Phase 2 Stream Geomorphic Assessment

East Creek Watershed
Towns of Rutland, East Pittsford, and Chittenden
Rutland County, Vermont

March 2007

Prepared for:
Rutland Regional Planning Commission
The Opera House
P.O. Box 965, 67 Merchant's Row
Rutland, VT 05737

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March 22, 2007

Mr. Steve Schild
Rutland Regional Planning Commission
The Opera House
P.O. Box 965, 67 Merchant's Row
Rutland, VT 05737

Re: Phase 2 Stream Geomorphic Assessment
East Creek Watershed
Rutland County, Vermont
JCO Project No. 1-1872-5

Dear Mr. Schild:

The Johnson Company is pleased to present the following Phase 2 Stream Geomorphic Assessment report to the Rutland Regional Planning Commission. This report includes the results of Phase 2 Geomorphic Assessments performed in accordance with the Vermont Agency of Natural Resources (VTANR) Stream Geomorphic Assessment Protocols on 5 reaches of the East Creek mainstem.

Should you have any questions or require additional assistance, please do not hesitate to contact me at (802) 229-4600. Thank you for the opportunity to be of assistance to the RRPC on this project.

Sincerely,

THE JOHNSON COMPANY, INC.

By: _____
Noelia Báez Rodríguez
Staff Scientist

C: Shannon Pytlik, VTANR

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EXECUTIVE SUMMARY

The Johnson Company was retained by Rutland Regional Planning Commission to perform Phase 2 Geomorphic Assessments on five reaches of the East Creek mainstem (M04, M06, M08, M09, and M10) during the summer of 2006. Due to difficulties with landowner access, the geomorphic assessments of M08 and M10 were incomplete. Bridge and Culvert Assessments were conducted on all structures within all five reaches. All of the Phase 2 Assessments were conducted in accordance with the 2006 Vermont Agency of Natural Resources (VT ANR) Stream Geomorphic Assessment Protocols (VT ANR 2006) Steps 1-7. All of the collected data were recorded on the VT ANR Phase 2 data sheets and entered into the VT ANR Stream Geomorphic Assessment Web Based Data Management System (DMS). A thorough internal QA review was performed by The Johnson Company in November, 2006. An independent QA review was performed by VT ANR in January 2007 and the Phase 1 and 2 DMS were updated in March, 2007. Goals and Objectives for the project included the following:

- Determine the existing stream type for each targeted reach and field verify the previously collected Phase 1 assessments;
- Conduct geomorphic condition evaluations for each reach which detail the current condition and sensitivity to existing and future natural and anthropogenic stressors;
- Collect and interpret the Phase 2 data to assess which reaches are responding to anthropogenic and natural modifications, and help prioritize which reaches warrant further study and/or restoration activities.

Individual narratives for each assessed reach are included as Appendix A. Based on the field measurements taken during the Phase 2 Assessments, the evolution stages of the assessed reaches are as follows: M04 – Stage IV –planform adjustment; M06 – Stage II –degradation; M09A – Stage I – equilibrium; and M09B – Stage II-degradation. A description of the different channel evolution stages can be found in the VT ANR Stream Geomorphic Assessment Protocols, which may be found online at: http://www.anr.state.vt.us/dec/waterq/rivers/htm/rv_geoassess.htm.

Stream types for the assessed reaches were: M04 C riffle-pool; M06 C riffle-pool; M09A – C riffle-pool; and M09B – B step-pool. Departures from the reference stream type were noted in segment M09B which departed from reference type C to B. The dominant sediment regime for the watershed is aggradation. The sensitivity ratings for M06 and M09B were very high and for M04 were high, indicating the potential for future degradation in these reaches. Sensitivity for M09A was rated as moderate, and since the segment was in evolution Stage I, this segment was at low risk for future degradation. The reaches were generally well buffered with most segments having buffer widths wider than 50 feet. Debris jams, which acted as channel constrictions, were common throughout the assessed reaches.

The bridge and culvert assessment found undersized bridges in M04, M06, M08, and M09B. One undersized culvert was noted in M08 and five undersized culverts were noted in M10. During future bridge and culvert replacement projects the collected data should be used to ensure that the new bridges are correctly sized.

Based on the results of the Phase 2 Assessments and visual observations, potential restoration/corridor protection projects identified within the watershed are described below. Figures 3 through 5 depict the project locations. Photos of some of the project areas are shown in Appendix A.

- M04 – While this reach is generally well buffered, inadequate buffer widths were noted adjacent to fields in agricultural use. Buffer installation on these fields is recommended.

- M06 – Removal of the berms which are corridor encroachments in this reach is recommended. Also, this reach is relatively undeveloped and contains some riparian wetlands, so a Corridor Protection Plan is also recommended.

- M09B – Since this segment is constricted by a significant berm on the right side, removal of part or all of this berm is recommended. Further study of the site is necessary to assess potential for negative impacts on adjacent property from berm removal. The removal of the stone wall that acts as a revetment is also recommended.

There are federal programs which could potentially provide funding in support of these projects such as the Conservation Reserve Enhancement Program (CREP), and Environmental Quality Improvement Program (EQIP), which compensates landowners for the loss of cropland to enhance riparian buffers. Funds from the Vermont River Management Program (RMP) may also be available for projects not eligible for the federal programs.

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1.0 PROJECT OVERVIEW

The Johnson Company was retained by Rutland Regional Planning Commission to perform Phase 2 Geomorphic Assessments on five reaches of the East Creek mainstem (M04, M06, M08, M09, and M10) during the summer of 2006 (Figure 1 through 2). Due to difficulties with landowner access, the geomorphic assessments of M08 and M10 were incomplete. Bridge and Culvert Assessments were conducted on all structures within all five reaches. Funding for the project was provided by the Vermont Agency of Natural Resources (VT ANR) Rivers Management Section. Quality Assurance responsibilities were coordinated between The Johnson Company and the Vermont Agency of Natural Resources (VT ANR). Phase 1 Geomorphic Assessments of the watershed were completed by Rutland Regional Planning Commission in 2006.

The East Creek watershed encompasses approximately 61 square miles within the towns of Chittenden, East Pittsford, Mendon, Rutland Town and Rutland City, and is a major tributary of the Otter Creek. The study area included most of the mainstem of the East Creek from Rutland Town to its head waters at Chittenden Reservoir. The study area for East Creek included the five most upstream stream reaches, except M05 and M07 which were not included as part of the assessment.

Goals and Objectives for the project included the following:

- Determine the existing stream type for each targeted reach and field verify the previously collected Phase 1 assessments;
- Conduct geomorphic condition evaluations for each reach which detail the current condition and sensitivity to existing and future natural and anthropogenic stressors;
- Collect and interpret the Phase 2 data to assess which reaches are responding to anthropogenic and natural modifications, and help prioritize which reaches warrant further study and/or restoration activities;

2.0 BACKGROUND INFORMATION

2.1 GEOGRAPHIC SETTING

The East Creek watershed encompasses approximately 61 square miles within the towns of Chittenden, East Pittsford, Mendon, Rutland Town and Rutland City, and is a major tributary of the Otter Creek which flows into Lake Champlain. The watershed elevation ranges from approximately 615 feet above mean sea level at Rutland Town and more than 1,465 feet at the upstream end of its tributaries. Figure 1 and 2 shows the geographic setting for the watershed.

Much of the watershed is located in the Green Mountain National Forest and the Rutland City Forest, so the upper reaches of the watershed are forested. The watershed also encompasses the Chittenden Reservoir and the village of Chittenden. The lower reaches of the watershed extend into more developed areas in Rutland Town and Rutland City. The reaches in this assessment were shown in Figure 1 and 2.

2.2 GEOLOGIC SETTING

Much of the East Creek watershed is located in the Green Mountain National Forest. Like other areas within Vermont, the area has been periodically covered by glaciers, the most recent of which occurred from approximately 10,000 to 30,000 years ago. Bedrock in the study area is dominated by a combination of the Holly Complex, Hoosic, Dalton, and Dunham Formations which are comprised of various types of quartzite, schist, and calcite and dolomite marbles (Doll 1961). The surficial geology is comprised of glaciofluvial gravel and terminal moraine and littoral gravels and sands (Doll 1970) (Stewart and MacClintock 1970). Soils in the study area are dominated by loam, silt loam, and loamy sands predominantly associated with the following series; Turnbridge Berkshire Complex, Berkshire-Colton Association, Udifluvents and fluvaquents near level, and Udipsamment nearly level (USDA SCS 1985).

2.3 GEOMORPHIC SETTING

The locations of the assessed reaches are shown on Figures 1 and 2. The study area included the mainstem of the East Creek (M04 to M10) from Rutland Town to its head waters at

the Chittenden Reservoir with the exception of two short reaches (M05 and M07). However, due to problems with landowner permission for access, M08 and M10 were not fully assessed.

The channel slopes for the study area ranged from 0.89% to 3.11% within the East Creek (Rutland Regional Planning Commission 2006). Bedrock grade controls were noted in all the reaches.

Based on the Phase 1 data, all five reaches within the study have a C as reference stream type characterized by slopes of less than 4% with substrate ranging from gravel to cobble. The valley types for all assessed reaches range from broad to very broad. The calculated valley widths ranged from 366 feet in M10 to nearly 3,458 feet in M04 (Rutland Regional Planning Commission 2006).

2.4 HYDROLOGY

No stream gages are located on East Creek. The nearest USGS gage for the study area is on the Otter Creek at its outlet in Rutland Center downstream from of the study area, and in Rutland. A significant flood occurred in 1947 after heavy rains and a malfunction of the dam at the Chittenden Reservoir. The hydrology of the study area is influenced by the dam at the Chittenden Reservoir, upstream of M10, and the Glen Dam in M05, a reach that was not assessed in this study.

2.5 ECOLOGICAL SETTING

The study area includes a variety of aquatic and upland habitat types which range from forest, agricultural crop and pasture land to beaver ponds. The majority of the aquatic habitat consists of a riffle-pool community which has been affected by some amount of aggradation causing filling of pools and embedding of riffle substrates (M04, M06, and M08). The majority of the riparian zone in the East Creek consists of hardwood and softwood forests. Several beaver ponds and alder wetlands (M06, M08, and M09) were noted, and residential and agricultural areas were also present in M04 and M09.

3.0 METHODOLOGY

3.1 FLUVIAL GEOMORPHIC ASSESSMENT PROTOCOLS

All of the Phase 2 Assessments were conducted in accordance with the 2006 Vermont Agency of Natural Resources (VT ANR) Stream Geomorphic Assessment Protocols (VT ANR 2006) Steps 1-7. All of the collected data were recorded on the VT ANR Phase 2 data sheets and entered into the VT ANR Stream Geomorphic Assessment Web Based Data Management System (DMS). Copies of the DMS Reports are provided in Appendix B. Following a thorough quality assurance (QA) review, the previously collected Phase 1 data were updated based on the findings of the Phase 2 Assessments. Bridge and Culvert Assessments were conducted in all five reaches, and the collected data was recorded on the appropriate VT ANR Bridge and Culvert Data Sheets and later entered into the VT ANR Bridge and Culvert Database.

In accordance with the protocols each of the assessed reaches was walked in its entirety prior to collecting any measurements to allow for reach segmentation where appropriate and identification of potential bankfull identifiers and cross section locations. A detailed Site Sketch Map was created for each of the assessed reaches documenting the locations of cross sections, photo points, pebble counts, bank erosion and revetments, grade controls, debris jams, depositional features, channel cut-offs and avulsions, and other important features. Cross sections were measured at representative locations within each reach using a staff gage and measuring tape.

3.2 QUALITY ASSURANCE AND QUALITY CONTROL

A thorough internal QA review was performed by The Johnson Company in November 2006. An independent QA review was performed by VT ANR in January 2007 and the Phase 1 and 2 DMS were updated in March, 2007. All of the collected data are stored in the DMS and original copies of the data sheets may be found at The Johnson Company's office in Montpelier, VT.

4.0 RESULTS

4.1 WATERSHED SCALE STRESSORS

Figures 3 through 6 depict the geomorphic features identified on the East Creek during the Phase 2 Assessments.

4.1.1 Hydrologic Alterations

The East Creek watershed is dominated by forest land and rural residential development. As shown in Figures 3 through 6, most of the riparian corridor is forest land with some residential development near the floodplain boundaries. Based on field observations and historic maps, it does not appear that a significant amount of wetland loss has occurred in the watershed in the recent past. Two hydroelectric dams with impoundments and five beaver dams were located in the study area (See Section 4.1.2).

4.1.2 Dams

There are two active dams located in the study area, the Glen Dam in M05, and the Chittenden Reservoir Dam at the upstream end of M10 (Figure 1 through 2). Both dams are used for hydropower generation. M05 was not assessed during this study, but the downstream effects from both dams were noted (See Appendix A). An old dam is located in mid-reach on M10 which acts as a grade control. Beaver dams were noted in M06, M08, and M09.

4.1.3 Sediment Load Indicators

As previously stated, a majority of the study area is dominated by forest land, mostly hardwood and erosion was not a widespread problem. More areas of erosion were observed in M04, M06, and M08 where more of the floodplain has been developed. Areas of bank erosion are located along poorly buffered sections of the riparian corridor. Areas of erosion in the individual reaches are discussed in Appendix A. No mass failures were observed.

The lowest reach assessed within the study area, M04 contained multiple steep riffles, and enlarged bars, signs of the aggradational process. Other depositional features which were common include point bars, diagonal bars, delta bars, side bars, mid bars and islands. Flood chutes were noted in all of the reaches. Four channel avulsions were identified: one in M08;

two in M09—one in each segment; and one in M10. A few braided channels were observed in four of the reaches M04, M06, M08 and M09, though all of them were associated with beaver activity where dams have blown out and the large slug of water and sediment formed a short braided section immediately downstream or within the former dam.

4.2 REACH SCALE STRESSORS – BOUNDARY CONDITIONS

Individual narratives for each assessed reach are included as Appendix A. Below is a summary of the dominant reach scale stressors observed throughout the watershed. Figures 3 through 6 depict the geomorphic features identified on the East Creek during the Phase 2 Assessments.

4.2.1 Channel Bed Modifiers

The measured incision ratios in M04, M06, and M09A were less than 1.4 and the entrenchment ratios were greater than 2.2, so while some incision has taken place, the stream still access to its floodplain. The incision ratio for M09B was 3.5 and the entrenchment ratio was 2.3. Thus the stream is highly incised and moderately entrenched. Evidence of gravel mining on point bars was present in M04.

4.2.2 Bank and Riparian Vegetation Modifiers

Figures 3 through 6 show the locations of bank armoring and active erosion. Relatively short areas of rip-rap were noted in M04, M08, M09A, and M10. More extensive rip-rap and other revetments were noted in M09B.

Since most of the reaches had buffer widths greater than 50 feet, lack of riparian buffer and woody vegetation is a minor stressor to the East Creek watershed. Riparian buffers serve many functions. They help to stabilize stream banks and prevent erosion, provide shade and cover for aquatic species, and serve as natural filters to help remove excess nutrients and organic matter from the system.

4.3 REACH SCALE STRESSORS – ENERGY GRADE

4.3.1 Slope Modifiers

While some channelization was noted in all the assessed reaches, it was not a significant stressor except in M09B, where approximately one-third of the reach had been straightened. Straightening increases the channel slope and power and velocity of the water within the stream. This can lead to degradation and increased stream bank erosion.

Both natural constrictions and human made ones, such as bridges and dams were observed. Naturally occurring bedrock channel constrictions were found in the following reaches: M04, M09A and M09B. Bridges were found on all study segments and culverts were observed in M08, and M10. One undersized bridge was found in M04, M06 and M09. Undersized culverts were noted in M08 and M10. The effect of these constrictions was limited to the immediate area upstream and downstream of the constriction and was principally the accumulation of excess sediment above the constriction and scour and deposition downstream of the constriction.

There are two dams located in the study area, one in M05 immediately upstream of M04, and one at the upstream end of M10 (Figures 1 through 2). Both dams are used for hydropower generation. M05 was not assessed during this study. Downstream effects from both dams were noted (See Appendix A). In M04, the segment immediately downstream of the dam had less fine sediment and was slightly more incised than at the cross section (incision ratio 1.2 compared to 1.1 for the cross section), but this difference was not significant enough to segment the reach. One possible reason for the lack of degradation directly downstream of the dam is the amount of water that bypasses the channel through the diversion structure. Since M10 was not fully assessed, the influence of the Chittenden Reservoir Dam directly downstream of the dam was not measured. An old dam is located in mid-reach on M08 which acts as a grade control. The beaver dams in M06, M08, and M09, and the debris jams in M06, M08, M09, and M10 act as slope modifiers.

4.3.2 Floodplain Modifiers

No active head cuts were observed. All of the assessed reaches had incision ratios greater than 1.0 indicating that some incision had occurred. However, the entrenchment ratios in for all of the assessed reaches were greater than 2.2 indicating floodplain access at 2 times maximum depth. In reach M09, segment B, the incision ratio was 3.5 and the entrenchment ratio was 2.3 suggesting that further incision would reduce floodplain access in this reach also.

While there were some documented river corridor encroachments within the watershed, they were not as substantial as what would be expected in a more developed setting. Roads have encroached upon portions of M04, M06, M09, and M10. Berm constructions were also observed in M04, M06, M09 and M10. The berm in M09 has had a significant impact on the loss of floodplain access in this reach.

4.4 BRIDGE AND CULVERT ASSESSMENTS

Bridge and Culvert Assessments were completed in all of the study reaches because they were all located where access was possible. Summary reports from the VT ANR DMS are included in Appendix B. None of the assessed bridges were found to be threatened by nearby bank erosion or undermining abutments. Several bridges are slightly undersized and act as local channel and floodplain constrictions, though none of the identified problem areas are directly associated with a particular bridge. The culverts in M10 are undersized and act as channel constrictions. During future bridge and culvert replacement projects the collected data should be used to ensure that the new bridges and culverts are correctly sized.

5.0 PRELIMINARY PROJECT IDENTIFICATION

5.1 DEPARTURE ANALYSIS – CHANNEL EVOLUTION STAGE

Based on the field measurements taken during the Phase 2 Assessments, one reach, M09 segment A, is in equilibrium, Stage I. M06 and M09B are in evolution Stage II (degradation), and M04 is in Stage IV (aggradation). The basic evolution model has five stages. In Stage I the stream is in equilibrium condition. In Stage II stream degradation is triggered by some stressor whereby the stream bed elevation is lowered and the stream no longer has adequate access to its

floodplain. Without floodplain access, which dissipates the energy during high flow events, the stream banks erode and the channel widens (Stage III). The widened channel does not have the force to move all of the sediment through the system so sediment buildup and aggradation occur and a new floodplain begins to form at a lower elevation (Stage IV). Once the new floodplain is fully developed the stream is back in equilibrium (Stage V). Further information regarding stream evolution models can be found at http://www.anr.state.vt.us/dec/waterq/rivers/htm/rv_geoassess.htm. Stream type departures were observed in M09B. M09B departed from the reference type C to a B type channel due to historic degradation and anthropogenic factors. The sediment regime for the studied reaches, overall, is dominated by aggradation, but signs of degradation were noted in M06 and M09.

5.2 SENSITIVITY ANALYSIS – DOMINANT ADJUSTMENT PROCESS

The dominant adjustment process for the overall watershed appears to be aggradation, although as noted above degradation is a significant stressor in Reach M09B and a portion of M06. The other assessed reaches are evolution Stages II and IV. Reach M09A is in Stage I, equilibrium. Based on the evolution stage and stream type, reaches M06 and M09B have a very high sensitivity rating, and M04 has a high sensitivity rating. Thus these three reaches can be expected to continue to widen.

5.3 POTENTIAL PROJECT AREAS

Based on the results of the Phase 2 Assessments and visual observations, potential restoration/corridor protection projects identified within the watershed are described below. Figures 3 through 7 depict the project locations.

- M04 – While this reach is generally well buffered, inadequate buffer widths were noted adjacent to fields in agricultural use. Buffer installation on these fields is recommended.
- M06 – Removal of the berms which are corridor encroachments in this reach is recommended. Also, this reach is relatively undeveloped and contains some riparian wetlands, so a Corridor Protection Plan is also recommended.
- M09B – Since this segment is constricted by a significant berm on the right side, removal of part or all of this berm is recommended. Further study of the site is necessary to assess

potential for negative impacts on adjacent property from berm removal. The removal of the stone wall that acts as a revetment is also recommended.

There are federal programs which could potentially provide funding in support of these projects such as the Conservation Reserve Enhancement Program (CREP), and Environmental Quality Improvement Program (EQIP), which compensates landowners for the loss of cropland to enhance riparian buffers. Funds from the Vermont River Management Program (RMP) may also be available for projects not eligible for the federal programs.

6.0 REFERENCES

Doll, Charles, Centennial Geologic Map of Vermont, State of Vermont Geologists Office, 1961.

Doll, Charles, Surficial Geologic Map of Vermont, State of Vermont Geologists Office, 1970.

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FIGURES

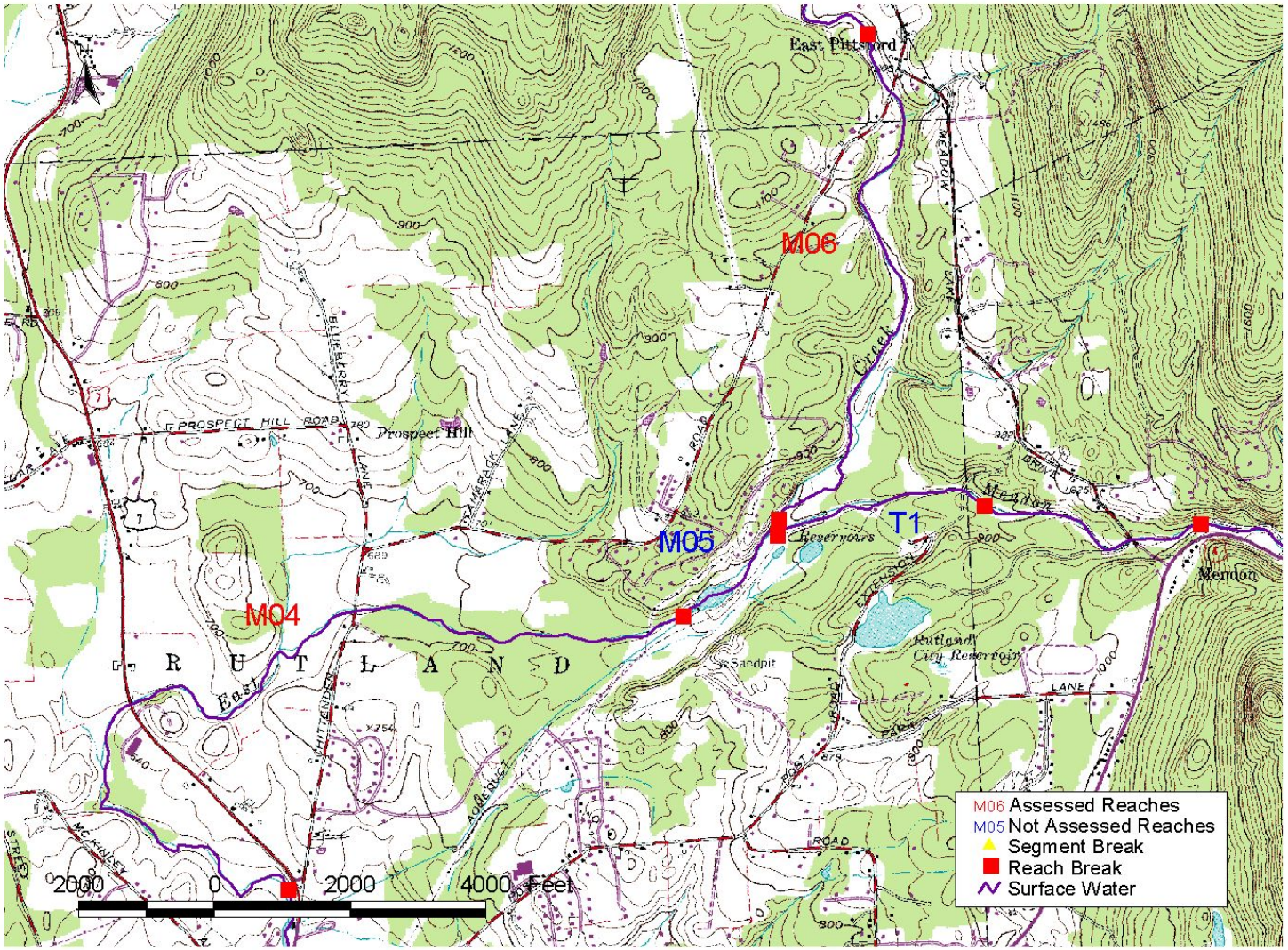

Figure 1 Site locations of the studied reaches M04 and M06 along the East Creek River, Rutland County, VT.

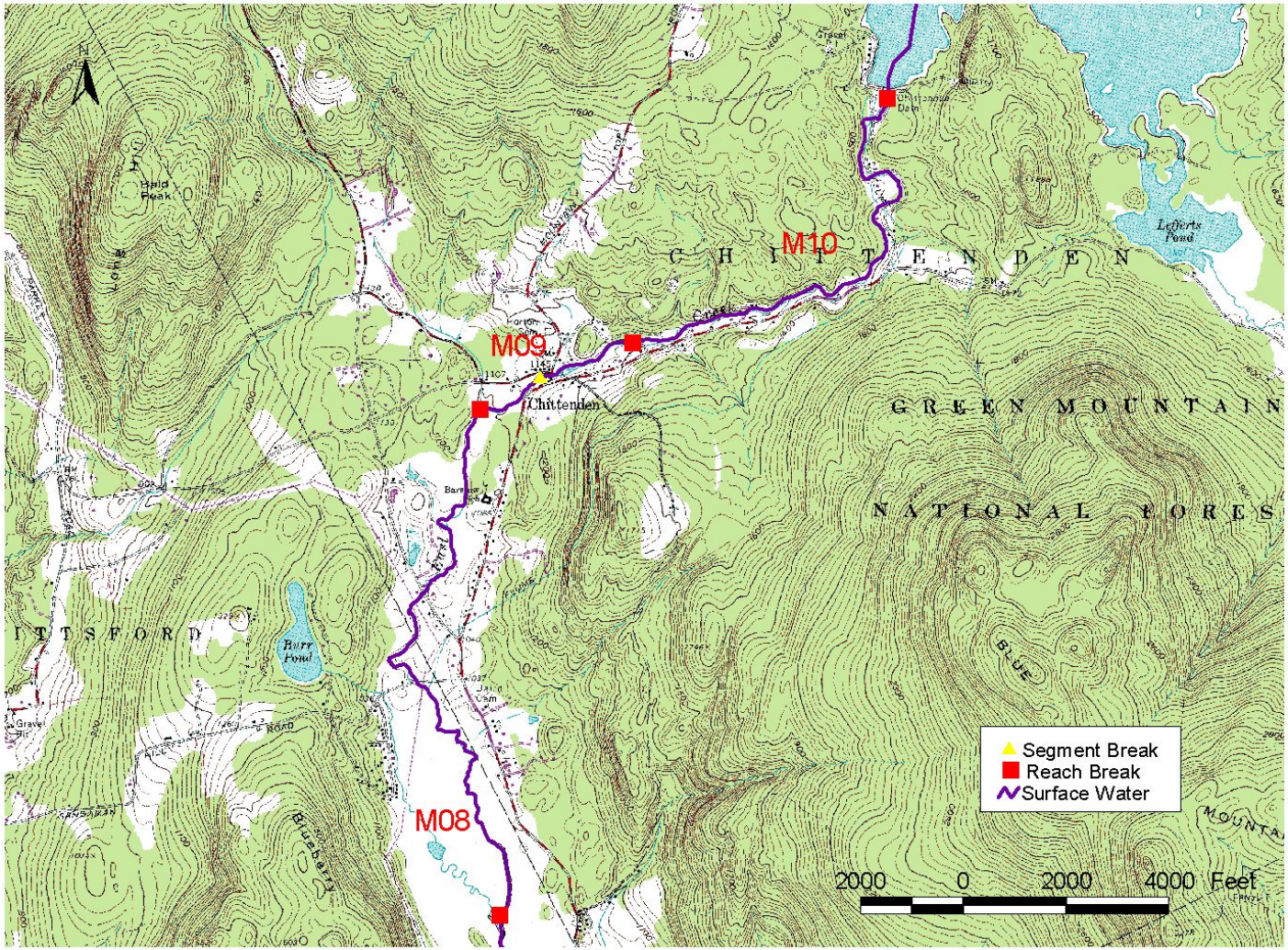

Figure 2 Site locations of the studied reaches M08, M09 and M10 along the East Creek River, Rutland County, VT.

APPENDIX A
INDIVIDUAL REACH NARRATIVES

East Creek – M04

M04 is the most downstream reach in the East Creek assessment area. It extends from approximately 30 feet from the Route 7 intersection with East Pittsford Road to approximately 100 feet downstream of the Glen Dam. This reach was in regime with its reference stream type C. The stream in this reach is slightly incised, incision ratio of 1.1, and still has access to its floodplain at bankfull stage, entrenchment ration of 5.8. It was found to be in Stage IV of evolution with a sensitivity rating of high. Active channel migration was evidenced by flood chutes. The bedform is riffle-pool. Limited areas of erosion were noted on both right and left banks (approximately 5 feet high and 100 feet long).

Given the meander pattern in the reach and the presence of the dam upstream, we assume that it was straightened in the past, but the 1893 USGS map of the stream shows it in essentially the same place as it is now. We also expected to see highly eroded banks and degradation in this reach, but the assessment did not confirm this expectation. The segment immediately downstream of the dam did have less fine sediment and was slightly more incised (incision ratio 1.2 compared to 1.1 for the cross section) but this difference was not significant enough to segment the reach. One possible reason for the lack of degradation directly downstream of the dam is the amount of water that bypasses the channel through the diversion structure. The observed bankfull width, 52 feet, was narrower than the 75 foot width estimated in the Phase I assessment. This narrow bankfull width is further evidence of the impact of the dam and diversion structure.

The reach is well buffered by trees on both sides with buffer widths ranging from 51 feet to more than 100 feet. The geomorphic assessment rating was “good”, 0.7, and the habitat assessment rating was also “good”, 0.7. This is a high gradient stream showing evidence of aggradation by the number of mid, point, and side bars and steep riffles. Some scalping of gravel from a point bar was noted. Effects of the Glen Dam can be observed at the upstream end of the reach.

Two bridges were located in this reach which showed deposition above and below and evidence of scour. While not forming channel constrictions, these bridges were flood prone constrictions.

While this reach is generally well buffered, inadequate buffer widths were noted adjacent to fields in agricultural use. Buffer installation on these fields is recommended.

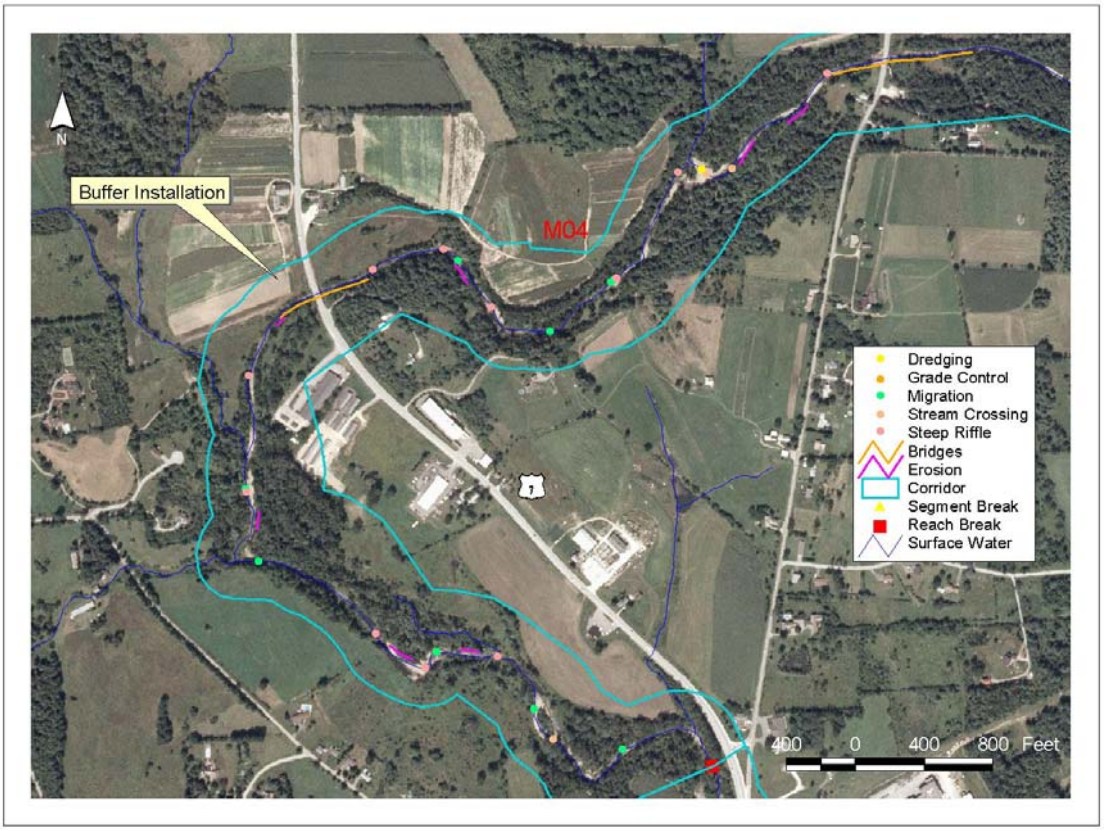

Figure 3 Proposed buffer installations on the right side of Reach M04

East Creek – M06

M06 extends from approximately 400 feet upstream from the confluence of the Mendon Brook with the East Creek to approximately 700 feet upstream from the bridge at East Pittsford. This reach was in regime with its reference stream type C. The stream is slightly incised, incision ratio 1.2, but not entrenched (entrenchment ratio 11.8), so it still has floodplain access at high flows. It was found to be in Stage II of evolution with a very high sensitivity rating, which indicates that the stream is currently incised. Active channel migration was evidenced by flood chutes. A ledge provided bedrock grade control within the reach. Berms were noted on both sides of the downstream portion of the reach, limiting the floodplain access.

The reach was well buffered by trees on both sides, with buffers generally in excess of 100 feet wide. This is a high gradient stream and a large amount of woody debris was noted in this reach. The geomorphic assessment rating was “fair” but the habitat rating was “good”. Two beaver dams and one debris jam were located on the lower to mid-portion of the reach acting as grade control and channel constriction. One bridge was located in this reach which acted as a channel constriction.

Removal of the berms which are corridor encroachments in this reach is recommended. Also, this reach is relatively undeveloped and contains some riparian wetlands, so a Corridor Protection Plan is also recommended.

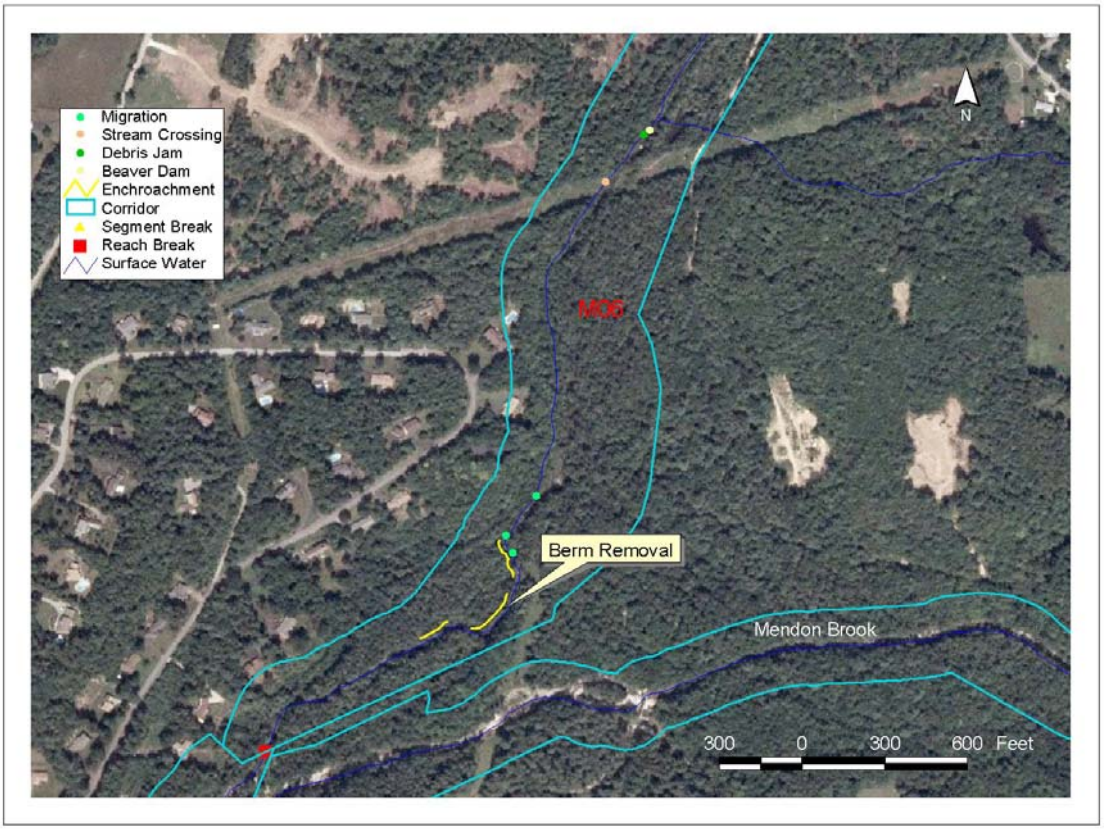

Figure 4 Potential for a berm removal project in Reach M06

East Creek – M08

M08 extends downstream approximately 4,800 from Sangaman Hill Road and upstream approximately 1,500 feet from Barstow School. This reach was not fully assessed due to lack of landowner permission to access the stream, so geomorphic and habitat assessment data are not available. One channel avulsion was noted mid-way in this reach. The bridge and culvert survey was conducted for this reach and some areas of erosion and riprap were recorded. Three beaver dams were located on mid and two lower portions of the reach. Two bridges were assessed. The bridge located on a driveway off of Power House Road acted as a channel constriction causing deposition upstream and downstream of the constriction. The second bridge on Power House Road did not appear to be a constriction, but deposition was noted below the bridge.

East Creek – M09

Reach M09 is located in the village of Chittenden, and was segmented into M09A and M09B due to corridor encroachment.

M09A extends from the confluence of the East Creek with an unnamed tributary located approximately 1,500 downstream from the Bridge at Holden Road to approximately 100 feet downstream from the bridge at Holden Road. The reach was in regime with its reference type C stream and was found to be in channel evolution Stage I, equilibrium. Stream sensitivity was moderate. One channel avulsion was noted in the lower portion of the segment. One beaver dam and one debris jam acted as grade control and channel constriction. Active channel migration was evidenced by flood chutes. The segment was well buffered with trees. Both the geomorphic and habitat assessment ratings for this segment were "good".

M09B extends from approximately 100 feet downstream from the Holden Road bridge to approximately 400 feet downstream from the culvert at the Fox Creek Inn. This segment had departed from its reference stream type C to a type B. The stream is highly incised (incision ratio 3.5 and entrenchment ratio 2.3) and was found to be in channel evolution Stage II, with a very high sensitivity rating. Active channel migration was evidenced by flood chutes. One debris jam acted as channel constriction. The stream has lost access to its historic floodplain and is now confined by a terrace on the left side and a berm on the right side that is continuous along almost all of the right side of the segment. The distance from the top of the terrace to the valley wall is less than 50 feet and the distance from the top of the berm to the valley wall are approximately 100 feet. Both the geomorphic and habitat assessment ratings for this segment were "fair." The bridge at Holden Road in Chittenden Village was undersized and showed evidence of scour both above and below.

The areas of erosion noted were limited, but the reach was armored with rip-rap and stone walls. One channel avulsion was noted near on the upstream end of M09B. Historic evidence of straightening was found. The right side of this reach was not well buffered.

Since M09B is constricted by a significant berm on the right side, removal of part or all of this berm is recommended. Further study of the site is necessary to assess potential for negative impacts on adjacent property from berm removal. The removal of the stone wall that acts as a revetment is also recommended.

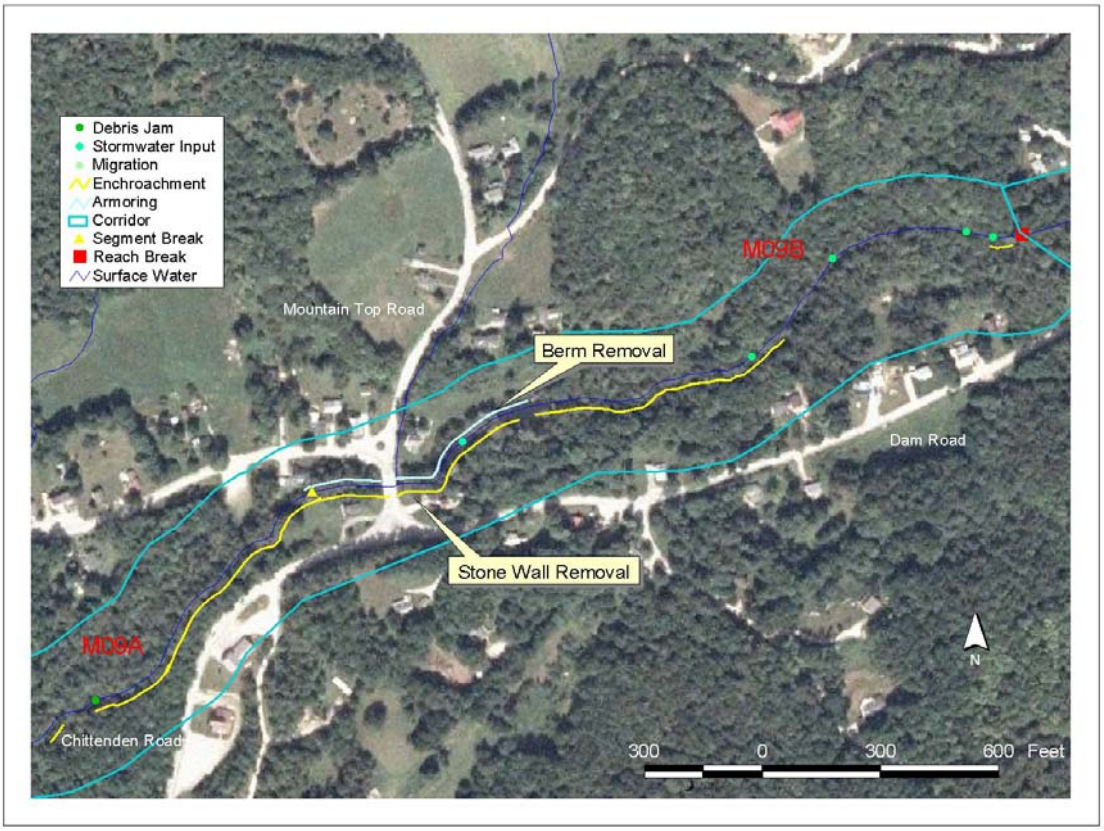

Figure 5 Segmentation of Reach M09 and potential sites for berm and stone wall removal

Figure 6 Adjacent properties to the berm removal project on the right side of M09.

East Creek – M10

M10 extends from approximately 400 feet downstream from the culvert at the Fox Creek Inn to the Chittenden Reservoir. This reach was not fully assessed due to lack of landowner permission for access so geomorphic and habitat assessment data are not available. The dam at the Chittenden reservoir creates an impoundment upstream of M10. An old dam which created a grade control was noted in mid-reach. Active channel migration was evidenced by flood chutes. Two debris jams are acting as constrictions. One bridge and five culvert assessments were performed for this reach. All the culverts that were noted provided channel constructions. The culverts were mostly located on private property driveways and deposition and scour were noted upstream of the constrictions.

APPENDIX B
PHASE 2 DATA MANAGEMENT SYSTEM REPORTS

Project: **Otter Creek - East Creek Trib**
Stream: **East Creek**
Organization: **Johnson Company**
Segment Length (ft): **15,164**

Phase 2 Segment Summary

Reach # **M04** Segment: **0**
Observers: **Noelia Báez Rodríguez, Adam**
Segment Location: **Rutland Town**

March 9, 2007 **FIT: Yes**
Completion Date: **September 11, 2006**
Why Not assessed:
Rain: **Yes**

Step 1. Valley and Floodplain

1.1 Segmentation **None**
1.2 Alluvial Fan **No**
1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	281	0
Roads	1,077	0
Railroads	0	0
Improved Paths	0	0
Development	2,774	1,041

1.4 Adjacent Side	Left	Right
Hillside Slope	Very Steep	Very Steep
Continuous w/	Sometimes	Sometimes
W/in 1 Bankfill	Sometimes	Sometimes
Texture	Bedrock	Bedrock

1.5 Valley Features
Valley Width (ft): **1,000**
Width Determination: **Estimated**
Confinement Type: **Very Broad**
Rock Gorge? **No**
Human-caused changed valley width? **no**

Notes:

Historic Straightening.
Landowner working on a rip-rap on the left bank and scalping on a point bar.

Step 2. Stream Channel

2.1 Bankfull Width: **52**
2.2 Max Depth (ft): **3.40**
2.3 Mean Depth (ft): **2.40**
2.4 Floodprone Width (ft): **300**
2.5 Aband. Floodpln: **3.70**
2.6 Width/Depth Ratio: **21.54**
2.7 Entrenchment Ratio: **5.80**
2.8 Incision Ratio: **1.09**
2.9 Sinuosity: **Moderate**
2.10 Riffles Type: **Sedimented**
2.11 Riffle/Step Spacing (ft): **200**

2.12 Substrate Composition

Bedrock	0 %
Boulder	1 %
Cobble	37 %
Coarse Gravel	42 %
Fine Gravel	15 %
Sand	5 %

Silt/Clay Present? **No**
Detritus: **10** %
Large Woody: **36**

2.13 Average Largest Particle on

Bed	200.0	mm
Bar	150.0	mm

2.14 Stream Type
Stream Type: **C**
Bed Material: **Gravel**
Subclass Slope: **None**
Bed Form: **Riffle-Pool**
2.15 Reference Stream Type
(if different from Phase 1)

Step 3. Riparian Features

3.1 Stream Banks
Typical Bank Slope **Steep**

Bank Texture	Left	Right
Upper		
Material Type	Gravel	Gravel
Consistency	Non-cohesive	Non-cohesive
Lower		
Material Type	Boulder/Cobbl	Boulder/Cobbl
Consistency	Non-cohesive	Non-cohesive

Bank Erosion	Left	Right
Erosion Length (ft)	849	878
Erosion Height (ft)	4.83	5.50
Revetmt. Type	Rip-Rap	Rip-Rap
Revetmt. Length (ft)	585	101

Near Bank Veg. Type	Left	Right
Dominant	Herbaceous	Herbaceous
Sub-dominant	Shrubs/Saplin	Shrubs/Saplin

Bank Canopy	Left	Right
Canopy %	51-75	51-75
Mid-Channel Canopy		Open

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	51-100	51-100
Sub-dominant	>100	>100

Buffer Veg. Type	Left	Right
Dominant	Coniferous	Deciduous
Sub-dominant	Shrubs/Saplin	Shrubs/Saplin

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Forest	Forest
Sub-dominant	Crop	Crop

	Amount	Mean Height
Mass Failures	None	0.00
Gullies	None	0.00

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps: **Some**
4.2 Adjacent Wetlands: **Some**
4.3 Flow Status: **Low**
4.4 # of Debris Jams: **0**
4.5 Impoundments: **Large**
Impoundmt. Location: **Upstream**
4.6 # of Stormwater Inputs: **0**
4.7 Upstream Flow: **Store-release**
4.9 # of Beaver Dams: **0**
Affected Length (ft): **0**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
13	22	14

Diagonal	Delta	Island
2	2	2

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
10	0	0	2

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
15	0	No

5.4 Stream Ford or Animal: **Yes**
5.5 Straightening: **Yes**
Straightening Length: **2,051**
5.5 Dredging: **Gravel Mining**

Note:
Step 1.6 - Grade Controls and Step 4.8 - Channel Constrictions are on The second page of this report - Steps 6 through 7.

1.6 Grade Controls **None**

Type	Location	Total	Total Height Above Water	Photo Taken	GPSTaken

4.8 Channel Constrictions

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?
Bridge	**135.**	**Yes**	**Yes**	**No**	**Yes**
Problem	**Deposition Above,Deposition Below,Scour**				
Bridge	**126.**	**Yes**	**Yes**	**No**	**Yes**
Problem	**Deposition Above,Deposition Below,Scour**				

Narrative:
Evidence of aggradation showing by the abundance of steep riffles.

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Unconfined**

	Score	STD	Historic
7.1 Channel Degradation	**16**	**None**	**Yes**
7.2 Channel Aggradation	**11**	**None**	**Yes**
7.3 Widening Channel	**14**		
7.4 Change in Planform	**15**		
Total Score	**56**		
Geomorphic Rating	**0.7**		

Channel Evolution Model	**F**
Channel Evolution Stage	**IV**
Geomorphic Condition	**Good**
Stream Sensitivity	**High**

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type **High**

	Score
6.1 Epifaunal Substrate - Available Cover	**14**
6.2 Embeddedness	**8**
6.3 Velocity/Depth Patterns	**15**
6.4 Sediment Deposition	**13**
6.5 Channel Flow Status	**8**
6.6 Channel Alteration	**12**
6.7 Frequency of Riffles/Steps	**15**
6.8 Bank Stability	**Left: 8 Right: 8**
6.9 Bank Vegetation Protection	**Left: 8 Right: 8**
6.10 Riparian Vegetation Zone Width	**Left: 8 Right: 8**
Total Score	**133**
Habitat Rating	**0.665**

Habitat Stream Condition **Good**

Project: **Otter Creek - East Creek Trib**
Stream: **East Creek**
Organization: **Johnson Company**
Segment Length (ft): **8,719**

Phase 2 Segment Summary

Reach # **M06** Segment: **0**
Observers: **Noelia Báez Rodríguez, Adam**
Segment Location: **Pittsford, Rutland Town**

March 9, 2007 **FIT: Yes**
Completion Date: **September 18, 2006**
Why Not assessed:
Rain: **No**

Step 1. Valley and Floodplain

1.1 Segmentation **None**
1.2 Alluvial Fan **No**
1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	117	345
Roads	0	0
Railroads	0	0
Improved Paths	0	0
Development	460	0

1.4 Adjacent Side

	Left	Right
Hillside Slope	Very Steep	Very Steep
Continuous w/	Sometimes	Sometimes
W/in 1 Bankfill	Sometimes	Sometimes
Texture	Not Evalua	Not Evalua

1.5 Valley Features
Valley Width (ft): **605**
Width Determination: **Estimated**
Confinement Type: **Very Broad**
Rock Gorge? **No**
Human-caused changed valley width? **no**

Notes:
Historic Straightening

Step 2. Stream Channel

2.1 Bankfull Width	34
2.2 Max Depth (ft)	3.00
2.3 Mean Depth (ft)	2.30
2.4 Floodprone Width (ft)	400
2.5 Aband. Floodpln	3.50
2.6 Width/Depth Ratio	14.78
2.7 Entrenchment Ratio	11.76
2.8 Incision Ratio	1.17
2.9 Sinuosity	Moderate
2.10 Riffles Type	Complete
2.11 Riffle/Step Spacing (ft)	200

2.12 Substrate Composition

Bedrock	0 %
Boulder	2 %
Cobble	36 %
Coarse Gravel	39 %
Fine Gravel	20 %
Sand	3 %

Silt/Clay Present? **No**
Detritus **10** %
Large Woody **85**

2.13 Average Largest Particle on

Bed	150.0	mm
Bar	100.0	mm

2.14 Stream Type
Stream Type: **C**
Bed Material: **Gravel**
Subclass Slope: **b**
Bed Form: **Riffle-Pool**
2.15 Reference Stream Type
(if different from Phase 1)

Step 3. Riparian Features

3.1 Stream Banks
Typical Bank Slope **Steep**

Bank Texture	Left	Right
Upper		
Material Type	Gravel	Gravel
Consistency	Non-cohesive	Non-cohesive
Lower		
Material Type	Boulder/Cobbl	Boulder/Cobbl
Consistency	Non-cohesive	Non-cohesive

Bank Erosion	Left	Right
Erosion Length (ft)	111	41
Erosion Height (ft)	6.00	7.00
Revetmt. Type	None	None
Revetmt. Length (ft)	0	0

Near Bank Veg. Type	Left	Right
Dominant	Herbaceous	Herbaceous
Sub-dominant	Deciduous	Deciduous

Bank Canopy	Left	Right
Canopy %	51-75	51-75
Mid-Channel Canopy		Open

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	>100	>100
Sub-dominant	51-100	51-100

Buffer Veg. Type	Left	Right
Dominant	Mixed Trees	Mixed Trees
Sub-dominant	Shrubs/Saplin	Shrubs/Saplin

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Forest	Forest
Sub-dominant	Shrubs/Saplin	Shrubs/Saplin

	Amount	Mean Height
Mass Failures	None	0.00
Gullies	None	0.00

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps	Some
4.2 Adjacent Wetlands	Some
4.3 Flow Status	Moderate
4.4 # of Debris Jams	1
4.5 Impoundments	None
Impoundmt. Location	
4.6 # of Stormwater Inputs	0
4.7 Upstream Flow	None
4.9 # of Beaver Dams	1
Affected Length (ft)	200

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
3	14	6

Diagonal	Delta	Island
1	1	7

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
9	0	0	1

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
1	0	No

5.4 Stream Ford or Animal **Yes**
5.5 Straightening **Yes**
Straightening Length: **774**
5.5 Dredging **None**

Note:
Step 1.6 - Grade Controls and Step 4.8 - Channel Constrictions are on The second page of this report - Steps 6 through 7.

1.6 Grade Controls

Type	Location	Total	Total Height Above Water	Photo Taken	GPSTaken
Ledge	**Upstream**	**2.00**	**1.00**		

4.8 Channel Constrictions

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?
Bridge	**24.0**	**Yes**	**Yes**	**Yes**	**Yes**
Problem	**Deposition Below,Scour Below**				

Narrative:
Changes in planform

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Unconfined**

	Score	STD	Historic
7.1 Channel Degradation	**11**	**None**	**Yes**
7.2 Channel Aggradation	**13**	**None**	**Yes**
7.3 Widening Channel	**14**		**No**
7.4 Change in Planform	**13**		**No**
Total Score	**51**		
Geomorphic Rating	**0.6375**		

Channel Evolution Model	**F**
Channel Evolution Stage	**II**
Geomorphic Condition	**Fair**
Stream Sensitivity	**Very High**

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type **High**

	Score
6.1 Epifaunal Substrate - Available Cover	**13**
6.2 Embeddedness	**8**
6.3 Velocity/Depth Patterns	**12**
6.4 Sediment Deposition	**15**
6.5 Channel Flow Status	**14**
6.6 Channel Alteration	**17**
6.7 Frequency of Riffles/Steps	**13**
6.8 Bank Stability	**Left: 9 Right: 9**
6.9 Bank Vegetation Protection	**Left: 9 Right: 9**
6.10 Riparian Vegetation Zone Width	**Left: 9 Right: 9**
Total Score	**146**
Habitat Rating	**0.73**

Habitat Stream Condition **Good**

Project: **Otter Creek - East Creek Trib**
Stream: **East Creek**
Organization: **Johnson Company**
Segment Length (ft): **13,147**

Phase 2 Segment Summary

Reach # **M08**
Observers: **Noelia Báez Rodríguez, Dan**
Segment Location: **Chittenden, Pittsford**

March 9, 2007 **FIT: Yes**
Segment: **0** Completion Date: **September 28, 2006**
Why Not assessed: Rain: **No**

Step 1. Valley and Floodplain

1.1 Segmentation **Substrate Size**
1.2 Alluvial Fan **No**
1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
Roads	0	0
Railroads	0	0
Improved Paths	0	0
Development	1,654	344

1.4 Adjacent Side	Left	Right
Hillside Slope	**Very Steep**	**Steep**
Continuous w/	**Sometimes**	**Sometimes**
W/in 1 Bankfill	**Sometimes**	**Sometimes**
Texture	**Not Evalua**	**Not Evalua**

1.5 Valley Features
Valley Width (ft): **2,146**
Width Determination: **Estimated**
Confinement Type: **Very Broad**
Rock Gorge? **No**
Human-caused changed valley width? **No**

Notes:

Approximately 3,300 ft of the stream section was not cover in the survey. The SGA was not complete due to land owner access. The reach assessment implies segmentation based on substrate size and/or flow status on the lower section.

Step 2. Stream Channel

2.1 Bankfull Width: **0**
2.2 Max Depth (ft): **0.00**
2.3 Mean Depth (ft): **0.00**
2.4 Floodprone Width (ft): **0**
2.5 Aband. Floodpln: **0.00**
2.6 Width/Depth Ratio: **0.00**
2.7 Entrenchment Ratio: **0.00**
2.8 Incision Ratio: **0.00**
2.9 Sinuosity: **High**
2.10 Riffles Type: **Not Evaluated**
2.11 Riffle/Step Spacing (ft): **0**

2.12 Substrate Composition

Silt/Clay Present? **Yes**
Detritus **0** %
Large Woody **0**

2.13 Average Largest Particle on
Bed **0.0**
Bar **0.0**

Not Evaluated

2.14 Stream Type
Stream Type:
Bed Material:
Subclass Slope:
Bed Form:

2.15 Reference Stream Type
(if different from Phase 1)

Step 3. Riparian Features

3.1 Stream Banks
Typical Bank Slope **Steep**

Bank Texture	Left	Right
Upper		
Material Type	**Sand**	**Sand**
Consistency	**Non-cohesive**	**Non-cohesive**
Lower		
Material Type	**Gravel**	**Gravel**
Consistency	**Cohesive**	**Non-cohesive**

Bank Erosion	Left	Right
Erosion Length (ft)	**304**	**549**
Erosion Height (ft)	**5.67**	**4.50**
Revetmt. Type	**Rip-Rap**	**Rip-Rap**
Revetmt. Length (ft)	**80**	**45**

Near Bank Veg. Type	Left	Right
Dominant	**Shrubs/Saplin**	**Shrubs/Saplin**
Sub-dominant	**Herbaceous**	**Herbaceous**

Bank Canopy	Left	Right
Canopy %	**26-50**	**26-50**
Mid-Channel Canopy		**Open**

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**51-100**	**51-100**
Sub-dominant	**26-50**	**26-50**

Buffer Veg. Type	Left	Right
Dominant	**Deciduous**	**Deciduous**
Sub-dominant	**Shrubs/Saplin**	**Shrubs/Saplin**

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	**Forest**	**Forest**
Sub-dominant	**Residential**	**Residential**

	Amount	Mean Height
Mass Failures	**None**	**0.00**
Gullies	**None**	**0.00**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps: **Some**
4.2 Adjacent Wetlands: **Some**
4.3 Flow Status: **Low**
4.4 # of Debris Jams: **5**
4.5 Impoundments: **Small**
Impoundmt. Location: **In Reach**
4.6 # of Stormwater Inputs: **0**
4.7 Upstream Flow: **Run-of-river**
4.9 # of Beaver Dams: **3**
Affected Length (ft): **170**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
7	17	6

Diagonal	Delta	Island
4	1	3

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
2	2	1	2

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
1	0	No

5.4 Stream Ford or Animal: **No**
5.5 Straightening: **Yes**
Straightening Length: **455**
5.5 Dredging: **None**

Note:
Step 1.6 - Grade Controls and Step 4.8 - Channel Constrictions are on The second page of this report - Steps 6 through 7.

1.6 Grade Controls

Type	Location	Total	Total Height Above Water	Photo Taken	GPSTaken
Dam	**Mid-Segment**	**2.00**	**1.00**		

4.8 Channel Constrictions

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?
Instream	**12.4**	**Yes**	**Yes**	**Yes**	**No**
Problem	**Deposition Above,Scour Below**				
Bridge	**12.0**	**Yes**	**Yes**	**Yes**	**No**
Problem	**Deposition Above,Deposition Below**				
Bridge	**13.0**	**Yes**	**Yes**	**No**	**No**
Problem	**Deposition Below**				

Narrative:

Step 7. Rapid Geomorphic Assessment Data

Confinement Type

Channel Evolution Model
Channel Evolution Stage
Geomorphic Condition
Stream Sensitivity

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type

Habitat Stream Condition

Project: **Otter Creek - East Creek Trib**
Stream: **East Creek**
Organization: **Johnson Company**
Segment Length (ft): **1,400**

Phase 2 Segment Summary

Reach # **M09**
Observers: **Noelia Báez Rodríguez**
Segment Location: **Chittenden**

March 9, 2007 **FIT: Yes**
Segment: **A** Completion Date: **September 20, 2006**
Why Not assessed: Rain: **No**

Step 1. Valley and Floodplain

1.1 Segmentation **Corridor Encroachment**
1.2 Alluvial Fan **No**
1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	**54**	**0**
Roads	**231**	**616**
Railroads	**0**	**0**
Improved Paths	**0**	**0**
Development	**0**	**88**

1.4 Adjacent Side	Left	Right
Hillside Slope	**Very Steep**	**Hilly**
Continuous w/	**Sometimes**	**Sometimes**
W/in 1 Bankfill	**Sometimes**	**Sometimes**
Texture	**Not Evalua**	**Not Evalua**

1.5 Valley Features
Valley Width (ft): **715**
Width Determination: **Estimated**
Confinement Type: **Very Broad**
Rock Gorge? **No**
Human-caused changed valley width? **no**

Notes:

Step 2. Stream Channel

2.1 Bankfull Width	**21**
2.2 Max Depth (ft)	**2.80**
2.3 Mean Depth (ft)	**1.50**
2.4 Floodprone Width (ft)	**471**
2.5 Aband. Floodpln	**3.70**
2.6 Width/Depth Ratio	**14.00**
2.7 Entrenchment Ratio	**22.43**
2.8 Incision Ratio	**1.32**
2.9 Sinuosity	**Moderate**
2.10 Riffles Type	**Eroded**
2.11 Riffle/Step Spacing (ft)	**0**

2.12 Substrate Composition

Bedrock	**0** %
Boulder	**9** %
Cobble	**42** %
Coarse Gravel	**16** %
Fine Gravel	**10** %
Sand	**23** %

Silt/Clay Present?	**No**
Detritus	**12** %
# Large Woody	**20**

2.13 Average Largest Particle on

Bed	**200.0**	**mm**
Bar	**64.0**	**mm**

2.14 Stream Type
Stream Type: **C**
Bed Material: **Cobble**
Subclass Slope: **b**
Bed Form: **Riffle-Pool**
2.15 Reference Stream Type
(if different from Phase 1)

Step 3. Riparian Features

3.1 Stream Banks
Typical Bank Slope **Moderate**

Bank Texture	Left	Right
Upper		
Material Type	**Sand**	**Sand**
Consistency	**Non-cohesive**	**Non-cohesive**
Lower		
Material Type	**Gravel**	**Gravel**
Consistency	**Non-cohesive**	**Non-cohesive**

Bank Erosion	Left	Right
Erosion Length (ft)	**18**	**0**
Erosion Height (ft)	**6.00**	**0.00**
Revetmt. Type	**None**	**Rip-Rap**
Revetmt. Length (ft)	**0**	**17**

Near Bank Veg. Type	Left	Right
Dominant	**Deciduous**	**Deciduous**
Sub-dominant	**Herbaceous**	**Herbaceous**

Bank Canopy	Left	Right
Canopy %	**76-100**	**76-100**
Mid-Channel Canopy		**Open**

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**51-100**	**>100**
Sub-dominant	**>100**	**51-100**

Buffer Veg. Type	Left	Right
Dominant	**Mixed Trees**	**Deciduous**
Sub-dominant	**Deciduous**	**Shrubs/Saplin**

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	**Forest**	**Forest**
Sub-dominant	**Residential**	**Residential**

	Amount	Mean Height
Mass Failures	**None**	**0.00**
Gullies	**None**	**0.00**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps	**Some**
4.2 Adjacent Wetlands	**Some**
4.3 Flow Status	**Low**
4.4 # of Debris Jams	**1**
4.5 Impoundments	**Large**
Impoundmt. Location	**Upstream**
4.6 # of Stormwater Inputs	**0**
4.7 Upstream Flow	**Store-release**
4.9 # of Beaver Dams	**1**
Affected Length (ft)	**250**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
1	**2**	**0**

Diagonal	Delta	Island
1	**0**	**1**

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
1	**0**	**1**	**1**

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
0	**0**	**No**

5.4 Stream Ford or Animal **No**
5.5 Straightening **Yes**
Straightening Length: **181**
5.5 Dredging **None**

Note:
Step 1.6 - Grade Controls and
Step 4.8 - Channel Constrictions
are on The second page of this
report - Steps 6 through 7.

1.6 Grade Controls **None**

Type	Location	Total	Total Height Above Water	Photo Taken	GPSTaken

4.8 Channel Constrictions **None**

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?

Narrative:
Channel Degradation

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Unconfined**

	Score	STD	Historic
7.1 Channel Degradation	**12**	**None**	
7.2 Channel Aggradation	**14**	**None**	**No**
7.3 Widening Channel	**14**		
7.4 Change in Planform	**15**		
Total Score	**55**		
Geomorphic Rating	**0.6875**		
Channel Evolution Model	**F**		
Channel Evolution Stage	**I**		
Geomorphic Condition	**Good**		
Stream Sensitivity	**Moderate**		

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type **High**

	Score
6.1 Epifaunal Substrate - Available Cover	**13**
6.2 Embeddedness	**15**
6.3 Velocity/Depth Patterns	**13**
6.4 Sediment Deposition	**11**
6.5 Channel Flow Status	**15**
6.6 Channel Alteration	**13**
6.7 Frequency of Riffles/Steps	**16**
6.8 Bank Stability	**Left: 8 Right: 9**
6.9 Bank Vegetation Protection	**Left: 8 Right: 8**
6.10 Riparian Vegetation Zone Width	**Left: 5 Right: 6**
Total Score	**140**
Habitat Rating	**0.7**
Habitat Stream Condition	**Good**

Project: **Otter Creek - East Creek Trib**
Stream: **East Creek**
Organization: **Johnson Company**
Segment Length (ft): **2,142**

Phase 2 Segment Summary

Reach # **M09** Segment: **B**
Observers: **Noelia Báez Rodríguez**
Segment Location: **Chittenden**

March 9, 2007 **FIT: Yes**
Completion Date: **September 20, 2006**
Why Not assessed:
Rain: **No**

Step 1. Valley and Floodplain

1.1 Segmentation **Corridor Encroachment**
1.2 Alluvial Fan **No**
1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	433	0
Roads	1,084	193
Railroads	0	0
Improved Paths	0	0
Development	91	709

1.4 Adjacent Side	Left	Right
Hillside Slope	Steep	Very Steep
Continuous w/	Sometimes	Sometimes
W/in 1 Bankfill	Sometimes	Sometimes
Texture	Not Evalua	Not Evalua

1.5 Valley Features
Valley Width (ft) **715**
Width Determination **Estimated**
Confinement Type **Very Broad**
Rock Gorge? **No**
Human-caused changed valley width? **no**

Notes:

Historic Straightening.

Step 2. Stream Channel

2.1 Bankfull Width	24
2.2 Max Depth (ft)	2.70
2.3 Mean Depth (ft)	1.80
2.4 Floodprone Width (ft)	54
2.5 Aband. Floodpln	9.50
2.6 Width/Depth Ratio	13.33
2.7 Entrenchment Ratio	2.25
2.8 Incision Ratio	3.52
2.9 Sinuosity	Low
2.10 Riffles Type	Eroded
2.11 Riffle/Step Spacing (ft)	0

2.12 Substrate Composition

Bedrock	2	%
Boulder	16	%
Cobble	27	%
Coarse Gravel	30	%
Fine Gravel	7	%
Sand	18	%

Silt/Clay Present? **No**
Detritus **22** %
Large Woody **10**

2.13 Average Largest Particle on

Bed	200.0	mm
Bar	60.0	mm

2.14 Stream Type
Stream Type: **B**
Bed Material: **Gravel**
Subclass Slope: **None**
Bed Form: **Step-Pool**

2.15 Reference Stream Type
(if different from Phase 1)

Step 3. Riparian Features

3.1 Stream Banks
Typical Bank Slope **Steep**

Bank Texture	Left	Right
Upper		
Material Type	Boulder/Cobbl	Boulder/Cobbl
Consistency	Non-cohesive	Non-cohesive
Lower		
Material Type	Boulder/Cobbl	Boulder/Cobbl
Consistency	Non-cohesive	Non-cohesive

Bank Erosion	Left	Right
Erosion Length (ft)	72	14
Erosion Height (ft)	5.00	6.00
Revetmt. Type	Multiple	Rip-Rap
Revetmt. Length (ft)	474	595

Near Bank Veg. Type	Left	Right
Dominant	Deciduous	Deciduous
Sub-dominant	Shrubs/Saplin	Shrubs/Saplin

Bank Canopy	Left	Right
Canopy %	76-100	76-100

Mid-Channel Canopy **Open**

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	51-100	26-50
Sub-dominant	>100	51-100

Buffer Veg. Type	Left	Right
Dominant	Deciduous	Deciduous
Sub-dominant	Shrubs/Saplin	Shrubs/Saplin

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Forest	Forest
Sub-dominant	Residential	Residential

	Amount	Mean Height
Mass Failures	None	0.00
Gullies	None	0.00

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps	None
4.2 Adjacent Wetlands	None
4.3 Flow Status	Low
4.4 # of Debris Jams	0
4.5 Impoundments	Large
Impoundmt. Location	Upstream
4.6 # of Stormwater Inputs	1
4.7 Upstream Flow	Store-release
4.9 # of Beaver Dams	0
Affected Length (ft)	0

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
0	6	2

Diagonal	Delta	Island
1	0	0

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
3	0	1	0

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
0	0	No

5.4 Stream Ford or Animal **No**
5.5 Straightening **Yes**
Straightening Length: **766**
5.5 Dredging **None**

Note:
Step 1.6 - Grade Controls and
Step 4.8 - Channel Constrictions
are on The second page of this
report - Steps 6 through 7.

1.6 Grade Controls **None**

Type	Location	Total	Total Height Above Water	Photo Taken	GPSTaken

4.8 Channel Constrictions

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?
Bridge	**54.0**	**Yes**	**Yes**	**No**	**Yes**
Problem	**None**				
Other	**90.0**	**Yes**	**Yes**	**Yes**	**Yes**
Problem	**Scour Above,Scour Below,Alignment**				

Narrative:
Degradation

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Unconfined**

	Score	STD	Historic
7.1 Channel Degradation	**5**	**C to B**	**Yes**
7.2 Channel Aggradation	**13**	**None**	**Yes**
7.3 Widening Channel	**11**		
7.4 Change in Planform	**12**		
Total Score	**41**		
Geomorphic Rating	**0.5125**		

Channel Evolution Model	**F**
Channel Evolution Stage	**II**
Geomorphic Condition	**Fair**
Stream Sensitivity	**Very High**

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type **High**

	Score
6.1 Epifaunal Substrate - Available Cover	**10**
6.2 Embeddedness	**13**
6.3 Velocity/Depth Patterns	**11**
6.4 Sediment Deposition	**16**
6.5 Channel Flow Status	**15**
6.6 Channel Alteration	**6**
6.7 Frequency of Riffles/Steps	**16**
6.8 Bank Stability	**Left: 6 Right: 8**
6.9 Bank Vegetation Protection	**Left: 8 Right: 5**
6.10 Riparian Vegetation Zone Width	**Left: 5 Right: 6**
Total Score	**125**
Habitat Rating	**0.625**

Habitat Stream Condition **Fair**

Project: **Otter Creek - East Creek Trib**
Stream: **East Creek**
Organization: **Johnson Company**
Segment Length (ft): **10,364**

Phase 2 Segment Summary

Reach # **M10**
Observers: **Noelia Báez Rodríguez**
Segment Location: **Chittenden**

March 9, 2007 **FIT: Yes**
Segment: **0** Completion Date: **October 2, 2006**
Why Not assessed: Rain: **No**

Step 1. Valley and Floodplain

1.1 Segmentation **None**
1.2 Alluvial Fan **No**
1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	**809**	**0**
Roads	**9,868**	**9,868**
Railroads	**0**	**0**
Improved Paths	**0**	**0**
Development	**3,649**	**0**

1.4 Adjacent Side	Left	Right
Hillside Slope	**Very Steep**	**Extremely**
Continuous w/	**Sometimes**	**Sometimes**
W/in 1 Bankfill	**Sometimes**	**Sometimes**
Texture	**Not Evalua**	**Not Evalua**

1.5 Valley Features
Valley Width (ft): **366**
Width Determination: **Estimated**
Confinement Type: **Very Broad**
Rock Gorge? **No**
Human-caused changed valley width? **No**

Notes:

Approximately 4800ft of the stream was not cover during the field work. The assessment was not complete due to land owner access. The Rapid Habitat Assessment or Rapid Geomorphic Assessment and a cross section was not complete.

Step 2. Stream Channel

2.1 Bankfull Width: **18**
2.2 Max Depth (ft): **0.00**
2.3 Mean Depth (ft): **0.00**
2.4 Floodprone Width (ft): **0**
2.5 Aband. Floodpln: **0.00**
2.6 Width/Depth Ratio: **0.00**
2.7 Entrenchment Ratio: **0.00**
2.8 Incision Ratio: **0.00**
2.9 Sinuosity: **Low**
2.10 Riffles Type: **Not Applicable**
2.11 Riffle/Step Spacing (ft): **0**

2.12 Substrate Composition

Silt/Clay Present?
Detritus **0** %
Large Woody **0**

2.13 Average Largest Particle on
Bed **0.0**
Bar **0.0**

Not Evaluated

2.14 Stream Type
Stream Type:
Bed Material:
Subclass Slope:
Bed Form:

2.15 Reference Stream Type
(if different from Phase 1)

Step 3. Riparian Features

3.1 Stream Banks
Typical Bank Slope **Steep**

Bank Texture	Left	Right
Upper		
Material Type	**Gravel**	**Gravel**
Consistency	**Non-cohesive**	**Non-cohesive**
Lower		
Material Type	**Boulder/Cobbl**	**Boulder/Cobbl**
Consistency	**Non-cohesive**	**Non-cohesive**

Bank Erosion	Left	Right
Erosion Length (ft)	**21**	**0**
Erosion Height (ft)	**5.00**	**0.00**
Revetmt. Type	**None**	**Rip-Rap**
Revetmt. Length (ft)	**0**	**1,271**

Near Bank Veg. Type	Left	Right
Dominant	**Deciduous**	**Deciduous**
Sub-dominant	**Coniferous**	**Coniferous**

Bank Canopy	Left	Right
Canopy %	**51-75**	**76-100**
Mid-Channel Canopy		**Open**

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**26-50**	**>100**
Sub-dominant	**5-25**	**51-100**

Buffer Veg. Type	Left	Right
Dominant	**Deciduous**	**Deciduous**
Sub-dominant	**Mixed Trees**	**Mixed Trees**

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	**Residential**	**Forest**
Sub-dominant		**Forest Shrubs/Saplin**

	Amount	Mean Height
Mass Failures	**None**	**0.00**
Gullies	**None**	**0.00**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps: **Abundant**
4.2 Adjacent Wetlands: **Some**
4.3 Flow Status: **Moderate**
4.4 # of Debris Jams: **2**
4.5 Impoundments: **Large**
Impoundmt. Location: **Upstream**
4.6 # of Stormwater Inputs: **3**
4.7 Upstream Flow: **Store-release**
4.9 # of Beaver Dams: **0**
Affected Length (ft): **0**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
1	**4**	**4**

Diagonal	Delta	Island
0	**0**	**1**

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
2	**0**	**1**	**0**

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
0	**0**	**No**

5.4 Stream Ford or Animal: **No**
5.5 Straightening: **Yes**
Straightening Length: **2,893**
5.5 Dredging: **None**

Note:
Step 1.6 - Grade Controls and Step 4.8 - Channel Constrictions are on The second page of this report - Steps 6 through 7.

1.6 Grade Controls

Type	Location	Total	Total Height Above Water	Photo Taken	GPSTaken
Dam	**Mid-Segment**	**3.00**	**3.00**		

4.8 Channel Constrictions

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?
Instream	**12.0**	**Yes**	**Yes**	**Yes**	**No**
Problem	**Scour Above**				
Instream	**8.00**	**Yes**	**Yes**	**Yes**	**Yes**
Problem	**Deposition Above,Scour Above**				
Instream	**8.00**	**Yes**	**Yes**	**Yes**	**No**
Problem	**None**				
Instream	**10.0**	**Yes**	**Yes**	**Yes**	**No**
Problem	**None**				
Instream	**11.0**	**Yes**	**Yes**	**Yes**	**No**
Problem	**None**				

Narrative:
Minor degradation process acting based on observations.

Step 7. Rapid Geomorphic Assessment Data

Confinement Type

Channel Evolution Model
Channel Evolution Stage
Geomorphic Condition
Stream Sensitivity

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type

Habitat Stream Condition

Stream Geomorphic Assessment

VT DEC

Bridge Summary Report

General Information

VTrans Structure ID	vtrans-700001001211043	**Local Structure ID**	---
Assessment Date	09/25/2006	**Observers**	Noelia Báez Rodríguez
Town	Chittenden		
Location	Drive way 133, intersect with Dam Rd		
Latitude	43.71	**Longitude**	-72.92
Road Name	---	**Road Type**	---
Stream Name	East Creek		
Channel width	24 ft. (Measured)	**High flow stage**	No

Bridge/Arch Information

Material	Timber	**Number of bridge piers/arches**	1
Bridge Width	10 ft.	**Skewed to roadway?**	Yes
Bridge Clearance	7 ft.		
Bridge/Arch Span	36 ft.		

Geomorphic Information

Floodplain filled by roadway approaches	Not Significant
Structure is located at significant break in valley slope	No
Obstructions at the opening of the structure	---
Steep riffle present immediately upstream of structure	No
If channel avulses, stream will	Follow Road
Estimated distance avulsion would follow road	120 ft.
Angle of stream flow approaching structure	Sharp Bend
Pool present immediately downstream of structure	No
Downstream bank heights are substantially higher than upstream bank heights	No
Stepped footers	No

More Geomorphic Information

	Upstream	Downstream	In Structure
Dominant Bed Material	Boulder	Boulder	Cobble
Bedrock Present	No	No	No
Type of Sediment Deposits	---	---	---
Elevation of sediment deposits greater than 1/2 bankfull	No	No	No
Bank Erosion	Low	None	
Hard Bank Armoring	None	Intact	
Stream bed scour causing undermining around or under structure	---	---	
Beaver Dam near Structure	No	No	
Beaver Dam distance (ft.)	---	---	

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Deciduous Forest	Deciduous Forest	
Dominant Vegetation Type - Right	Deciduous Forest	Deciduous Forest	
Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?			
Vegetation Band - Left	Yes	Yes	
Vegetation Band - Right	Yes	Yes	

Wildlife

	Roadkill	Outside Structure	Inside Structure
Species	---	---	---

Other Information			
Spatial location data collected with GPS?	Yes	**Photos taken?**	Yes
Comments	---		

Stream Geomorphic Assessment

VT DEC

Culvert Summary Report

General Information

VTrans Structure ID	vtrans-700001001311043	**Local Structure ID**	---
Assessment Date	09/25/2006	**Observers**	Noelia Báez Rodríguez
Town	Chittenden		
Location	Dirt road that intersect with Route 2, where acueduct run over East Creek.		
Latitude	43.72	**Longitude**	-72.92
Road Name	---	**Road Type**	Gravel
Stream Name	East Creek		
Channel width	15 ft. (Measured)	**High flow stage**	No

Culvert Information

Material	Steel Corrugated	**Number of culverts**	1
Culvert Length	12 ft.	**Skewed to roadway?**	No
Culvert Height	68 inches (5.7 ft.)	**Culvert Overflow Pipe**	No
Culvert Width	96 inches (8.0 ft.)		

Geomorphic Information

Floodplain filled by roadway approaches	Partially
Structure is located at significant break in valley slope	Yes
Obstructions at the opening of the structure	---
Culvert slope as compared with channel slope is significantly	Same
Steep riffle present immediately upstream of structure	No
If channel avulses, stream will	Cross Road
Estimated distance avulsion would follow road	--- ft.
Angle of stream flow approaching structure	Sharp Bend
Culvert outlet invert	At Grade
Outlet drop (invert to water surface)	--- ft.
Water depth in culvert (at outlet)	--- ft.
Pool present immediately downstream of structure	Yes
Downstream bank heights are substantially higher than upstream bank heights	No

More Geomorphic Information

	Upstream	Downstream	In Structure
Dominant Bed Material	Gravel	Cobble	None
Bedrock Present	No	No	
Material Present throughout			No
Type of Sediment Deposits	---	---	---
Elevation of sediment deposits greater than 1/2 bankfull	No	No	No
Bank Erosion	Low	None	
Hard Bank Armoring	Intact	Intact	
Stream bed scour causing undermining around or under structure	---	---	
Beaver Dam near Structure	No	No	
Beaver Dam distance (ft.)	---	---	

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Shrub/Sapling	Herbaceous/Grass	
Dominant Vegetation Type - Right	Shrub/Sapling	Shrub/Sapling	
Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?			
Vegetation Band - Left	No	No	
Vegetation Band - Right	No	No	

Wildlife

	Roadkill	Outside Structure	Inside Structure
Species	---	---	---

Other Information

Spatial location data collected with GPS?	Yes	**Photos taken?**	Yes
Comments	---		

Stream Geomorphic Assessment

VT DEC

Culvert Summary Report

General Information

VTrans Structure ID	vtrans-700001001411043	**Local Structure ID**	---
Assessment Date	09/25/2006	**Observers**	Noelia Báez Rodríguez
Town	Chittenden		
Location	O'Neil drive way 193, intersect Dam Road		
Latitude	43.72	**Longitude**	-72.92
Road Name	---	**Road Type**	Gravel
Stream Name	East Creek		
Channel width	15 ft. (Measured)	**High flow stage**	No

Culvert Information

Material	Aluminum Corrugated	**Number of culverts**	1
Culvert Length	21 ft.	**Skewed to roadway?**	No
Culvert Height	48 inches (4.0 ft.)	**Culvert Overflow Pipe**	No
Culvert Width	96 inches (8.0 ft.)		

Geomorphic Information

Floodplain filled by roadway approaches	Partially
Structure is located at significant break in valley slope	No
Obstructions at the opening of the structure	---
Culvert slope as compared with channel slope is significantly	Same
Steep riffle present immediately upstream of structure	No
If channel avulses, stream will	Cross Road
Estimated distance avulsion would follow road	--- ft.
Angle of stream flow approaching structure	Mild Bend
Culvert outlet invert	At Grade
Outlet drop (invert to water surface)	--- ft.
Water depth in culvert (at outlet)	--- ft.
Pool present immediately downstream of structure	No
Downstream bank heights are substantially higher than upstream bank heights	No

More Geomorphic Information

	Upstream	Downstream	In Structure
Dominant Bed Material	Cobble	Cobble	None
Bedrock Present	---	---	
Material Present throughout			---
Type of Sediment Deposits	---	---	---
Elevation of sediment deposits greater than 1/2 bankfull	No	No	No
Bank Erosion	None	None	
Hard Bank Armoring	Intact	Intact	
Stream bed scour causing undermining around or under structure	---	---	
Beaver Dam near Structure	No	No	
Beaver Dam distance (ft.)	---	---	

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Shrub/Sapling	Shrub/Sapling	
Dominant Vegetation Type - Right	Shrub/Sapling	Shrub/Sapling	
Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?			
Vegetation Band - Left	No	No	
Vegetation Band - Right	No	No	

Wildlife

	Roadkill	Outside Structure	Inside Structure
Species	---	---	---

Other Information

Spatial location data collected with GPS?	Yes	**Photos taken?**	Yes
Comments	---		

Stream Geomorphic Assessment

VT DEC

Culvert Summary Report

General Information

VTrans Structure ID	vtrans-700001003211043	**Local Structure ID**	---
Assessment Date	09/25/2006	**Observers**	Noelia Báez Rodríguez
Town	Chittenden		
Location	Drive way 125, intersect Dam Rd		
Latitude	43.71	**Longitude**	-72.93
Road Name	---	**Road Type**	Gravel
Stream Name	East Creek		
Channel width	13 ft. (Measured)	**High flow stage**	No

Culvert Information

Material	Aluminum Corrugated	**Number of culverts**	2
Culvert Length	15 ft.	**Skewed to roadway?**	No
Culvert Height	62 inches (5.2 ft.)	**Culvert Overflow Pipe**	No
Culvert Width	60 inches (5.0 ft.)		

Geomorphic Information

Floodplain filled by roadway approaches	Entirely
Structure is located at significant break in valley slope	No
Obstructions at the opening of the structure	---
Culvert slope as compared with channel slope is significantly	Lower
Steep riffle present immediately upstream of structure	Yes
If channel avulses, stream will	Cross Road
Estimated distance avulsion would follow road	--- ft.
Angle of stream flow approaching structure	Mild Bend
Culvert outlet invert	At Grade
Outlet drop (invert to water surface)	--- ft.
Water depth in culvert (at outlet)	--- ft.
Pool present immediately downstream of structure	Yes
Downstream bank heights are substantially higher than upstream bank heights	Yes

More Geomorphic Information

	Upstream	Downstream	In Structure
Dominant Bed Material	Cobble	Boulder	None
Bedrock Present	No	No	
Material Present throughout			No
Type of Sediment Deposits	---	---	---
Elevation of sediment deposits greater than 1/2 bankfull	No	No	No
Bank Erosion	None	None	
Hard Bank Armoring	Intact	Intact	
Stream bed scour causing undermining around or under structure	---	---	
Beaver Dam near Structure	No	No	
Beaver Dam distance (ft.)	---	---	

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Coniferous Forest	Deciduous Forest	
Dominant Vegetation Type - Right	Shrub/Sapling	Deciduous Forest	
Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?			
Vegetation Band - Left	No	Yes	
Vegetation Band - Right	No	Yes	

Wildlife

	Roadkill	Outside Structure	Inside Structure
Species	---	---	---

Other Information

Spatial location data collected with GPS?	Yes	**Photos taken?**	Yes
Comments	---		

Stream Geomorphic Assessment

VT DEC

Culvert Summary Report

General Information

VTrans Structure ID	vtrans-700001003911043	**Local Structure ID**	---
Assessment Date	10/02/2006	**Observers**	Noelia Báez Rodríguez
Town	Chittenden		
Location	Drive way to Fox Creek Inn, intersect with Dam Rd.		
Latitude	43.71	**Longitude**	-72.94
Road Name	---	**Road Type**	Gravel
Stream Name	East Creek		
Channel width	21 ft. (Measured)	**High flow stage**	No

Culvert Information

Material	Aluminum Corrugated	**Number of culverts**	2
Culvert Length	30 ft.	**Skewed to roadway?**	No
Culvert Height	72 inches (6.0 ft.)	**Culvert Overflow Pipe**	No
Culvert Width	66 inches (5.5 ft.)		

Geomorphic Information

Floodplain filled by roadway approaches	Partially
Structure is located at significant break in valley slope	No
Obstructions at the opening of the structure	---
Culvert slope as compared with channel slope is significantly	Higher
Steep riffle present immediately upstream of structure	No
If channel avulses, stream will	Cross Road
Estimated distance avulsion would follow road	--- ft.
Angle of stream flow approaching structure	Channelized Straight
Culvert outlet invert	Free Fall
Outlet drop (invert to water surface)	0.8 ft.
Water depth in culvert (at outlet)	2.0 ft.
Pool present immediately downstream of structure	Yes
Downstream bank heights are substantially higher than upstream bank heights	No

More Geomorphic Information

	Upstream	Downstream	In Structure
Dominant Bed Material	Cobble	Cobble	None
Bedrock Present	No	No	
Material Present throughout			No
Type of Sediment Deposits	---	---	---
Elevation of sediment deposits greater than 1/2 bankfull	No	No	No
Bank Erosion	None	None	
Hard Bank Armoring	Intact	Intact	
Stream bed scour causing undermining around or under structure	---	---	
Beaver Dam near Structure	No	No	
Beaver Dam distance (ft.)	---	---	

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Deciduous Forest	Shrub/Sapling	
Dominant Vegetation Type - Right	Shrub/Sapling	Deciduous Forest	
Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?			
Vegetation Band - Left	Yes	No	
Vegetation Band - Right	No	Yes	

Wildlife

	Roadkill	Outside Structure	Inside Structure
Species	---	---	---

Other Information

Spatial location data collected with GPS?	Yes	**Photos taken?**	Yes
Comments	---		

Stream Geomorphic Assessment

VT DEC

Bridge Summary Report

General Information

VTrans Structure ID	vtrans-700002005511043	**Local Structure ID**	---
Assessment Date	09/28/2006	**Observers**	Noelia Báez Rodríguez
Town	Chittenden		
Location	Drive way, intersect with Dam Rd.		
Latitude	43.69	**Longitude**	-72.96
Road Name	---	**Road Type**	Gravel
Stream Name	East Creek		
Channel width	21 ft. (Measured)	**High flow stage**	No

Bridge/Arch Information

Material	Timber	**Number of bridge piers/arches**	0
Bridge Width	12 ft.	**Skewed to roadway?**	No
Bridge Clearance	5 ft.		
Bridge/Arch Span	13 ft.		

Geomorphic Information

Floodplain filled by roadway approaches	Entirely
Structure is located at significant break in valley slope	No
Obstructions at the opening of the structure	---
Steep riffle present immediately upstream of structure	No
If channel avulses, stream will	Follow Road
Estimated distance avulsion would follow road	300 ft.
Angle of stream flow approaching structure	Naturally Straight
Pool present immediately downstream of structure	Yes
Downstream bank heights are substantially higher than upstream bank heights	No
Stepped footers	No

More Geomorphic Information

	Upstream	Downstream	In Structure
Dominant Bed Material	Cobble	Cobble	Gravel
Bedrock Present	No	No	No
Type of Sediment Deposits	---	---	---
Elevation of sediment deposits greater than 1/2 bankfull	No	No	No
Bank Erosion	None	None	
Hard Bank Armoring	Failing	Intact	
Stream bed scour causing undermining around or under structure	---	---	
Beaver Dam near Structure	No	No	
Beaver Dam distance (ft.)	---	---	

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Shrub/Sapling	Herbaceous/Grass	
Dominant Vegetation Type - Right	Shrub/Sapling	Herbaceous/Grass	
Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?			
Vegetation Band - Left	No	Yes	
Vegetation Band - Right	No	Yes	

Wildlife

	Roadkill	Outside Structure	Inside Structure
Species	---	---	---

Other Information			
Spatial location data collected with GPS?	Yes	**Photos taken?**	Yes
Comments	---		

Stream Geomorphic Assessment

VT DEC

Culvert Summary Report

General Information

VTrans Structure ID	vtrans-700001001111043	**Local Structure ID**	---
Assessment Date	09/25/2006	**Observers**	Noelia Báez Rodríguez
Town	Chittenden		
Location	Chittenden Reservoir at Dam Rd		
Latitude	43.72	**Longitude**	-72.92
Road Name	DAM RD	**Road Type**	Paved
Stream Name	East Creek		
Channel width	20 ft. (Measured)	**High flow stage**	No

Culvert Information

Material	Aluminum Corrugated	**Number of culverts**	1
Culvert Length	100 ft.	**Skewed to roadway?**	No
Culvert Height	144 inches (12.0 ft.)	**Culvert Overflow Pipe**	No
Culvert Width	144 inches (12.0 ft.)		

Geomorphic Information

Floodplain filled by roadway approaches	Entirely
Structure is located at significant break in valley slope	No
Obstructions at the opening of the structure	---
Culvert slope as compared with channel slope is significantly	Lower
Steep riffle present immediately upstream of structure	No
If channel avulses, stream will	Cross Road
Estimated distance avulsion would follow road	--- ft.
Angle of stream flow approaching structure	Channelized Straight
Culvert outlet invert	At Grade
Outlet drop (invert to water surface)	0.5 ft.
Water depth in culvert (at outlet)	0.8 ft.
Pool present immediately downstream of structure	No
Downstream bank heights are substantially higher than upstream bank heights	No

More Geomorphic Information

	Upstream	Downstream	In Structure
Dominant Bed Material	Unknown	Gravel	None
Bedrock Present	No	No	
Material Present throughout			No
Type of Sediment Deposits	---	---	---
Elevation of sediment deposits greater than 1/2 bankfull	No	No	No
Bank Erosion	None	None	
Hard Bank Armoring	None	None	
Stream bed scour causing undermining around or under structure	---	---	
Beaver Dam near Structure	No	No	
Beaver Dam distance (ft.)	---	---	

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Herbaceous/Grass	Shrub/Sapling	
Dominant Vegetation Type - Right	Herbaceous/Grass	Shrub/Sapling	
Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?			
Vegetation Band - Left	No	No	
Vegetation Band - Right	No	No	

Wildlife

	Roadkill	Outside Structure	Inside Structure
Species	---	---	---

Other Information

Spatial location data collected with GPS?	Yes	**Photos taken?**	Yes
Comments	Low flow coming from the outlet of the dam. Wetland complex at the base of the outlet.		

Stream Geomorphic Assessment

VT DEC

Bridge Summary Report

General Information

VTrans Structure ID	vtrans-700001004411043	**Local Structure ID**	---
Assessment Date	09/20/2006	**Observers**	Noelia Báez Rodríguez
Town	Chittenden		
Location	Intersection between Haiden Rd and Dam Rd		
Latitude	43.71	**Longitude**	-72.95
Road Name	HOLDEN RD	**Road Type**	Paved
Stream Name	East Creek		
Channel width	18 ft. (Measured)	**High flow stage**	No

Bridge/Arch Information

Material	Concrete	**Number of bridge piers/arches**	0
Bridge Width	30 ft.	**Skewed to roadway?**	No
Bridge Clearance	10 ft.		
Bridge/Arch Span	54 ft.		

Geomorphic Information

Floodplain filled by roadway approaches	Partially
Structure is located at significant break in valley slope	No
Obstructions at the opening of the structure	---
Steep riffle present immediately upstream of structure	No
If channel avulses, stream will	Cross Road
Estimated distance avulsion would follow road	--- ft.
Angle of stream flow approaching structure	Channelized Straight
Pool present immediately downstream of structure	No
Downstream bank heights are substantially higher than upstream bank heights	No
Stepped footers	Yes

More Geomorphic Information

	Upstream	Downstream	In Structure
Dominant Bed Material	Boulder	Cobble	Cobble
Bedrock Present	No	No	No
Type of Sediment Deposits	---	---	---
Elevation of sediment deposits greater than 1/2 bankfull	No	No	No
Bank Erosion	None	None	
Hard Bank Armoring	Intact	Intact	
Stream bed scour causing undermining around or under structure	---	---	
Beaver Dam near Structure	No	No	
Beaver Dam distance (ft.)	---	---	

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Shrub/Sapling	Shrub/Sapling	
Dominant Vegetation Type - Right	Shrub/Sapling	Shrub/Sapling	
Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?			
Vegetation Band - Left	No	No	
Vegetation Band - Right	No	No	

Wildlife

	Roadkill	Outside Structure	Inside Structure
Species	---	---	---

Other Information			
Spatial location data collected with GPS?	Yes	**Photos taken?**	Yes
Comments	---		

Stream Geomorphic Assessment

VT DEC

Bridge Summary Report

General Information

VTrans Structure ID	vtrans-700002005411043	**Local Structure ID**	---
Assessment Date	09/25/2006	**Observers**	Noelia Báez Rodriguez
Town	Chittenden		
Location	Power House Rd		
Latitude	43.70	**Longitude**	-72.96
Road Name	POWERHOUSE RD	**Road Type**	Paved
Stream Name	East Creek		
Channel width	24 ft. (Measured)	**High flow stage**	No

Bridge/Arch Information

Material	Concrete	**Number of bridge piers/arches**	0
Bridge Width	44 ft.	**Skewed to roadway?**	No
Bridge Clearance	4 ft.		
Bridge/Arch Span	12 ft.		

Geomorphic Information

Floodplain filled by roadway approaches	Partially
Structure is located at significant break in valley slope	Unsure
Obstructions at the opening of the structure	---
Steep riffle present immediately upstream of structure	Yes
If channel avulses, stream will	Cross Road
Estimated distance avulsion would follow road	--- ft.
Angle of stream flow approaching structure	Sharp Bend
Pool present immediately downstream of structure	Yes
Downstream bank heights are substantially higher than upstream bank heights	No
Stepped footers	No

More Geomorphic Information

	Upstream	Downstream	In Structure
Dominant Bed Material	Gravel	Gravel	Sand
Bedrock Present	Yes	No	No
Type of Sediment Deposits	---	---	---
Elevation of sediment deposits greater than 1/2 bankfull	No	No	No
Bank Erosion	None	None	
Hard Bank Armoring	Intact	Intact	
Stream bed scour causing undermining around or under structure	---	---	
Beaver Dam near Structure	No	No	
Beaver Dam distance (ft.)	---	---	

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Shrub/Sapling	Herbaceous/Grass	
Dominant Vegetation Type - Right	Herbaceous/Grass	Herbaceous/Grass	
Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?			
Vegetation Band - Left	No	No	
Vegetation Band - Right	No	No	

Wildlife

	Roadkill	Outside Structure	Inside Structure
Species	---	---	---

Other Information			
Spatial location data collected with GPS?	Yes	**Photos taken?**	Yes
Comments	---		

Stream Geomorphic Assessment

VT DEC

Culvert Summary Report

General Information

VTrans Structure ID	vtrans-700001002911043	**Local Structure ID**	---
Assessment Date	09/28/2006	**Observers**	Noelia Báez Rodríguez
Town	Chittenden		
Location	Sangamon Road		
Latitude	43.69	**Longitude**	-72.96
Road Name	SANGAMON RD	**Road Type**	Paved
Stream Name	East Creek		
Channel width	18 ft. (Measured)	**High flow stage**	No

Culvert Information

Material	Aluminum Corrugated	**Number of culverts**	2
Culvert Length	42 ft.	**Skewed to roadway?**	No
Culvert Height	72 inches (6.0 ft.)	**Culvert Overflow Pipe**	No
Culvert Width	74 inches (6.2 ft.)		

Geomorphic Information

Floodplain filled by roadway approaches	Partially
Structure is located at significant break in valley slope	No
Obstructions at the opening of the structure	---
Culvert slope as compared with channel slope is significantly	Same
Steep riffle present immediately upstream of structure	No
If channel avulses, stream will	Follow Road
Estimated distance avulsion would follow road	210 ft.
Angle of stream flow approaching structure	Naturally Straight
Culvert outlet invert	At Grade
Outlet drop (invert to water surface)	--- ft.
Water depth in culvert (at outlet)	--- ft.
Pool present immediately downstream of structure	Yes
Downstream bank heights are substantially higher than upstream bank heights	No

More Geomorphic Information

	Upstream	Downstream	In Structure
Dominant Bed Material	Gravel	Cobble	None
Bedrock Present	No	No	
Material Present throughout			---
Type of Sediment Deposits	---	---	---
Elevation of sediment deposits greater than 1/2 bankfull	No	No	No
Bank Erosion	None	Low	
Hard Bank Armoring	Intact	Intact	
Stream bed scour causing undermining around or under structure	---	---	
Beaver Dam near Structure	No	No	
Beaver Dam distance (ft.)	---	---	

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Shrub/Sapling	Herbaceous/Grass	
Dominant Vegetation Type - Right	Deciduous Forest	Shrub/Sapling	
Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?			
Vegetation Band - Left	No	No	
Vegetation Band - Right	Yes	No	

Wildlife

	Roadkill	Outside Structure	Inside Structure
Species	---	---	---

Other Information

Spatial location data collected with GPS?	Yes	**Photos taken?**	Yes
Comments	---		

Stream Geomorphic Assessment

VT DEC

Bridge Summary Report

General Information

VTrans Structure ID	vtrans-700026024511043	**Local Structure ID**	---
Assessment Date	09/18/2006	**Observers**	Noelia Báez Rodríguez
Town	Rutland Town		
Location	E. Pittsford road		
Latitude	43.67	**Longitude**	-72.94
Road Name	E PITTSFORD RD	**Road Type**	Paved
Stream Name	East Creek		
Channel width	24 ft. (Measured)	**High flow stage**	No

Bridge/Arch Information

Material	Concrete	**Number of bridge piers/arches**	0
Bridge Width	70 ft.	**Skewed to roadway?**	No
Bridge Clearance	15 ft.		
Bridge/Arch Span	24 ft.		

Geomorphic Information

Floodplain filled by roadway approaches	Entirely
Structure is located at significant break in valley slope	No
Obstructions at the opening of the structure	---
Steep riffle present immediately upstream of structure	No
If channel avulses, stream will	Cross Road
Estimated distance avulsion would follow road	--- ft.
Angle of stream flow approaching structure	Mild Bend
Pool present immediately downstream of structure	Yes
Downstream bank heights are substantially higher than upstream bank heights	No
Stepped footers	Yes

More Geomorphic Information

	Upstream	Downstream	In Structure
Dominant Bed Material	Cobble	Cobble	Unknown
Bedrock Present	No	No	No
Type of Sediment Deposits	---	---	---
Elevation of sediment deposits greater than 1/2 bankfull	No	No	No
Bank Erosion	None	None	
Hard Bank Armoring	Intact	Intact	
Stream bed scour causing undermining around or under structure	---	---	
Beaver Dam near Structure	No	No	
Beaver Dam distance (ft.)	---	---	

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Deciduous Forest	Herbaceous/Grass	
Dominant Vegetation Type - Right	Deciduous Forest	Herbaceous/Grass	
Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?			
Vegetation Band - Left	Yes	Yes	
Vegetation Band - Right	Yes	Yes	

Wildlife

	Roadkill	Outside Structure	Inside Structure
Species	---	---	---

Other Information			
Spatial location data collected with GPS?	Yes	**Photos taken?**	Yes
Comments	---		

Stream Geomorphic Assessment

VT DEC

Bridge Summary Report

General Information

VTrans Structure ID	vtrans-700073046611203	**Local Structure ID**	---
Assessment Date	09/11/2006	**Observers**	Noelia Báez Rodríguez
Town	Rutland Town		
Location	E. Pittsford Road south of 1881 corn farm		
Latitude	43.65	**Longitude**	-72.97
Road Name	E PITTSFORD RD	**Road Type**	Paved
Stream Name	East Creek		
Channel width	70 ft. (Measured)	**High flow stage**	No

Bridge/Arch Information

Material	Concrete	**Number of bridge piers/arches**	0
Bridge Width	30 ft.	**Skewed to roadway?**	No
Bridge Clearance	10 ft.		
Bridge/Arch Span	126 ft.		

Geomorphic Information

Floodplain filled by roadway approaches	Not Significant
Structure is located at significant break in valley slope	No
Obstructions at the opening of the structure	---
Steep riffle present immediately upstream of structure	No
If channel avulses, stream will	Cross Road
Estimated distance avulsion would follow road	--- ft.
Angle of stream flow approaching structure	Naturally Straight
Pool present immediately downstream of structure	No
Downstream bank heights are substantially higher than upstream bank heights	No
Stepped footers	No

More Geomorphic Information

	Upstream	Downstream	In Structure
Dominant Bed Material	Cobble	Cobble	Cobble
Bedrock Present	No	No	No
Type of Sediment Deposits	---	---	---
Elevation of sediment deposits greater than 1/2 bankfull	Yes	No	No
Bank Erosion	None	Low	
Hard Bank Armoring	Intact	Intact	
Stream bed scour causing undermining around or under structure	---	---	
Beaver Dam near Structure	No	No	
Beaver Dam distance (ft.)	---	---	

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Herbaceous/Grass	Herbaceous/Grass	
Dominant Vegetation Type - Right	Herbaceous/Grass	Herbaceous/Grass	
Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?			
Vegetation Band - Left	No	No	
Vegetation Band - Right	No	No	

Wildlife

	Roadkill	Outside Structure	Inside Structure
Species	---	---	---

Other Information			
Spatial location data collected with GPS?	Yes	**Photos taken?**	Yes
Comments	---		

Stream Geomorphic Assessment

VT DEC

Bridge Summary Report

General Information

VTrans Structure ID	vtrans-700004006811203	**Local Structure ID**	---
Assessment Date	09/11/2006	**Observers**	Noelia Báez Rodríguez
Town	Rutland Town		
Location	Route 7		
Latitude	43.65	**Longitude**	-72.99
Road Name	Route 7	**Road Type**	Paved
Stream Name	East Creek		
Channel width	39 ft. (Measured)	**High flow stage**	No

Bridge/Arch Information

Material	Concrete	**Number of bridge piers/arches**	2
Bridge Width	40 ft.	**Skewed to roadway?**	No
Bridge Clearance	30 ft.		
Bridge/Arch Span	135 ft.		

Geomorphic Information

Floodplain filled by roadway approaches	Not Significant
Structure is located at significant break in valley slope	No
Obstructions at the opening of the structure	---
Steep riffle present immediately upstream of structure	No
If channel avulses, stream will	Cross Road
Estimated distance avulsion would follow road	--- ft.
Angle of stream flow approaching structure	Naturally Straight
Pool present immediately downstream of structure	Yes
Downstream bank heights are substantially higher than upstream bank heights	No
Stepped footers	No

More Geomorphic Information

	Upstream	Downstream	In Structure
Dominant Bed Material	Gravel	Gravel	Gravel
Bedrock Present	No	No	No
Type of Sediment Deposits	---	---	---
Elevation of sediment deposits greater than 1/2 bankfull	No	No	No
Bank Erosion	Low	Low	
Hard Bank Armoring	Intact	Intact	
Stream bed scour causing undermining around or under structure	---	---	
Beaver Dam near Structure	No	No	
Beaver Dam distance (ft.)	---	---	

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Shrub/Sapling	Herbaceous/Grass	
Dominant Vegetation Type - Right	Shrub/Sapling	Shrub/Sapling	
Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?			
Vegetation Band - Left	No	No	
Vegetation Band - Right	No	No	

Wildlife

	Roadkill	Outside Structure	Inside Structure
Species	---	---	---

Other Information			
Spatial location data collected with GPS?	Yes	**Photos taken?**	Yes
Comments	---		