

Basin: **Northern Champlain**
Stream Name: **Southern Tributary** Reach **T1.05**
Topo Maps: **ESSEX CENTER**
Date Last Edited: **Mon, July 16, 2007**
Watershed: **Lewis Creek, Little Otter, Lake Champlain**
Sub-watershed: **Malletts Bay**
Is Reach an Impoundment? **No**

Step 1. Reach Location

1.1 Reach Description: **From approx. 450 ft above Gentes Rd crossing up to termination of**
1.2 Towns: **Essex**
1.3 Downstream Latitude: **44.53**
1.3 Downstream Longitude: **-73.12**

Step 2. Stream Type

2.1 Elevation Upstream: **440**
2.1 Elevation Downstream: **340**
2.1 Is Gradient Gentle? **No**
2.2 Valley Length: **2460** feet. **0.47** Miles.
2.3 Valley Slope: **4.07** %
2.4.Channel Length: **2496** feet. **0.47** Miles.
2.5 Channel Slope: **4.01** %
2.6 Sinuosity: **1.01**
2.7 Watershed Area: **0** Square Miles
2.8 Channel Width: **5** feet.
2.9 Valley Width: **30** feet.
2.10 Confinement Ratio: **6.0**
2.10 Confinement Type: **Narrow**
2.11 Reference Stream Type: **B**
Bedform: **Step-Pool**
Sub-class Slope: **None**
Bed Material: **Cobble**

Step 3. Basin Characteristics:

3.1 Alluvial Fan: **None**
3.2 Grade Control: **None**
3.3 Dominant Geologic Mat.: **Till** **48.0** %
3.3 Sub-dominant Geological Mat.: **Glacial Lake**
3.4 Left Valley Side **Extremely Steep**
3.4 Right Valley Side **Extremely Steep**
3.5 Soils

Hydrologic Group:	**D**	**90.0** %
Flooding:	**None/Rare**	**100.** %
Water Table Deep:	**6.0**	**52.0** %
Water Table Shallow:	**0.0**	**42.0** %
Erodibility:	**High -**	**79.0** %

7.4 Comments:

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Forest**
Current Dominant land Cover: **Forest** **89.0** %
Current Sub-Dominant Land Cover:
4.2 Corridor
Historic Land Cover: **Forest**
Current Dominant land Cover: **Forest** **65.0** %
Current Sub-Dominant Land Cover: **Crop**
4.3 Riparian Buffer - Left Bank: **>100**
4.3 Riparian Buffer - Right Bank: **>100**
4.4 Ground Water Inputs: **Minimal**

Step 5. Instream Channel Modifications

5.1 Flow Regulation: **None**
5.2 Bridges and Culverts: **0** **0** %
5.3 Bank Armoring: **None** **None**
5.4 Channel Straightening: **None** **None**
5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms and Roads: **0** **0**
6.2 Floodplain Development: **0** **0**
6.3 Channel Bars: **None**
6.4 Meander Migration: **Not Evaluated**
6.5 Meander Width: **Not** Ratio: **0.0**
6.6 Wavelength: **Not** Ratio: **0.0**

Step 7. Windshield Survey

7.2 Bank Erosion: **No Data**
7.2 Bank Height: **No Data**
7.3 Ice/Debris Jam Potential: **None**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.2	7.3	Total
0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0

Smith Creek

Phase 1 - Reach Summary Report

Basin: **Northern Champlain**
Stream Name: **Smith Creek** Reach **M01**
Topo Maps: **COLCHESTER**
Date Last Edited: **Thu, July 26, 2007**
Watershed: **Lewis Creek, Little Otter, Lake Champlain**
Sub-watershed: **Malletts Bay**
Is Reach an Impoundment? **No**

Step 1. Reach Location

1.1 Reach Description: **From Outlet at Malletts Bay up to break just east of Colchester Middle**
1.2 Towns: **Colchester**
1.3 Downstream Latitude: **44.55**
1.3 Downstream Longitude: **-73.21**

Step 2. Stream Type

2.1 Elevation Upstream: **165**
2.1 Elevation Downstream: **95**
2.1 Is Gradient Gentle? **No**
2.2 Valley Length: **3151** feet. **0.60** Miles.
2.3 Valley Slope: **2.22** %
2.4.Channel Length: **3189** feet. **0.60** Miles.
2.5 Channel Slope: **2.20** %
2.6 Sinuosity: **1.01**
2.7 Watershed Area: **1** Square Miles
2.8 Channel Width: **15** feet.
2.9 Valley Width: **50** feet.
2.10 Confinement Ratio: **3.3**
2.10 Confinement Type: **Semi-confined**
2.11 Reference Stream Type: **B**
Bedform: **Dune-Ripple**
Sub-class Slope: **None**
Bed Material: **Sand**

Step 3. Basin Characteristics:

3.1 Alluvial Fan: **None**
3.2 Grade Control: **None**
3.3 Dominant Geologic Mat.: **Ice-Contact** **100.** %
3.3 Sub-dominant Geological Mat.:
3.4 Left Valley Side **Very Steep**
3.4 Right Valley Side **Very Steep**
3.5 Soils

Hydrologic Group:	**B**	**71.0**	%
Flooding:	**None/Rare**	**100.**	%
Water Table Deep:	**6.0**	**100.**	%
Water Table Shallow:	**6.0**	**100.**	%
Erodibility:	**High -**	**90.0**	%

7.4 Comments:

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Forest**
Current Dominant land Cover: **Forest** **36.0** %
Current Sub-Dominant Land Cover:
4.2 Corridor
Historic Land Cover: **Forest**
Current Dominant land Cover: **Urban** **75.0** %
Current Sub-Dominant Land Cover: **Forest**
4.3 Riparian Buffer - Left Bank: **>100**
4.3 Riparian Buffer - Right Bank: **>100**
4.4 Ground Water Inputs: **Minimal**

Step 5. Instream Channel Modifications

5.1 Flow Regulation: **None**
5.2 Bridges and Culverts: **1** **0** %
5.3 Bank Armoring: **None** **None**
5.4 Channel Straightening: **None** **None**
5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms and Roads: **0** **0**
6.2 Floodplain Development: **0** **0**
6.3 Channel Bars: **Not Evaluated**
6.4 Meander Migration: **Not Evaluated**
6.5 Meander Width: **Not** Ratio: **0.0**
6.6 Wavelength: **Not** Ratio: **0.0**

Step 7. Windshield Survey

7.2 Bank Erosion: **None**
7.2 Bank Height: **No Data**
7.3 Ice/Debris Jam Potential: **Culvert**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.2	7.3	Total
2 High	2 High	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	4

Smith Creek

Phase 1 - Reach Summary Report

Basin: **Northern Champlain**
Stream Name: **Smith Creek** Reach **M02**
Topo Maps: **COLCHESTER**
Date Last Edited: **Thu, July 26, 2007**
Watershed: **Lewis Creek, Little Otter, Lake Champlain**
Sub-watershed: **Malletts Bay**
Is Reach an Impoundment? **No**

Step 1. Reach Location

1.1 Reach Description: **From Colchester Middle School Fields up to Williams Road Crossing.**
1.2 Towns: **Colchester**
1.3 Downstream Latitude: **44.54**
1.3 Downstream Longitude: **-73.21**

Step 2. Stream Type

2.1 Elevation Upstream: **175**
2.1 Elevation Downstream: **165**
2.1 Is Gradient Gentle? **No**
2.2 Valley Length: **2516** feet. **0.48** Miles.
2.3 Valley Slope: **0.40** %
2.4.Channel Length: **2577** feet. **0.49** Miles.
2.5 Channel Slope: **0.39** %
2.6 Sinuosity: **1.02**
2.7 Watershed Area: **1** Square Miles
2.8 Channel Width: **14** feet.
2.9 Valley Width: **140** feet.
2.10 Confinement Ratio: **9.7**
2.10 Confinement Type: **Broad**
2.11 Reference Stream Type: **E**
Bedform: **Dune-Ripple**
Sub-class Slope: **None**
Bed Material: **Sand**

Step 3. Basin Characteristics:

3.1 Alluvial Fan: **None**
3.2 Grade Control: **None**
3.3 Dominant Geologic Mat.: **Ice-Contact** **100.** %
3.3 Sub-dominant Geological Mat.:
3.4 Left Valley Side **Very Steep**
3.4 Right Valley Side **Very Steep**
3.5 Soils

Hydrologic Group:	**A**	**100.**	%
Flooding:	**None/Rare**	**100.**	%
Water Table Deep:	**6.0**	**100.**	%
Water Table Shallow:	**6.0**	**100.**	%
Erodibility:	**High -**	**81.0**	%

7.4 Comments:

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Forest**
Current Dominant land Cover: **Forest** **41.0** %
Current Sub-Dominant Land Cover:
4.2 Corridor
Historic Land Cover: **Forest**
Current Dominant land Cover: **Urban** **52.0** %
Current Sub-Dominant Land Cover: **Forest**
4.3 Riparian Buffer - Left Bank: **>100**
4.3 Riparian Buffer - Right Bank: **>100**
4.4 Ground Water Inputs: **Abundant**

Step 5. Instream Channel Modifications

5.1 Flow Regulation: **None**
5.2 Bridges and Culverts: **1** **0** %
5.3 Bank Armoring: **None** **None**
5.4 Channel Straightening: **None** **None**
5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms and Roads: **0** **0**
6.2 Floodplain Development: **666** **12 %**
6.3 Channel Bars: **Not Evaluated**
6.4 Meander Migration: **Not Evaluated**
6.5 Meander Width: **100** Ratio: **6.9**
6.6 Wavelength: **110** Ratio: **7.6**

Step 7. Windshield Survey

7.2 Bank Erosion: **None**
7.2 Bank Height: **No Data**
7.3 Ice/Debris Jam Potential: **Culvert**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.2	7.3	Total
2 High	2 High	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	1 Low	0 N.S.	0 N.S.	0 N.S.	1 Low	0 N.S.	0 N.S.	6

Smith Creek

Phase 1 - Reach Summary Report

Basin: **Northern Champlain**
Stream Name: **Smith Creek** Reach **M03**
Topo Maps: **COLCHESTER**
Date Last Edited: **Thu, July 26, 2007**
Watershed: **Lewis Creek, Little Otter, Lake Champlain**
Sub-watershed: **Malletts Bay**
Is Reach an Impoundment? **No**

Step 1. Reach Location

1.1 Reach Description: **From Williams Road crossing up to approx. 800 ft upstream of I-89**
1.2 Towns: **Colchester**
1.3 Downstream Latitude: **44.53**
1.3 Downstream Longitude: **-73.20**

Step 2. Stream Type

2.1 Elevation Upstream: **190**
2.1 Elevation Downstream: **175**
2.1 Is Gradient Gentle? **No**
2.2 Valley Length: **2855** feet. **0.54** Miles.
2.3 Valley Slope: **0.53** %
2.4.Channel Length: **3194** feet. **0.60** Miles.
2.5 Channel Slope: **0.47** %
2.6 Sinuosity: **1.12**
2.7 Watershed Area: **1** Square Miles
2.8 Channel Width: **13** feet.
2.9 Valley Width: **130** feet.
2.10 Confinement Ratio: **10.1**
2.10 Confinement Type: **Very Broad**
2.11 Reference Stream Type: **E**
Bedform: **Dune-Ripple**
Sub-class Slope: **None**
Bed Material: **Sand**

Step 3. Basin Characteristics:

3.1 Alluvial Fan: **None**
3.2 Grade Control: **None**
3.3 Dominant Geologic Mat.: **Glacial Lake 40.0** %
3.3 Sub-dominant Geological Mat.: **Till**
3.4 Left Valley Side **Hilly**
3.4 Right Valley Side **Hilly**
3.5 Soils

Hydrologic Group:	**D**	**29.0** %
Flooding:	**None/Rare**	**100.** %
Water Table Deep:	**6.0**	**78.0** %
Water Table Shallow:	**6.0**	**78.0** %
Erodibility:	**High -**	**85.0** %

7.4 Comments:

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Field**
Current Dominant land Cover: **Forest** **46.0** %
Current Sub-Dominant Land Cover:
4.2 Corridor
Historic Land Cover: **Field**
Current Dominant land Cover: **Forest** **27.0** %
Current Sub-Dominant Land Cover: **Crop**
4.3 Riparian Buffer - Left Bank: **>100**
4.3 Riparian Buffer - Right Bank: **>100**
4.4 Ground Water Inputs: **Abundant**

Step 5. Instream Channel Modifications

5.1 Flow Regulation: **None**
5.2 Bridges and Culverts: **3** **0** %
5.3 Bank Armoring: **None** **None**
5.4 Channel Straightening: **534** **16 %**
5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms and Roads: **0** **0**
6.2 Floodplain Development: **0** **0**
6.3 Channel Bars: **None**
6.4 Meander Migration: **Migration**
6.5 Meander Width: **65** Ratio: **5.1**
6.6 Wavelength: **75** Ratio: **5.8**

Step 7. Windshield Survey

7.2 Bank Erosion: **None**
7.2 Bank Height: **No Data**
7.3 Ice/Debris Jam Potential: **Culvert**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.2	7.3	Total
2 High	2 High	0 N.S.	0 N.S.	0 N.S.	0 N.S.	2 High	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	2 High	0 N.S.	0 N.S.	8

Smith Creek

Phase 1 - Reach Summary Report

Basin: **Northern Champlain**
Stream Name: **Smith Creek** Reach **M04**
Topo Maps: **COLCHESTER**
Date Last Edited: **Thu, July 26, 2007**
Watershed: **Lewis Creek, Little Otter, Lake Champlain**
Sub-watershed: **Malletts Bay**
Is Reach an Impoundment? **No**

Step 1. Reach Location

1.1 Reach Description: **From confluence with Trib 1 up to second (eastern) crossing in Colchester**
1.2 Towns:
1.3 Downstream Latitude: **44.53**
1.3 Downstream Longitude: **-73.19**

Step 2. Stream Type

2.1 Elevation Upstream: **205**
2.1 Elevation Downstream: **190**
2.1 Is Gradient Gentle? **No**
2.2 Valley Length: **2487** feet. **0.47** Miles.
2.3 Valley Slope: **0.60** %
2.4.Channel Length: **2604** feet. **0.49** Miles.
2.5 Channel Slope: **0.58** %
2.6 Sinuosity: **1.05**
2.7 Watershed Area: **0** Square Miles
2.8 Channel Width: **9** feet.
2.9 Valley Width: **231** feet.
2.10 Confinement Ratio: **26.5**
2.10 Confinement Type: **Very Broad**
2.11 Reference Stream Type: **E**
Bedform: **Dune-Ripple**
Sub-class Slope: **None**
Bed Material: **Sand**

Step 3. Basin Characteristics:

3.1 Alluvial Fan: **None**
3.2 Grade Control: **None**
3.3 Dominant Geologic Mat.: **Ice-Contact** **97.0** %
3.3 Sub-dominant Geological Mat.: **Glacial Lake**
3.4 Left Valley Side **Hilly**
3.4 Right Valley Side **Hilly**
3.5 Soils

Hydrologic Group:	**B**	**47.0** %
Flooding:	**None/Rare**	**100.** %
Water Table Deep:	**3.0**	**45.0** %
Water Table Shallow:	**1.5**	**45.0** %
Erodibility:	**High -**	**30.0** %

7.4 Comments:

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Field**
Current Dominant land Cover: **Forest** **41.0** %
Current Sub-Dominant Land Cover:
4.2 Corridor
Historic Land Cover: **Forest**
Current Dominant land Cover: **Forest** **30.0** %
Current Sub-Dominant Land Cover: **Crop**
4.3 Riparian Buffer - Left Bank: **>100**
4.3 Riparian Buffer - Right Bank: **>100**
4.4 Ground Water Inputs: **Abundant**

Step 5. Instream Channel Modifications

5.1 Flow Regulation: **None**
5.2 Bridges and Culverts: **2** **0** %
5.3 Bank Armoring: **None** **None**
5.4 Channel Straightening: **716** **27 %**
5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms and Roads: **0** **0**
6.2 Floodplain Development: **147.3** **2 %**
6.3 Channel Bars: **None**
6.4 Meander Migration: **None**
6.5 Meander Width: **20** Ratio: **2.3**
6.6 Wavelength: **35** Ratio: **4.0**

Step 7. Windshield Survey

7.2 Bank Erosion: **None**
7.2 Bank Height: **No Data**
7.3 Ice/Debris Jam Potential: **Culvert**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.2	7.3	Total
2 High	2 High	0 N.S.	0 N.S.	0 N.S.	0 N.S.	2 High	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	2 High	2 High	0 N.S.	0 N.S.	10

Smith Creek

Phase 1 - Reach Summary Report

Basin: **Northern Champlain**
Stream Name: **Smith Creek** Reach **M05**
Topo Maps: **COLCHESTER**
Date Last Edited: **Thu, July 26, 2007**
Watershed: **Lewis Creek, Little Otter, Lake Champlain**
Sub-watershed: **Malletts Bay**
Is Reach an Impoundment? **No**

Step 1. Reach Location

1.1 Reach Description: **From Edgewoods Estates up to stormwater pond outlet from**
1.2 Towns: **Colchester**
1.3 Downstream Latitude: **44.53**
1.3 Downstream Longitude: **-73.19**

Step 2. Stream Type

2.1 Elevation Upstream: **280**
2.1 Elevation Downstream: **205**
2.1 Is Gradient Gentle? **No**
2.2 Valley Length: **3508** feet. **0.66** Miles.
2.3 Valley Slope: **2.14** %
2.4.Channel Length: **3582** feet. **0.68** Miles.
2.5 Channel Slope: **2.09** %
2.6 Sinuosity: **1.02**
2.7 Watershed Area: **0** Square Miles
2.8 Channel Width: **5** feet.
2.9 Valley Width: **100** feet.
2.10 Confinement Ratio: **18.9**
2.10 Confinement Type: **Very Broad**
2.11 Reference Stream Type: **B**
Bedform: **Riffle-Pool**
Sub-class Slope: **None**
Bed Material: **Gravel**

Step 3. Basin Characteristics:

3.1 Alluvial Fan: **None**
3.2 Grade Control: **None**
3.3 Dominant Geologic Mat.: **Ice-Contact** **70.0** %
3.3 Sub-dominant Geological Mat.: **Glacial Lake**
3.4 Left Valley Side **Hilly**
3.4 Right Valley Side **Hilly**
3.5 Soils

Hydrologic Group:	**A**	**70.0** %
Flooding:	**None/Rare**	**100.** %
Water Table Deep:	**6.0**	**71.0** %
Water Table Shallow:	**6.0**	**71.0** %
Erodibility:	**High -**	**85.0** %

7.4 Comments:

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Field**
Current Dominant land Cover: **Forest** **41.0** %
Current Sub-Dominant Land Cover:
4.2 Corridor
Historic Land Cover: **Field**
Current Dominant land Cover: **Forest** **23.0** %
Current Sub-Dominant Land Cover: **Crop**
4.3 Riparian Buffer - Left Bank: **>100**
4.3 Riparian Buffer - Right Bank: **>100**
4.4 Ground Water Inputs: **Minimal**

Step 5. Instream Channel Modifications

5.1 Flow Regulation: **None**
5.2 Bridges and Culverts: **0** **0** %
5.3 Bank Armoring: **None** **None**
5.4 Channel Straightening: **None** **None**
5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms and Roads: **0** **0**
6.2 Floodplain Development: **109.1** **1 %**
6.3 Channel Bars: **None**
6.4 Meander Migration: **None**
6.5 Meander Width: **Not** Ratio: **0.0**
6.6 Wavelength: **Not** Ratio: **0.0**

Step 7. Windshield Survey

7.2 Bank Erosion: **None**
7.2 Bank Height: **No Data**
7.3 Ice/Debris Jam Potential: **None**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.2	7.3	Total
2 High	2 High	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	4

Smith Creek

Phase 1 - Reach Summary Report

Basin: **Northern Champlain**
Stream Name: **Northern Tributary** Reach **T1.01**
Topo Maps: **COLCHESTER**
Date Last Edited: **Fri, July 13, 2007**
Watershed: **Lewis Creek, Little Otter, Lake Champlain**
Sub-watershed: **Malletts Bay**
Is Reach an Impoundment? **No**

Step 1. Reach Location

1.1 Reach Description: **From confluence with main stem up to approx. 100 ft. above the**
1.2 Towns: **Colchester**
1.3 Downstream Latitude: **44.53**
1.3 Downstream Longitude: **-73.19**

Step 2. Stream Type

2.1 Elevation Upstream: **200**
2.1 Elevation Downstream: **190**
2.1 Is Gradient Gentle? **No**
2.2 Valley Length: **1646** feet. **0.31** Miles.
2.3 Valley Slope: **0.61** %
2.4.Channel Length: **1840** feet. **0.35** Miles.
2.5 Channel Slope: **0.54** %
2.6 Sinuosity: **1.12**
2.7 Watershed Area: **0** Square Miles
2.8 Channel Width: **7** feet.
2.9 Valley Width: **206** feet.
2.10 Confinement Ratio: **28.9**
2.10 Confinement Type: **Very Broad**
2.11 Reference Stream Type: **E**
Bedform: **Dune-Ripple**
Sub-class Slope: **None**
Bed Material: **Sand**

Step 3. Basin Characteristics:

3.1 Alluvial Fan: **None**
3.2 Grade Control: **None**
3.3 Dominant Geologic Mat.: **Glacial Lake 59.0** %
3.3 Sub-dominant Geological Mat.: **Ice-Contact**
3.4 Left Valley Side **Hilly**
3.4 Right Valley Side **Hilly**
3.5 Soils

Hydrologic Group:	**B**	**98.0** %
Flooding:	**None/Rare**	**100.** %
Water Table Deep:	**6.0**	**58.0** %
Water Table Shallow:	**6.0**	**58.0** %
Erodibility:	**High -**	**58.0** %

7.4 Comments:

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Field**
Current Dominant land Cover: **Forest** **45.0** %
Current Sub-Dominant Land Cover:
4.2 Corridor
Historic Land Cover: **Field**
Current Dominant land Cover: **Crop** **24.0** %
Current Sub-Dominant Land Cover: **Forest**
4.3 Riparian Buffer - Left Bank: **>100**
4.3 Riparian Buffer - Right Bank: **>100**
4.4 Ground Water Inputs: **Minimal**

Step 5. Instream Channel Modifications

5.1 Flow Regulation: **None**
5.2 Bridges and Culverts: **0** **0** %
5.3 Bank Armoring: **0** **0**
5.4 Channel Straightening: **0**
5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms and Roads: **0** **0**
6.2 Floodplain Development: **0** **0**
6.3 Channel Bars: **None**
6.4 Meander Migration: **Migration**
6.5 Meander Width: **41** Ratio: **5.8**
6.6 Wavelength: **70** Ratio: **9.8**

Step 7. Windshield Survey

7.2 Bank Erosion: **None**
7.2 Bank Height: **No Data**
7.3 Ice/Debris Jam Potential: **None**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.2	7.3	Total
2 High	2 High	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	4

Smith Creek

Phase 1 - Reach Summary Report

Basin: **Northern Champlain**
Stream Name: **Northern Tributary** Reach **T1.02**
Topo Maps: **COLCHESTER**
Date Last Edited: **Thu, July 26, 2007**
Watershed: **Lewis Creek, Little Otter, Lake Champlain**
Sub-watershed: **Malletts Bay**
Is Reach an Impoundment? **No**

Step 1. Reach Location

1.1 Reach Description: **From above confluence with subtributaries entering from north to**
1.2 Towns: **Colchester**
1.3 Downstream Latitude: **44.53**
1.3 Downstream Longitude: **-73.19**

Step 2. Stream Type

2.1 Elevation Upstream: **280**
2.1 Elevation Downstream: **200**
2.1 Is Gradient Gentle? **No**
2.2 Valley Length: **2875** feet. **0.54** Miles.
2.3 Valley Slope: **2.78** %
2.4.Channel Length: **2934** feet. **0.56** Miles.
2.5 Channel Slope: **2.73** %
2.6 Sinuosity: **1.02**
2.7 Watershed Area: **0** Square Miles
2.8 Channel Width: **4** feet.
2.9 Valley Width: **75** feet.
2.10 Confinement Ratio: **18.0**
2.10 Confinement Type: **Very Broad**
2.11 Reference Stream Type: **B**
Bedform: **Riffle-Pool**
Sub-class Slope: **None**
Bed Material: **Gravel**

Step 3. Basin Characteristics:

3.1 Alluvial Fan: **None**
3.2 Grade Control: **None**
3.3 Dominant Geologic Mat.: **Ice-Contact** **95.0** %
3.3 Sub-dominant Geological Mat.: **Till**
3.4 Left Valley Side **Hilly**
3.4 Right Valley Side **Hilly**

3.5 Soils

Hydrologic Group:	**A**	**77.0** %
Flooding:	**None/Rare**	**100.** %
Water Table Deep:	**6.0**	**84.0** %
Water Table Shallow:	**6.0**	**84.0** %
Erodibility:	**High -**	**54.0** %

7.4 Comments:

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Field**
Current Dominant land Cover: **Urban** **28.0** %
Current Sub-Dominant Land Cover:

4.2 Corridor
Historic Land Cover: **Field**
Current Dominant land Cover: **Crop** **29.0** %
Current Sub-Dominant Land Cover: **Urban**
4.3 Riparian Buffer - Left Bank: **26-50**
4.3 Riparian Buffer - Right Bank: **26-50**
4.4 Ground Water Inputs: **Minimal**

Step 5. Instream Channel Modifications

5.1 Flow Regulation: **Impoundment**
5.2 Bridges and Culverts: **1** **0** %
5.3 Bank Armoring: **None** **None**
5.4 Channel Straightening: **1396** **47 %**
5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms and Roads: **0** **0**
6.2 Floodplain Development: **189** **3 %**
6.3 Channel Bars: **None**
6.4 Meander Migration: **Migration**
6.5 Meander Width: **30** Ratio: **7.2**
6.6 Wavelength: **70** Ratio: **16.8**

Step 7. Windshield Survey

7.2 Bank Erosion: **None**
7.2 Bank Height: **No Data**
7.3 Ice/Debris Jam Potential: **Culvert**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.2	7.3	Total
2 High	2 High	1 Low	0 N.S.	0 N.S.	0 N.S.	2 High	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	2 High	0 N.S.	0 N.S.	9

Smith Creek

Phase 1 - Reach Summary Report

Basin: **Northern Champlain**
Stream Name: **Middle Tributary** Reach **T2.01**
Topo Maps: **COLCHESTER**
Date Last Edited: **Thu, July 26, 2007**
Watershed: **Lewis Creek, Little Otter, Lake Champlain**
Sub-watershed: **Malletts Bay**
Is Reach an Impoundment? **No**

Step 1. Reach Location

1.1 Reach Description: **From Edgewood Estates crossing (east) up to confluence with Colchester**
1.2 Towns:
1.3 Downstream Latitude: **44.53**
1.3 Downstream Longitude: **-73.19**

Step 2. Stream Type

2.1 Elevation Upstream: **220**
2.1 Elevation Downstream: **210**
2.1 Is Gradient Gentle? **No**
2.2 Valley Length: **1408** feet. **0.27** Miles.
2.3 Valley Slope: **0.71** %
2.4.Channel Length: **1458** feet. **0.28** Miles.
2.5 Channel Slope: **0.69** %
2.6 Sinuosity: **1.04**
2.7 Watershed Area: **0** Square Miles
2.8 Channel Width: **6** feet.
2.9 Valley Width: **75** feet.
2.10 Confinement Ratio: **13.4**
2.10 Confinement Type: **Very Broad**
2.11 Reference Stream Type: **E**
Bedform: **Dune-Ripple**
Sub-class Slope: **None**
Bed Material: **Sand**

Step 3. Basin Characteristics:

3.1 Alluvial Fan: **None**
3.2 Grade Control: **None**
3.3 Dominant Geologic Mat.: **Ice-Contact** **100.** %
3.3 Sub-dominant Geological Mat.:
3.4 Left Valley Side **Hilly**
3.4 Right Valley Side **Hilly**
3.5 Soils

Hydrologic Group:	**D**	**72.0**	%
Flooding:	**None/Rare**	**100.**	%
Water Table Deep:	**0.5**	**72.0**	%
Water Table Shallow:	**-1.0**	**72.0**	%
Erodibility:	**High -**	**0.0**	%

7.4 Comments:

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Field**
Current Dominant land Cover: **Forest** **33.0** %
Current Sub-Dominant Land Cover:
4.2 Corridor
Historic Land Cover: **Field**
Current Dominant land Cover: **Urban** **35.0** %
Current Sub-Dominant Land Cover: **Forest**
4.3 Riparian Buffer - Left Bank: **>100**
4.3 Riparian Buffer - Right Bank: **51-100**
4.4 Ground Water Inputs: **Minimal**

Step 5. Instream Channel Modifications

5.1 Flow Regulation: **None**
5.2 Bridges and Culverts: **2** **0** %
5.3 Bank Armoring: **None** **None**
5.4 Channel Straightening: **None** **None**
5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms and Roads: **369** **12 %**
6.2 Floodplain Development: **382** **13 %**
6.3 Channel Bars: **None**
6.4 Meander Migration: **None**
6.5 Meander Width: **Not** Ratio: **0.0**
6.6 Wavelength: **Not** Ratio: **0.0**

Step 7. Windshield Survey

7.2 Bank Erosion: **None**
7.2 Bank Height: **No Data**
7.3 Ice/Debris Jam Potential: **Culvert**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.2	7.3	Total
2 High	2 High	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	1 Low	1 Low	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	6

Smith Creek

Phase 1 - Reach Summary Report

Basin: **Northern Champlain**
Stream Name: **Blakely Road Tributary** Reach **T2.01.S1.01**
Topo Maps: **COLCHESTER**
Date Last Edited: **Thu, July 26, 2007**
Watershed: **Lewis Creek, Little Otter, Lake Champlain**
Sub-watershed: **Malletts Bay**
Is Reach an Impoundment? **No**

Step 1. Reach Location

1.1 Reach Description: **Along south side of Blakely Road up to just south of intersection with Colchester**
1.2 Towns:
1.3 Downstream Latitude: **44.53**
1.3 Downstream Longitude: **-73.18**

Step 2. Stream Type

2.1 Elevation Upstream: **260**
2.1 Elevation Downstream: **220**
2.1 Is Gradient Gentle? **No**
2.2 Valley Length: **1065** feet. **0.20** Miles.
2.3 Valley Slope: **3.76** %
2.4.Channel Length: **1074** feet. **0.20** Miles.
2.5 Channel Slope: **3.72** %
2.6 Sinuosity: **1.01**
2.7 Watershed Area: **0** Square Miles
2.8 Channel Width: **3** feet.
2.9 Valley Width: **45** feet.
2.10 Confinement Ratio: **14.4**
2.10 Confinement Type: **Very Broad**
2.11 Reference Stream Type: **B**
Bedform: **Riffle-Pool**
Sub-class Slope: **None**
Bed Material: **Gravel**

Step 3. Basin Characteristics:

3.1 Alluvial Fan: **None**
3.2 Grade Control: **None**
3.3 Dominant Geologic Mat.: **Ice-Contact** **100.** %
3.3 Sub-dominant Geological Mat.:
3.4 Left Valley Side **Hilly**
3.4 Right Valley Side **Hilly**
3.5 Soils

Hydrologic Group:	**A**	**55.0** %
Flooding:	**None/Rare**	**100.** %
Water Table Deep:	**6.0**	**55.0** %
Water Table Shallow:	**6.0**	**55.0** %
Erodibility:	**High -**	**27.0** %

7.4 Comments:

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Field**
Current Dominant land Cover: **Urban** **39.0** %
Current Sub-Dominant Land Cover:
4.2 Corridor
Historic Land Cover: **Field**
Current Dominant land Cover: **Urban** **52.0** %
Current Sub-Dominant Land Cover: **Forest**
4.3 Riparian Buffer - Left Bank: **51-100**
4.3 Riparian Buffer - Right Bank: **>100**
4.4 Ground Water Inputs: **Minimal**

Step 5. Instream Channel Modifications

5.1 Flow Regulation: **None**
5.2 Bridges and Culverts: **1** **0** %
5.3 Bank Armoring: **None** **None**
5.4 Channel Straightening: **None** **None**
5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms and Roads: **1068.5** **49 %**
6.2 Floodplain Development: **0** **0**
6.3 Channel Bars: **None**
6.4 Meander Migration: **None**
6.5 Meander Width: **Not** Ratio: **0.0**
6.6 Wavelength: **Not** Ratio: **0.0**

Step 7. Windshield Survey

7.2 Bank Erosion: **None**
7.2 Bank Height: **No Data**
7.3 Ice/Debris Jam Potential: **None**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.2	7.3	Total
2 High	2 High	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	2 High	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	6

Smith Creek

Phase 1 - Reach Summary Report

Basin: **Northern Champlain**
Stream Name: **Middle Tributary** Reach **T2.02**
Topo Maps: **COLCHESTER**
Date Last Edited: **Thu, July 26, 2007**
Watershed: **Lewis Creek, Little Otter, Lake Champlain**
Sub-watershed: **Malletts Bay**
Is Reach an Impoundment? **No**

Step 1. Reach Location

1.1 Reach Description: **From confluence with Blakely Rd tributary up to source at farm west**
1.2 Towns: **Colchester**
1.3 Downstream Latitude: **44.53**
1.3 Downstream Longitude: **-73.18**

Step 2. Stream Type

2.1 Elevation Upstream: **280**
2.1 Elevation Downstream: **220**
2.1 Is Gradient Gentle? **No**
2.2 Valley Length: **1700** feet. **0.32** Miles.
2.3 Valley Slope: **3.53** %
2.4.Channel Length: **1712** feet. **0.32** Miles.
2.5 Channel Slope: **3.50** %
2.6 Sinuosity: **1.01**
2.7 Watershed Area: **0** Square Miles
2.8 Channel Width: **4** feet.
2.9 Valley Width: **145** feet.
2.10 Confinement Ratio: **34.6**
2.10 Confinement Type: **Very Broad**
2.11 Reference Stream Type: **B**
Bedform: **Riffle-Pool**
Sub-class Slope: **None**
Bed Material: **Gravel**

Step 3. Basin Characteristics:

3.1 Alluvial Fan: **None**
3.2 Grade Control: **None**
3.3 Dominant Geologic Mat.: **Ice-Contact** **93.0** %
3.3 Sub-dominant Geological Mat.: **Glacial Lake**
3.4 Left Valley Side **Hilly**
3.4 Right Valley Side **Hilly**
3.5 Soils

Hydrologic Group:	**A**	**90.0** %
Flooding:	**None/Rare**	**100.** %
Water Table Deep:	**6.0**	**90.0** %
Water Table Shallow:	**6.0**	**90.0** %
Erodibility:	**High -**	**97.0** %

7.4 Comments:

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Field**
Current Dominant land Cover: **Forest** **32.0** %
Current Sub-Dominant Land Cover:
4.2 Corridor
Historic Land Cover: **Field**
Current Dominant land Cover: **Forest** **17.0** %
Current Sub-Dominant Land Cover: **Crop**
4.3 Riparian Buffer - Left Bank: **>100**
4.3 Riparian Buffer - Right Bank: **>100**
4.4 Ground Water Inputs: **Minimal**

Step 5. Instream Channel Modifications

5.1 Flow Regulation: **None**
5.2 Bridges and Culverts: **0** **0** %
5.3 Bank Armoring: **None** **None**
5.4 Channel Straightening: **None** **None**
5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms and Roads: **0** **0**
6.2 Floodplain Development: **222** **6 %**
6.3 Channel Bars: **None**
6.4 Meander Migration: **None**
6.5 Meander Width: **Not** Ratio: **0.0**
6.6 Wavelength: **Not** Ratio: **0.0**

Step 7. Windshield Survey

7.2 Bank Erosion: **None**
7.2 Bank Height: **No Data**
7.3 Ice/Debris Jam Potential: **None**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.2	7.3	Total
2 High	2 High	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	1 Low	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	5

APPENDIX D

QA/QC SUMMARY

July 24, 2007

Phase 1 QA Review: Pond Brook
Reviewed by Jared Carrano

Pond Brook Phase 1 data was collected by Fitzgerald Environmental Associates, LLC. Documentation of their meta-data and data collection information has been provided; along with the SGAT and FIT project files.

Overall the data is good and few QA issues will need to be addressed. QA notes for relevant reaches are listed. For the DEC-RMP QA, the 2003 NAIP photos and USGS topographic maps, were used in conjunction with shapefiles provided by Fitzgerald Environmental Associates, LLC. The following QA notes are suggestions for possible data corrections/modifications and/or things to be aware of when using the data.

The assessor should review the following comments to determine if they need to change/modify their information and provide documentation on where changes to the original data were made, or where a change was not warranted.

Reach Number:

M02 Do you think parts of this reach were straightened? The channel itself seems somewhat straight, but I think sometimes this is an effect of the way swampy reaches get digitized. The adjacent land use doesn't overwhelmingly support straightening, especially on the up-stream length indexed, but it could very well be. I thought I'd point it out for a double check.
The historic land use (from 1937 aerial photography) suggests that small sections of the reach were straightened. Data have been kept. (EPF; 7/25/07)

M06 & M07 You have manually entered an impoundment for each of these reaches, but it appears only M08 actually has one. Plus, you have indexed the impoundment location in M07(most likely by mistake as it is right on the reach break). Also, in the (near) future you will not be able to manually enter this field. There is a bug in the FIT upload that is preventing the automatic entry into the DMS.
Data for impoundment on reaches M06 and M07 (originally entered to indicate upstream impact, as in Phase 2 methods) have been removed. Impoundment location has been moved to M08 (EPF; 7/25/07)

M07 You've only indexed one bridge/culvert for this reach. It appears that there is another (culvert?) near the upstream reach break.
Bridge just upstream from grade control has been entered. (EPF; 7/25/07)

T1.03 There is a bridge/culvert that did not get indexed in this reach.
Bridge just downstream from reach break has been entered. (EPF; 7/25/07)

July 24, 2007

Phase 1 QA Review: Smith Creek
Reviewed by Jared Carrano

Pond Brook Phase 1 data was collected by Fitzgerald Environmental Associates, LLC. Documentation of their meta-data and data collection information has been provided; along with the SGAT and FIT project files.

Overall the data is good and few QA issues will need to be addressed. QA notes for relevant reaches are listed. For the DEC-RMP QA, the 2003 NAIP photos and USGS topographic maps, were used in conjunction with shapefiles provided by Fitzgerald Environmental Associates, LLC. The following QA notes are suggestions for possible data corrections/modifications and/or things to be aware of when using the data.

The assessor should review the following comment to determine if they need to change/modify their information and provide documentation on where changes to the original data were made, or where a change was not warranted.

Reach Number:

T2.01	It looks as though this corridor was created using the adjacent road as the valley wall. Have you field verified this as the correct valley wall? The difference here would be whether there was a significant road encroachment in the reach or not. **Encroachment has been added to a short section of the reach where the valley was likely narrowed by the road. (EPF; 7/25/07)**