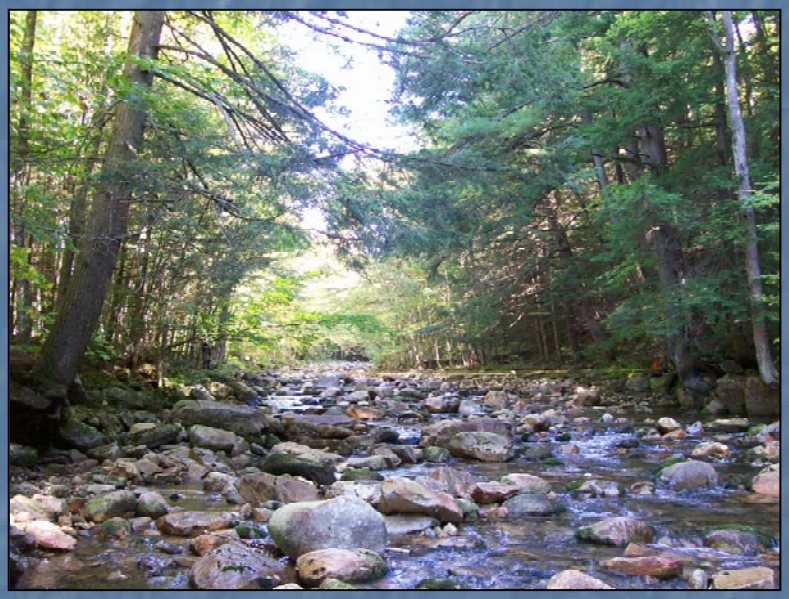
Phase 2
Stream Geomorphic Assessment of
City Stream and Bolles Brook
Woodford, VT



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Executive Summary

A Phase 2 Rapid Stream Assessment was conducted on City Stream and Bolles Brook in Woodford, VT, in September of 2007. Phase 2, the second of three phases of the Vermont Stream Geomorphic Assessment (SGA) protocols, is a detailed method for gathering scientifically sound information about a stream channel and its riparian corridor. Field observations and measurements conducted during the Phase 2 assessment help verify Phase 1 stream geomorphic data and provide more specific information about stream reaches of interest. The geomorphic and habitat assessments performed on City Stream and Bolles Brook provide a picture of the current condition of the streams, will help to identify erosion hazards and understand the changes that stream systems are undergoing, and can be used in watershed planning and protection efforts.

Bolles Brook and City Stream are part of the 156-square mile Walloomsac River drainage basin. Both are high-gradient streams originating from the Green Mountains in southern Vermont. City Stream originates from Woodford Lake (locally known as Big Pond) and flows along a mountaintop plateau before descending steeply from Woodford Mountain to meet Bolles Brook in Woodford Hollow. Bolles Brook originates in the Green Mountain National Forest, flowing through mostly forested, mountainous terrain followed by rural residential development before meeting up with City Stream in Woodford Hollow to form the Roaring Branch. The Roaring Branch flows through the towns of Woodford and Bennington and into the Walloomsac River.

The Phase 2 assessment was conducted on four of the seven reaches of City Stream and two of the three reaches of Bolles Brook, for a total of 5.13 river miles. The remaining reaches were not assessed because they were either impounded (S1.05 and S1.07), or high-gradient, A-type streams (S1.03 and T3.07). In general, Bolles Brook seems to be in slightly better geomorphic condition than City Stream. While all but two of the segments on City Stream have experienced a stream type departure, none of those on Bolles Brook have yet departed from their reference stream type. However, most of the segments on both City Stream and Bolles Brook were found to be in major adjustment (fair condition). Only the uppermost assessed reach of each stream—both braided systems—are in good condition. Most of City Stream—especially in the lower reaches—has lost some or all access to its floodplain through encroachment by Route 9, berms, and, to a lesser extent, development. Bolles Brook is also encroached by a road (Harbour Road), but it is a secondary gravel road and not considered to be the valley wall as Route 9 is for City Stream. The main issue for Bolles Brook is existing and new residential development, which has impacted the majority of the lower reach.

Habitat appears to be in slightly better condition on Bolles Brook as well, although it is suffering from the impact of development along the lower reach. City Stream also has fairly good habitat, but has more areas with sparsely vegetated road embankments and fragmented buffers.

Thirteen bridges and culverts on City Stream and Bolles Brook were assessed during Phase 2. Most of the structures were found to be in good condition with little potential to fail. About half of the structures act as a confinement to the stream or its ability to access its floodplains.

In addition to providing specific information about City Stream and Bolles Brook, the Phase 2 assessment of these two streams will enhance existing knowledge about the geomorphic condition of the entire Walloomsac River watershed. A Phase 2 SGA of the Walloomsac River and its tributary, Roaring Branch, in Bennington, VT was completed in 2006. Due to the active adjustment and erosion hazards observed in these streams, an expansion of scope upstream to include City Stream and Bolles Brook will help to develop a more effective and sustainable River Corridor Protection and Channel Management Plan.

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List of Acronyms and Abbreviations

ANR	Agency of Natural Resources
BCCD	Bennington County Conservation District
CEM	Channel Evolution Model
CR	Confinement Ratio
DEC	Department of Environmental Conservation
DMS	Data Management System
ER	Entrenchment Ratio
FEH	Fluvial Erosion Hazard
FIT	Feature Indexing Tool
ft	Feet
GIS	Geographic Information System
GPS	Global Positioning System
HEF	Human Elevated Floodplain
IR	Incision Ratio
mi	Miles
QA	Quality Assurance
Q_2	Two-year peak flow
RAF	Recently Abandoned Floodplain
RGA	Rapid Geomorphic Assessment
RHA	Rapid Habitat Assessment
RMP	River Management Program
SGAT	Stream Geomorphic Assessment Tool
USGS	United States Geological Survey
W/D	Width/Depth
WQD	Water Quality Division
QA	Quality Assurance

1.0 Project Background

A Phase 2 Rapid Stream Assessment was conducted on City Stream and Bolles Brook in Woodford, VT, in September of 2007. Phase 2, the second of three phases of the Vermont Stream Geomorphic Assessment (SGA) protocols, is a detailed method for gathering scientifically sound information about a stream channel and its riparian corridor. The geomorphic and habitat assessments performed on City Stream and Bolles Brook will provide a picture of the current condition of the streams, will help to identify erosion hazards and understand the changes that stream systems are undergoing, and can be used in watershed planning and protection efforts.

1.1 Goals and Objectives

The Phase 2 assessment was conducted to collect geomorphic and habitat data on selected reaches of City Stream and Bolles Brook.

The objectives of the Phase 2 assessment were to:

- Collect geomorphic and habitat data according to Vermont's rapid assessment protocols;
- Interpret the data to determine dominant channel processes, channel type, condition, and sensitivity;
- Identify where and how the river channels are responding to historic and ongoing human modifications; and
- Assess bridges and culverts in the study area and determine impact on the stream.

The products of a Phase 2 Rapid Stream Assessment for each assessed reach include (VT ANR, 2007):

- An existing stream type determination;
- A geomorphic condition evaluation that includes:
    - Reach condition,
    - Channel adjustment process, and
    - Reach sensitivity;
- A stream habitat assessment; and
- Field maps and photographs detailing the reach planform, typical condition, and assessed features.

1.2 Fluvial Geomorphic Setting

Bolles Brook and City Stream are part of the 156-square mile Walloomsac River drainage basin shown in Figure 1-1. Both are high-gradient streams originating from the Green Mountains in southern Vermont that converge in Woodford Hollow to form the Roaring Branch. Roaring Branch flows through the towns of Woodford and Bennington and into the Walloomsac River. The Walloomsac River flows generally northwest 16.4 miles to meet the Hoosic River in New York State.

City Stream originates from Woodford Lake, which is locally known as Big Pond. The stream flows along a mountaintop plateau before descending steeply from Woodford Mountain to meet Bolles Brook in Woodford Hollow. Bolles Brook originates in the Green Mountain National Forest, and flows steeply through forested terrain for most of its upper two reaches. In its lower reach its slope decreases and it flows through rural residential development before meeting up with City Stream in Woodford Hollow to form the Roaring Branch.

The assessment area is predominantly forested with some scattered residential areas. Beginning over 200 years ago, the watershed was cleared of its forests, which resulted in an increase in flooding, sediment loads, and erosion. In the 1930s, the Green Mountain National Forest was created, which allowed for more responsible forestry practices. After forests in the watershed were allowed to mature, the input of excess sediment and runoff to the stream system decreased.

Although City Stream and Bolles Brook flow through naturally unconfined valleys for the most part, roads, berms, development, and other encroachments built along these streams have reduced the amount of available floodplain, resulting in increased stream power. These changes in land use can have a direct bearing on the magnitude, duration, and timing of flow in the streams, and can significantly increase sediment loading as well. Often, anthropogenic influences such as increased urbanization, dam construction, culverts, bridges, etc. will impact the normal conveyance of flow and sediment in a river. These influences commonly throw the watershed inputs of flow and sediment out of balance, causing channel instability and uncontrolled down-cutting.

City Stream in particular is artificially confined along much of its length due to the encroachments of State Route 9 and several berms constructed along the lower reaches of the stream to protect the road and a few residential properties from flooding and erosion. City Stream appears to have been straightened in many areas to accommodate these encroachments. Such constraints have likely resulted in increased stream power and sediment transport. According to historical topographical maps of the area dated 1898, City Stream at that time was closely paralleled by the road that is now State Route 9, and Bolles Brook was encroached by both a rail grade and a secondary road. Over 100 years of anthropogenic confinement along these two streams has likely resulted in major stream adjustments throughout that time period.

1.3 Phase 2 Assessment Study Area

The Phase 1 assessment was conducted on seven reaches of City Stream and on three reaches of Bolles Brook (Figure 1-2). A sub-set of stream reaches were selected for the Phase 2 assessment. A total of four of the reaches assessed in Phase 1 were not assessed in Phase 2 for the following reasons:

- Reach M06T3.07 on Bolles Brook is a steep first-order stream that flows through the undeveloped Green Mountain Nation Forest;
- Reaches M06T3.05S1.07 and M06T3.05S1.05 on City Stream are artificially impounded areas, known as Woodford Lake and Bugbee Mill Pond, respectively; and
- Reach M06T3.05S1.03 on City Stream is very steep (>6%), and is narrowly confined by both State Route 9 on the river right side and the natural valley wall on the river left side.

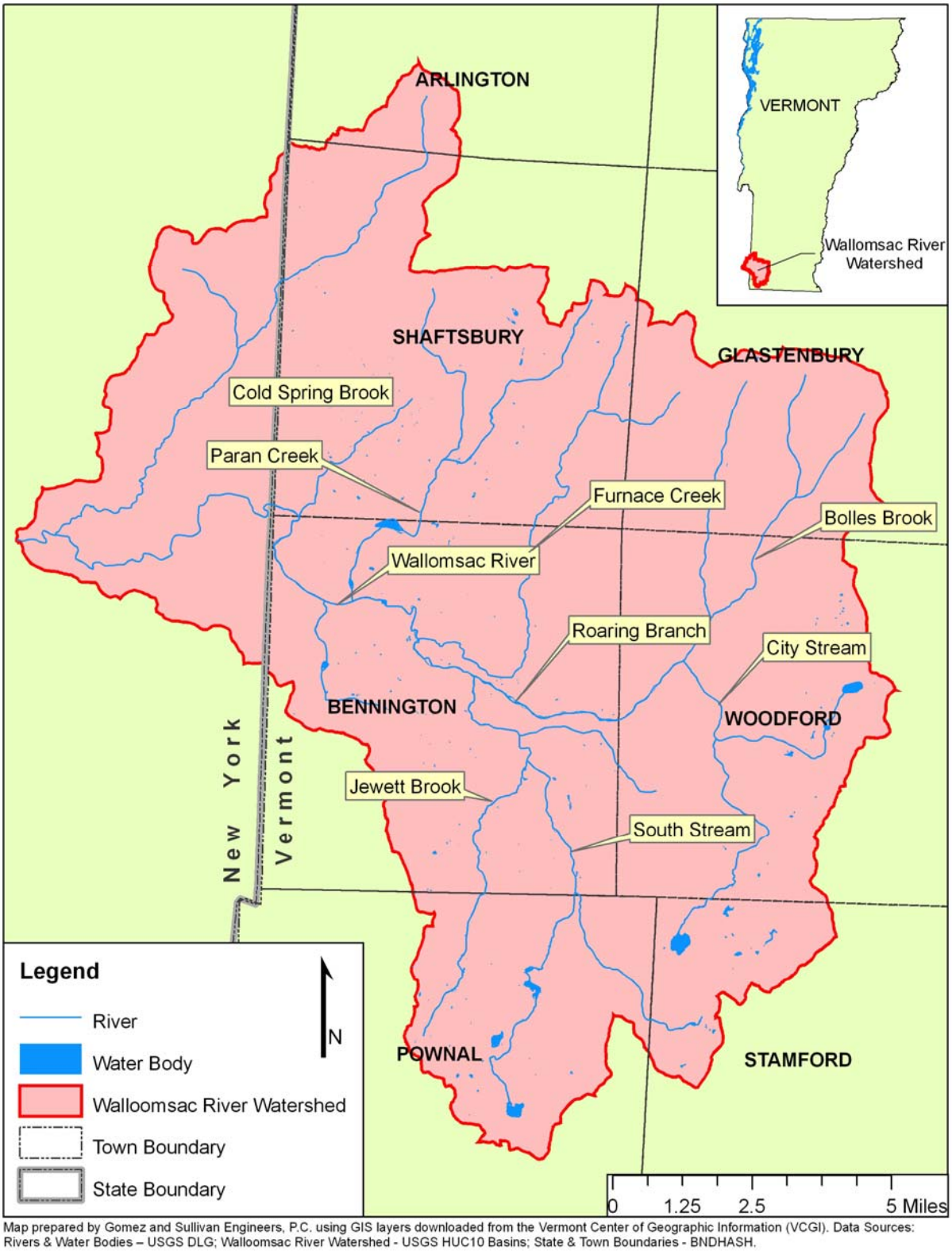


Figure 1-1: Walloomsac River Watershed.

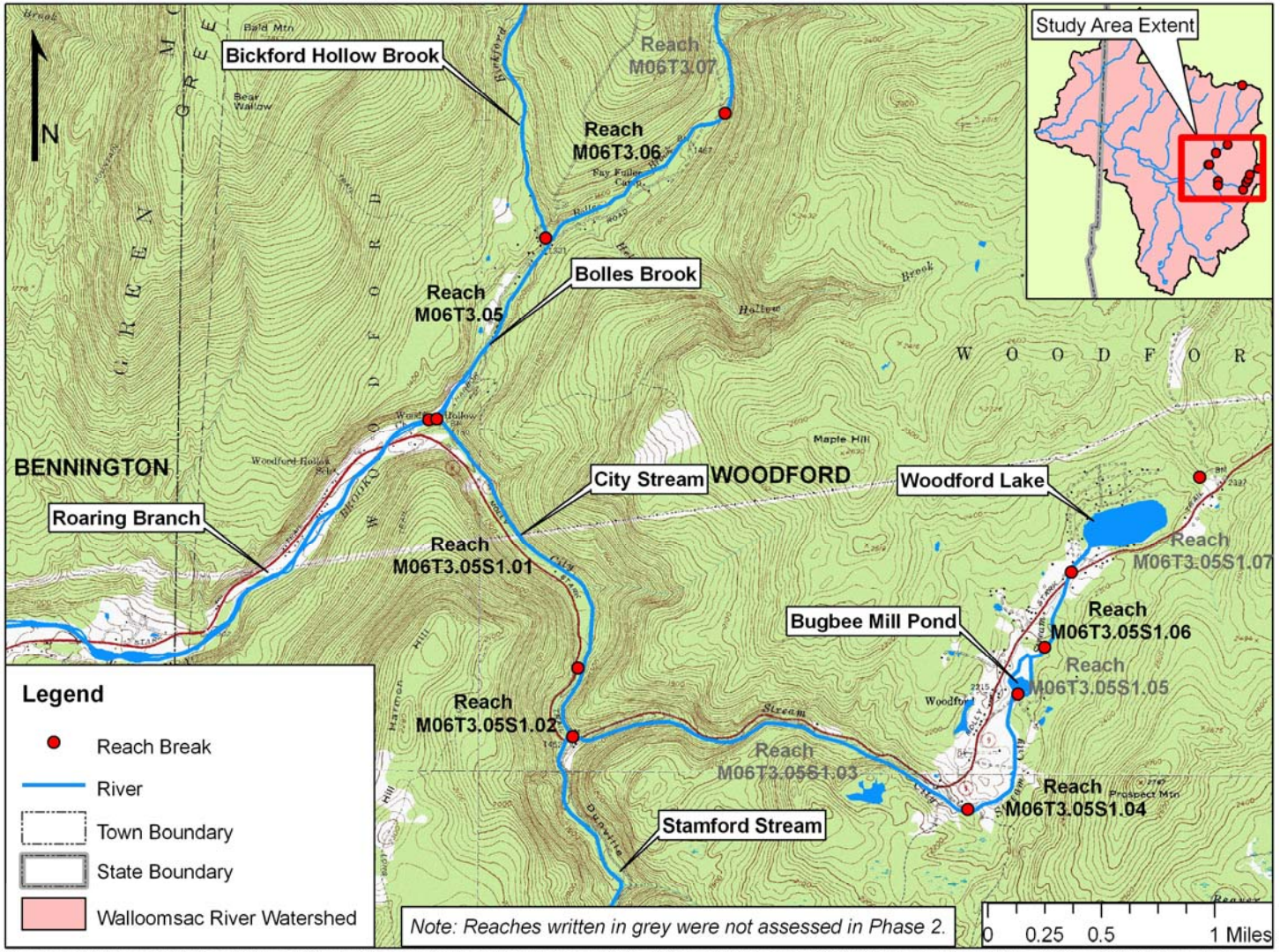


Figure 1-2: City Stream and Bolles Brook Phase 2 Study Area.

2.0 Methods

This study of the geomorphic characteristics of City Stream and Bolles Brook followed the methods presented in the Vermont Agency of Natural Resources' (VT ANR) Phase 2 Rapid Stream Geomorphic Assessment Field Protocols (VT ANR, 2007). Prior to conducting the Phase 2 field assessment, the data generated for the study area during the Phase 1 assessment were reviewed. Phase 1, the remote-sensing phase of the geomorphic assessment, was conducted by the Bennington County Conservation District (BCCD). The Phase 1 assessment involved the collection of data from topographic maps, aerial photographs, existing studies, and field reconnaissance (windshield surveys).

Phase 1 methods included selecting study streams, dividing streams into reaches of homogeneous geomorphic channel and valley characteristics, and evaluating geology, soils, land cover, reach hydrology, in-stream channel modifications, and floodplain modifications on each reach. The evaluation of these parameters allowed for the assignment of a numeric impact rating for each reach, and provisional reference stream types were established based on valley land forms and geology. Predictions of channel condition (departure from reference), adjustment process, and reach sensitivity were based on evaluations of watershed and river corridor land use as well as channel and floodplain modifications.

The Phase 1 assessment was conducted on the entire lengths of City Stream and Bolles Brook, totaling ten reaches (seven on City Stream and three on Bolles Brook). Of these, four reaches of City Stream and two reaches of Bolles Brook were selected for the Phase 2 assessment.

2.1 Field Assessment

Phase 1 reaches were divided into segments where appropriate to distinguish sections of the reaches having different reference and existing conditions. A segment has the same reference stream type as its reach but is distinct from other segments in the reach in one or more of the following parameters: grade controls, channel dimensions, substrate size, planform and slope, depositional features, corridor encroachments, banks and buffers, flow status, property access, valley width, or others. Different segments in a reach are labeled with capital letters (A, B, C…) suffixed to the reach number and assigned sequentially from downstream to upstream (VT ANR, 2007). Segments created during the Phase 2 assessment are shown in Figure 2-1. Reaches and segments not assessed in Phase 2 are shown in grey.

A total of 5.13 river miles on City Stream and Bolles Brook were assessed using Phase 2 protocols during September 2007. Field efforts consisted of identifying bankfull features and collecting field measurements of channel dimensions, stream impacts, bottom substrates, shoreline and riparian conditions, and floodplain encroachments and modifications. The measurements were collected to determine the existing stream type, condition, and sensitivity for each reach.

Each reach was traversed by a field crew of two or three persons. Each crew had a complete set of aerial photographs, topographic maps, and Phase 1 summary reports for each reach. Starting from the downstream end, reaches were covered on foot and the floodplain and terrace areas on each side of the river were examined. A field sketch was completed for each reach and representative photographs were taken.

Cross-section analyses were performed at representative locations within each reach/segment. A survey level, rod, and tape were used to obtain elevation and width measurements. Channel dimensions and ratios were derived from the cross-sections in order to verify (or modify, if needed) the stream type and bedform type classifications. The Phase 2 field work included a Rapid Habitat Assessment (RHA) and Rapid Geomorphic Assessment (RGA) for each stream reach and segment.

Bridges and culverts along both streams were also assessed. This involved visiting each stream crossing and collecting information in accordance with the methods outlined in Appendix G (Bridge and Culvert Assessment) of the Vermont ANR's Phase 2 handbook (VT ANR, 2007).

2.2 Data Management

Standard field forms from Appendix A (Phase 2 Field Forms) of the Vermont ANR's Phase 2 handbook were used to record field data (VT ANR, 2007). For each segment or reach, these forms included rapid stream assessment field notes, a tally sheet, a cross-section worksheet, a photo log, an RHA form, and an RGA form. Stream features and impacts were sketched on forms prepared prior to field mobilization that included an outline of surface water and the Phase 1 stream corridor for each reach at a scale of approximately 1:2500.

The field teams collected GPS data of the in-stream features consistent with the protocols. The feature types collected with GPS are listed in Table 2-1. Data were collected in the field using a Trimble Model Pro-XH high-resolution GPS backpack unit. The GPS data collected in the field were differentially corrected in the office to improve accuracy and then reviewed with ArcGIS software. These data could not be directly imported into the Stream Geomorphic Assessment Tool (SGAT). Rather, the data were uploaded to ArcView 3 and the features collected in the field were re-created within the SGAT extension.

All of the field forms were scanned and archived. Photographs were organized into separate appendices. The field data and cross-section plots were entered and uploaded into the Vermont ANR's online Data Management System (DMS).

2.3 Data Interpretation

The field assessment data were compiled and evaluated using methods detailed in the Vermont ANR's Phase 2 handbook (VT ANR, 2007). Parameters that were measured and calculated to define the stream channel geometry are described in Table 2-2. These parameters—particularly the entrenchment ratio (ER), the width/depth (W/D) ratio, and the Phase 1 parameter sinuosity—were used to determine an existing stream type for each assessed segment. Figure 2-2 provides the Rosgen stream channel classification system flow chart (Rosgen, 1996).

A Rapid Geomorphic Assessment (RGA) was completed to determine the geomorphic condition, major channel adjustment processes, and sensitivity of the stream. Stream condition is classified based on RGA scores as reference (0.85 – 1.0), good (0.65 – 0.84), fair (0.35 – 0.64), or poor (0.00 – 0.34). Per the protocols, stream segments can receive a condition descriptor outside the range of their score as long as justification is given. Channel adjustment processes include degradation, aggradation, widening, and planform adjustment—all of which can be noted as historic processes. Stream sensitivity is dependent on the existing stream type and whether the stream is in regime (reference or good condition), in major adjustment (fair condition), or has experienced a stream type departure (poor condition). All of these factors were considered to determine what stage (I-V) of the Channel Evolution Model (CEM) the stream is currently undergoing. Diagrams and descriptions of the five stages of the F-stage CEM is provided in Figure 2-3.

2.4 Quality Assurance

In order to ensure the collection of accurate and consistent data, users of the Vermont ANR Phase 2 Rapid Stream Geomorphic Assessment Field Protocols need to establish a quality assurance (QA) program for each phase of the assessment. The protocols outline three key components of quality assurance: training,

data review, and use of a data management system. Conducting a QA program at all levels of assessment ensures that data is accurate and complete.

The trained Field Coordinator was on-site during the entire Phase 2 field assessment. The Phase 2 data were first reviewed and interpreted by field assessors and then presented to River Management Program staff for their review and discussion. As a result of the QA review, field data sheets were adjusted at the direction of River Management Program staff. These adjustments resulted in several changes to the stream channel types, conditions, and sensitivities as originally interpreted by the consultant. Data were entered into the DMS and the automatic QA process was performed.

Because so many aspects of the Phase 2 assessment depend on accurate identification and measurement of bankfull features, bankfull elevations were checked by four methods. First, the cross-sectional area at each cross-section location was calculated (bankfull width times mean bankfull depth) and the areas were compared to make sure they decreased moving upstream (Table 2-3). Next, the drainage area and flow statistics were determined for each cross-section location using the U.S. Geological Survey (USGS) Vermont StreamStats basin delineation tool (USGS, 2007). Relative magnitudes of decrease in cross-sectional areas moving upstream were checked to see how well they corresponded with relative magnitudes of decrease in drainage areas and two-year peak flows (Table 2-3). Furthermore, the cross-sectional area for each location was predicted using the following Vermont regional hydraulic geometry curve, which has an R-squared value of 0.95 (VT ANR, 2006):

$$\text{Cross Sectional Area} = 12.38 \times (\text{Drainage Area})^{0.75}$$

The field-determined cross-sectional areas were compared to the predicted cross-sectional areas to make sure magnitudes (Table 2-3) and trends (Figures 2-4 and 2-5) were relatively similar. Finally, the drainage areas, bankfull widths, mean depths, and cross-sectional areas for each cross-section location were compared to those of reference streams contained in the Vermont hydraulic geometry dataset as shown in Table 2-4 (VT ANR, 2006). Based upon this thorough analysis, slight (less than half a foot) changes were made to the bankfull elevation of four segments. Bankfull elevation was raised slightly for segments S1.01B, S1.02A, and S1.04B, and lowered slightly for segment T3.05B. Corresponding changes in channel dimensions, calculated ratios, etc. were made and checked with River Management Program staff.

Table 2-1: Stream Impacts Documented with GPS During the Phase 2 Assessment.

	Impact	Sub-Impact
Point Features	Alluvial Fan	N/A
	Grade Control	Dam
		Ledge
		Waterfall
		Weir
	Mass Failure	N/A
	Dredging	Dredging
		Gravel Mining
		Commercial Mining
	Debris Jam	N/A
	Stormwater Input	N/A
	Beaver Dam	N/A
	Migration	Neck Cut-off
		Flood Chute
		Avulsion
		Braiding
	Head Cut or Steep Riffle	Head Cut
		Steep Riffle
	Stream Crossing	Stream Ford
		Animal Crossing
	Flow Regulation and Water Withdrawal	Drinking
		Irrigation
		Snow Making
		Bypass
	Gully	N/A
	Bridge or Culvert	N/A
	Constriction	N/A
	Segment Break	N/A
	Cross Section Location	N/A
Line Features	Development	N/A
	Encroachment	Berm
		Improved Path
		Road
		Railroad
	Bank Armoring and Revetment	Rip-Rap
		Hard Bank
		Other
	Erosion	N/A
	Straightening	Straightening
		With Windrowing

Table 2-2: Summary of Terms.

Term	Definition
Bankfull Discharge	The stream discharge corresponding to the water stage that first overtops the natural banks onto the active floodplain, occuring on average about once every one to two years
Bankfull Width	The top surface width of a stream channel when flowing at bankfull discharge
Bankfull Mean Depth	The mean depth of a channel within a riffle segment when flowing at bankfull discharge
Bankfull Max Depth	The maximum depth of a channel within a riffle segment when flowing at bankfull discharge
Floodprone Width	The width of a stream when flooded to an elevation twice the maximum depth of the bankfull channel
Recently Abandoned Floodplain (RAF)	The height of the lowest floodplain feature a stream had access to within the past 200 years, but has lost access to at bankfull stage
Human-Elevated Floodplain (HEF)	The height of a feature such as a railroad, road, berm, levee, or improved path that is higher than and blocks access to the RAF
Width/Depth (W/D) Ratio	The bankfull width divided by mean the bankfull mean depth
Entrenchment Ratio (ER)	The width of the floodprone area divided by the bankfull width
Incision Ratio (IR)	The RAF height divided by the bankfull maximum depth

Table 2-3: Quality Assurance Check of Field-Measured Bankfull Geometry.

Stream	Segment ID	Width (ft)	Mean Depth (ft)	Cross-Sectional Area (ft^2)	Drainage Area (mi^2)*	Two-Year Peak Flow, Q_2 (ft^3/s)*	Predicted Cross-Sectional Area (ft)**
City Stream	M06T3.05S1.01A	62	1.98	122.6	17.60	589.0	106.4
	M06T3.05S1.01B	*57*	*2.11*	*119.6*	17.00	568.0	103.6
	M06T3.05S1.01C	54	2.19	118.5	16.70	557.0	102.3
	M06T3.05S1.02A	*61*	*1.70*	*103.1*	15.70	522.0	97.6
	M06T3.05S1.02B	52	1.97	102.6	15.50	515.0	96.7
	M06T3.05S1.04B	*23*	*0.89*	*20.8*	2.76	90.9	26.5
	M06T3.05S1.04D	16	1.09	17.5	2.31	74.9	23.2
	M06T3.05S1.06	16	0.95	15.5	1.34	42.2	15.4
Bolles Brook	M06T3.05A	48	2.18	104.8	19.40	763.0	114.4
	M06T3.05B	*56*	*1.87*	*103.8*	19.30	759.0	114.0
	M06T3.05C	32	2.62	83.8	18.10	716.0	108.6
	M06T3.06	29	1.76	51.2	8.66	365.0	62.5

Values in italics were adjusted slightly during the QA.
**Determined using USGS VT StreamStats (USGS, 2007).*
***Calculated based on drainage area using VT hydraulic geometry curve (VT ANR, 2006).*

Table 2-4: Quality Assurance Comparison to VT Hydraulic Geometry Dataset.

Reference Stream or Segment ID	Drainage Area (mi^2)	Cross-Sectional Area (ft^2)	Width (ft)	Mean Depth (ft)
M06T3.05S1.06	1.34	15.5	16	0.95
M06T3.05S1.04D	2.31	17.5	16	1.09
M06T3.05S1.04B	2.76	20.8	23	0.89
Sucker Brook	3	27.5	22	1.25
Deerfield	5	57.6	32	1.80
M06T3.06	8.66	51.2	29	1.76
East Orange Br.	9	53.2	28	1.90
W. Br. Battenkill	13	63.2	40	1.58
M06T3.05S1.02B	15.50	102.6	52	1.97
M06T3.05S1.02A	15.70	103.1	61	1.70
M06T3.05S1.01C	16.70	118.5	54	2.19
M06T3.05S1.01B	17.00	119.6	57	2.11
M06T3.05S1.01A	17.60	122.6	62	1.98
M06T3.05C	18.10	83.8	32	2.62
M06T3.05B	19.30	103.8	56	1.87
M06T3.05A	19.40	104.8	48	2.18
Ottaquechee	23.0	201.6	63	3.2

This table shows how closely the bankfull measurements taken at each cross-section correlate with bankfull geometry of streams with similar drainage areas in the Vermont hydraulic geometry dataset (VT ANR, 2006).

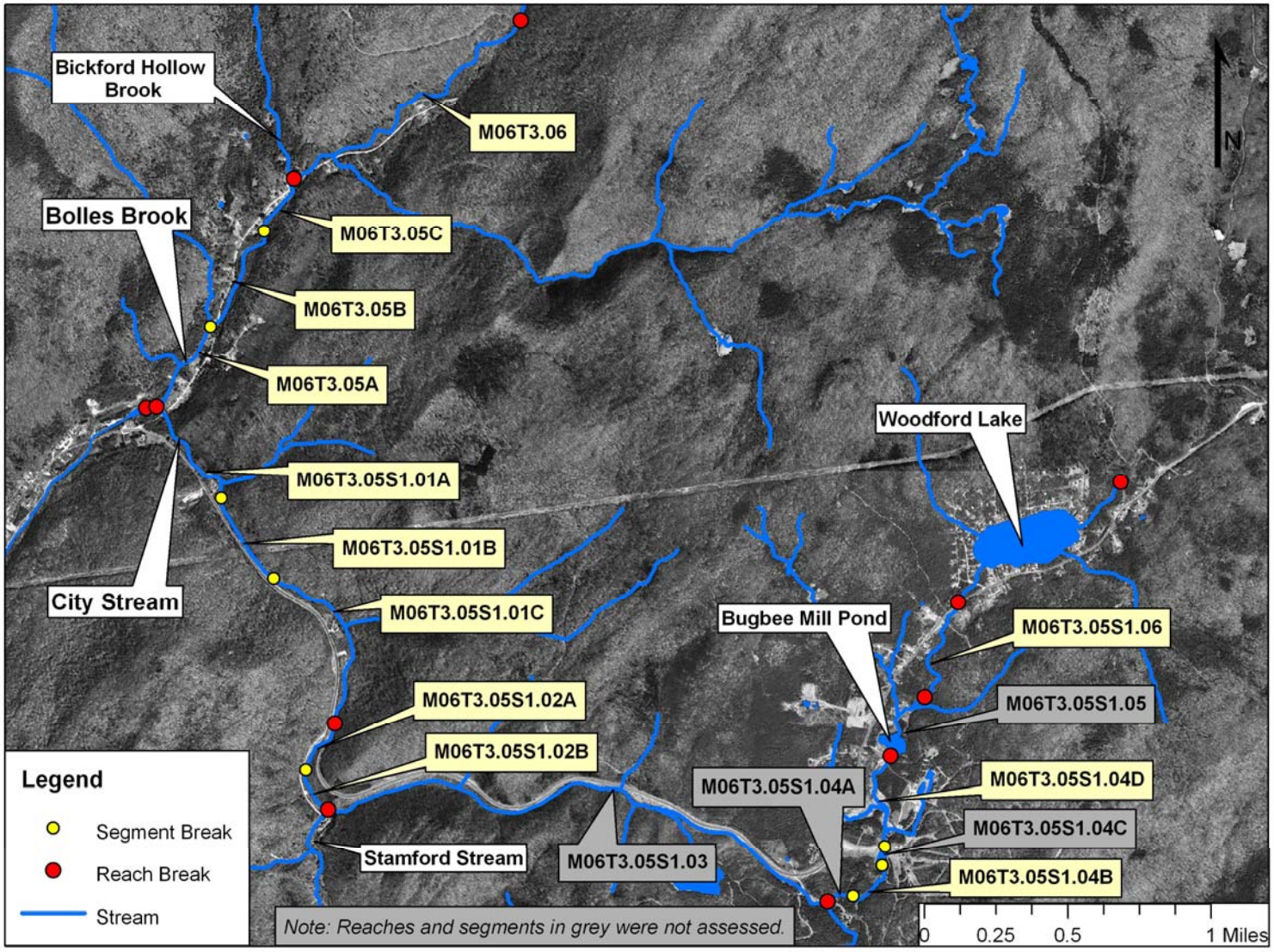
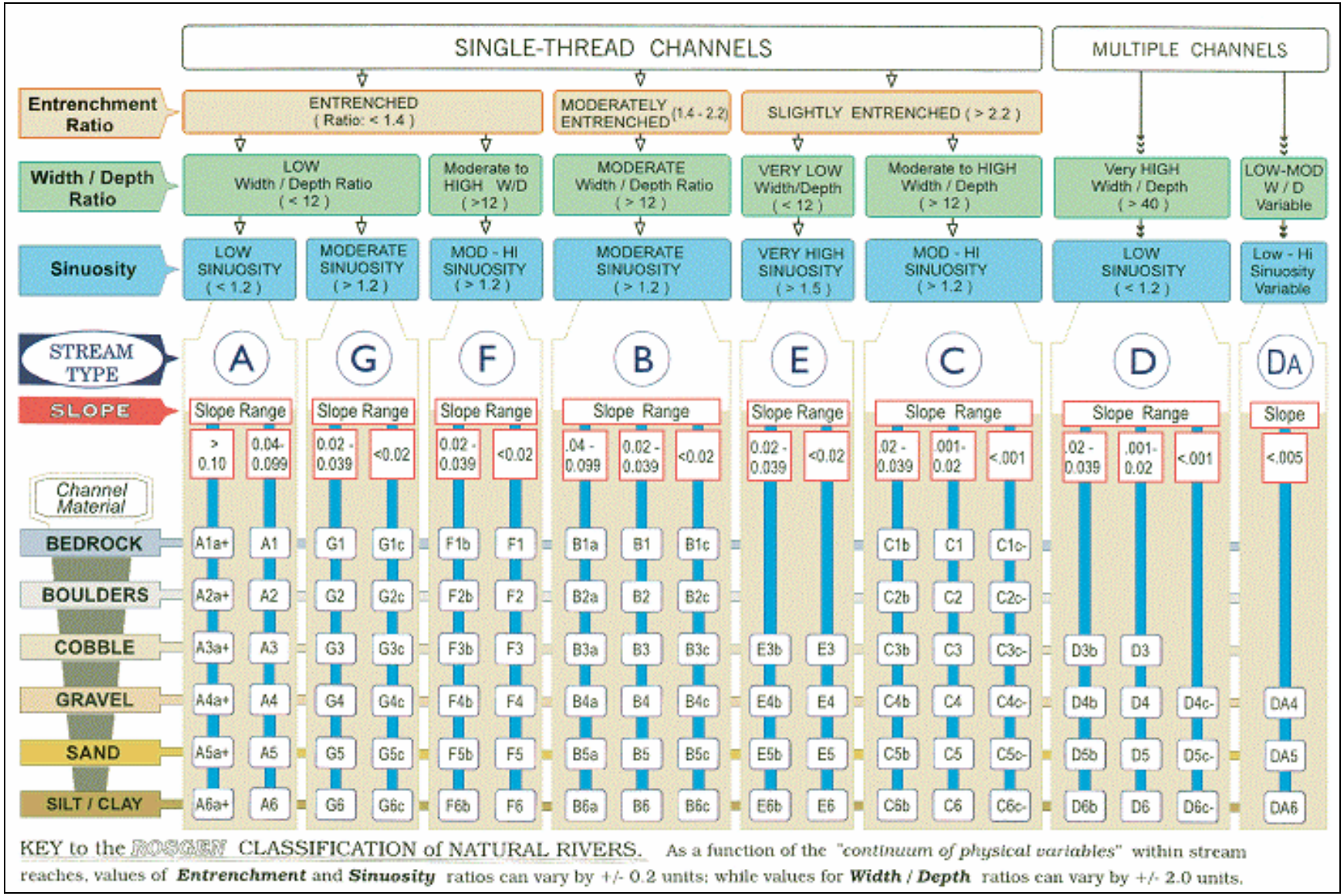


Figure 2-1: City Stream and Bolles Brook Phase 2 Assessment Reaches and Segments.



KEY to the ROSGEN CLASSIFICATION of NATURAL RIVERS. As a function of the *"continuum of physical variables"* within stream reaches, values of ***Entrenchment*** and ***Sinuosity*** ratios can vary by +/- 0.2 units; while values for ***Width / Depth*** ratios can vary by +/- 2.0 units.

Figure 2-2: Rosgen Stream Classification System (Rosgen, 1996).

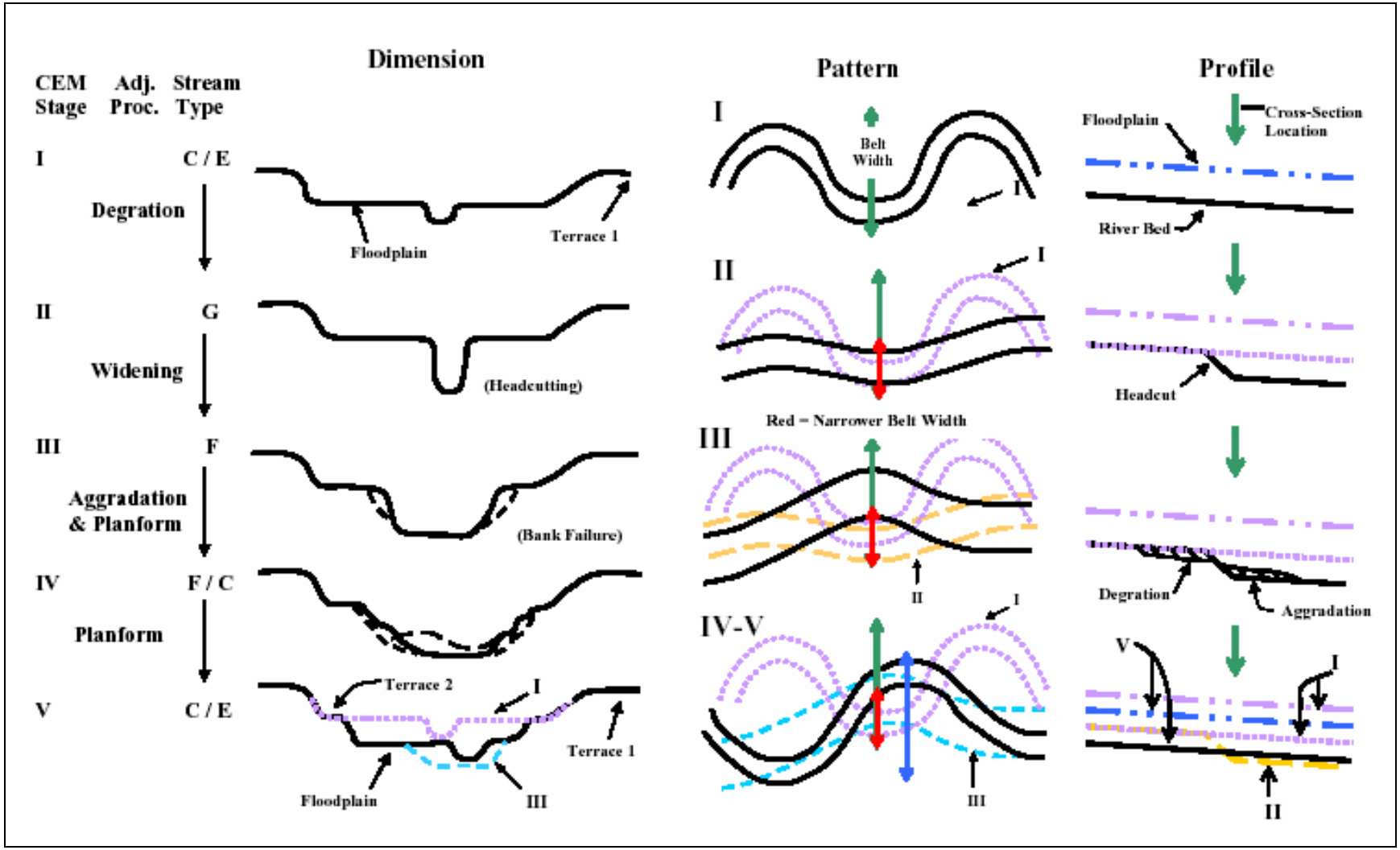


Figure 2-3: F-Stage Channel Evolution Process (VT ANR, 2007).

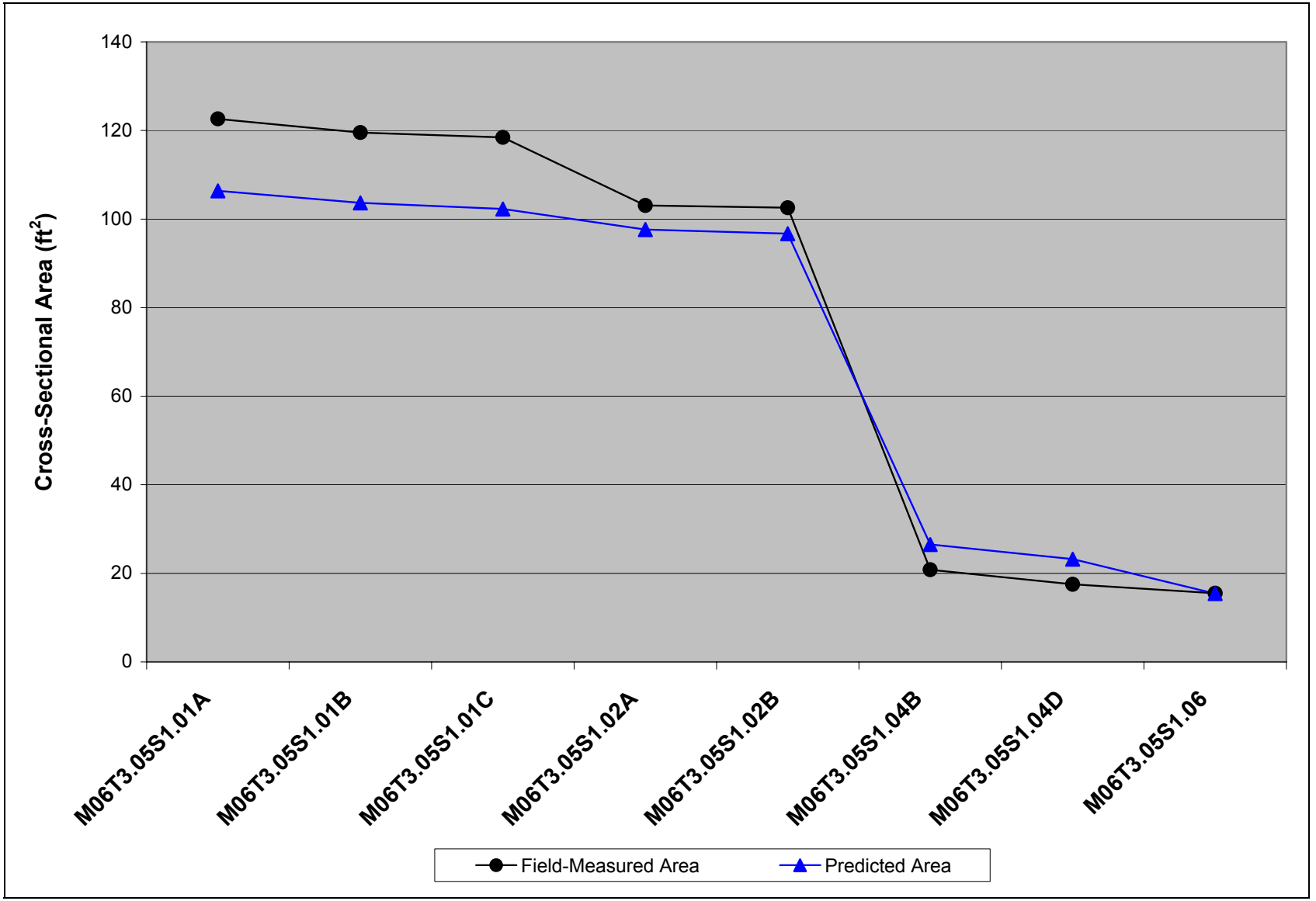


Figure 2-4: Quality Assurance Comparison of Cross-Sectional Areas for City Stream.

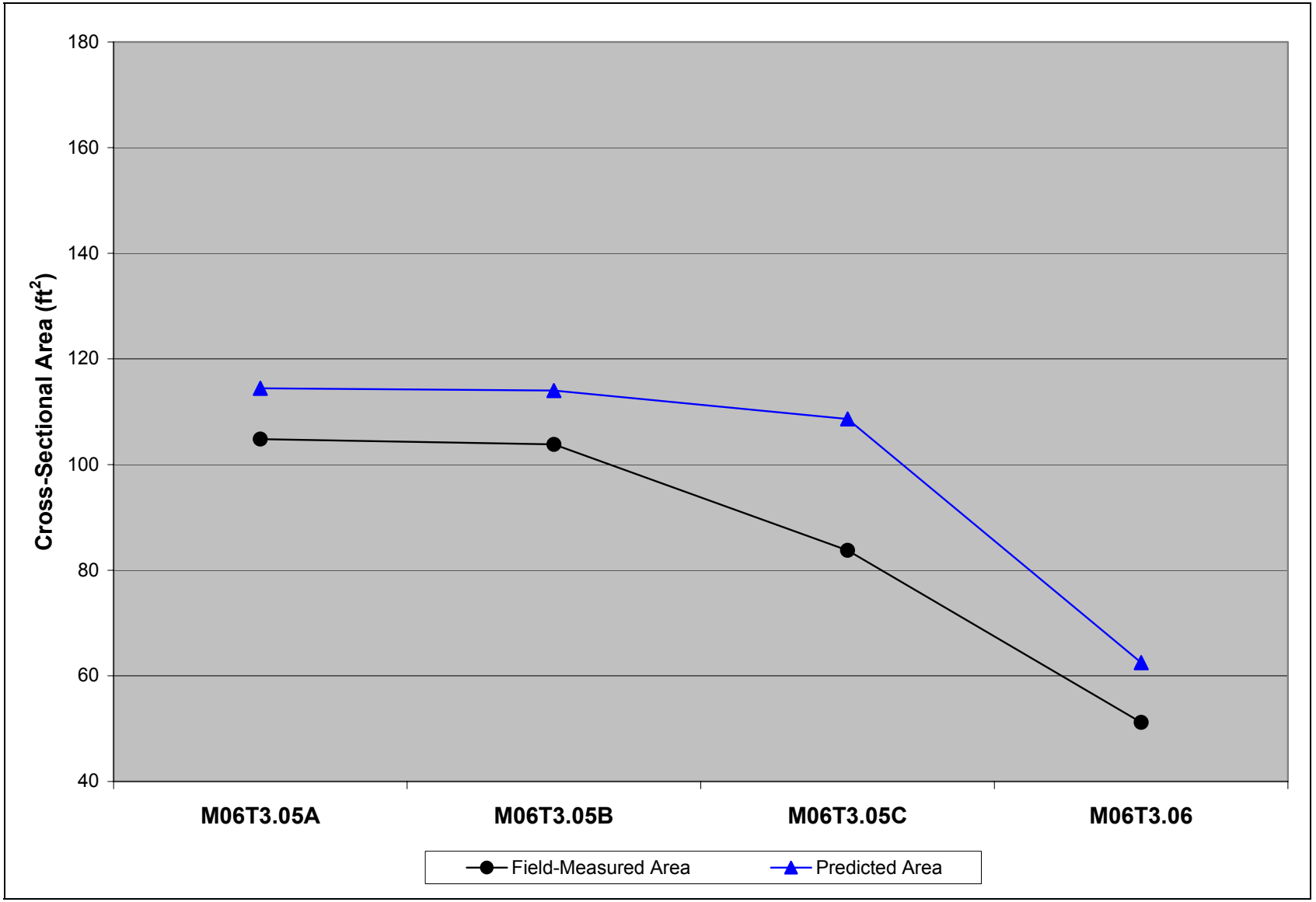


Figure 2-5: Quality Assurance Comparison of Cross-Sectional Areas for Bolles Brook.

3.0 Results

Reference stream types and other characteristics determined during the Phase 1 assessment for each assessed reach are given in Table 3-1 (data that was modified during QA of Phase 2 data is marked with an asterisk). The field-verified existing stream types and other characteristics determined during the Phase 2 assessment for each assessed segment are given in Table 3-2. Tables 3-3 and 3-4 show the measurements and associated calculations obtained from the cross-section analysis of each segment. Table 3-5 shows the results of the Rapid Habitat Assessment for each segment, and Table 3-6 shows the results of the Rapid Geomorphic Assessment (including stream type departures, adjustment processes, and sensitivity ratings). The percent of each segment's length affected by the stressors of berms, roads, development, and straightening is given in Table 3-7. Table 3-8 shows the Fluvial Erosion Hazard (FEH) ratings determined for each segment.

Cross-section diagrams produced from elevation data for each segment are provided in Appendix A. Each diagram depicts the approximate elevation of the bed/bank surface, current water surface, bankfull height, and floodprone height, as well as the location of the valley walls and any other prominent features. Appendix B presents a summary of all stream impacts and features recorded by the Feature Indexing Tool (FIT) for each segment. Appendix C contains maps of each reach or segment showing the locations of these impacts and features. A detailed description of each bridge and culvert is provided in Appendix D. Reports produced by the DMS concerning failure modes and problem conditions for the bridges and culverts assessed during Phase 2 are given in Appendix E. Appendices F and G contain field photographs taken during the reach assessments and the bridge and culvert assessments, respectively. Standard Phase 2 database output reports from the DMS are included in Appendix H.

A description of each reach and segment evaluated during the Phase 2 assessment is presented below. Note that left and right banks are always identified facing downstream. Also note that all channel evolution stages were identified by the F-stage Channel Evolution Model (CEM). Field data, cross-section plots, and spatially referenced stream features are also accessible online through the DMS.

3.1 Reach and Segment Descriptions

City Stream

M06T3.05S1.01A

Segment M06T3.05S1.01A (S1.01A) of City Stream is a reference C3b step-pool stream that has degraded to a type B3. It is semi-confined (CR=3.7) in its valley, which is generally defined by a steep mountainside on the right and Route 9 on the left. The segment is approximately 2,377 feet long and has a slope of about 2.5%. Encroachments such as berms, roads, and development impact much of its length (52%, 28%, and 35%, respectively). Berms in this segment are generally engineered structures reinforced with concrete and rock slab facing. A few braided areas and flood chutes are present. Both a head cut and a steep riffle (slightly downstream) were observed in the field. The segment is moderately entrenched (ER=1.61) with a high width/depth ratio (W/D=31.3). The incision ratio (IR) based on the recently abandoned floodplain (RAF) is 2.39, but the presence of a berm leads to a human-elevated floodplain (HEF) IR of 3.98. Banks and buffers are relatively well-vegetated with mixed trees and saplings. The segment received an RHA rating of "good" and an RGA rating of "fair." Because the stream has lost access to the majority of its floodplain, through both bed degradation and floodplain build-up in the form of berms, but is starting to widen, it was

determined to be in Stage III of the CEM. The major adjustment process is degradation. Due to the stream type departure (from C to B), the stream sensitivity is high.

M06T3.05S1.01B

Segment M06T3.05S1.01B (S1.01B) of City Stream is a reference C3b step-pool stream that has degraded to a type F3. The segment is approximately 1,346 feet long and has a slope of about 1.5%. It was segmented from Segment A because its entire length appears to be straightened, and it is narrowly confined (CR=1.4) by a steep mountainside on the right and Route 9 on the left. The left bank, which is essentially the road embankment, is eroded in areas and reinforced with rip-rap in others. A head cut and a bedrock constriction were observed in the field. This segment is entrenched (ER=1.15) with a high W/D ratio (26.9). The IR, based on an RAF at the top of the left bank, is 2.40. The right bank is relatively well-vegetated with mixed trees and saplings, whereas the left bank consists mainly of herbaceous and shrub/sapling vegetation. The segment received an RHA rating of "good." The RGA condition was modified from "fair" to "poor" due to a stream type departure from C to F. Because the stream has lost access to the majority of its floodplain through bed degradation and floodplain build-up (berms), but is starting to widen, it was determined to be in Stage III of the CEM. The major adjustment processes are degradation and widening, and the stream is extremely sensitive.

M06T3.05S1.01C

Segment M06T3.05S1.01C (S1.01C) of City Stream is a reference C3b step-pool stream that has degraded to a type B3. It is approximately 3,924 feet long and has a slope of about 3.1%. It was segmented because its valley, although narrow (CR=4.4), is relatively wider than that of Segment B and is only encroached by the road for approximately half (45%) of its length. The left bank and buffer vegetation is also more developed, with mixed trees and shrubs/saplings. Similar to Segment A, this segment is characterized by berms on the left side, and even has a section with a double berm (one on the bank and one set back 50-150 feet). The cross-section for the segment was taken through the double berm to capture this representative feature. The valley is defined by Route 9 on the left and the steep mountainside (which is sometimes set back from the bank up to 100 feet due to RAFs or terraces) on the right. There are several sections of erosion on both banks, and a small mass failure on the right. The left bank is reinforced with rip-rap near the downstream and upstream edges of the segment (where the road is closest to the stream). A steep riffle, flood chute, and several stormwater inputs were also observed. The segment is moderately entrenched (ER=1.64) and has a moderate W/D ratio (24.6). The IR based on the RAF behind the first berm is 1.39, but the presence of the berm leads to a human-elevated IR of 4.19. The segment received an RHA rating of "good" and an RGA rating of "fair." The major adjustment processes are degradation, widening, and planform adjustment. Due to the stream type departure from C to B, the stream sensitivity is high. Because the stream has lost access to the majority of its floodplain through bed degradation and floodplain build-up (berms), but is starting to widen and adjust planform as well, it was determined to be in Stage III of the CEM.

M06T3.05S1.02A

Segment M06T3.05S1.02A (S1.02A) of City Stream is a reference B2 step-pool stream that has degraded to a type F3. The segment is approximately 1,073 feet long and has a slope of about 1.9%. It is narrowly confined (CR=1.2) in its artificial valley of steep, high (>20 feet) road embankments on both sides—Route 9 on the right and Notch Road (old Route 9) on the left. The embankments are reinforced with rip-rap for much of the segment, particularly under/near the Route 9 bridge and on the right bank upstream of the bridge. The bank and buffer vegetation is therefore sparse and of the herbaceous and shrub/sapling type. The segment is entrenched (ER=1.12) with a high W/D ratio (35.6). Since both banks are over 20 feet high, the stream has no RAF, so the IR of 7.50 (based on the elevation of Notch Road) is human-elevated. The segment received a rating of "fair" for both the RHA and the RGA. Due to the stream type departure, the stream sensitivity is extreme. Because the stream is entrenched and over-widened due to historic floodplain filling, but is beginning to show signs of attempting to regain equilibrium by rebuilding a floodplain within the constraints of the two road embankments, it was determined to be between Stages III and IV of the CEM. The major adjustment processes are aggradation and widening, after historic degradation.

M06T3.05S1.02B

Segment M06T3.05S1.02B (S1.02B) of City Stream is a reference B2 step-pool stream that was classified during Phase 2 as a type B3a. It is slightly more entrenched (ER=1.21) than typical B-type stream, but its ER is within the allowance of +/– 0.2 units (Rosgen, 1996). The segment could also have been classified as a type F, but its high slope (4.4%) is not characteristic of F-type streams. This relatively short segment (899 feet) was separated from Segment A due to a sharp change in slope and a shift to significantly coarser bed material (see Photo #100_1013). Also, although its valley is narrow (CR=5.1), this segment is unconfined. Moving upstream from Segment A to Segment B, the river left valley wall crosses to the far side of Notch Road, and the river right valley wall veers 50-100 feet away from the bank to accommodate a small floodplain. The upstream reach break is marked by the entrance of Stamford Stream, which is actually the larger stream at the confluence. Stamford Stream seems to provide more influence on the downstream system, with its larger flow and sediment inputs. The banks and buffers on both sides of the stream are fairly well vegetated with mixed trees and shrubs/saplings, although the left bank is badly eroded along most of the upper half of the segment, and there is a small section of right bank erosion near the top of the segment as well. The W/D ratio is moderately high (26.4). The IR, based on the river right RAF, is 1.84. The segment is in good RHA condition and fair RGA condition. Because the stream has lost access to some of its floodplain due to degradation and historic floodplain filling, it was determined to be in Stage II of the CEM. The major adjustment process is degradation, and the stream sensitivity is high.

M06T3.05S1.03

Reach M06T3.05S1.03 (S1.03) of City Stream was not assessed because it is very steep (>6%), and is narrowly confined by both State Route 9 on the right and the natural valley wall on the left.

M06T3.05S1.04A

Segment M06T3.05S1.04A (S1.04A) of City Stream was not assessed during Phase 2 because it is a bedrock gorge. Several bedrock constrictions, ledges, and waterfalls were observed along its relatively short length.

M06T3.05S1.04B

Segment M06T3.05S1.04B (S1.04B) of City Stream is distinguished from Segment A (a bedrock gorge) by a marked decrease in slope (to approximately 0.9%), an opening of the canopy and transition from mixed forest to herbaceous vegetation, and a shift in bed material from bedrock and boulders to gravel, sand, and silt. The reference stream type for the reach is C4 riffle-pool, but this segment has degraded to a type F4. The segment is approximately 1,112 feet long. Its valley is very broad (CR=43.3), and is defined by Route 9 on the right and the natural and artificial grades of Prospect Mountain ski area on the left. The W/D ratio is relatively high (26.2). The upper limit of the segment is marked by a large beaver dam, which impounds the entirety of Segment C (Note: The aerial imagery depicts a distinct channel and separate pond in Segment C, but these have combined to form one large wetland/impoundment area and no distinct channel exists). The downstream end of the channel is nearly featureless, but a system of riffles, pools, and runs forms farther upstream. A steep riffle and a series of ledges are present near the top of the segment. The left bank is generally steep with shrub/sapling vegetation, while the right bank is a flat floodplain/wetland area with herbaceous vegetation. The stream was classified as entrenched (ER=1.30) because the floodprone height did not quite reach the elevation of the floodplain. This is likely due to a major adjustment process of degradation, and a CEM Stage of II. The IR based on this RAF elevation is 2.01. Due to the stream type departure, the stream sensitivity is extreme. The segment received a fair RGA rating and a good RHA rating.

M06T3.05S1.04C

Segment M06T3.05S1.04C (S1.04C) of City Stream was not assessed because it is an impoundment formed by a beaver dam at the segment break between Segments B and C. Note that although the aerial imagery depicts a distinct channel and pond in Segment C, these features have merged to form one large wetland/impoundment area and no distinct channel exists.

M06T3.05S1.04D

Segment M06T3.05S1.04D (S1.04D) of City Stream was segmented because Segment C is an impoundment that was not assessed. The reference stream type for the reach is C4 riffle-pool, but this segment has degraded to a type F4. The segment is approximately 1,957 feet long with a slope of about 0.8%. Its valley is very broad (CR=64.3), and is defined by Route 9 on the right and the natural and artificial grades of Greenwood Campground on the left. The W/D ratio is low (14.6). Recent beaver activity near bottom of the segment has resulted in a dam and small impoundment about 165 feet from the culvert. The upper limit of the segment is marked by the dam that impounds Bugbee Mill Pond (reach S1.05). The majority of the channel is nearly featureless, but a system of riffles, pools, and runs forms near the top of the segment. In this upper section, a gravel storage lot with piles of sand, stone, and other materials on the right bank and a newly cut dirt road just off the left bank are likely contributing to the numerous fine sediment deposits found in the channel nearby and further downstream. Vertical banks on both sides flatten out to a wide floodplain covered with meadow-type herbaceous and shrub vegetation. However, the stream was classified as entrenched (ER=1.33) because the floodprone height did not quite reach the elevation of the floodplain. This is likely due to a major adjustment process of degradation, and a CEM Stage of II. The IR based on this RAF elevation is 2.26. Due to the stream type departure, the stream sensitivity is extreme. The segment received a fair RGA rating and a good RHA rating.

M06T3.05S1.05

Reach M06T3.05S1.05 (S1.05) of City Stream was not assessed because it is an impoundment known as Bugbee Mill Pond.

M06T3.05S1.06

Reach M06T3.05S1.06 (S1.06) of City Stream is a reference D4b braided stream that was field-verified to be a type D4b. While the majority of the reach is braided, its upper portion where the stream is close to Route 9 has been channelized and straightened. The stream passes through a culvert and two bridges in this upper section. The valley is very broad (CR=43.3), and is generally defined by Route 9 on the right and natural slopes on the left. The reach is approximately 2,260 feet long and has a slope of about 3.3%. The downstream end of the reach begins in the wetland complex above Bugbee Mill Pond, and a small dam on a private pond marks the upstream end. Route 9 and patches of development encroach 21% and 14% of the river corridor, respectively. Both stream banks along the majority of the reach are heavily buffered with shrub/sapling vegetation, although larger trees are dominant towards the middle of the reach and near the cross-section. Snags, debris jams, and large woody debris were prevalent. A steep riffle, ledges, and flood chutes were also observed. Old stone fences/bridge abutments/dams have constricted and impacted the stream in two locations. The stream generally has access to a floodplain on one or both sides of the stream, with the exception of the channelized upper section. The reach is moderately entrenched (ER=2.13) with a moderate W/D ratio (17.1). The IR is 1.60. The reach received RHA and RGA ratings of "good." The reach was determined to be in Stage IV of the CEM, and is mostly adjusting in planform. The stream sensitivity is extreme, which is typical for braided stream types in any condition.

M06T3.05S1.07

Reach M06T3.05S1.07 (S1.07) of City Stream was not assessed because it is an impoundment named Woodford Lake, locally known as Big Pond.

Bolles Brook

M06T3.05A

Data collected along Segment M06T3.05A (T3.05A) of Bolles Brook indicated that this segment is a reference and existing B3 step-pool type stream. However, the segment has been exposed to new development (four new buildings and a large addition have been built within the river corridor since the aerial photographs were taken), which now encroaches 87% of the segment. In several of the developed areas, the buffer is less than 25 feet. The stream is also encroached by Harbour Road, which is gravel, for 43% of the segment. As a result of these encroachments and the associated loss of bank and buffer vegetation, erosion, scour, and mass failures were observed along much of the banks. Two head cuts and a flood chute are also present. The segment is approximately 2,043 feet long with a slope of about 2.0%. Its natural valley is broad (CR=9.3) but, even though Harbour Road is not a truly confining feature, it will certainly continue to have a confining effect on the stream as long as it is maintained. The valley is defined by steep mountainsides (behind Harbour Road on the left and on the bank or within one bankfull width on the right). This segment is moderately entrenched (ER=1.80) with a moderate W/D ratio (22.0). The IR, based on the river left top of bank, is 2.38. Bank and buffer vegetation, where present, is mostly shrub/sapling or mixed trees. There are several mowed lawn areas where the buffer is less than 25 feet. Therefore, the RHA score of 0.65 was adjusted from "good" to "fair." The RGA score is also "fair." Because the stream has lost access to the

majority of its floodplain through bed degradation and floodplain build-up (development), but is starting to widen, it was determined to be in Stage III of the CEM. The stream sensitivity is high.

M06T3.05B

Segment M06T3.05B (T3.05B) of Bolles Brook is a reference B3 step-pool stream that was found to be a B3c. It was segmented from Segment A because it is less encroached by development and has more floodplain access. The stream is still encroached by Harbour Road, for 74% of this segment. The segment is approximately 2,242 feet long with a slope of about 1.8%. Its natural valley is broad (CR=9.6) but, even though Harbour Road is not a truly confining feature, it will certainly continue to have a confining effect on the stream as long as it is maintained. The valley is defined by the mountain slope behind Harbour Road and the residential development on the right, and by a steep bedrock wall and high terrace near the bank on the left. An old railroad grade is present on top of the high terrace on the left. The left bank is a relatively flat or slightly sloping floodplain up to Harbour Road, but the stream has lost access to most of this feature. The IR based on this feature is 1.80. The stream is moderately entrenched (ER=1.57) with a high W/D ratio (29.7). Three steep riffles, two flood chutes and a braided area were observed. Old concrete slabs found along the bank and broken in the channel near the middle of the segment are causing left bank erosion and creating a grade control. More old concrete slabs (possibly from an old bridge) under the Harbour Road bridge in this segment are also creating a grade control and causing downstream deposition. Mixed trees and saplings cover both banks fairly well. The segment received an RHA score of "good" and an RGA score of "fair." Because the stream has lost access to the majority of its floodplain, but has widened and is reworking through aggradation, it was determined to be in Stage IV of the CEM, with the major adjustment processes being widening and aggradation. The stream sensitivity is high.

M06T3.05C

Segment M06T3.05C (T3.05C) of Bolles Brook is a reference B3 step-pool stream that was also found to be a B3c. It was segmented from Segment B because it is highly channelized, has less adequate bank/buffer vegetation, and is closely encroached by development and Harbour Road for its entire length. The segment is approximately 1,163 feet long with a slope of about 1.7%. Its natural valley is very broad (CR=14.3) but, even though Harbour Road is not a truly confining feature, it will certainly continue to have a confining effect on the stream as long as it is maintained. The valley is defined by a mountain slope behind Harbour Road and the residential development on the right, and by a steep mountainside that angles in to meet the stream at a bedrock wall near the top of the segment on the left. The stream has lost access to most of its floodplain due to residential and road fill, as well as natural bedrock. The human-elevated IR based on the right top of bank is 2.89. The stream is moderately entrenched (ER=1.85) with the lowest W/D ratio (12.2) of all the segments assessed. Near the top of the segment, just below the bridge, is a small dam and water withdrawal that supplies the town with drinking water. The small impoundment between the dam and the bridge was recently dredged in September. The right bank of this segment is steep, high, and armored with rip-rap for about half of its length. The left bank is flatter towards the bottom of the segment, but becomes a bedrock wall towards the top. Bank and buffer vegetation is mostly shrub/sapling, with more herbaceous vegetation on the right. Near the top of the segment, there is no vegetation on the rip-rapped bank, and the only buffer between the bank and the road is a mowed lawn. Because of this, the RHA score of 0.65 was adjusted from "good" to "fair." The RGA score was also "fair." Because the stream has lost access to the majority of its floodplain through

residential and road fill, it was determined to be in Stage II of the CEM, with the major adjustment process being degradation. The stream sensitivity is high.

M06T3.06

Reach M06T3.06 (T3.06) of Bolles Brook is a reference D3b braided stream that was field-verified to have the same existing stream type. It is approximately 5,734 feet long with a slope of about 3.4%. Its natural valley is very broad (CR=16.4), and it is only encroached by Harbour Road for 34% of its length. The valley is defined by steep mountain slopes on both sides. This reach is extensively braided, with multiple active channels as well as flood chutes and abandoned channels crisscrossing the floodplain along most of its length. Only two small areas of erosion were observed. A short section of an old berm or railroad grade was found between the left bank and Harbour Road. The cross-section was taken near the top of the reach, where there is one channel with flowing water, an adjacent stagnant channel that is currently blocked by a debris jam, and two abandoned channels or seepage channels on the right floodplain. At this location, the ER was 3.96 and the W/D ratio was 16.4. The IR, based on an RAF on top of the right bank, is 1.98. Both corridors are heavily forested for most of this reach. The reach received RHA and RGA ratings of "good." The reach was determined to be in Stage IV of the CEM, and is mostly adjusting in planform. The stream sensitivity is extreme.

M06T3.07

Reach M06T3.07 (T3.07) of Bolles Brook was not assessed because it is a steep first-order stream that flows through the undeveloped Green Mountain Nation Forest.

3.2 Summary of Reaches and Segments

3.2.1 Reach/Segment Condition

The majority of the reaches and segments assessed were found to be in good habitat condition. This was generally due to a mix of unembedded substrates and relatively well-vegetated banks and buffers. Three segments received fair RHA ratings because of a lack of adequate bank/buffer vegetation due to rip-rap armoring (S1.02A and T3.05C) or development (T3.05A). Table 3.5 gives a summary of the RHA results for each segment.

The geomorphic condition of the streams was not as good. Most of the segments were found to be in major adjustment (fair condition). This was often due to high incision and/or entrenchment, scoured or eroding banks, evidence of straightening and/or dredging, and human-caused changes in channel confinement and/or valley type. The uppermost assessed reaches on both streams (S1.06 on City Stream and T3.06 on Bolles Brook), which were both braided systems, lacked most of these impacts and were found to be in good geomorphic condition. The RGA rating for S1.01B was adjusted from "fair" to

"poor" due to the segment's narrow confinement, eroding banks, and stream type departure from C to F. Table 3-6 gives a summary of the RGA results for each segment.

3.2.2 Stream Type Departure and Sensitivity

All but two of the segments on City Stream have experienced a stream type departure, whereas none of those on Bolles Brook have yet departed from their reference stream types. Segment S1.02B of City Stream has not quite departed from its reference type of B, but is very close to becoming an F-type like the segment downstream of it. Reach S1.06 is mostly in its reference braided condition, although it has been straightened and channelized towards the top.

Stream sensitivity is either high or extreme on all assessed segments and reaches. Segments classified as extremely sensitive include S1.01B, S1.02A, S1.04B, S1.04D, and the two braided reaches—S1.06 and T3.06. The rest of the segments, which are all B-type streams, are classified as highly sensitive. Table 3-6 gives a summary of the stream type departures and sensitivities for each segment.

3.2.3 Fluvial Erosion Hazard Mapping

Using the stream sensitivity ratings based on stream type and RGA score, a fluvial erosion hazard (FEH) rating has been proposed for each stream segment in Table 3-8. Fluvial erosion hazard types are derived from six stream sensitivity ratings using two letter descriptors (VL=Very Low; LW=Low; MD=Moderate; HI=High; VH=Very High; and EX=Extreme). The stream sensitivity rating provides a basis for fluvial erosion hazard classification because major vertical or lateral channel adjustments are known to result in extensive erosion of adjacent lands causing damage to private property and public infrastructure (VT ANR, 2005).

FEH ratings for City Stream and Bolles Brook ranged from HI 5 to EX 10. The braided upper reaches of City Stream and Bolles Brook received the highest ratings (EX 10), whereas the B-type streams received the lower ratings (HI 5). These stream sensitivity and FEH ratings can be used to further assess fluvial erosion hazard types and develop an FEH river corridor based on belts widths, valley confinement, and sensitivity characteristics with guidance from the Vermont River Management Program.

3.3 Bridge and Culvert Assessments

Each bridge, culvert, and arch along City Stream and Bolles Brook was assessed according to Phase 2 protocols outlined in Appendix G (Bridge and Culvert Assessment) of the Vermont ANR's Phase 2 handbook (VT ANR, 2007). A summary of the structure locations, types, and dimensions are given in Table 3-9. A detailed description of each bridge is given in Appendix D. Failure mode and problem condition reports produced by the DMS are provided in Appendix E. Photographs of the inlet, outlet, upstream, and downstream views of each structure are contained in Appendix G.

According to the reports, the major potential failure modes affecting over half of the structures (all on City Stream) are out-flanking and ice or debris jam. Scour and erosion are also concerns to a lesser extent. Existing problems include upstream and downstream scour/erosion, poor location and alignment, and—most frequently—floodplain filled entirely or partially by roadway approaches. Problem conditions affecting the structures are: failing bank armoring (driveway bridge off City Stream Road and Route 9 culvert), higher downstream banks (third bridge Harbour Road bridge), sharp stream approach angle (Route 9 bridge and driveway bridge off City Stream Road), location at a significant valley break (first Harbour Road bridge), and potential avulsion following road (Route 9 bridge, second Harbour Road bridge, and National Forest bridge.

Table 3-1: Phase 1 Stream Characteristics.

Stream	Reach ID	Channel Length (ft)	Channel Slope	Valley Width (ft)	Confinement Type	Sinuosity	Stream Type	Bedform
City Stream	M06T3.05S1.01	7647	2.88%*	184*	Narrow	1.06	C3b*	Step-Pool
	M06T3.05S1.02	1972	3.80%	170*	Semi-Confined*	1.05	B2	Step-Pool
	M06T3.05S1.03**	10443	6.18%	NE	Narrowly Confined	1.03	A2	Step-Pool
	M06T3.05S1.04	4032	1.76%	1021*	Very Broad	1.12	C4	Riffle-Pool
	M06T3.05S1.06	2260	3.32%	705*	Very Broad	1.14	D4b*	Braided*
Bolles Brook	M06T3.05	5448	2.57%*	479*	Broad*	1.03	B3*	Step-Pool
	M06T3.06	5734	3.40%	476*	Very Broad*	1.11	D3b*	Braided*
	M06T3.07**	25432	6.02%	NE	Narrowly Confined	1.05	A	NE

**Modified during Phase 2 QA. **Reach not assessed in Phase 2.*

Table 3-2: Phase 2 Stream Characteristics.

Stream	Segment ID	Channel Length (ft)	Channel Slope	Confinement Type	Stream Type	Bedform
City Stream	M06T3.05S1.01A	2377	2.5%	Semi-Confined	B3	Step-Pool
	M06T3.05S1.01B	1346	1.5%	Narrowly Confined	F3	Step-Pool
	M06T3.05S1.01C	3924	3.1%	Narrow	B3	Step-Pool
	M06T3.05S1.02A	1073	1.9%	Narrowly Confined	F3	Step-Pool
	M06T3.05S1.02B	899	4.4%	Narrow	B3a	Step-Pool
	M06T3.05S1.04B	1112	0.9%	Very Broad	F4	Riffle-Pool
	M06T3.05S1.04D	1957	0.8%	Very Broad	F4	Plane Bed
	M06T3.05S1.06	2260	3.3%	Very Broad	D4b	Braided
Bolles Brook	M06T3.05A	2042	2.0%	Broad	B3	Step-Pool
	M06T3.05B	2242	1.8%	Broad	B3c	Step-Pool
	M06T3.05C	1163	1.7%	Very Broad	B3c	Step-Pool
	M06T3.06	5734	3.4%	Very Broad	D3b	Braided

Table 3-3: Cross-Section Measurements.

Stream	Segment ID	Bankfull Width (ft)	Floodprone Width (ft)	Valley Width (ft)	Max Depth (ft)	Mean Depth (ft)	RAF Height (ft)
City Stream	M06T3.05S1.01A	62	100	230	2.92	1.98	6.97
	M06T3.05S1.01B	57	65	82	3.07	2.11	7.36
	M06T3.05S1.01C	54	89	240	3.25	2.19	4.51
	M06T3.05S1.02A	61	68	72	2.94	1.70	22.06
	M06T3.05S1.02B	52	63	267	3.35	1.97	6.16
	M06T3.05S1.04B	23	30	1013	1.74	0.89	3.49
	M06T3.05S1.04D	16	21	1028	1.43	1.09	3.23
	M06T3.05S1.06	16	35	705	1.39	0.95	2.22
Bolles Brook	M06T3.05A	48	87	445	3.00	2.18	7.13
	M06T3.05B	56	87	535	2.88	1.87	5.18
	M06T3.05C	32	59	457	4.22	2.62	12.20
	M06T3.06	29	115	476	2.80	1.76	5.55

Table 3-4: Cross-Section Calculations.

Stream	Segment ID	Confinement Ratio	Entrenchment Ratio	Width/Depth Ratio	Incision Ratio	
					RAF	HEF
City Stream	M06T3.05S1.01A	3.7	1.61	31.3	2.39	3.98
	M06T3.05S1.01B	1.4	1.15	26.9	2.40	N/A
	M06T3.05S1.01C	4.4	1.64	24.6	1.39	4.19
	M06T3.05S1.02A	1.2	1.12	35.6	N/A	7.50
	M06T3.05S1.02B	5.1	1.21	26.4	1.84	N/A
	M06T3.05S1.04B	43.3	1.30	26.2	2.01	N/A
	M06T3.05S1.04D	64.3	1.33	14.6	2.26	N/A
	M06T3.05S1.06	43.3	2.13	17.1	1.60	N/A
Bolles Brook	M06T3.05A	9.3	1.80	22.0	2.38	N/A
	M06T3.05B	9.6	1.57	29.7	1.80	N/A
	M06T3.05C	14.3	1.85	12.2	N/A	2.89
	M06T3.06	16.4	3.96	16.4	1.98	N/A

Table 3-5: Rapid Habitat Assessment (RHA) Results.

Stream	Segment ID	RHA Score	RHA Condition
City Stream	M06T3.05S1.01A	0.74	Good
	M06T3.05S1.01B	0.66	Good
	M06T3.05S1.01C	0.68	Good
	M06T3.05S1.02A	0.60	Fair
	M06T3.05S1.02B	0.76	Good
	M06T3.05S1.04B	0.83	Good
	M06T3.05S1.04D	0.70	Good
	M06T3.05S1.06	0.84	Good
Bolles Brook	M06T3.05A	0.65	Fair*
	M06T3.05B	0.82	Good
	M06T3.05C	0.65	Fair*
	M06T3.06	0.81	Good

**Adjusted due to other factors.*

Table 3-6: Rapid Geomorphic Assessment (RGA) Results.

Stream	Segment ID	RGA Score	RGA Condition	Stream Type Departure	Evolution Stage	Adjustment Processes	Sensitivity
City Stream	M06T3.05S1.01A	0.60	Fair	Yes	III	Degradation	High
	M06T3.05S1.01B	0.51	Poor*	Yes	III	Degradation and Widening	Extreme
	M06T3.05S1.01C	0.48	Fair	Yes	III	Degradation, Widening, and Planform	High
	M06T3.05S1.02A	0.43	Fair	Yes	III-IV	Aggradation and Widening after Historic Degradation	Extreme
	M06T3.05S1.02B	0.51	Fair	No	II	Degradation	High
	M06T3.05S1.04B	0.64	Fair	Yes	II	Degradation	Extreme
	M06T3.05S1.04D	0.59	Fair	Yes	II	Degradation	Extreme
	M06T3.05S1.06	0.73	Good	No	IV	Planform	Extreme
Bolles Brook	M06T3.05A	0.50	Fair	No	III	Degradation and Widening	High
	M06T3.05B	0.56	Fair	No	IV	Widening and Aggradation	High
	M06T3.05C	0.60	Fair	No	II	Degradation	High
	M06T3.06	0.68	Good	No	IV	Planform	Extreme

**Adjusted due to other factors.*

Table 3-7: Percent of Stream Segments Impacted by Stressors.

Stream	Segment ID	Berms	Roads	Development	Straightening
City Stream	M06T3.05S1.01A	52%	28%	35%	5%
	M06T3.05S1.01B	32%	100%	0%	100%
	M06T3.05S1.01C	49%	45%	13%	100%
	M06T3.05S1.02A	0%	94%	0%	98%
	M06T3.05S1.02B	14%	100%	5%	93%
	M06T3.05S1.04B	0%	0%	0%	0%
	M06T3.05S1.04D	0%	40%	24%	53%
	M06T3.05S1.06	0%	21%	14%	11%
Bolles Brook	M06T3.05A	0%	43%	87%	85%
	M06T3.05B	0%	74%	29%	68%
	M06T3.05C	0%	97%	99%	75%
	M06T3.06	6%	34%	8%	0%

Table 3-8: Fluvial Erosion Hazard (FEH) Ratings.

Stream	Segment ID	Sensitivity	Stream Type Group	Existing Stream Type	Natural Valley Type	Departure from Equilibrium	FEH Rating	
City Stream	M06T3.05S1.01A	High	5	B3	Narrow	Stream Type Departure	HI	5
	M06T3.05S1.01B	Extreme	8	F3	Narrow	Stream Type Departure	EX	8
	M06T3.05S1.01C	High	5	B3	Narrow	Stream Type Departure	HI	5
	M06T3.05S1.02A	Extreme	8	F3	Narrowly Confined	Stream Type Departure	EX	8
	M06T3.05S1.02B	High	5	B3a	Narrowly Confined	Major Adjustment	HI	5
	M06T3.05S1.04B	Extreme	9	F4	Very Broad	Stream Type Departure	EX	9
	M06T3.05S1.04D	Extreme	9	F4	Very Broad	Stream Type Departure	EX	9
	M06T3.05S1.06	Extreme	10	D4b	Very Broad	Reference Condition	EX	10
Bolles Brook	M06T3.05A	High	5	B3	Broad	Major Adjustment	HI	5
	M06T3.05B	High	5	B3c	Broad	Major Adjustment	HI	5
	M06T3.05C	High	5	B3c	Very Broad	Major Adjustment	HI	5
	M06T3.06	Extreme	10	D3b	Very Broad	Reference Condition	EX	10

Table 3-9: Bridge and Culvert Locations and Dimensions.

Stream	Segment	Location	Type	Road Width (ft)	Structure Clearance/ Height (ft)	Structure Span/Width (ft)	Structure Width / Bankfull Width
City Stream	M06T3.05S1.01A	1st bridge on Harbour Rd.	Bridge	20.0	11.0	90.0	150%
	M06T3.05S1.02A	Route 9 (at Notch Rd.)	Bridge	45.0	30.0	250.0	556%
	M06T3.05S1.03	City Stream Rd.	Arch	40.0	8.5	16.0	59%
	M06T3.05S1.04A	Driveway off City Stream Rd.	Bridge	13.0	4.5	30.0	150%
	M06T3.05S1.04D	Prospect Access	Culvert	30.0	5.3	10.5	53%
	M06T3.05S1.04D	Greenwood Dr.	Culvert	23.5	6.0	12.0	67%
	M06T3.05S1.06	Driveway off Route 9	Bridge	11.5	4.2	14.5	97%
	M06T3.05S1.06	Snowmobile trail off Route 9	Bridge	7.0	4.7	45.0	300%
	M06T3.05S1.06	Route 9	Culvert	36.0	5.6	3.2	18%
	M06T3.05S1.07	Evergreen Ln.	Culvert	30.0	3.6	7.2	48%
Bolles Brook	M06T3.05B	2nd bridge on Harbour Rd.	Bridge	25.0	14.0	75.0	300%
	M06T3.05C	3rd bridge on Harbour Rd.	Bridge	20.0	7.0	80.0	133%
	M06T3.06	National Forest Rd.	Bridge	16.0	7.5	42.0	105%

4.0 Conclusions and Recommendations

In general, Bolles Brook seems to be in slightly better geomorphic condition than City Stream. While all but two of the segments on City Stream have experienced a stream type departure, none of those on Bolles Brook have yet departed from their reference stream type. However, most of the segments on both City Stream and Bolles Brook were found to be in major adjustment (fair condition). Only the uppermost assessed reach of each stream—both braided systems—are in good condition. Most of City Stream—especially in the lower reaches—has lost some or all access to its floodplain through encroachment by Route 9, berms, and, to a lesser extent, development. Bolles Brook is also encroached by a road (Harbour Road), but it is a secondary gravel road and not considered to be the valley wall as Route 9 is for City Stream. The main issue for Bolles Brook is existing and new residential development, which has impacted the majority of the lower reach. Stream sensitivity is either high or extreme on all assessed segments and reaches.

Habitat appears to be in slightly better condition on Bolles Brook as well, although it is suffering from the impact of development along the lower reach. City Stream also has fairly good habitat, but has more areas with sparsely vegetated road embankments and fragmented buffers.

Thirteen bridges and culverts on City Stream and Bolles Brook were assessed. Most of the structures were found to be in good condition with little potential to fail. About half of the structures act as a confinement to the stream channel or its ability to access its floodplains.

The information obtained from Phase 1 and Phase 2 stream geomorphic assessments can be a useful tool in creating a River Corridor Protection and Channel Management Plan to guide watershed decisions made by federal, state, and local agencies, organizations, and interest groups. Management strategies that resolve immediate site-specific conflicts in the context of broader, problem-solving goals will build community support and prove the most effective. More in-depth Phase 3 stream geomorphic assessments of target areas may be required before site-specific solutions for corridor protection and/or restoration can be developed and implemented.

Although it may be tempting to focus on the restoration of problem areas in fair or poor geomorphic condition, this strategy often requires intensive and potentially expensive in-stream management practices. Furthermore, elaborate channel restoration projects have the potential to fail, especially if the adjustment processes in the reach as well as upstream and downstream are not fully understood. Instead, using a watershed approach that places high priority on protecting those reaches that are currently in good condition or have a high recovery potential has proven to be a cost effective, long-term benefit to both the river and community as a whole. This approach will require coordination at the local, state, and federal level to educate the public and provide incentives to landowners.

Management alternatives can be classified as passive geomorphic approaches, active geomorphic approaches, channelization approaches, or no action approaches. Passive approaches involve strategies that remove constraints to a river's ability to establish geomorphic stability over time, and can include corridor conservation, land acquisition, berm removal/offsetting, and infrastructure alteration. Active geomorphic approaches attempt to restore the river to a geomorphically stable state through the construction of channel bed, bank, and/or floodplain modifications using process-driven and natural channel design concepts. Channelization approaches seek to maintain rivers through dredging and bank armoring applications where the dimension, pattern, and profile are not consistent with the condition. The no action approach takes no action whatsoever to address management conflicts. Erosion of bed and banks are allowed to continue and no effort is made to improve corridor ecological condition and function.

One passive approach that would help to protect undeveloped land from future development within the riparian corridor is to develop a Fluvial Erosion Hazard (FEH) zone. Potential avenues for FEH corridor protection implementation (e.g., ordinance, zoning, overlay districts, etc.) should be examined. A protected FEH corridor would allow for more natural adjustment of the streams, protect floodplain areas required for flow dispersement and sediment storage, decrease erosive forces within the channel, and allow for the rejuvenation and protection of a wooded corridor with increased erosion protection and ecological function. Areas in relatively good condition or with a high recovery potential that would benefit from such protection include the upper reaches of both streams (T3.06, T3.07, and S1.06) and the middle, relatively undeveloped segment of the lower reach on Bolles Brook (T3.05B).

Another protective measure that would help prevent further bank erosion, which can lead to bank armoring and degradation, is to plant stream buffer vegetation to stabilize the banks. Target areas should include locations where the buffer is currently less than 25 feet, such as most of the lower segment on Bolles Brook (T3.05A), as well as the straight, narrowly confined segment on the lower reach of City Stream (S1.01B). Removing or replacing structures such as undersized bridges/culverts or constrictions would provide the stream with more access to its floodplain. Target areas for structure removal could include the concrete slabs under the bridge in segment T3.05B of Bolles Brook or the old stone abutments/dams in reach S1.06 of City Stream. Although the removal or offsetting of berms along the lower reach of City Stream (S1.01) would provide more floodplain access, this strategy may not be feasible due to the potential for uncontrolled migration towards Route 9 and some residential properties. However, areas with a greater distance between the stream and Route 9 (specifically in segment S1.01C) may provide opportunities for offset berms. Finally, natural channel design of stream features such as meanders, bars, riffles, and pools may help restore over-widened reaches such as S1.02 (especially the lower segment) to a more sustainable balance of sediment and flow.

5.0 References

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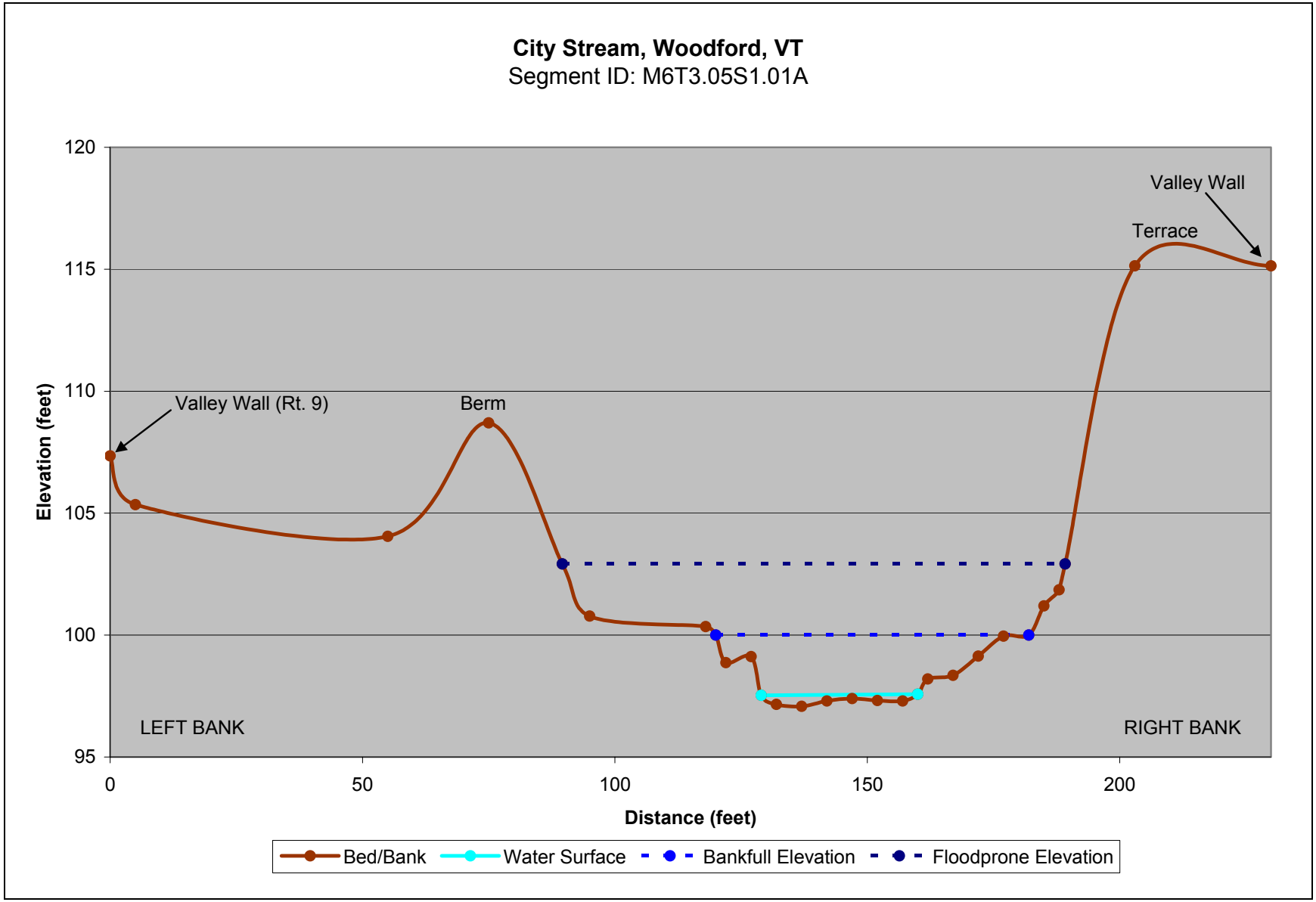
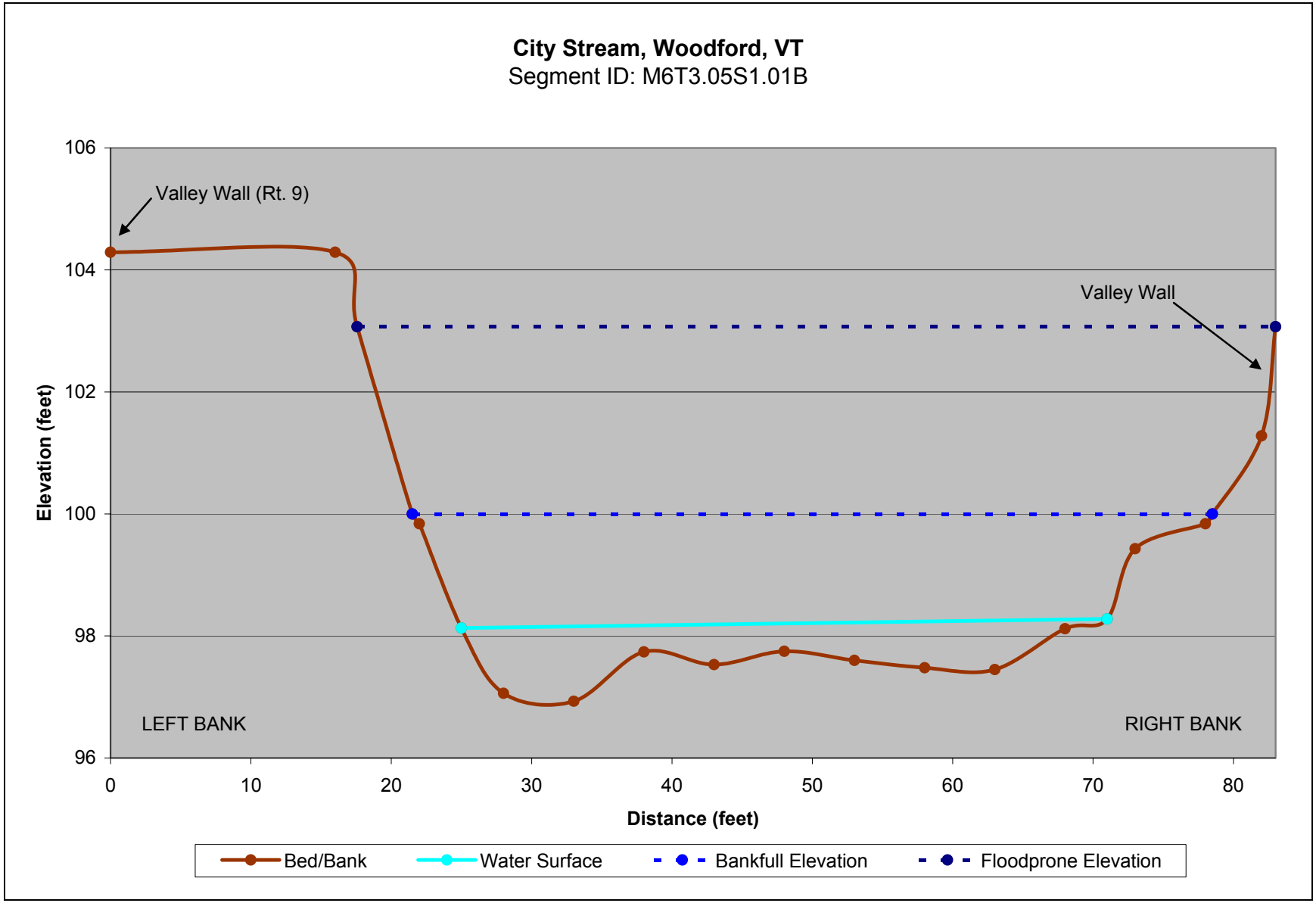
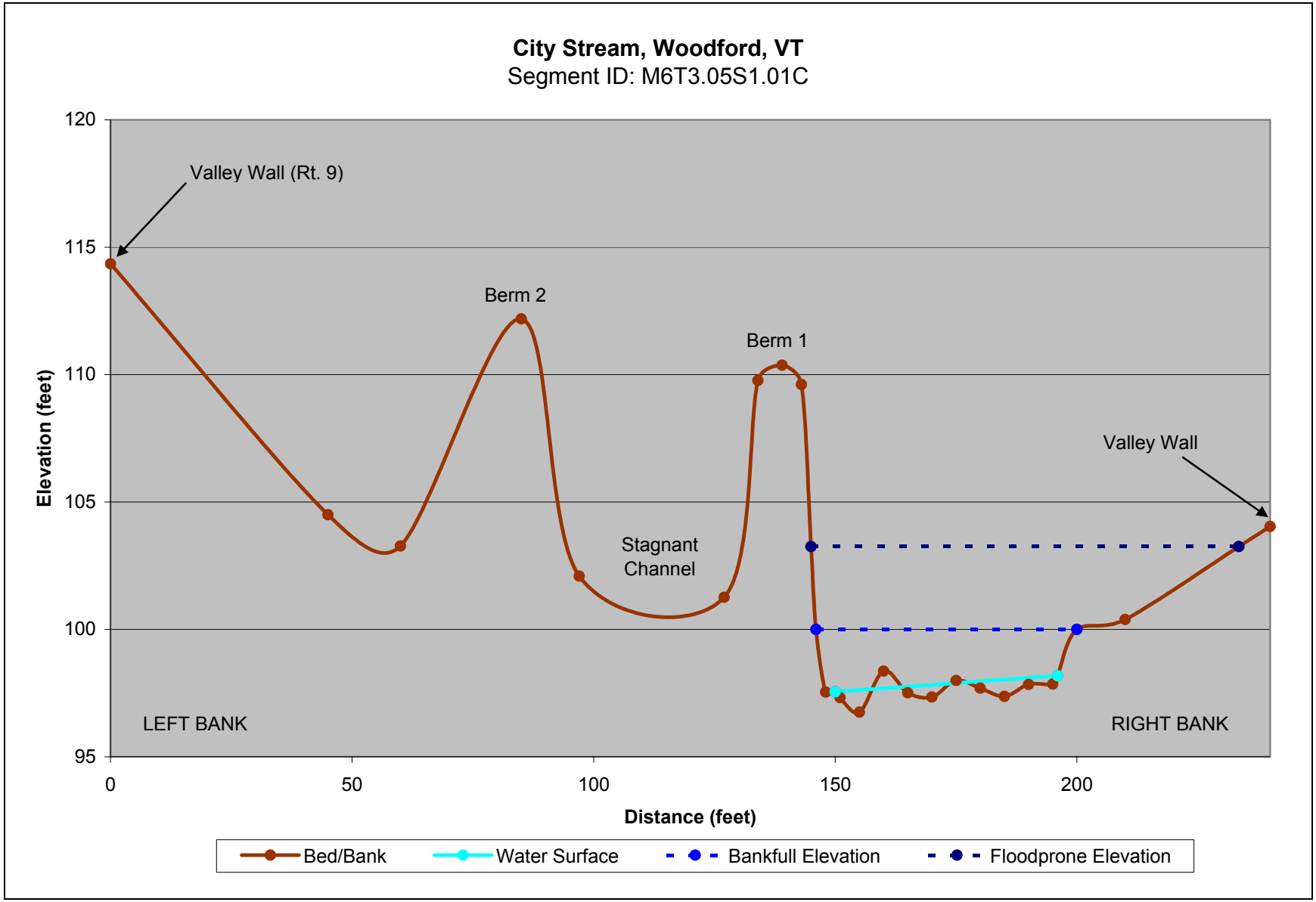
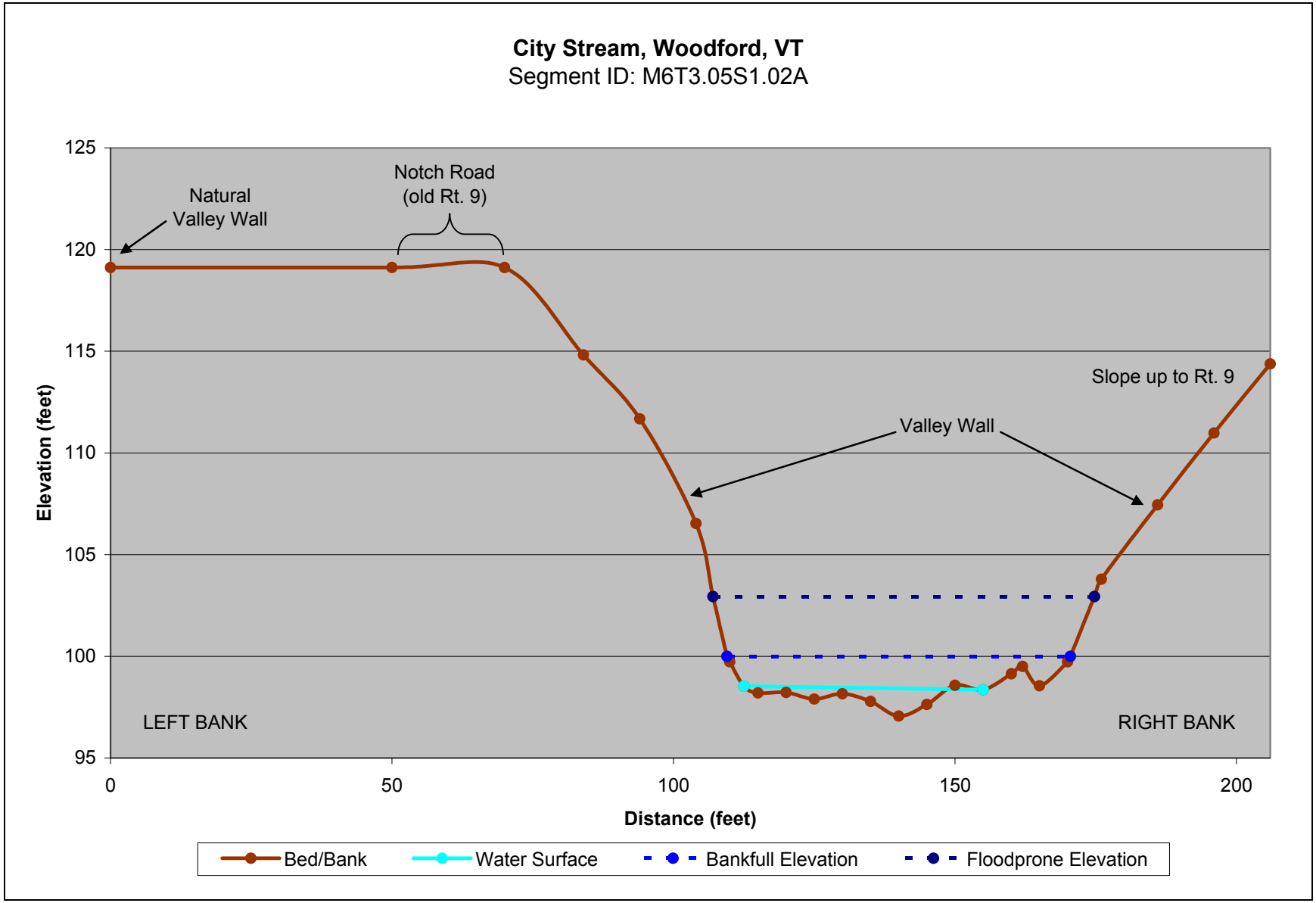
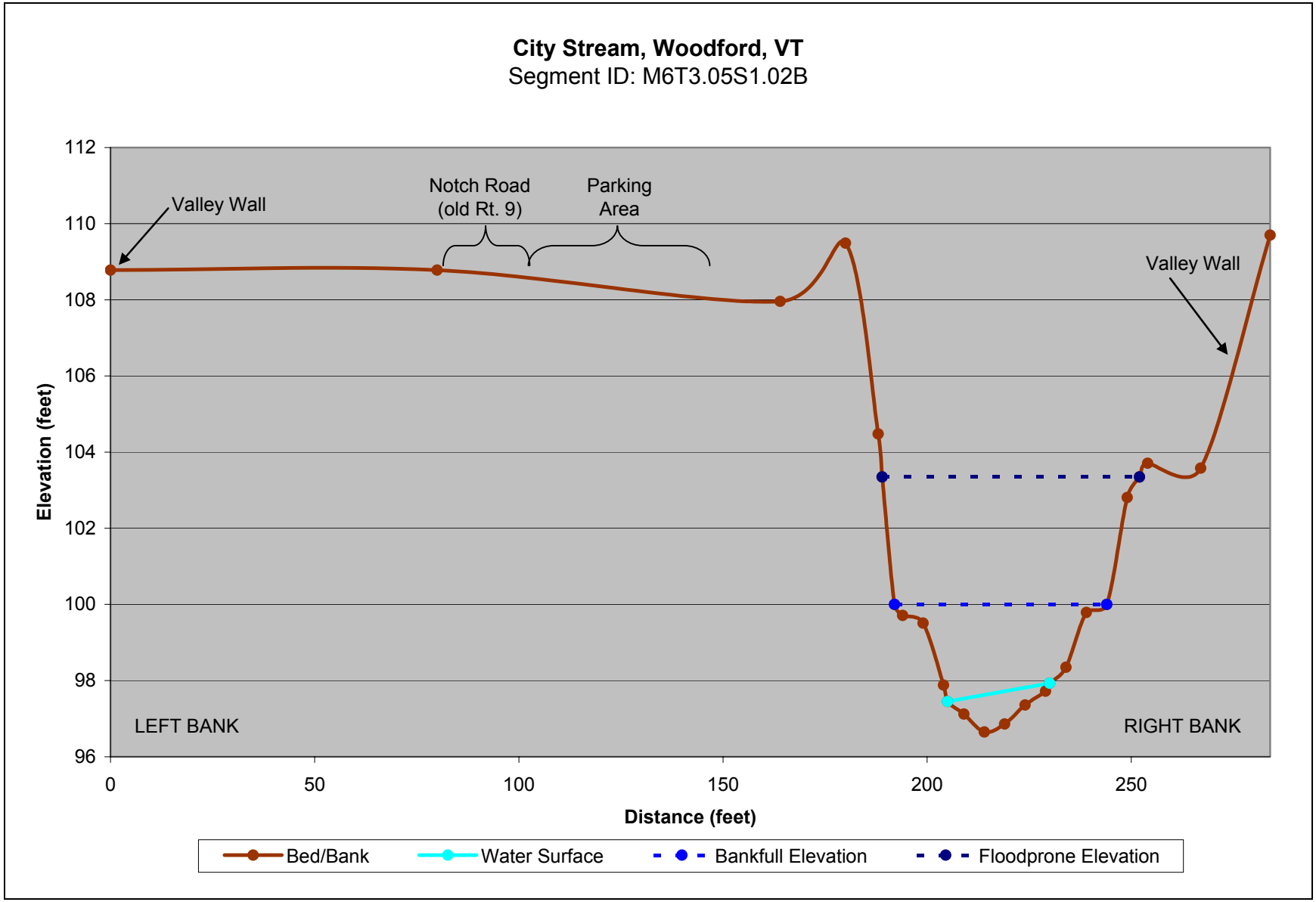
Appendix A: Cross-Section Diagrams

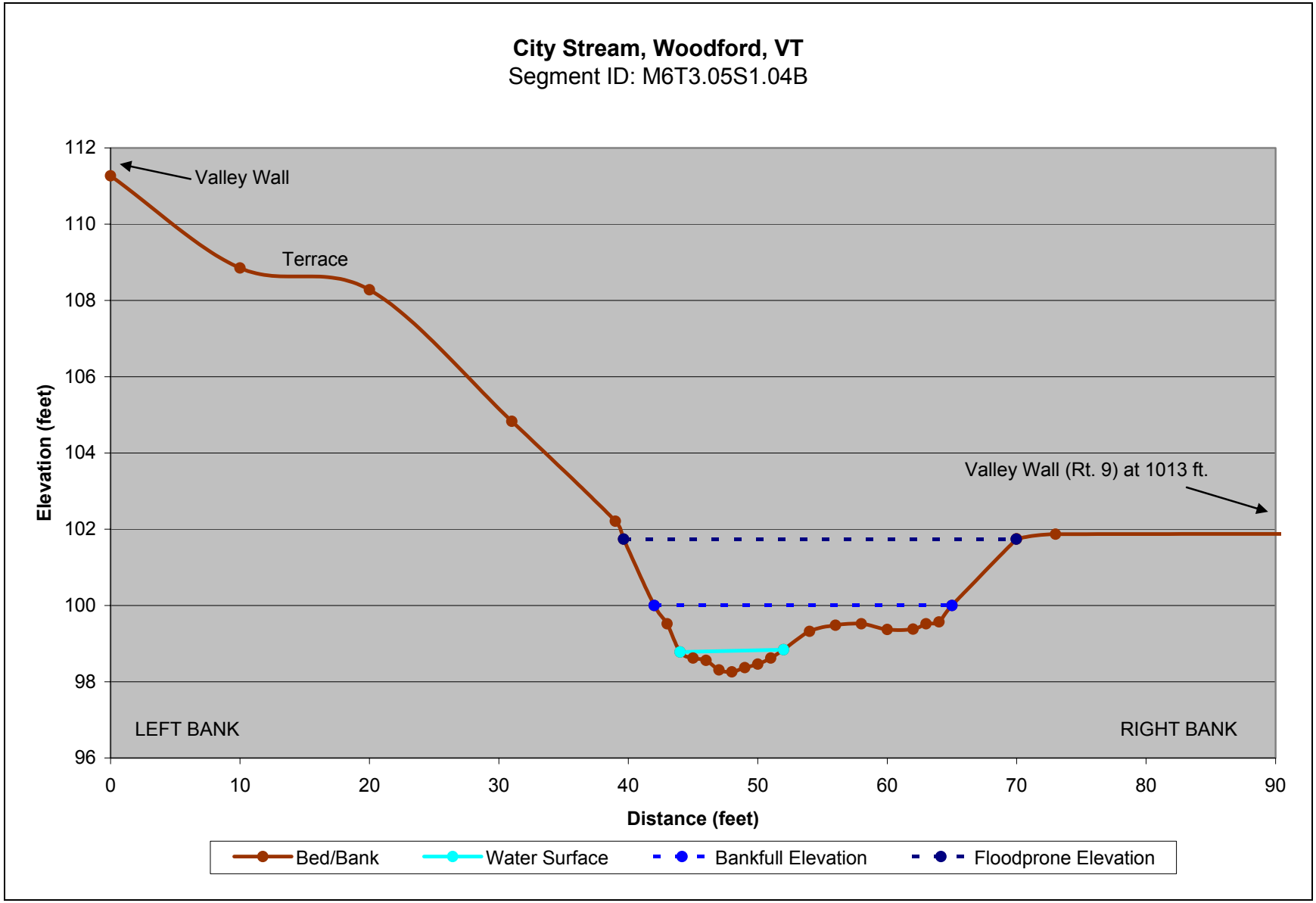

City Stream, Woodford, VT
Segment ID: M6T3.05S1.01A
120
115
110
105
100
95
Elevation (feet)
Valley Wall
Terrace
Valley Wall (Rt. 9)
Berm
LEFT BANK
RIGHT BANK
0
50
100
150
200
Distance (feet)
Bed/Bank
Water Surface
Bankfull Elevation
Floodprone Elevation

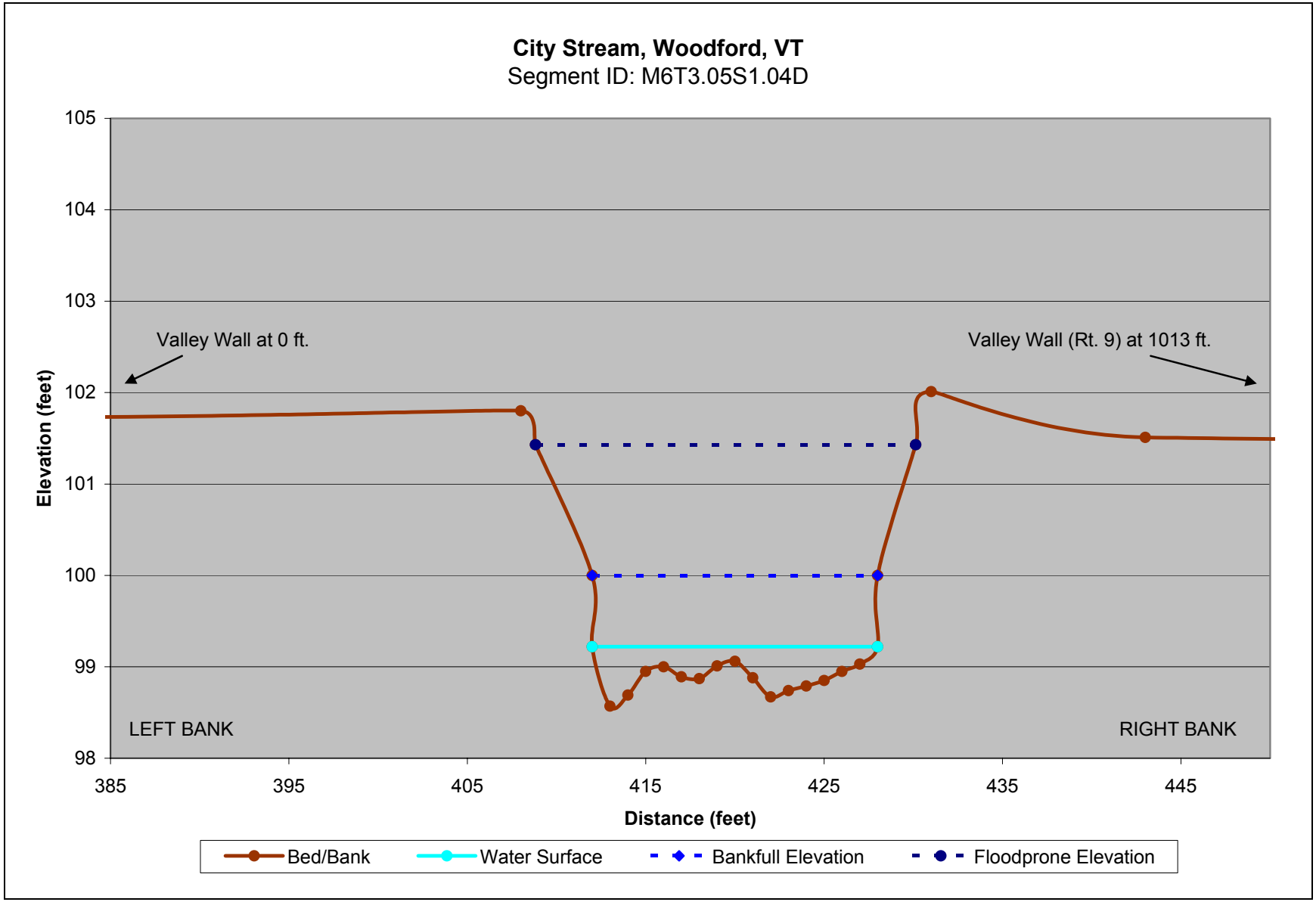

City Stream, Woodford, VT
Segment ID: M6T3.05S1.01B
Valley Wall (Rt. 9)
Valley Wall
LEFT BANK
RIGHT BANK
Elevation (feet)
Distance (feet)
106
104
102
100
98
96
0
10
20
30
40
50
60
70
80
Bed/Bank
Water Surface
Bankfull Elevation
Floodprone Elevation

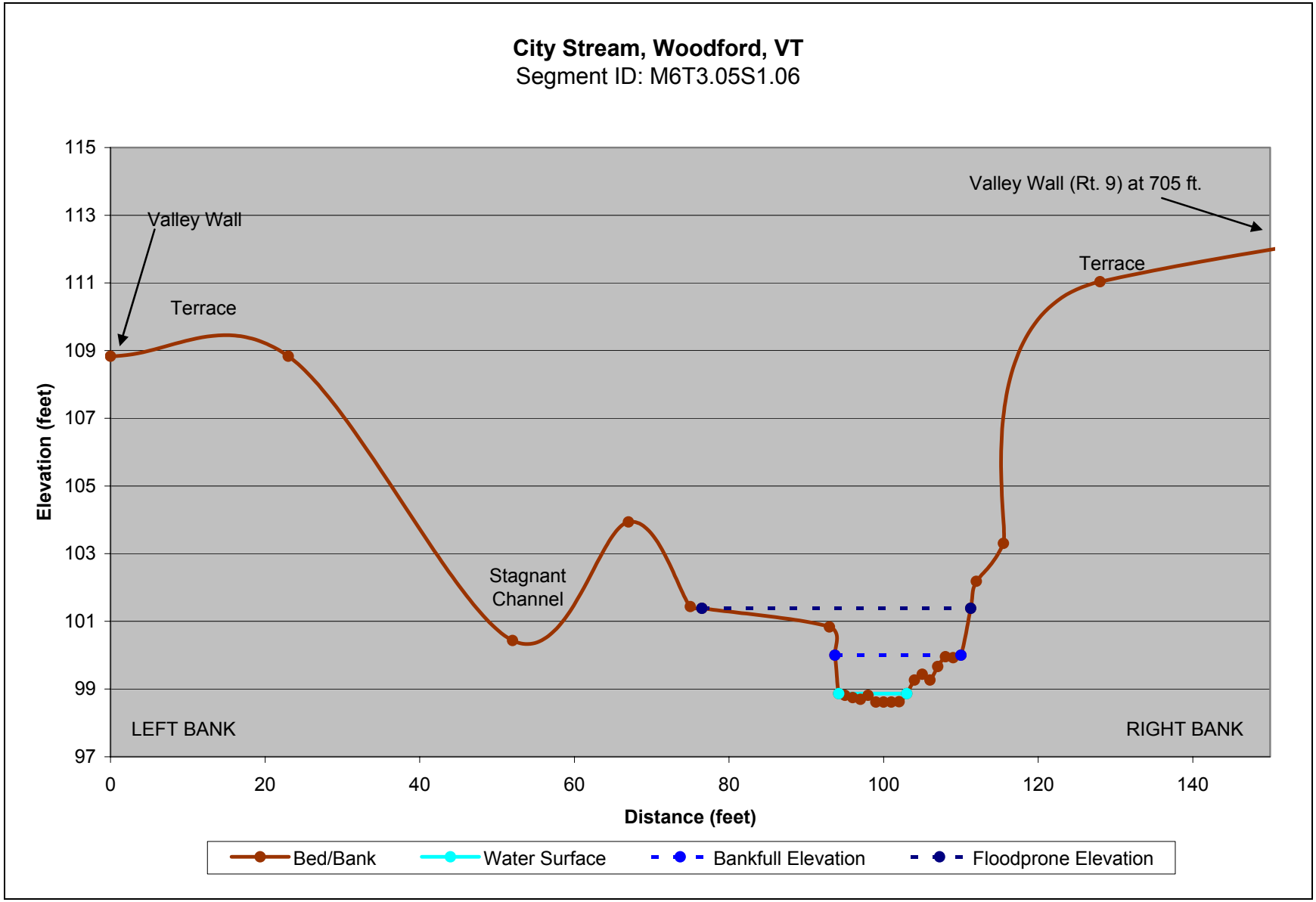

City Stream, Woodford, VT
Segment ID: M6T3.05S1.01C
120
115
110
105
100
95
Elevation (feet)
Valley Wall (Rt. 9)
Berm 2
Berm 1
Valley Wall
Stagnant
Channel
LEFT BANK
RIGHT BANK
0
50
100
150
200
Distance (feet)
Bed/Bank
Water Surface
Bankfull Elevation
Floodprone Elevation

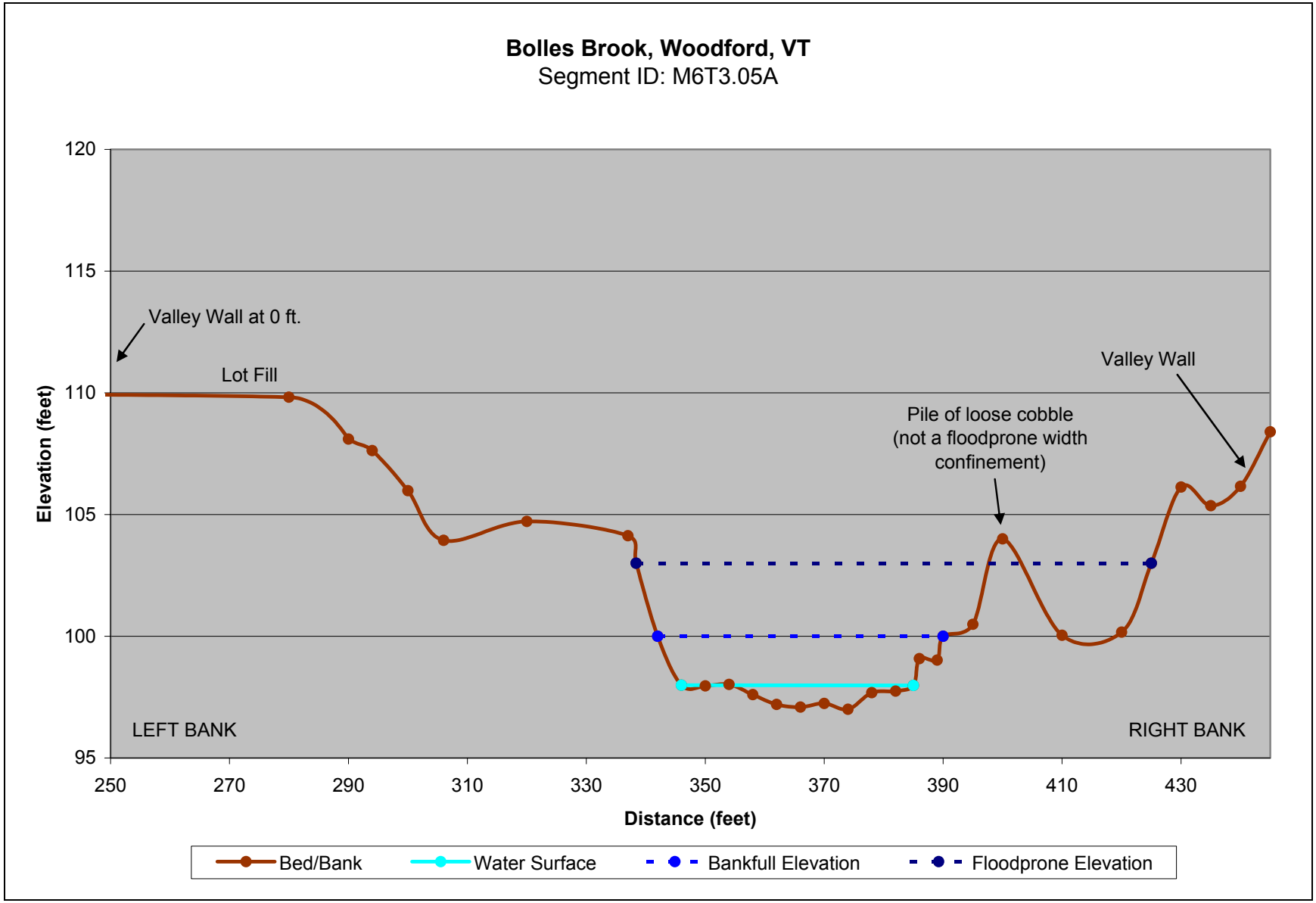

City Stream, Woodford, VT
Segment ID: M6T3.05S1.02A
Natural Valley Wall
Notch Road (old Rt. 9)
Slope up to Rt. 9
Valley Wall
LEFT BANK
RIGHT BANK
Elevation (feet)
125
120
115
110
105
100
95
0
50
100
150
200
Distance (feet)
Bed/Bank
Water Surface
Bankfull Elevation
Floodprone Elevation

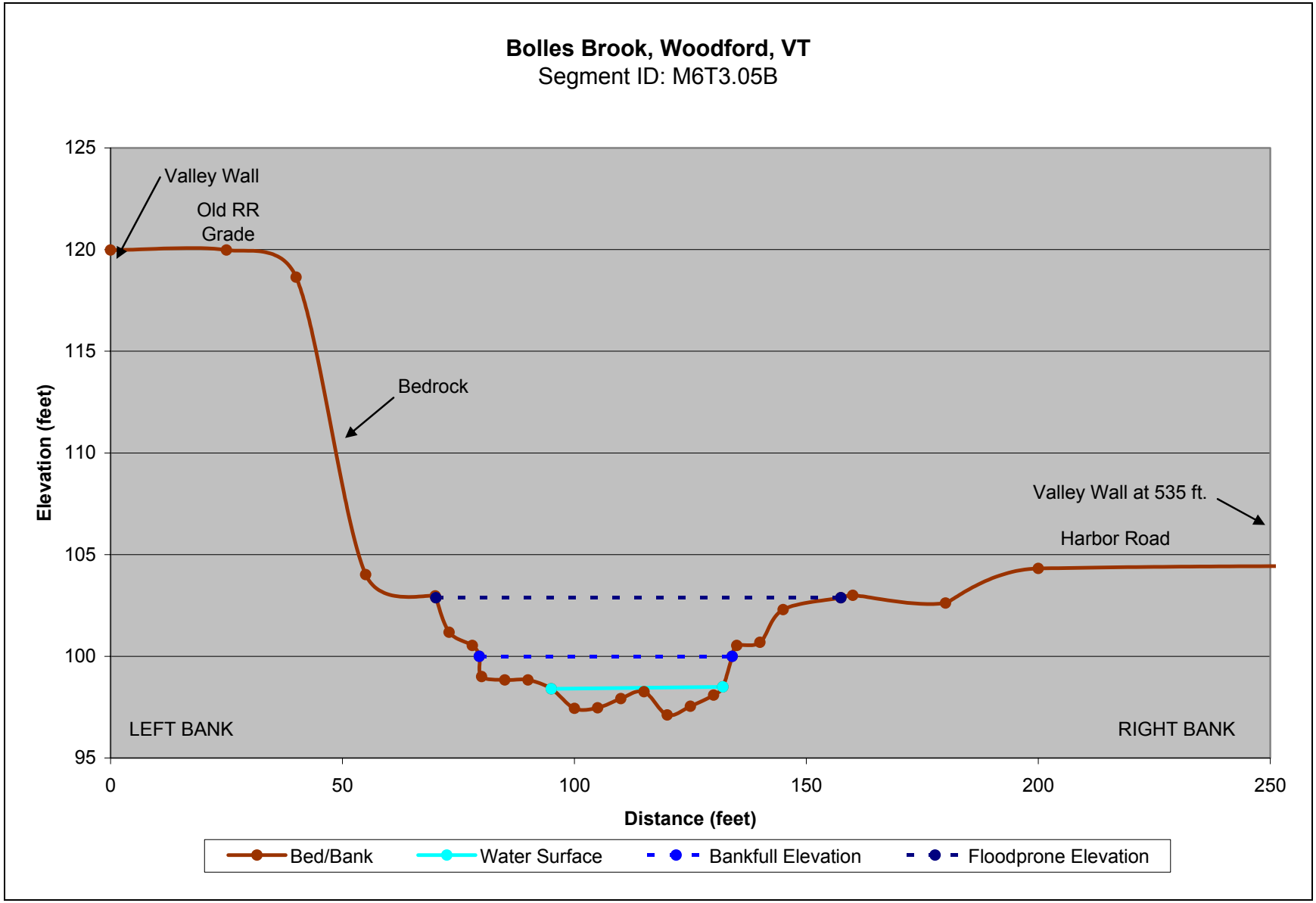

City Stream, Woodford, VT
Segment ID: M6T3.05S1.02B
Valley Wall
Notch Road
(old Rt. 9)
Parking
Area
Valley Wall
LEFT BANK
RIGHT BANK
Elevation (feet)
112
110
108
106
104
102
100
98
96
0
50
100
150
200
250
Distance (feet)
Bed/Bank
Water Surface
Bankfull Elevation
Floodprone Elevation

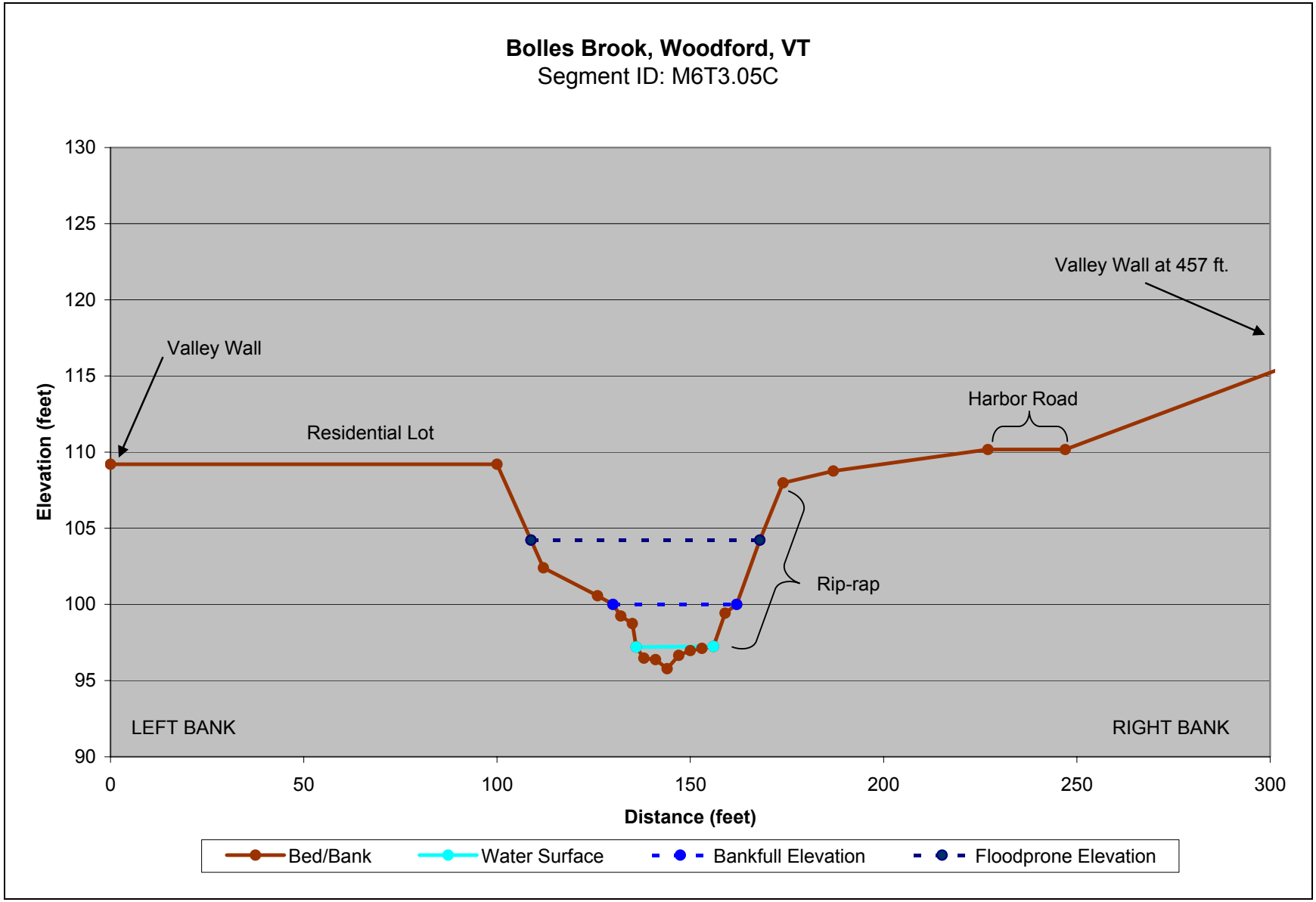

City Stream, Woodford, VT
Segment ID: M6T3.05S1.04B
Valley Wall
Terrace
Valley Wall (Rt. 9) at 1013 ft.
LEFT BANK
RIGHT BANK
Elevation (feet)
Distance (feet)
112
110
108
106
104
102
100
98
96
0
10
20
30
40
50
60
70
80
90
Bed/Bank
Water Surface
Bankfull Elevation
Floodprone Elevation

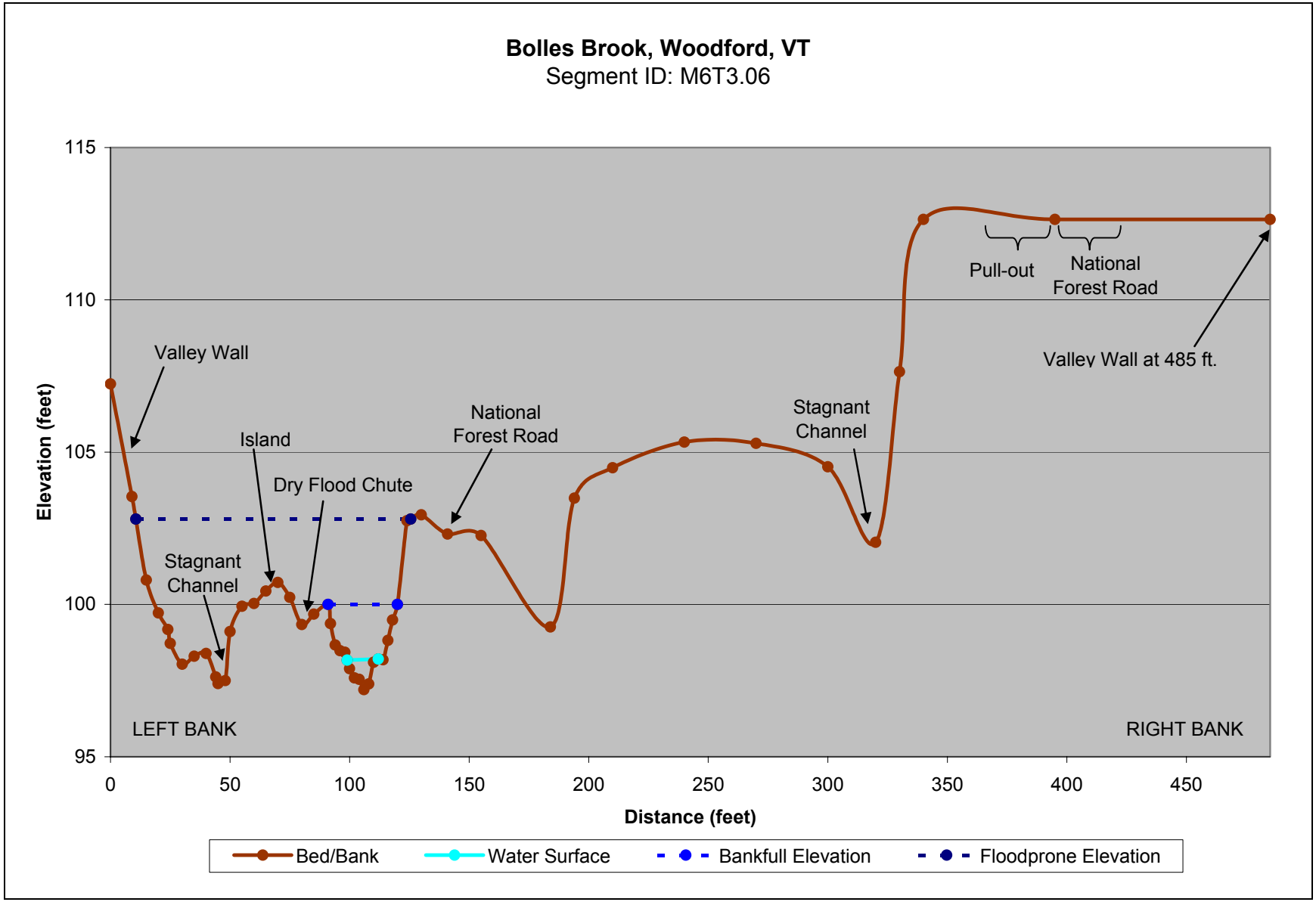

City Stream, Woodford, VT
Segment ID: M6T3.05S1.04D
105
104
103
102
101
100
99
98
Elevation (feet)
Valley Wall at 0 ft.
Valley Wall (Rt. 9) at 1013 ft.
LEFT BANK
RIGHT BANK
385
395
405
415
425
435
445
Distance (feet)
Bed/Bank
Water Surface
Bankfull Elevation
Floodprone Elevation


City Stream, Woodford, VT
Segment ID: M6T3.05S1.06
Valley Wall
Terrace
Stagnant Channel
Terrace
Valley Wall (Rt. 9) at 705 ft.
LEFT BANK
RIGHT BANK
Elevation (feet)
115
113
111
109
107
105
103
101
99
97
0
20
40
60
80
100
120
140
Distance (feet)
Bed/Bank
Water Surface
Bankfull Elevation
Floodprone Elevation


Bolles Brook, Woodford, VT
Segment ID: M6T3.05A
120
115
110
105
100
95
Elevation (feet)
Valley Wall at 0 ft.
Lot Fill
Pile of loose cobble
(not a floodprone width
confinement)
Valley Wall
LEFT BANK
RIGHT BANK
250
270
290
310
330
350
370
390
410
430
Distance (feet)
Bed/Bank
Water Surface
Bankfull Elevation
Floodprone Elevation


Bolles Brook, Woodford, VT
Segment ID: M6T3.05B
Valley Wall
Old RR Grade
Bedrock
Valley Wall at 535 ft.
Harbor Road
LEFT BANK
RIGHT BANK
Elevation (feet)
125
120
115
110
105
100
95
0
50
100
150
200
250
Distance (feet)
Bed/Bank
Water Surface
Bankfull Elevation
Floodprone Elevation


Bolles Brook, Woodford, VT
Segment ID: M6T3.05C
Elevation (feet)
130
125
120
115
110
105
100
95
90
0
50
100
150
200
250
300
Distance (feet)
Valley Wall
Valley Wall at 457 ft.
Residential Lot
Harbor Road
Rip-rap
LEFT BANK
RIGHT BANK
Bed/Bank
Water Surface
Bankfull Elevation
Floodprone Elevation


Bolles Brook, Woodford, VT
Segment ID: M6T3.06
Elevation (feet)
115
110
105
100
95
0
50
100
150
200
250
300
350
400
450
Distance (feet)
Valley Wall
Island
Dry Flood Chute
National Forest Road
Stagnant Channel
Stagnant Channel
Pull-out
National Forest Road
Valley Wall at 485 ft.
LEFT BANK
RIGHT BANK
Bed/Bank
Water Surface
Bankfull Elevation
Floodprone Elevation

Appendix B: Summary of Stream Features and Impacts

Table B-1: Summary of Stream Features and Impacts. *(Continued on pages B-2 through B-8)*

Reach/Segment	Impact	Sub-Impact	Comment	Length (ft)	Parameter 1	Value 1	Parameter 2	Value 2
M6T3.05S1.01A	Bank Armoring or Revetment	Rip-Rap	Right Bank	9.91	-----	0	-----	0
M6T3.05S1.01A	Bridge or Culvert	Bridge		0.00	Length	200	-----	0
M6T3.05S1.01A	Buffers Less than 25 feet		Left Bank	33.33	-----	0	-----	0
M6T3.05S1.01A	Buffers Less than 25 feet		Right Bank	181.38	-----	0	-----	0
M6T3.05S1.01A	Cross Section Location	Representative		0.00	Number	1	-----	0
M6T3.05S1.01A	Development		One Side	412.93	-----	0	-----	0
M6T3.05S1.01A	Development		One Side	242.28	-----	0	-----	0
M6T3.05S1.01A	Development		One Side	178.63	-----	0	-----	0
M6T3.05S1.01A	Dredging	Dredging	General Location	0.00	-----	0	-----	0
M6T3.05S1.01A	Dredging	Dredging	General Location	0.00	-----	0	-----	0
M6T3.05S1.01A	Dredging	Dredging	General Location	0.00	-----	0	-----	0
M6T3.05S1.01A	Dredging	Dredging	General Location	0.00	-----	0	-----	0
M6T3.05S1.01A	Dredging	Dredging	General Location	0.00	-----	0	-----	0
M6T3.05S1.01A	Encroachment	Berm	One Side	640.43	Height	10	-----	0
M6T3.05S1.01A	Encroachment	Berm	One Side	587.73	Height	6	-----	0
M6T3.05S1.01A	Encroachment	Road	One Side	569.79	Height	11	-----	0
M6T3.05S1.01A	Encroachment	Road	One Side	105.69	Height	8	-----	0
M6T3.05S1.01A	Erosion		Left Bank	109.64	Height	6	-----	0
M6T3.05S1.01A	Migration	Braiding		0.00	-----	0	-----	0
M6T3.05S1.01A	Migration	Braiding		0.00	-----	0	-----	0
M6T3.05S1.01A	Migration	Flood Chute		0.00	-----	0	-----	0
M6T3.05S1.01A	Migration	Flood Chute		0.00	-----	0	-----	0
M6T3.05S1.01A	Steep Riffle or Head Cut	Head Cut		0.00	-----	0	-----	0
M6T3.05S1.01A	Steep Riffle or Head Cut	Steep Riffle		0.00	-----	0	-----	0
M6T3.05S1.01A	Straightening	Straightening		125.93	-----	0	-----	0
M6T3.05S1.01A	Stream Crossing	Stream Ford		0.00	-----	0	-----	0
M6T3.05S1.01B	Bank Armoring or Revetment	Rip-Rap	Left Bank	172.18	-----	0	-----	0
M6T3.05S1.01B	Bank Armoring or Revetment	Rip-Rap	Left Bank	107.81	-----	0	-----	0
M6T3.05S1.01B	Bank Armoring or Revetment	Rip-Rap	Left Bank	22.73	-----	0	-----	0
M6T3.05S1.01B	Cross Section Location	Representative		0.00	Number	1	-----	0

Reach/Segment	Impact	Sub-Impact	Comment	Length (ft)	Parameter 1	Value 1	Parameter 2	Value 2
M6T3.05S1.01B	Dredging	Dredging	General Location	0.00	-----	0	-----	0
M6T3.05S1.01B	Encroachment	Berm	One Side	434.00	Height	6	-----	0
M6T3.05S1.01B	Encroachment	Road	One Side	1346.22	Height	8	-----	0
M6T3.05S1.01B	Erosion		Left Bank	221.92	Height	5	-----	0
M6T3.05S1.01B	Steep Riffle or Head Cut	Head Cut		0.00	-----	0	-----	0
M6T3.05S1.01B	Straightening	Straightening		1346.22	-----	0	-----	0
M6T3.05S1.01C	Bank Armoring or Revetment	Rip-Rap	Left Bank	278.60	-----	0	-----	0
M6T3.05S1.01C	Cross Section Location	Representative		0.00	Number	1	-----	0
M6T3.05S1.01C	Development		One Side	109.83	-----	0	-----	0
M6T3.05S1.01C	Development		One Side	412.34	-----	0	-----	0
M6T3.05S1.01C	Dredging	Dredging	General Location	0.00	-----	0	-----	0
M6T3.05S1.01C	Dredging	Dredging	General Location	0.00	-----	0	-----	0
M6T3.05S1.01C	Dredging	Dredging	General Location	0.00	-----	0	-----	0
M6T3.05S1.01C	Dredging	Dredging	General Location	0.00	-----	0	-----	0
M6T3.05S1.01C	Encroachment	Berm	One Side	678.81	Height	6	-----	0
M6T3.05S1.01C	Encroachment	Berm	One Side	199.67	Height	4	-----	0
M6T3.05S1.01C	Encroachment	Berm	One Side	412.50	Height	6	-----	0
M6T3.05S1.01C	Encroachment	Berm	One Side	463.99	Height	8	-----	0
M6T3.05S1.01C	Encroachment	Berm	One Side	249.34	Height	10	-----	0
M6T3.05S1.01C	Encroachment	Berm	One Side	613.01	Height	6	-----	0
M6T3.05S1.01C	Encroachment	Road	One Side	689.51	Height	8	-----	0
M6T3.05S1.01C	Encroachment	Road	One Side	1068.22	Height	20	-----	0
M6T3.05S1.01C	Erosion		Left Bank	222.80	Height	6	-----	0
M6T3.05S1.01C	Erosion		Left Bank	58.75	Height	5	-----	0
M6T3.05S1.01C	Erosion		Left Bank	109.87	Height	4	-----	0
M6T3.05S1.01C	Erosion		Left Bank	36.62	Height	4	-----	0
M6T3.05S1.01C	Erosion		Left Bank	60.87	Height	4	-----	0
M6T3.05S1.01C	Erosion		Right Bank	99.81	Height	8	-----	0
M6T3.05S1.01C	Erosion		Left Bank	62.11	Height	8	-----	0
M6T3.05S1.01C	Erosion		Right Bank	60.45	Height	8	-----	0
M6T3.05S1.01C	Erosion		Right Bank	158.43	Height	4	-----	0
M6T3.05S1.01C	Mass Failure		Right Bank	43.27	Height	20	-----	0

Reach/Segment	Impact	Sub-Impact	Comment	Length (ft)	Parameter 1	Value 1	Parameter 2	Value 2
M6T3.05S1.01C	Migration	Flood Chute		0.00	-----	0	-----	0
M6T3.05S1.01C	Steep Riffle or Head Cut	Steep Riffle		0.00	-----	0	-----	0
M6T3.05S1.01C	Stormwater Input	Road Ditch		0.00	-----	0	-----	0
M6T3.05S1.01C	Stormwater Input	Road Ditch		0.00	-----	0	-----	0
M6T3.05S1.01C	Stormwater Input	Road Ditch		0.00	-----	0	-----	0
M6T3.05S1.01C	Straightening	Straightening		953.63	-----	0	-----	0
M6T3.05S1.01C	Straightening	Straightening		1384.35	-----	0	-----	0
M6T3.05S1.01C	Straightening	Straightening		1573.17	-----	0	-----	0
M6T3.05S1.02A	Bank Armoring or Revetment	Hard Bank	Left Bank	280.23	-----	0	-----	0
M6T3.05S1.02A	Bank Armoring or Revetment	Hard Bank	Left Bank	236.23	-----	0	-----	0
M6T3.05S1.02A	Bank Armoring or Revetment	Rip-Rap	Left Bank	241.26	-----	0	-----	0
M6T3.05S1.02A	Bank Armoring or Revetment	Rip-Rap	Right Bank	392.71	-----	0	-----	0
M6T3.05S1.02A	Bank Armoring or Revetment	Rip-Rap	Left Bank	87.06	-----	0	-----	0
M6T3.05S1.02A	Cross Section Location	Representative		0.00	Number	1	-----	0
M6T3.05S1.02A	Encroachment	Road	One Side	409.25	Height	20	-----	0
M6T3.05S1.02A	Encroachment	Road	Both Sides	353.08	Height	25	-----	0
M6T3.05S1.02A	Encroachment	Road	One Side	246.10	Height	13	-----	0
M6T3.05S1.02A	Erosion		Left Bank	75.43	Height	8	-----	0
M6T3.05S1.02A	Erosion		Right Bank	57.96	Height	8	-----	0
M6T3.05S1.02A	Steep Riffle or Head Cut	Steep Riffle		0.00	-----	0	-----	0
M6T3.05S1.02A	Stormwater Input	Road Ditch		0.00	-----	0	-----	0
M6T3.05S1.02A	Stormwater Input	Road Ditch		0.00	-----	0	-----	0
M6T3.05S1.02A	Stormwater Input	Road Ditch		0.00	-----	0	-----	0
M6T3.05S1.02A	Straightening	Straightening		332.34	-----	0	-----	0
M6T3.05S1.02A	Straightening	Straightening		716.22	-----	0	-----	0
M6T3.05S1.02B	Bank Armoring or Revetment	Hard Bank	Left Bank	70.23	-----	0	-----	0
M6T3.05S1.02B	Cross Section Location	Representative		0.00	Number	1	-----	0
M6T3.05S1.02B	Development		One Side	42.40	-----	0	-----	0
M6T3.05S1.02B	Dredging	Dredging	General Location	0.00	-----	0	-----	0
M6T3.05S1.02B	Encroachment	Berm	One Side	126.96	Height	6	-----	0
M6T3.05S1.02B	Encroachment	Road	One Side	898.92	Height	13	-----	0
M6T3.05S1.02B	Erosion		Right Bank	39.49	Height	8	-----	0

Reach/Segment	Impact	Sub-Impact	Comment	Length (ft)	Parameter 1	Value 1	Parameter 2	Value 2
M6T3.05S1.02B	Erosion		Left Bank	321.24	Height	3	-----	0
M6T3.05S1.02B	Erosion		Right Bank	132.81	Height	4	-----	0
M6T3.05S1.02B	Straightening	Straightening		837.61	-----	0	-----	0
M6T3.05S1.03-	Bridge or Culvert	Bridge		0.00	Length	200	-----	0
M6T3.05S1.03-	Bridge or Culvert	Culvert		0.00	Length	75	-----	0
M6T3.05S1.03-	Buffers Less than 25 feet		Left Bank	119.51	-----	0	-----	0
M6T3.05S1.03-	Buffers Less than 25 feet		Left Bank	28.05	-----	0	-----	0
M6T3.05S1.03-	Buffers Less than 25 feet		Right Bank	649.46	-----	0	-----	0
M6T3.05S1.03-	Buffers Less than 25 feet		Right Bank	2980.00	-----	0	-----	0
M6T3.05S1.03-	Buffers Less than 25 feet		Right Bank	255.25	-----	0	-----	0
M6T3.05S1.03-	Development		One Side	984.95	-----	0	-----	0
M6T3.05S1.03-	Development		One Side	103.62	-----	0	-----	0
M6T3.05S1.03-	Encroachment	Road	One Side	118.24	Height	13	-----	0
M6T3.05S1.03-	Encroachment	Road	One Side	6267.29	Height	0	-----	0
M6T3.05S1.03-	Encroachment	Road	One Side	294.43	Height	0	-----	0
M6T3.05S1.03-	Encroachment	Road	Both Sides	62.16	Height	0	-----	0
M6T3.05S1.03-	Encroachment	Road	One Side	568.77	Height	6	-----	0
M6T3.05S1.03-	Grade Control	Ledge	Picture	0.00	Height	0	HtAbvWater	0
M6T3.05S1.04A	Buffers Less than 25 feet		Left Bank	35.83	-----	0	-----	0
M6T3.05S1.04A	Encroachment	Road	One Side	72.78	Height	6	-----	0
M6T3.05S1.04A	Grade Control	Ledge	Picture	0.00	Height	1	HtAbvWater	0
M6T3.05S1.04A	Grade Control	Waterfall	Picture	0.00	Height	6	HtAbvWater	5
M6T3.05S1.04B	Cross Section Location	Representative		0.00	Number	1	-----	0
M6T3.05S1.04B	Encroachment	Improved Path	One Side	300.92	Height	10	-----	0
M6T3.05S1.04B	Grade Control	Ledge	Picture	0.00	Height	2	HtAbvWater	1
M6T3.05S1.04B	Grade Control	Ledge	Picture	0.00	Height	1	HtAbvWater	1
M6T3.05S1.04B	Steep Riffle or Head Cut	Steep Riffle		0.00	-----	0	-----	0
M6T3.05S1.04C	Bank Armoring or Revetment	Rip-Rap	Left Bank	22.63	-----	0	-----	0
M6T3.05S1.04C	Bank Armoring or Revetment	Rip-Rap	Right Bank	14.87	-----	0	-----	0
M6T3.05S1.04C	Beaver Dam			0.00	Length	420	-----	0
M6T3.05S1.04C	Bridge or Culvert	Culvert		0.00	Length	75	-----	0
M6T3.05S1.04C	Development		Both Sides	263.48	-----	0	-----	0

Reach/Segment	Impact	Sub-Impact	Comment	Length (ft)	Parameter 1	Value 1	Parameter 2	Value 2
M6T3.05S1.04C	Encroachment	Road	One Side	60.14	Height	6	-----	0
M6T3.05S1.04C	Straightening	Straightening		254.45	-----	0	-----	0
M6T3.05S1.04D	Bank Armoring or Revetment	Rip-Rap	Right Bank	56.06	-----	0	-----	0
M6T3.05S1.04D	Bank Armoring or Revetment	Rip-Rap	Right Bank	131.06	-----	0	-----	0
M6T3.05S1.04D	Beaver Dam			0.00	Length	150	-----	0
M6T3.05S1.04D	Bridge or Culvert	Bridge		0.00	Length	0	-----	0
M6T3.05S1.04D	Bridge or Culvert	Bridge		0.00	Length	0	-----	0
M6T3.05S1.04D	Bridge or Culvert	Culvert		0.00	Length	75	-----	0
M6T3.05S1.04D	Buffers Less than 25 feet		Right Bank	509.01	-----	0	-----	0
M6T3.05S1.04D	Development		One Side	243.75	-----	0	-----	0
M6T3.05S1.04D	Development		Both Sides	30.80	-----	0	-----	0
M6T3.05S1.04D	Development		Both Sides	196.25	-----	0	-----	0
M6T3.05S1.04D	Encroachment	Improved Path	One Side	501.48	Height	0	-----	0
M6T3.05S1.04D	Encroachment	Road	One Side	255.90	Height	6	-----	0
M6T3.05S1.04D	Encroachment	Road	One Side	530.25	Height	7	-----	0
M6T3.05S1.04D	Straightening	Straightening		700.14	-----	0	-----	0
M6T3.05S1.04D	Straightening	Straightening		332.00	-----	0	-----	0
M6T3.05S1.05-	Buffers Less than 25 feet		Right Bank	20.59	-----	0	-----	0
M6T3.05S1.05-	Grade Control	Dam	No Picture	0.00	Height	0	HtAbvWater	0
M6T3.05S1.06-	Bridge or Culvert	Bridge		0.00	Length	200	-----	0
M6T3.05S1.06-	Bridge or Culvert	Culvert		0.00	Length	75	-----	0
M6T3.05S1.06-	Buffers Less than 25 feet		Left Bank	26.49	-----	0	-----	0
M6T3.05S1.06-	Buffers Less than 25 feet		Left Bank	330.04	-----	0	-----	0
M6T3.05S1.06-	Buffers Less than 25 feet		Right Bank	29.74	-----	0	-----	0
M6T3.05S1.06-	Buffers Less than 25 feet		Right Bank	335.45	-----	0	-----	0
M6T3.05S1.06-	Debris Jam			0.00	-----	0	-----	0
M6T3.05S1.06-	Debris Jam			0.00	-----	0	-----	0
M6T3.05S1.06-	Debris Jam			0.00	-----	0	-----	0
M6T3.05S1.06-	Debris Jam			0.00	-----	0	-----	0
M6T3.05S1.06-	Debris Jam			0.00	-----	0	-----	0
M6T3.05S1.06-	Development		Both Sides	307.47	-----	0	-----	0
M6T3.05S1.06-	Encroachment	Road	One Side	467.26	Height	8	-----	0

Reach/Segment	Impact	Sub-Impact	Comment	Length (ft)	Parameter 1	Value 1	Parameter 2	Value 2
M6T3.05S1.06-	Grade Control	Ledge	Picture	0.00	Height	1	HtAbvWater	1
M6T3.05S1.06-	Grade Control	Ledge	Picture	0.00	Height	2	HtAbvWater	1
M6T3.05S1.06-	Migration	Braiding		0.00	-----	0	-----	0
M6T3.05S1.06-	Migration	Braiding		0.00	-----	0	-----	0
M6T3.05S1.06-	Migration	Braiding		0.00	-----	0	-----	0
M6T3.05S1.06-	Migration	Braiding		0.00	-----	0	-----	0
M6T3.05S1.06-	Migration	Braiding		0.00	-----	0	-----	0
M6T3.05S1.06-	Migration	Flood Chute		0.00	-----	0	-----	0
M6T3.05S1.06-	Steep Riffle or Head Cut	Steep Riffle		0.00	-----	0	-----	0
M6T3.05S1.06-	Straightening	Straightening		249.38	-----	0	-----	0
M6T3.05S1.07-	Bridge or Culvert	Culvert		0.00	Length	75	-----	0
M6T3.05S1.07-	Buffers Less than 25 feet		Left Bank	32.20	-----	0	-----	0
M6T3.05S1.07-	Buffers Less than 25 feet		Left Bank	229.55	-----	0	-----	0
M6T3.05S1.07-	Buffers Less than 25 feet		Right Bank	54.71	-----	0	-----	0
M6T3.05S1.07-	Buffers Less than 25 feet		Right Bank	143.65	-----	0	-----	0
M6T3.05S1.07-	Development		One Side	367.13	-----	0	-----	0
M6T3.05S1.07-	Development		Both Sides	62.44	-----	0	-----	0
M6T3.05S1.07-	Grade Control	Dam	No Picture	0.00	Height	0	HtAbvWater	0
M6T3.05S1.07-	Straightening	Straightening		800.18	-----	0	-----	0
M6T3.05A	Buffers Less than 25 feet		Left Bank	421.69	-----	0	-----	0
M6T3.05A	Buffers Less than 25 feet		Left Bank	188.90	-----	0	-----	0
M6T3.05A	Buffers Less than 25 feet		Right Bank	185.49	-----	0	-----	0
M6T3.05A	Buffers Less than 25 feet		Left Bank	87.73	-----	0	-----	0
M6T3.05A	Cross Section Location	Representative		0.00	Number	1	-----	0
M6T3.05A	Development		One Side	1775.28	-----	0	-----	0
M6T3.05A	Encroachment	Road	One Side	647.10	Height	8	-----	0
M6T3.05A	Encroachment	Road	One Side	234.89	Height	13	-----	0
M6T3.05A	Erosion		Right Bank	54.29	Height	4	-----	0
M6T3.05A	Erosion		Left Bank	137.59	Height	7	-----	0
M6T3.05A	Erosion		Right Bank	127.31	Height	4	-----	0
M6T3.05A	Mass Failure		Right Bank	102.66	Height	20	-----	0
M6T3.05A	Mass Failure		Right Bank	44.99	Height	20	-----	0

Reach/Segment	Impact	Sub-Impact	Comment	Length (ft)	Parameter 1	Value 1	Parameter 2	Value 2
M6T3.05A	Migration	Braiding		0.00	-----	0	-----	0
M6T3.05A	Migration	Flood Chute		0.00	-----	0	-----	0
M6T3.05A	Steep Riffle or Head Cut	Head Cut		0.00	-----	0	-----	0
M6T3.05A	Steep Riffle or Head Cut	Head Cut		0.00	-----	0	-----	0
M6T3.05A	Straightening	Straightening		1727.14	-----	0	-----	0
M6T3.05B	Bank Armoring or Revetment	Other	Left Bank	51.54	-----	0	-----	0
M6T3.05B	Bank Armoring or Revetment	Rip-Rap	Left Bank	99.47	-----	0	-----	0
M6T3.05B	Bank Armoring or Revetment	Rip-Rap	Right Bank	61.55	-----	0	-----	0
M6T3.05B	Bridge or Culvert	Bridge		0.00	Length	200	-----	0
M6T3.05B	Buffers Less than 25 feet		Right Bank	136.32	-----	0	-----	0
M6T3.05B	Cross Section Location	Representative		0.00	Number	1	-----	0
M6T3.05B	Development		One Side	109.31	-----	0	-----	0
M6T3.05B	Development		One Side	396.61	-----	0	-----	0
M6T3.05B	Development		One Side	140.86	-----	0	-----	0
M6T3.05B	Encroachment	Road	One Side	1663.74	Height	8	-----	0
M6T3.05B	Erosion		Right Bank	95.23	Height	4	-----	0
M6T3.05B	Erosion		Left Bank	236.34	Height	8	-----	0
M6T3.05B	Grade Control	Ledge	Picture	0.00	Height	5	HtAbvWater	4
M6T3.05B	Grade Control	Ledge	Picture	0.00	Height	3	HtAbvWater	2
M6T3.05B	Migration	Braiding		0.00	-----	0	-----	0
M6T3.05B	Migration	Flood Chute		0.00	-----	0	-----	0
M6T3.05B	Migration	Flood Chute		0.00	-----	0	-----	0
M6T3.05B	Steep Riffle or Head Cut	Steep Riffle		0.00	-----	0	-----	0
M6T3.05B	Steep Riffle or Head Cut	Steep Riffle		0.00	-----	0	-----	0
M6T3.05B	Steep Riffle or Head Cut	Steep Riffle		0.00	-----	0	-----	0
M6T3.05B	Straightening	Straightening		1404.26	-----	0	-----	0
M6T3.05B	Straightening	Straightening		114.52	-----	0	-----	0
M6T3.05C	Bank Armoring or Revetment	Rip-Rap	Right Bank	108.52	-----	0	-----	0
M6T3.05C	Bank Armoring or Revetment	Rip-Rap	Right Bank	188.47	-----	0	-----	0
M6T3.05C	Bank Armoring or Revetment	Rip-Rap	Right Bank	340.02	-----	0	-----	0
M6T3.05C	Bridge or Culvert	Bridge		0.00	Length	200	-----	0
M6T3.05C	Buffers Less than 25 feet		Left Bank	91.27	-----	0	-----	0

Reach/Segment	Impact	Sub-Impact	Comment	Length (ft)	Parameter 1	Value 1	Parameter 2	Value 2
M6T3.05C	Buffers Less than 25 feet		Right Bank	116.08	-----	0	-----	0
M6T3.05C	Buffers Less than 25 feet		Right Bank	773.29	-----	0	-----	0
M6T3.05C	Cross Section Location	Representative		0.00	Number	1	-----	0
M6T3.05C	Development		One Side	1150.13	-----	0	-----	0
M6T3.05C	Dredging	Dredging	Exact Location	0.00	-----	0	-----	0
M6T3.05C	Encroachment	Road	Both Sides	171.69	Height	15	-----	0
M6T3.05C	Encroachment	Road	One Side	961.23	Height	15	-----	0
M6T3.05C	Flow Regs and Withdrawals	Small Bypass	Drinking Water	0.00	-----	0	-----	0
M6T3.05C	Grade Control	Dam	Picture	0.00	Height	8	HtAbvWater	5
M6T3.05C	Straightening	Straightening		870.98	-----	0	-----	0
M6T3.06-	Bridge or Culvert	Bridge		0.00	Length	0	-----	0
M6T3.06-	Buffers Less than 25 feet		Left Bank	241.36	-----	0	-----	0
M6T3.06-	Buffers Less than 25 feet		Left Bank	98.57	-----	0	-----	0
M6T3.06-	Cross Section Location	Representative		0.00	Number	1	-----	0
M6T3.06-	Development		One Side	480.93	-----	0	-----	0
M6T3.06-	Encroachment	Berm	One Side	344.70	Height	0	-----	0
M6T3.06-	Encroachment	Road	One Side	172.55	Height	0	-----	0
M6T3.06-	Encroachment	Road	One Side	123.21	Height	0	-----	0
M6T3.06-	Encroachment	Road	One Side	259.91	Height	0	-----	0
M6T3.06-	Encroachment	Road	One Side	832.39	Height	0	-----	0
M6T3.06-	Encroachment	Road	One Side	559.08	Height	0	-----	0
M6T3.06-	Erosion		Left Bank	100.67	Height	8	-----	0
M6T3.06-	Erosion		Right Bank	108.41	Height	6	-----	0
M6T3.06-	Migration	Braiding		0.00	-----	0	-----	0
M6T3.06-	Migration	Braiding		0.00	-----	0	-----	0
M6T3.06-	Migration	Braiding		0.00	-----	0	-----	0
M6T3.06-	Migration	Braiding		0.00	-----	0	-----	0
M6T3.06-	Migration	Braiding		0.00	-----	0	-----	0
M6T3.06-	Migration	Braiding		0.00	-----	0	-----	0
M6T3.06-	Migration	Braiding		0.00	-----	0	-----	0
M6T3.06-	Migration	Braiding		0.00	-----	0	-----	0
M6T3.06-	Migration	Braiding		0.00	-----	0	-----	0

Reach/Segment	Impact	Sub-Impact	Comment	Length (ft)	Parameter 1	Value 1	Parameter 2	Value 2
M6T3.06-	Migration	Braiding		0.00	-----	0	-----	0
M6T3.06-	Migration	Braiding		0.00	-----	0	-----	0
M6T3.06-	Migration	Flood Chute		0.00	-----	0	-----	0
M6T3.06-	Migration	Flood Chute		0.00	-----	0	-----	0
M6T3.06-	Migration	Flood Chute		0.00	-----	0	-----	0
M6T3.06-	Migration	Flood Chute		0.00	-----	0	-----	0
M6T3.06-	Migration	Flood Chute		0.00	-----	0	-----	0
M6T3.06-	Migration	Flood Chute		0.00	-----	0	-----	0
M6T3.06-	Migration	Flood Chute		0.00	-----	0	-----	0
M6T3.06-	Migration	Flood Chute		0.00	-----	0	-----	0
M6T3.06-	Migration	Flood Chute		0.00	-----	0	-----	0
M6T3.06-	Migration	Flood Chute		0.00	-----	0	-----	0

Appendix C: Reach and Segment Impact Maps

Figure C-1: Segment M06T3.05S1.01A Impact Map

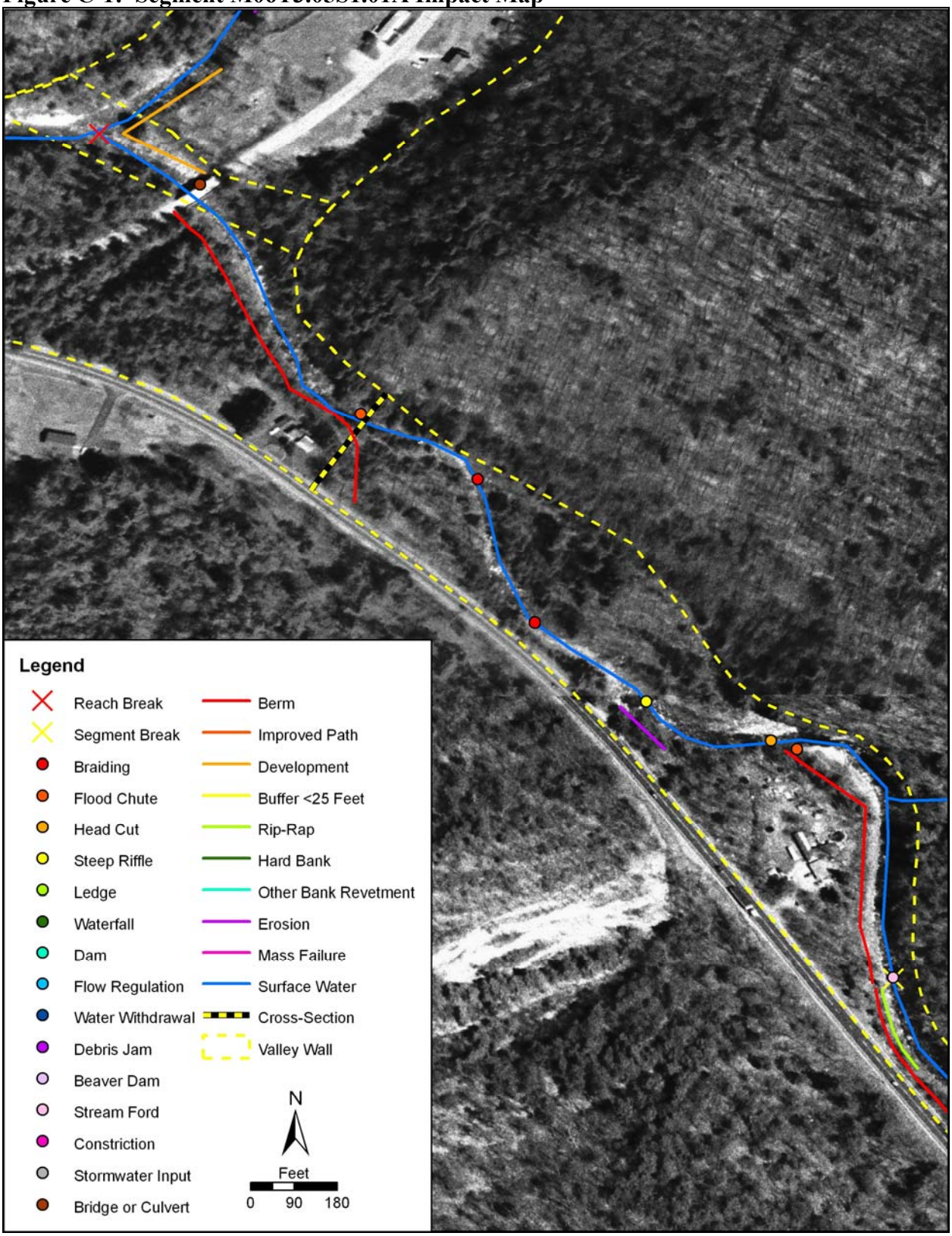


Figure C-2: Segment M06T3.05S1.01B Impact Map

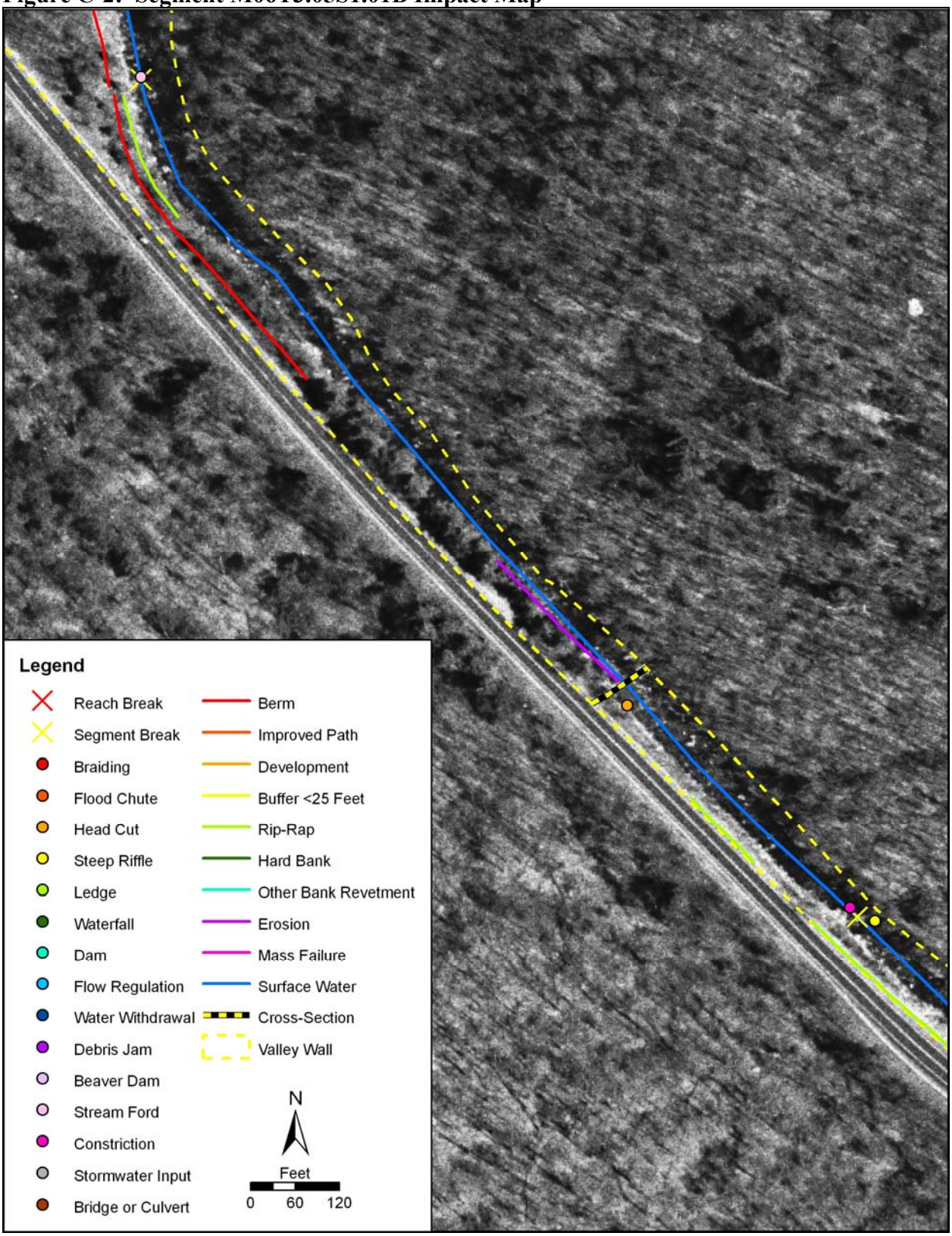


Figure C-3: Segment M06T3.05S1.01C Impact Map

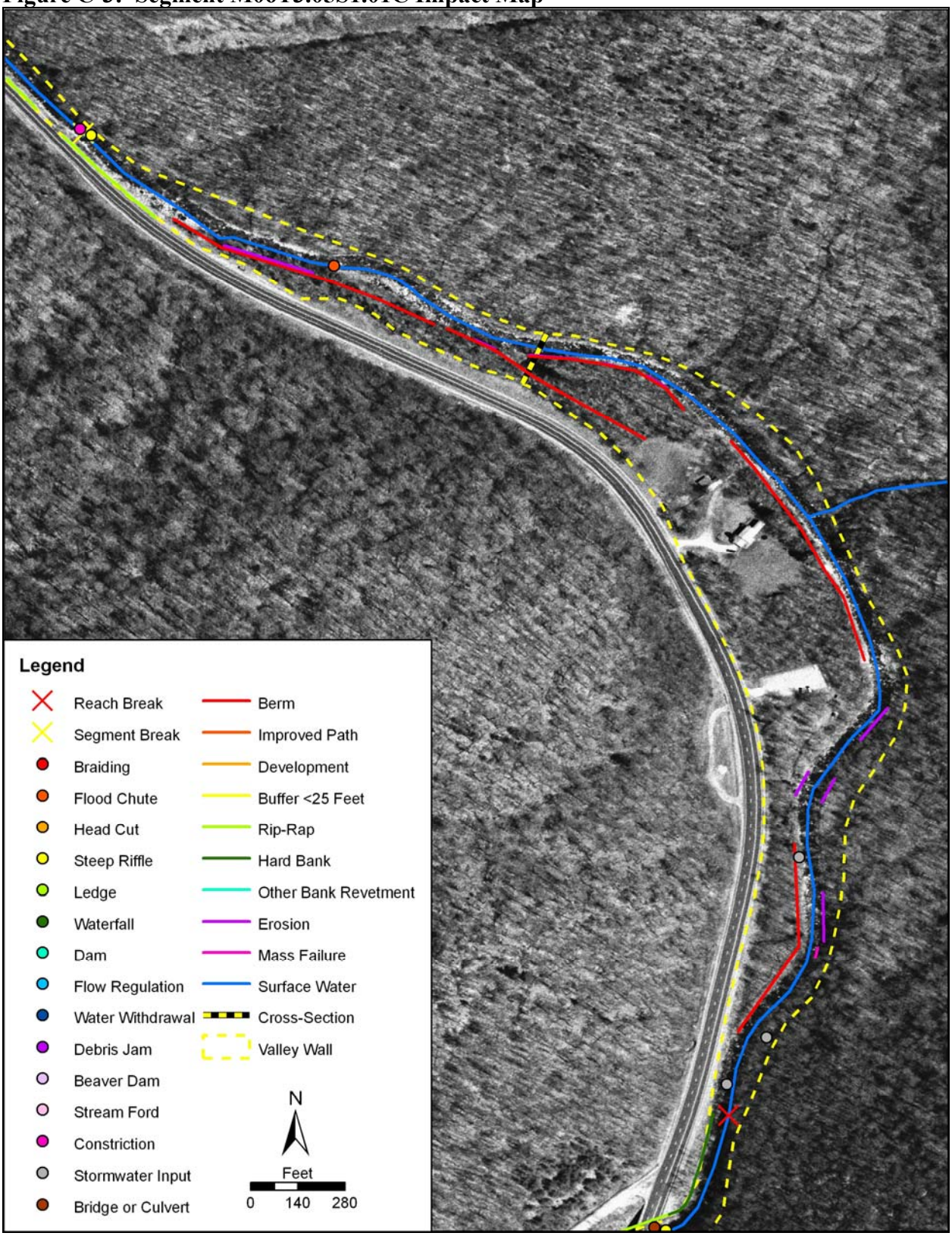


Figure C-4: Reach M06T3.05S1.02 (Segments A and B) Impact Map

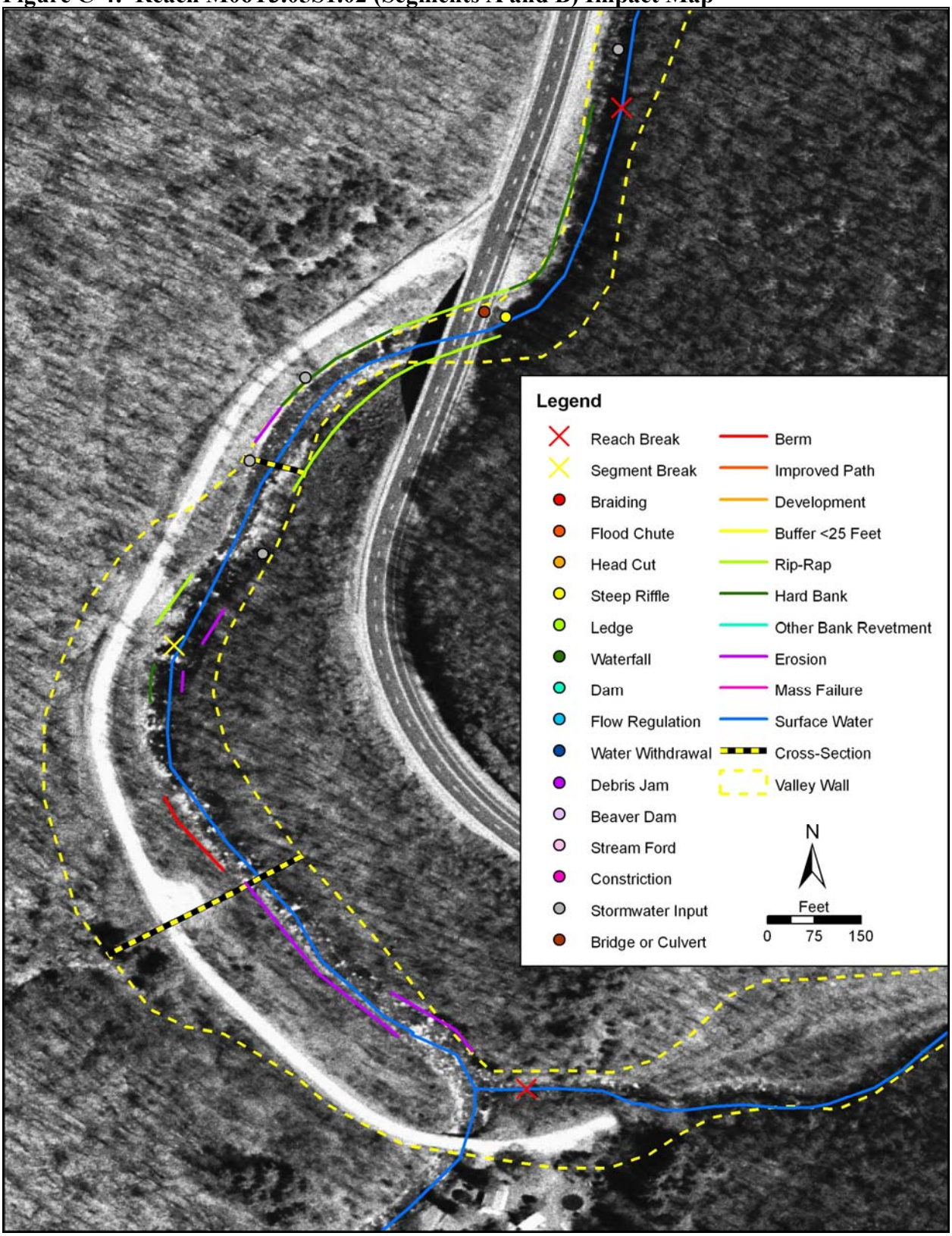


Figure C-5: Reach M06T3.05S1.04 (Segments A, B, C, and D) Impact Map

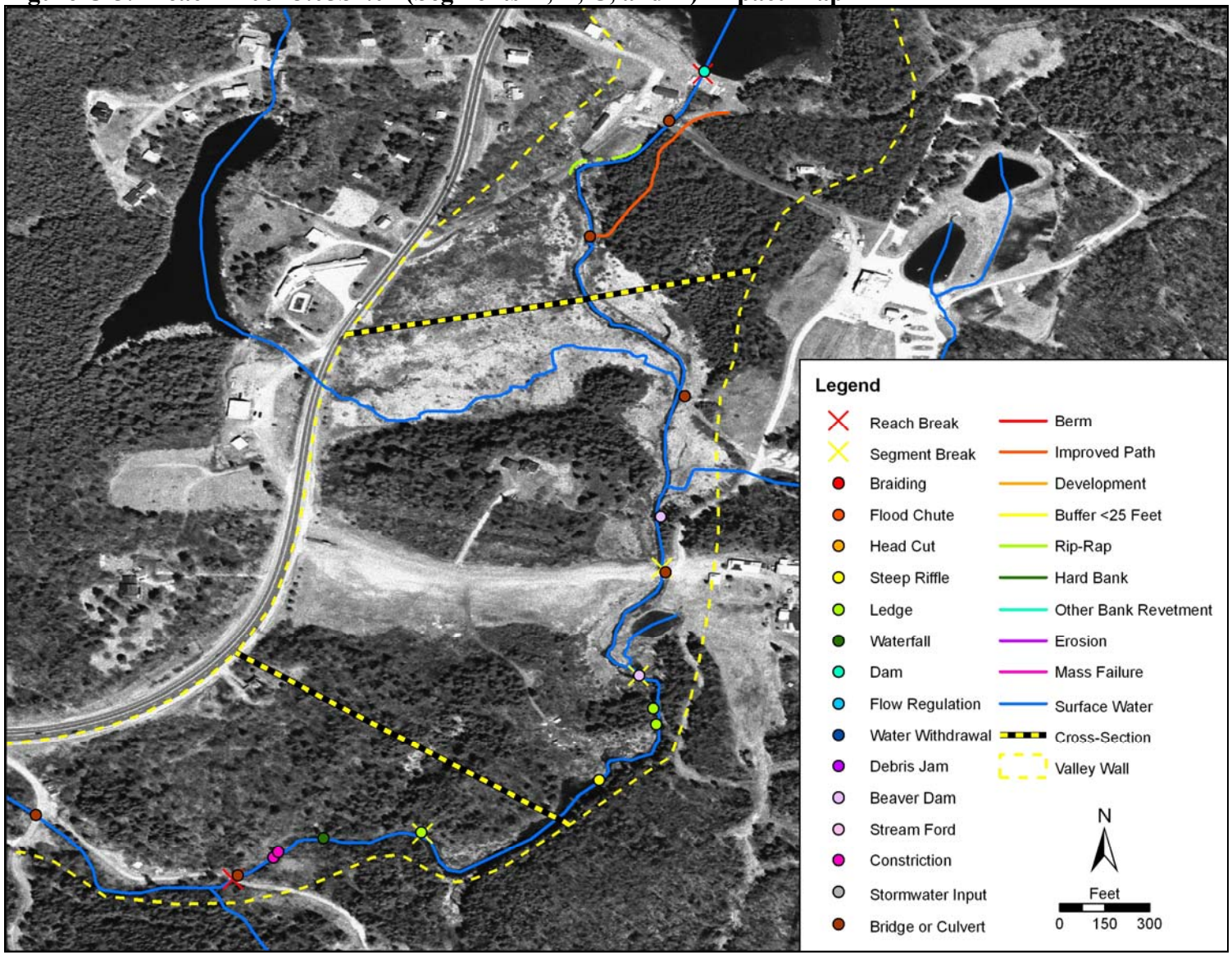


Figure C-6: Reach M06T3.05S1.06 Impact Map

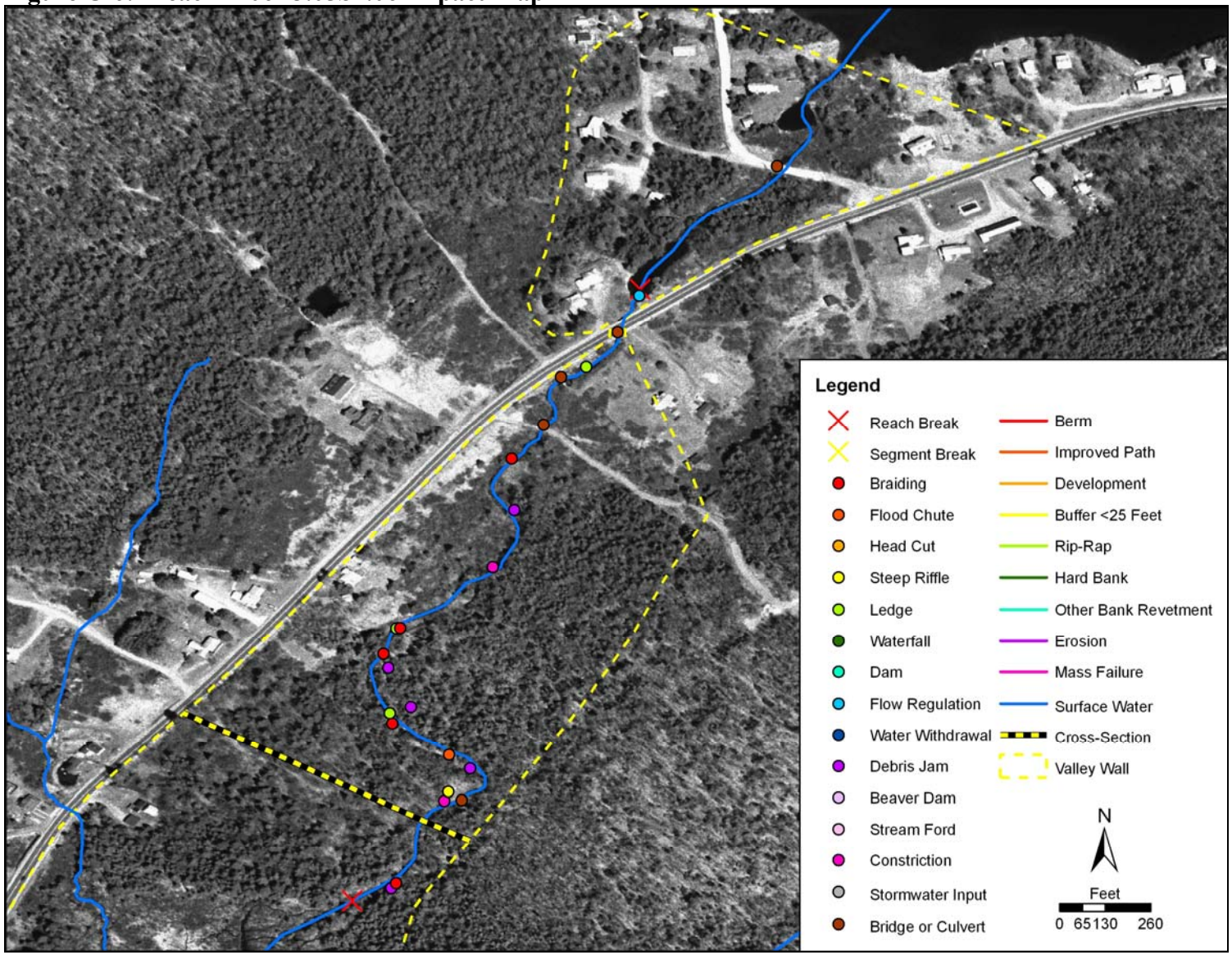


Figure C-7: Segment M06T3.05A Impact Map

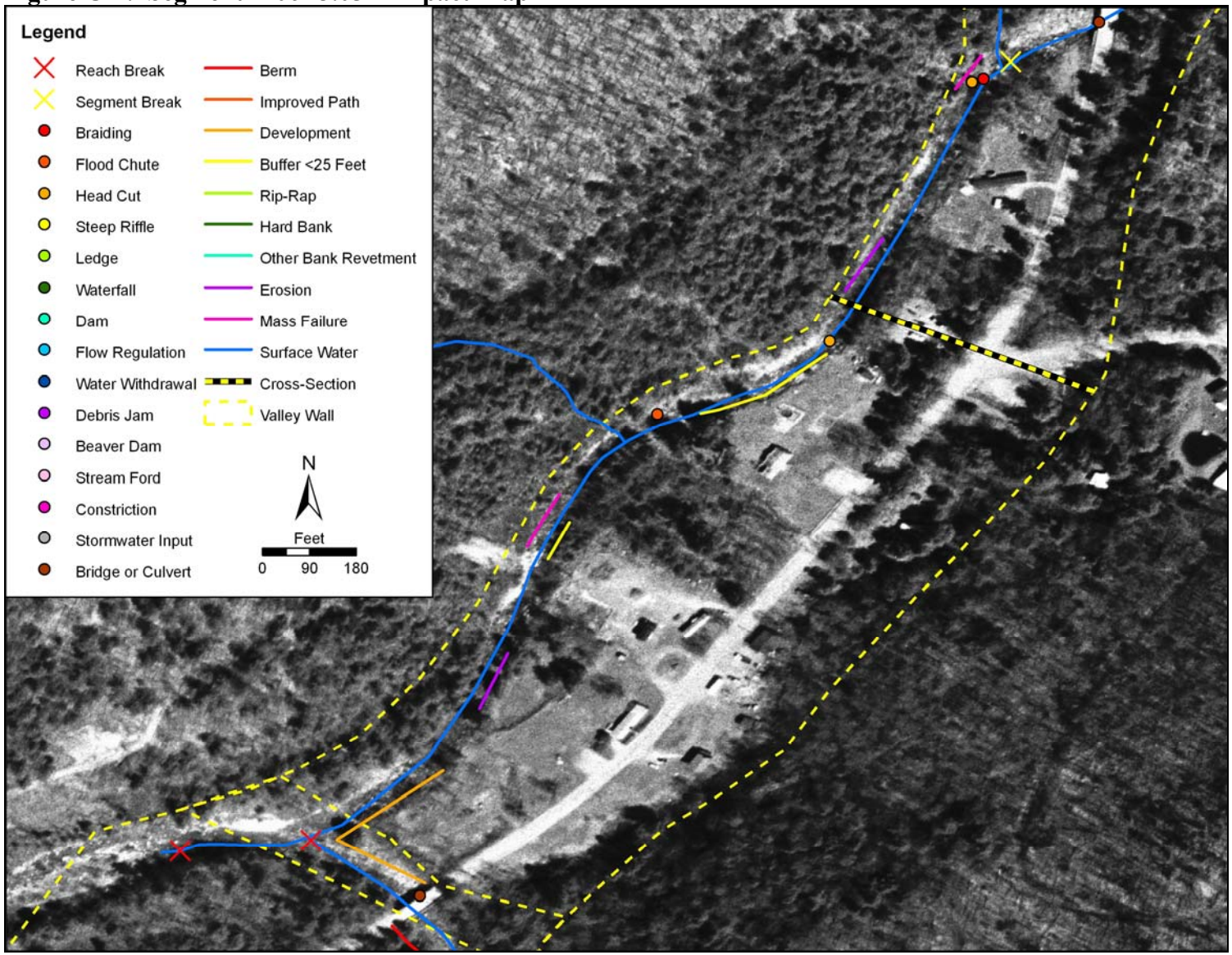


Figure C-8: Segment M06T3.05B Impact Map

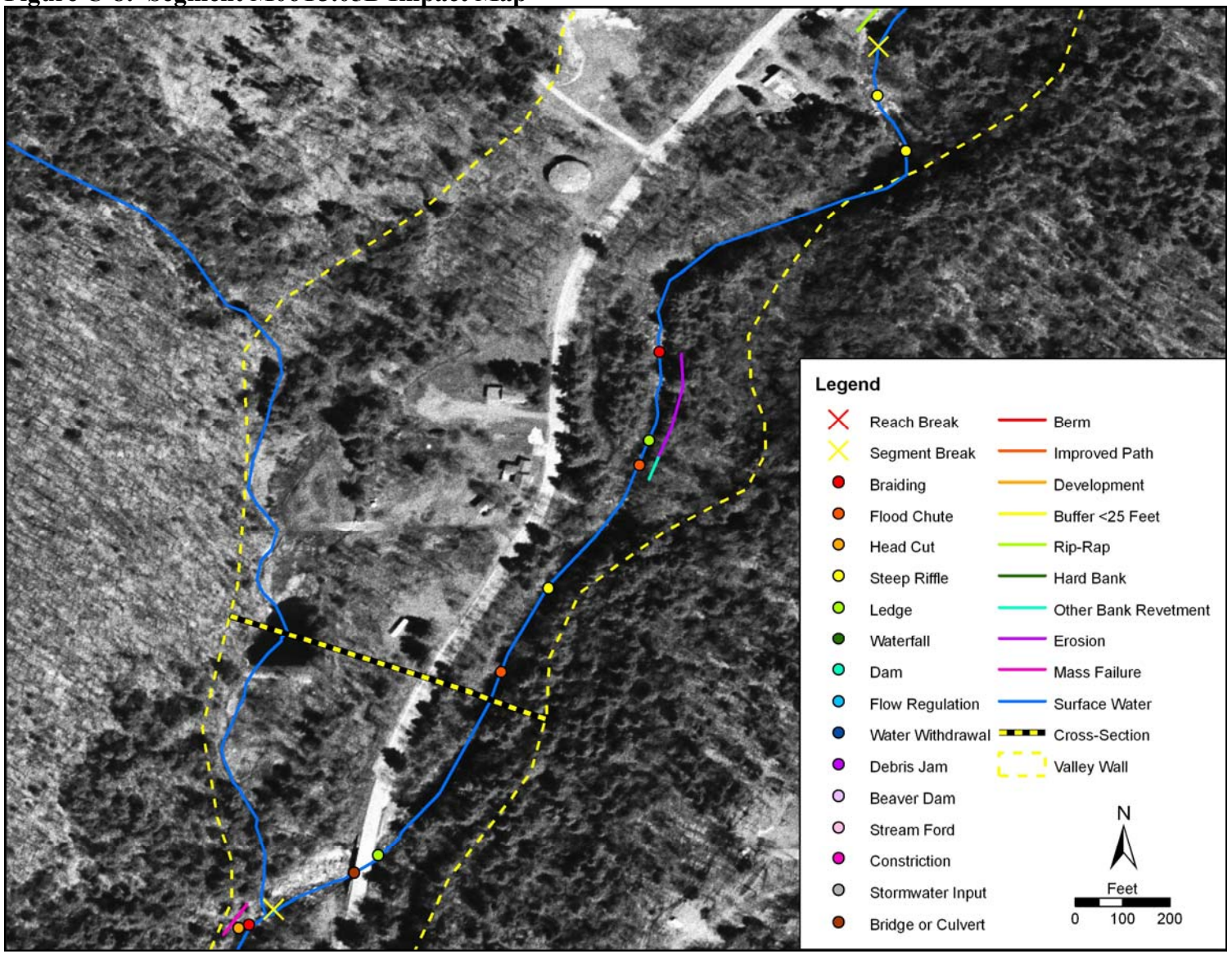


Figure C-9: Segment M06T3.05C Impact Map

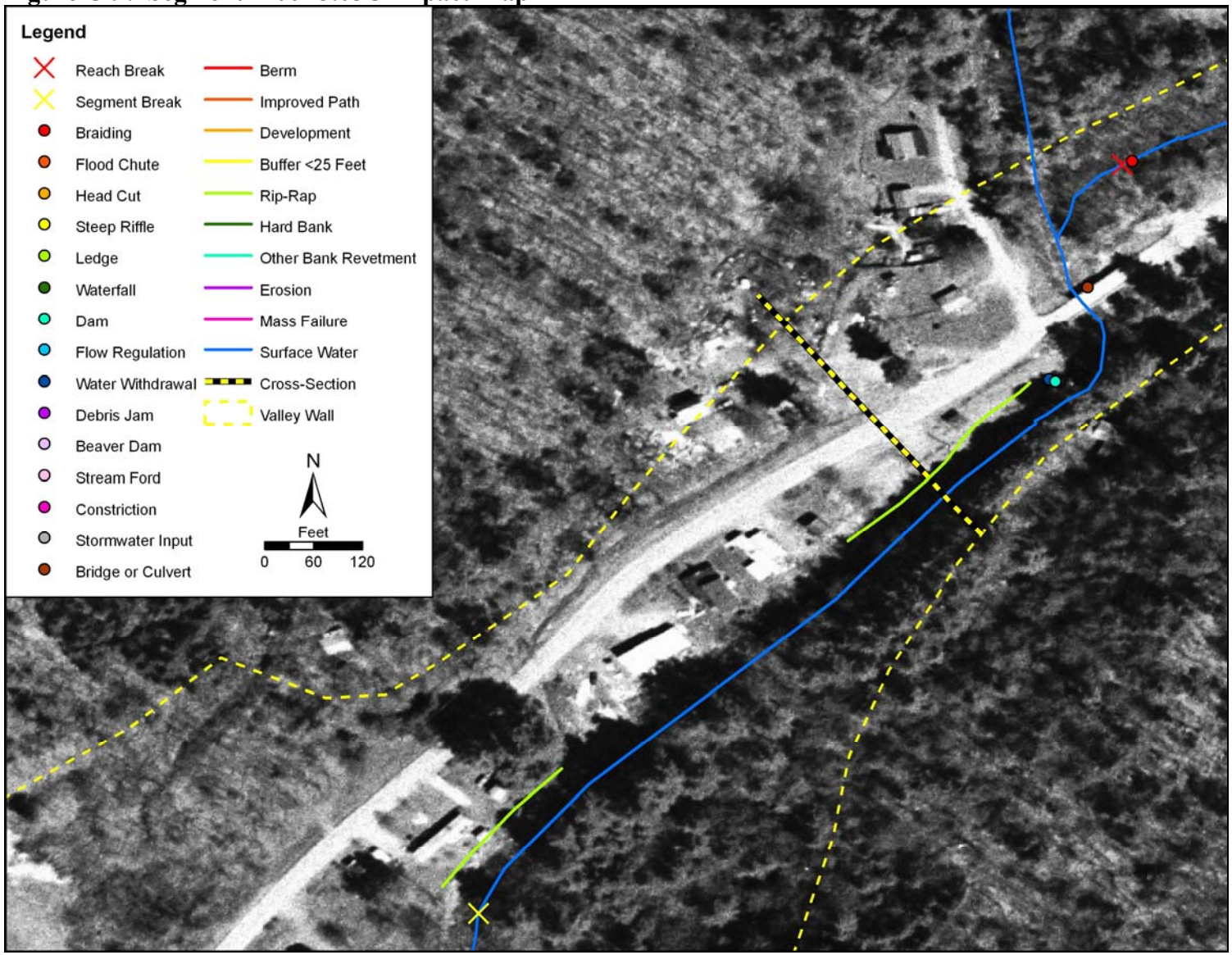
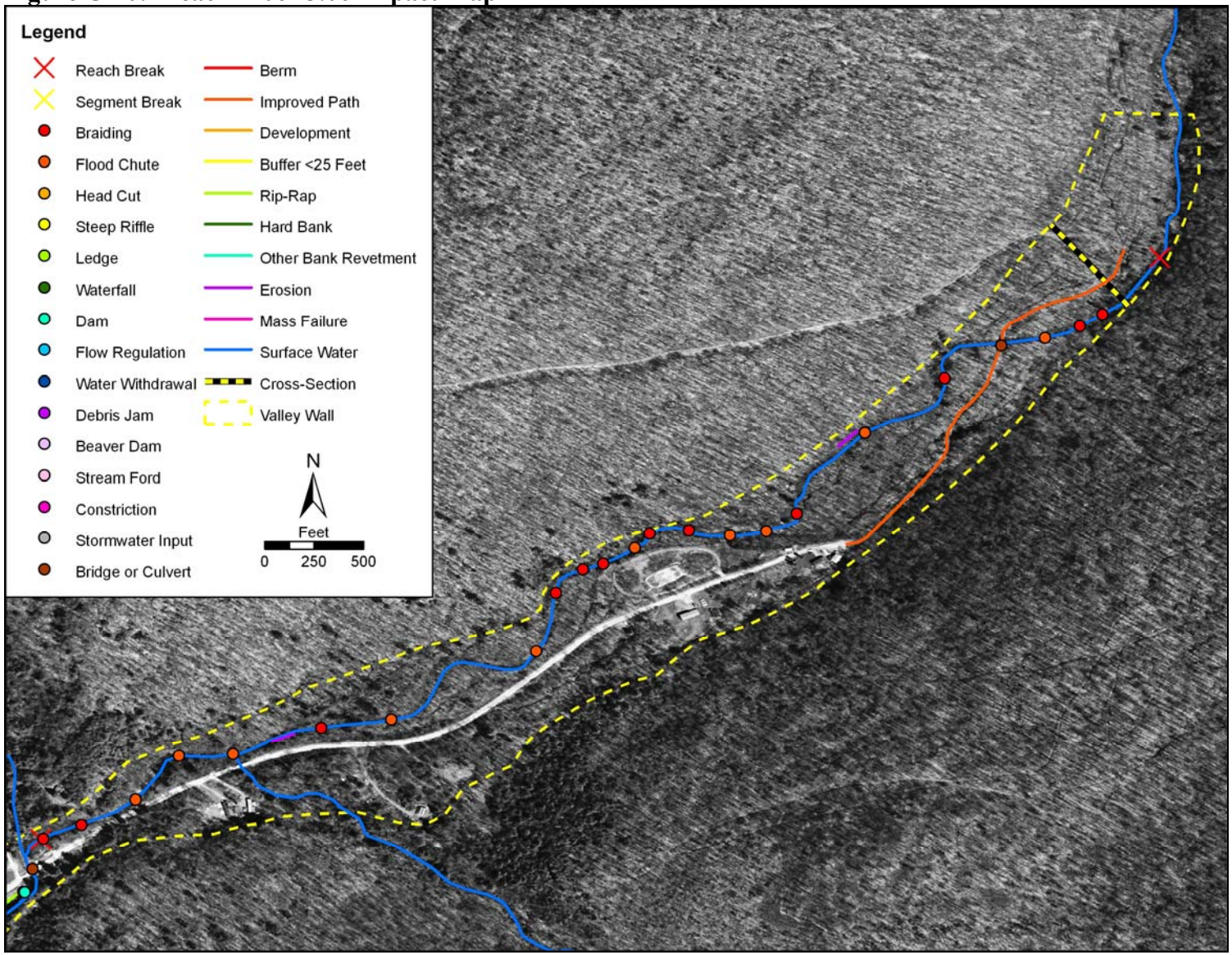


Figure C-10: Reach M06T3.06 Impact Map



Appendix D: Bridge and Culvert Descriptions

Bridge and Culvert Descriptions

S1.01A Harbour Road Bridge

The most downstream bridge on City Stream is located on Harbour Road, which is gravel, in segment S1.01A. The bridge width is 150% of the channel width, and does not confine the stream any more than the left bank berm already does. An adequate buffer of mixed trees surrounds the bridge in all directions except the downstream right bank, where there has been recent lot clearing and fill for the construction of a new house. Sediment deposits downstream of the bridge are more likely due to the confluence with Bolles Brook than the bridge itself. Overall, the bridge seems to be in relatively good condition with a low potential to fail or to have future significant impacts on the stream.

S1.02A Route 9 Bridge

This bridge is located in segment S1.02A of City Stream on Route 9 at its intersection with Notch Road (old Route 9). With a 250-foot span, this concrete and steel bridge was by far the largest structure assessed. The bridge width is over 500% of the channel width, and does not appear to confine the stream. Contrarily, alterations made to the stream during the re-routing of Route 9 and the construction of the bridge seem to have drastically over-widened the channel through the bridge opening as well as upstream. Because of this, the sediment loads from the high-gradient tributary Stamford Stream (which is actually the larger stream) just upstream do not have enough velocity to be carried through the reach, and have formed large deposits above, underneath, and just below the bridge. The high banks in all directions except downstream right are heavily armored with rip-rap and have minimal herbaceous or shrub/sapling vegetation. The structure itself does not appear to be affecting the stream or have the potential to fail, but the extensive fill and channel alterations to accommodate both Route 9 and Notch Road have certainly impacted this reach.

S1.03 City Stream Road Arch

This structure is a small arch near the top of reach S1.03 of City Stream, just off Route 9 on City Stream Road (gravel). With a width 59% of the channel width, this structure acts as both a channel and floodplain confinement. Shrub/sapling vegetation lines both upstream and downstream banks, more densely on the left side. The arch seems to be in relatively good condition with a low potential to fail, although it does confine the stream somewhat.

S1.04A Driveway Bridge

This structure is a small wooden bridge across a driveway just upstream at the break between reaches S1.03 and S1.04 of City Stream. A new bridge with steel beams and a timber deck was recently built over top of the old, failing bridge by its private owner. The bridge is located at the base of a bedrock gorge at a bend in the stream, and the effect of the high stream power is evidenced by failing bank armoring on the upstream side of the bridge. The banks and buffers are well-forested in all directions. Now that the bridge has been reinforced and rebuilt, it appears to have a low potential to fail, but the remaining old bridge materials may soon fail and impede the stream flow.

S1.04D Prospect Access Culvert

This structure is a culvert across a gravel access road at the base of Prospect Mountain ski area, located at the break between segments S1.04C and S1.04D of City Stream. The combined width of the two culverts is 53% of the channel width. An overflow pipe is also present. Below the culvert, the entire length of segment S1.01C is impounded by a beaver dam at its downstream end. A relatively new beaver dam about 165 feet upstream of the culvert has created a small impoundment in segment S1.01D as well. A potential problem for this structure is sediment runoff since the surrounding area is relatively bare (gravel parking lot and mowed lawn), although little evidence of sedimentation was observed in the immediate vicinity of the culvert. The structure itself appears to be in good condition with little potential to fail, although it does confine the stream.

S1.04D Greenwood Drive Culvert

This culvert is located just below the outlet of Bugbee Mill Pond near the top of segment S1.04D on Greenwood Drive. It has two openings with a combined width 67% of the channel width. Herbaceous and shrub vegetation lines both banks, although just downstream a new dirt road is being cut on the left and a gravel lot is on the right. Both of these developments are contributing to heavy sediment runoff and deposition in the channel downstream. The structure itself appears to be in good condition with little potential to fail, although it does confine the stream.

S1.06 Driveway Bridge

This bridge is located on a driveway just off Route 9 in reach S1.06 of City Stream. Although the structure span is as wide as the channel, large stone abutments beneath the bridge confine the stream. Shrub/sapling vegetation lines both banks, more extensively in the left corridor. The stone abutments do not appear to be in the best condition and could possibly fail during a flood event.

S1.06 Snowmobile Trail Bridge

This bridge is on a snowmobile trail that crosses Route 9 in reach S1.06 of City Stream. The bridge's light timber deck, with a span 300% of the channel width, does not appear to confine the stream. Rip-rap armoring is intact. The left bank is buffered with shrub/sapling vegetation, whereas the right is the Route 9 embankment. The structure seems to be in good condition with a low potential to fail or impact the stream.

S1.06 Route 9 Culvert

This structure is a culvert across Route 9 near the upper end of reach S1.06 of City Stream. The structure is skewed to the roadway to accommodate the sharp angle of the stream. With a width of only 3.2 feet (18% of the channel width), this culvert is the most confining structure assessed on either City Stream or Bolles Brook. The stream is highly channelized in this area, especially above the culvert where concrete wingwalls extend upstream. Still, the structure seems to be in good condition with little potential to fail. It is likely that the small dam and impoundment just upstream of the culvert (at the reach break) provide some flow regulation to protect the structure.

S1.07 Evergreen Lane Culvert

The most upstream structure on City Stream is a culvert across Evergreen Lane below Woodford Lake (Big Pond) on reach S1.07. Two corrugated plastic culverts have a combined width that is 48% of the channel width. Shrub/sapling vegetation lines the banks in both directions. The structure seems to be in good condition with a low potential to fail or impact the stream, although it does confine the stream.

T3.05B Harbour Road Bridge

The most downstream structure on Bolles Brook is the second bridge on Harbour Road, just above the segment break between T3.05A and T3.05B. With a span 300% of the channel width, this bridge does not appear to confine the stream, but does create a floodplain confinement. The stream is relatively straight approaching the bridge, but passes through the bridge at an angle and bends to the left just downstream, where a small mass failure has occurred on the right bank. Shrub/sapling vegetation and mixed trees provide buffer in both directions. A potential problem is the presence of multiple large concrete slabs, possibly from an old bridge, in the channel underneath the structure. These slabs have created a steep grade control and may be partially responsible for the large sediment deposits downstream (which may also be due to the entrance of a tributary). Otherwise, the bridge is in relatively good condition, with a low potential to fail or impact the stream.

T3.05C Harbour Road Bridge

This structure is the third bridge on Harbour Road, near the top of segment T3.05C of Bolles Brook. It is located just above the small dam and drinking water withdrawal. Just upstream of the bridge, a tributary (Bickford Hollow Brook) enters Bolles Brook. The stream makes 90-degree bends just above and below the bridge. A bedrock wall on the outside of the downstream bend has likely prevented bank erosion. Above the bridge, Bolles Brook is extensively braided, whereas downstream it has been channelized. Although the span of the bridge is 133% of the stream width, the concrete abutments act as a channel and floodplain confinement. The small impoundment between the bridge and the dam was recently dredged in September 2007. Overall, the bridge itself is in relatively good condition, with a low potential to fail or impact the stream.

T3.06 National Forest Road Bridge

The most upstream structure on Bolles Brook is a timber bridge near the top of reach T3.06 on the Green Mountain National Forest dirt road that continues from Harbour Road. This bridge spans approximately the same width as the channel, and does not seem to confine the stream. Mixed forest vegetation provides adequate buffer on both sides. The bridge is in good condition with a low potential to fail or impact the stream.

Appendix E: Bridge and Culvert Reports

Key for Tables E-1 and E-2:

Width: Structure width divided by channel width as a percent (% bankfull width)

Failure Modes

- **F1:** Concern for structure due to fluvial condition or process
- **F2:** Potential failure due to out-flanking
- **F3:** Potential failure due to scour
- **F4:** Potential failure due to ice or debris jam
- **F5:** Structure related damage due to flooding of adjacent property
- **F6:** Structure related damage due to erosion of adjacent property

Existing Problems

- **P1:** Upstream sediment deposit
- **P2:** Upstream Scour and/or erosion present
- **P3:** Downstream Scour and/or erosion present
- **P4:** Inlet obstruction present
- **P5:** Poor location or alignment
- **P6:** Beaver activity
- **P7:** Floodplain filled entirely or partially by roadway approaches

Upstream Sediment Deposition

- **C1:** Opening obstructed by sediment
- **C2:** Sediment deposits >= half bankfull
- **C3:** Steep riffle upstream

Upstream Scour and Erosion

- **C4:** Bank armoring failing
- **C5:** Bank erosion high
- **C6:** Scour under structure

Downstream Scour and Erosion

- **C7:** Bank armoring failing
- **C8:** Bank erosion high
- **C9:** Scour under structure
- **C10:** Banks higher downstream than upstream
- **C11:** Culvert outlet is cascade or freefall

Poor Location or Alignment

- **C12:** Stream approach angle is sharp bend
- **C13:** Located at significant valley break
- **C14:** Avulsion follow road

Table E-1: Bridge and Culvert Failure Mode Report

Stream	Segment	Location	Type	Width	F1	F2	F3	F4	F5	F6	P1	P2	P3	P4	P5	P6	P7
City Stream	M06T3.05S1.01A	1st bridge on Harbour Rd.	Bridge	150%	X	-	X	-	-	-	-	-	X	-	X	-	-
	M06T3.05S1.02A	Route 9 (at Notch Rd.)	Bridge	556%	-	-	-	X	-	X	-	-	-	-	X	-	X
	M06T3.05S1.03	City Stream Rd.	Arch	59%	-	X	-	X	-	-	-	-	-	-	-	-	X
	M06T3.05S1.04A	Driveway off City Stream Rd.	Bridge	150%	-	-	-	X	-	X	-	X	-	-	X	-	-
	M06T3.05S1.04D	Prospect Access	Culvert	53%	-	X	-	X	-	-	-	-	-	-	-	-	-
	M06T3.05S1.04D	Greenwood Dr.	Culvert	67%	-	X	-	X	-	-	-	-	-	-	-	-	X
	M06T3.05S1.06	Driveway off Route 9	Bridge	97%	-	-	-	-	-	-	-	-	-	-	-	-	X
	M06T3.05S1.06	Snowmobile trail off Route 9	Bridge	300%	-	-	-	X	-	-	-	-	-	-	-	-	-
	M06T3.05S1.06	Route 9	Culvert	18%	-	X	X	X	-	X	-	X	-	-	-	-	X
	M06T3.05S1.07	Evergreen Ln.	Culvert	48%	-	X	-	X	-	-	-	-	-	-	-	-	X
Bolles Brook	M06T3.05B	2nd bridge on Harbour Rd.	Bridge	300%	-	-	-	-	-	X	-	-	-	-	X	-	-
	M06T3.05C	3rd bridge on Harbour Rd.	Bridge	133%	-	-	-	-	-	-	-	-	X	-	-	-	-
	M06T3.06	National Forest Rd.	Bridge	105%	-	-	-	-	-	X	-	-	-	-	X	-	X

Table E-2: Bridge and Culvert Failure Mode Problem Conditions

Stream	Segment	Location	Type	Width	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14
City Stream	M06T3.05S1.01A	1st bridge on Harbour Rd.	Bridge	150%	-	-	-	-	-	-	-	-	-	-		-	X	-
	M06T3.05S1.02A	Route 9 (at Notch Rd.)	Bridge	556%	-	-	-	-	-	-	-	-	-	-		X	-	X
	M06T3.05S1.03	City Stream Rd.	Arch	59%	-	-	-	-	-	-	-	-	-	-		-	-	-
	M06T3.05S1.04A	Driveway off City Stream Rd.	Bridge	150%	-	-	-	X	-	-	-	-	-	-		X	-	-
	M06T3.05S1.04D	Prospect Access	Culvert	53%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	M06T3.05S1.04D	Greenwood Dr.	Culvert	67%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	M06T3.05S1.06	Driveway off Route 9	Bridge	97%	-	-	-	-	-	-	-	-	-	-		-	-	-
	M06T3.05S1.06	Snowmobile trail off Route 9	Bridge	300%	-	-	-	-	-	-	-	-	-	-		-	-	-
	M06T3.05S1.06	Route 9	Culvert	18%	-	-	-	X	-	-	-	-	-	-	-	-	-	-
	M06T3.05S1.07	Evergreen Ln.	Culvert	48%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bolles Brook	M06T3.05B	2nd bridge on Harbour Rd.	Bridge	300%	-	-	-	-	-	-	-	-	-	-		-	-	X
	M06T3.05C	3rd bridge on Harbour Rd.	Bridge	133%	-	-	-	-	-	-	-	-	-	X		-	-	-
	M06T3.06	National Forest Rd.	Bridge	105%	-	-	-	-	-	-	-	-	-	-		-	-	X

Appendix F: Reach Assessment Photographs

Segment ID: S1.01A	**Photo #:** 100_0875	**Date:** 9/11/2007
View: US	**Description:** Bottom of segment S1.01A	

Segment ID: S1.01A	**Photo #:** 100_0976	**Date:** 9/17/2007
View: US	**Description:** Bedrock wall and steep riffle	

Segment ID: S1.01A	**Photo #:** 100_0977	**Date:** 9/17/2007
View: US	**Description:** Close-up of bedrock wall and steep riffle	

Segment ID: S1.01A	**Photo #:** 100_0978	**Date:** 9/17/2007
View: DS	**Description:** Left bank erosion along Rt. 9	

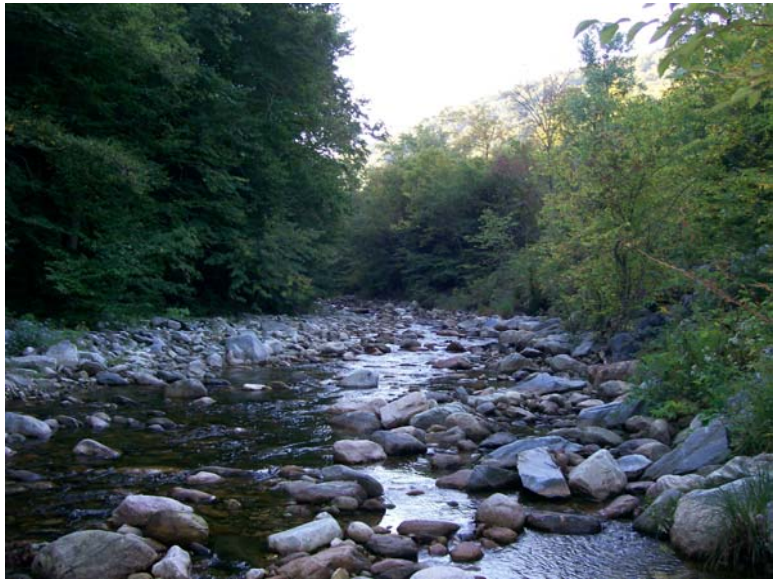
Segment ID: S1.01A	**Photo #:** 100_0987	**Date:** 9/17/2007
View: US	**Description:** Cross-section of segment S1.01A	

Segment ID: S1.01A	**Photo #:** 100_0988	**Date:** 9/17/2007
View: DS	**Description:** Cross-section of segment S1.01A	

Segment ID: S1.01A	**Photo #:** 100_0989	**Date:** 9/17/2007
View: RB	**Description:** Cross-section of segment S1.01A	

Segment ID: S1.01A	**Photo #:** 100_0992	**Date:** 9/18/2007
View: DS	**Description:** Top of segment S1.01A	

Segment ID: S1.01B	**Photo #:** 100_0993	**Date:** 9/18/2007	**Segment ID:** S1.01B	**Photo #:** 100_0995	**Date:** 9/18/2007
View: US	**Description:** Bottom of segment S1.01B		**View:** LB	**Description:** Rip-rap on berm	



Segment ID: S1.01B	**Photo #:** 100_0997	**Date:** 9/18/2007	**Segment ID:** S1.01B	**Photo #:** 100_0998	**Date:** 9/18/2007
View: LB	**Description:** Bank erosion along Rt. 9 (near cross-section)		**View:** US	**Description:** Head cut	

Segment ID: S1.01B	**Photo #:** 100_1000	**Date:** 9/18/2007
View: US	**Description:** Bedrock constriction/steep riffle (segment break)	

Segment ID: S1.01B	**Photo #:** 100_0990	**Date:** 9/17/2007
View: US	**Description:** Cross-section of segment S1.01B	

Segment ID: S1.01B	**Photo #:** 100_0991	**Date:** 9/17/2007
View: DS	**Description:** Cross-section of segment S1.01B	

Segment ID: S1.01C	**Photo #:** 100_1003	**Date:** 9/18/2007
View: LB	**Description:** Berm erosion	

Segment ID: S1.01C	**Photo #:** 100_1004	**Date:** 9/18/2007
View: US	**Description:** Berm erosion and sedimentation upstream	

Segment ID: S1.01C	**Photo #:** 100_1005	**Date:** 9/18/2007
View: US	**Description:** Large mid-channel bar upstream of berm erosion	

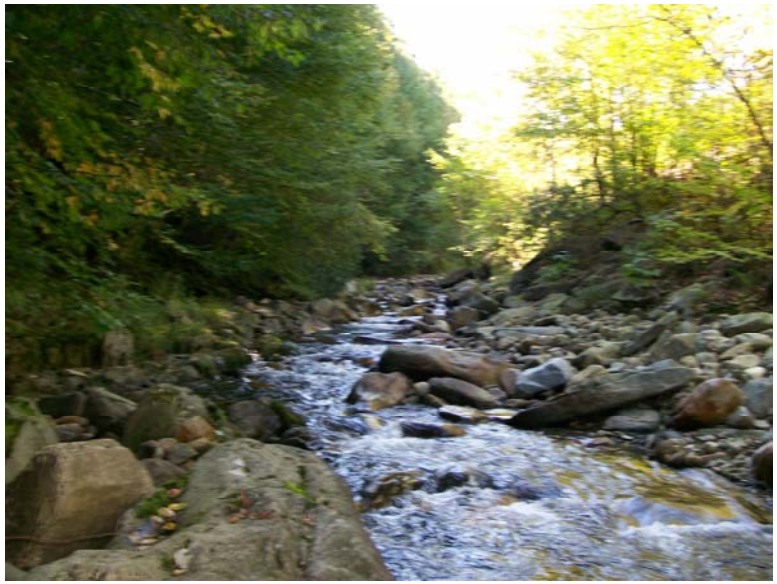
Segment ID: S1.01C	**Photo #:** 100_1007	**Date:** 9/18/2007
View: DS	**Description:** Top of segment S1.01C	

Segment ID: S1.01C	**Photo #:** 100_1009	**Date:** 9/18/2007
View: US	**Description:** Cross-section of segment S1.01C	

Segment ID: S1.01C	**Photo #:** 100_1010	**Date:** 9/18/2007
View: LB	**Description:** Cross-section of segment S1.01C	

Segment ID: S1.01C	**Photo #:** 100_1011	**Date:** 9/18/2007
View: DS	**Description:** Cross-section of segment S1.01C	

Segment ID: S1.02A	**Photo #:** 100_1008	**Date:** 9/18/2007	**Segment ID:** S1.02A	**Photo #:** 100_0918	**Date:** 9/12/2007
View: US	**Description:** Bottom of segment S1.02A		**View:** US	**Description:** Deposition under Rt. 9 bridge	



Segment ID: S1.02A	**Photo #:** 100_0919	**Date:** 9/12/2007	**Segment ID:** S1.02A	**Photo #:** 100_1012	**Date:** 9/18/2007
View: DS	**Description:** Sedimentation above Rt. 9 bridge		**View:** US	**Description:** Left bank erosion upstream of Rt. 9 bridge	

Segment ID: S1.02A	**Photo #:** 100_1029	**Date:** 9/19/2007
View: US	**Description:** Cross-section of segment S1.02A	

Segment ID: S1.02A	**Photo #:** 100_1028	**Date:** 9/19/2007
View: DS	**Description:** Cross-section of segment S1.02A	

Segment ID: S1.02A	**Photo #:** 100_1025	**Date:** 9/18/2007
View: DS	**Description:** Top of segment S1.02A	

Segment ID: S1.02B	**Photo #:** 100_1027	**Date:** 9/18/2007
View: US	**Description:** Bottom of segment S1.02B	

Segment ID: S1.02B	**Photo #:** 100_1013	**Date:** 9/18/2007
View: US	**Description:** Enlargement of bed material at reach break	

Segment ID: S1.02B	**Photo #:** 100_1015	**Date:** 9/18/2007
View: LB	**Description:** Piled dredging material along left bank	

Segment ID: S1.02A	**Photo #:** 100_1017	**Date:** 9/18/2007
View: DS	**Description:** Left bank erosion and leaning trees	

Segment ID: S1.02B	**Photo #:** 100_1018	**Date:** 9/18/2007
View: US	**Description:** Left bank erosion	

Segment ID: S1.02B	**Photo #:** 100_1020	**Date:** 9/18/2007	**Segment ID:** S1.02B	**Photo #:** 100_1022	**Date:** 9/18/2007
View: RB	**Description:** Right bank erosion where valley wall meets bank		**View:** DS	**Description:** Top of segment S1.02B	

Segment ID: S1.03	**Photo #:** 100_1021	**Date:** 9/18/2007	**Segment ID:** S1.02B	**Photo #:** 100_1023	**Date:** 9/18/2007
View: US	**Description:** Top of reach S1.03		**View:** US	**Description:** Confluence with Stamford Stream	

Segment ID: S1.02B	**Photo #:** 100_1024	**Date:** 9/18/2007
View: US	**Description:** Stamford Stream	

Segment ID: S1.02B	**Photo #:** 100_1033	**Date:** 9/19/2007
View: US	**Description:** Cross-section of segment S1.02B	

Segment ID: S1.02B	**Photo #:** 100_1030	**Date:** 9/19/2007
View: DS	**Description:** Cross-section of segment S1.02B	

Segment ID: S1.03	**Photo #:** 100_0947	**Date:** 9/14/2007
View: DS	**Description:** Top of reach S1.03 (not assessed)	

Segment ID: S1.04A	**Photo #:** 100_0946	**Date:** 9/14/2007
View: US	**Description:** Bottom of segment S1.04A (bedrock gorge)	

Segment ID: S1.04A	**Photo #:** 100_0948	**Date:** 9/14/2007
View: US	**Description:** Bedrock outcrops causing channel constriction	

Segment ID: S1.04A	**Photo #:** 100_0949	**Date:** 9/14/2007
View: DS	**Description:** Bedrock outcrops causing channel constriction	

Segment ID: S1.04A	**Photo #:** 100_0952	**Date:** 9/14/2007	**Segment ID:** S1.04A	**Photo #:** 100_0956	**Date:** 9/14/2007
View: US	**Description:** Grade control (waterfall)		**View:** DS	**Description:** Top of segment S1.04A (bedrock gorge)	

Segment ID: S1.04B	**Photo #:** 100_0957	**Date:** 9/14/2007	**Segment ID:** S1.04B	**Photo #:** 100_0958	**Date:** 9/14/2007
View: US	**Description:** Bottom of segment S1.04B		**View:** US	**Description:** Steep riffle	

Segment ID: S1.04B	**Photo #:** 100_0959	**Date:** 9/14/2007	**Segment ID:** S1.04B	**Photo #:** 100_0961	**Date:** 9/14/2007
View: US	**Description:** Grade controls (series of ledges)		**View:** DS	**Description:** Top of segment S1.04B	

Segment ID: S1.04B	**Photo #:** 100_0974	**Date:** 9/17/2007	**Segment ID:** S1.04B	**Photo #:** 100_0975	**Date:** 9/17/2007
View: US	**Description:** Cross section of segment S1.04B		**View:** DS	**Description:** Cross section of segment S1.04B	

Segment ID: S1.04B	**Photo #:** 100_0960	**Date:** 9/14/2007
View: US	**Description:** Beaver dam (bottom of segment S1.04C)	

Segment ID: S1.04C	**Photo #:** 100_0962	**Date:** 9/14/2007
View: US	**Description:** Impoundment above beaver dam (not assessed)	

Segment ID: S1.04C	**Photo #:** 100_0964	**Date:** 9/14/2007
View: DS	**Description:** Top of segment S1.04C (not assessed)	

Segment ID: S1.04D	**Photo #:** 100_0963	**Date:** 9/14/2007
View: US	**Description:** Bottom of segment S1.04D	

Segment ID: S1.04D	**Photo #:** 100_0945	**Date:** 9/14/2007
View: US	**Description:** New beaver dam near bottom of segment S1.04D	

Segment ID: S1.04D	**Photo #:** 100_0965	**Date:** 9/14/2007
View: DS	**Description:** Characteristic view of segment	

Segment ID: S1.04D	**Photo #:** 100_0966	**Date:** 9/14/2007
View: US	**Description:** Steel bridge support (no deck)	

Segment ID: S1.04D	**Photo #:** 100_0967	**Date:** 9/14/2007
View: DS	**Description:** Top of segment S1.04D (dam spillway)	

Segment ID: S1.05	**Photo #:** 100_0968	**Date:** 9/14/2007
View: US	**Description:** Bottom of segment S1.05 (Bugbee Mill Pond)	

Segment ID: S1.04D	**Photo #:** 100_0969	**Date:** 9/14/2007
View: RB	**Description:** Cross section of segment S1.04D	

Segment ID: S1.04D	**Photo #:** 100_0970	**Date:** 9/14/2007
View: US	**Description:** Cross section of segment S1.04D	

Segment ID: S1.06	**Photo #:** 100_0934	**Date:** 9/13/2007	**Segment ID:** S1.06	**Photo #:** 100_0935	**Date:** 9/13/2007
View: US	**Description:** Bottom of reach S1.06		**View:** DS	**Description:** Top of reach S1.05 (impoundment—not assessed)	

Segment ID: S1.06	**Photo #:** 100_0936	**Date:** 9/13/2007	**Segment ID:** S1.06	**Photo #:** 100_0937	**Date:** 9/13/2007
View: US	**Description:** Old stone fence causing channel constriction		**View:** US	**Description:** Wooden footbridge	

Segment ID: S1.06	**Photo #:** 100_0938	**Date:** 9/13/2007	**Segment ID:** S1.06	**Photo #:** 100_0939	**Date:** 9/13/2007
View: US	**Description:** Old stone fence/dam causing channel constriction		**View:** DS	**Description:** Channel caused by old stone fence/dam	

Segment ID: S1.06	**Photo #:** 100_0900	**Date:** 9/12/2007	**Segment ID:** S1.06	**Photo #:** 100_0901	**Date:** 9/12/2007
View: US	**Description:** Upstream of snowmobile bridge		**View:** DS	**Description:** Downstream of snowmobile bridge	

Segment ID: S1.06	**Photo #:** 100_0940	**Date:** 9/13/2007
View: US	**Description**: Pond above dam at reach break	

Segment ID: S1.06	**Photo #:** 100_0941	**Date:** 9/13/2007
View: DS	**Description:** Reach break dam and channel below	

Segment ID: S1.06	**Photo #:** 100_0943	**Date:** 9/13/2007
View: US	**Description:** Cross-section	

Segment ID: S1.06	**Photo #:** 100_0944	**Date:** 9/13/2007
View: DS	**Description:** Cross-section	

Segment ID: T3.05A	**Photo #:** 100_1034	**Date:** 9/19/2007
View: DS	**Description:** Muddy water from dredging above dam	

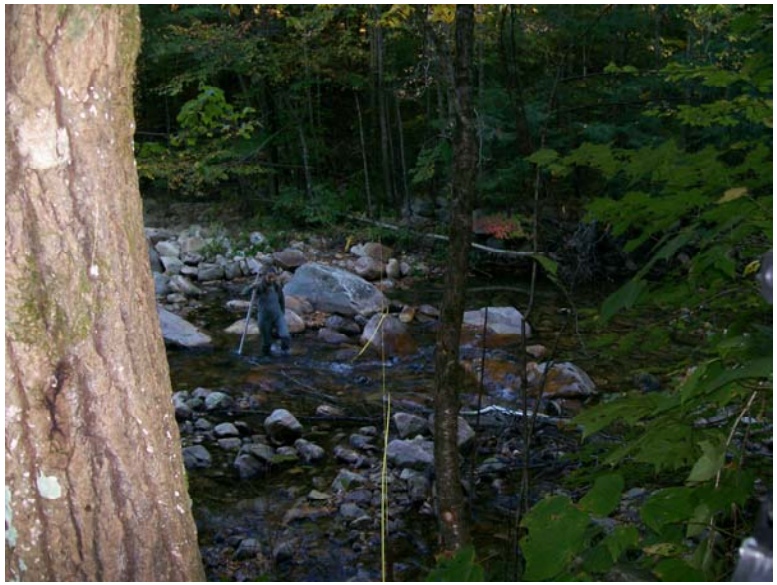
Segment ID: T3.05A	**Photo #:** 100_1035	**Date:** 9/19/2007
View: US	**Description:** Left bank erosion	

Segment ID: T3.05A	**Photo #:** 100_1036	**Date:** 9/19/2007
View: DS	**Description:** Left bank erosion and development	

Segment ID: T3.05A	**Photo #:** 100_1037	**Date:** 9/19/2007
View: US	**Description:** Head cut	

Segment ID: T3.05A	**Photo #:** 100_1069	**Date:** 9/25/2007	**Segment ID:** T3.05A	**Photo #:** 100_1070	**Date:** 9/25/2007
View: US	**Description:** Cross section		**View:** DS	**Description:** Cross section and development	

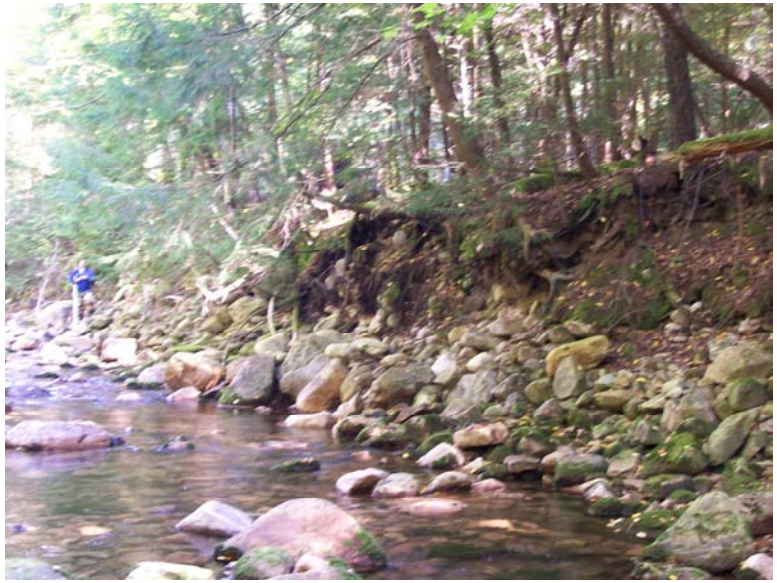
Segment ID: T3.05A	**Photo #:** 100_1067	**Date:** 9/25/2007	**Segment ID:** T3.05A	**Photo #:** 100_1038	**Date:** 9/19/2007
View: RB	**Description:** Cross section		**View:** US	**Description:** Diagonal bar (bottom of segment T3.05B)	



Segment ID: T3.05B	**Photo #:** 100_1043	**Date:** 9/19/2007	**Segment ID:** T3.05B	**Photo #:** 100_1044	**Date:** 9/24/2007
View: US	**Description:** Old concrete slabs under bridge (grade control)		**View:** US	**Description:** Bedrock outcrop and steep riffle/diagonal bar	

Segment ID: T3.05B	**Photo #:** 100_1046	**Date:** 9/24/2007	**Segment ID:** T3.05B	**Photo #:** 100_1049	**Date:** 9/24/2007
View: LB	**Description:** Old concrete slab bank revetment		**View:** US	**Description:** Old concrete slabs in channel (grade control)	

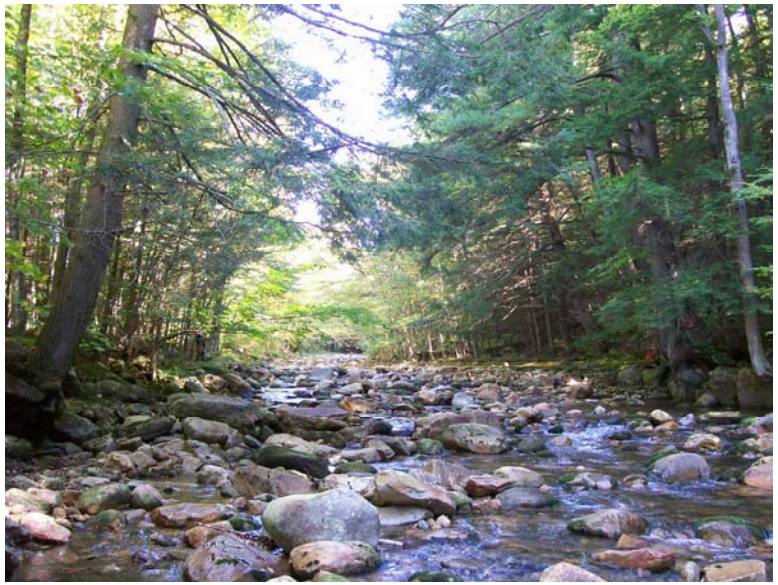
Segment ID: T3.05B	**Photo #:** 100_1050	**Date:** 9/24/2007
View: US	**Description:** Left bank erosion	



Segment ID: T3.05B	**Photo #:** 100_1052	**Date:** 9/24/2007
View: US	**Description:** Large point bar, steep riffle, and bedrock outcrop	

Segment ID: T3.05B	**Photo #:** 100_1053	**Date:** 9/24/2007
View: US	**Description:** Steep riffle (top of segment T3.05B)	

Segment ID: T3.05B	**Photo #:** 100_1072	**Date:** 9/25/2007
View: US	**Description:** Cross section	



Segment ID: T3.05B	**Photo #:** 100_1074	**Date:** 9/25/2007
View: LB	**Description:** Cross section	

Segment ID: T3.05C	**Photo #:** 100_0887	**Date:** 9/24/2007
View: LB	**Description:** Small dam and drinking water withdrawal	

Segment ID: T3.05C	**Photo #:** 100_1078	**Date:** 9/25/2007
View: DS	**Description:** Cross section	

Segment ID: T3.05C	**Photo #:** 100_1079	**Date:** 9/25/2007
View: US	**Description:** Cross section	

Segment ID: T3.05C	**Photo #:** 100_1054	**Date:** 9/24/2007
View: DS	**Description:** Top of segment T3.05C	

Segment ID: T3.06	**Photo #:** 100_1055	**Date:** 9/24/2007
View: US	**Description:** Bottom of reach (braiding, islands)	

Segment ID: T3.06	**Photo #:** 100_1056	**Date:** 9/24/2007
View: US	**Description:** Mouth of Bickford Hollow Brook at reach break	

Segment ID: T3.06	**Photo #:** 100_1058	**Date:** 9/24/2007
View: US	**Description:** Steep riffle and large deposition	

Segment ID: T3.06	**Photo #:** 100_1059	**Date:** 9/24/2007
View: DS	**Description:** Top of characteristic dry side channel	

Segment ID: T3.06	**Photo #:** 100_1060	**Date:** 9/24/2007	**Segment ID:** T3.06	**Photo #:** 100_1061	**Date:** 9/24/2007
View: DS	**Description:** Incising section with right bank erosion		**View:** DS	**Description:** Debris jam blocking side channel above x-section	

Segment ID: T3.06	**Photo #:** 100_1062	**Date:** 9/24/2007	**Segment ID:** T3.06	**Photo #:** 100_1064	**Date:** 9/24/2007
View: US	**Description:** Bottom of reach T3.07		**View:** US	**Description:** Cross section	

Segment ID: T3.06	**Photo #:** 100_1066	**Date:** 9/24/2007
View: DS	**Description:** Cross section	

Appendix G: Bridge and Culvert Assessment Photographs

Segment ID: S1.01A	**Photo #:** 100_0873	**Date:** 9/11/2007	**Segment ID:** S1.01A	**Photo #:** 100_0874	**Date:** 9/11/2007
View: DS	**Description:** Inlet of Harbor Rd. bridge		**View:** US	**Description:** Outlet of Harbor Rd. bridge	

Segment ID: S1.01A	**Photo #:** 100_0871	**Date:** 9/11/2007	**Segment ID:** S1.01A	**Photo #:** 100_0872	**Date:** 9/11/2007
View: US	**Description:** Upstream of Harbor Rd. bridge		**View:** DS	**Description:** Downstream of Harbor Rd. bridge	

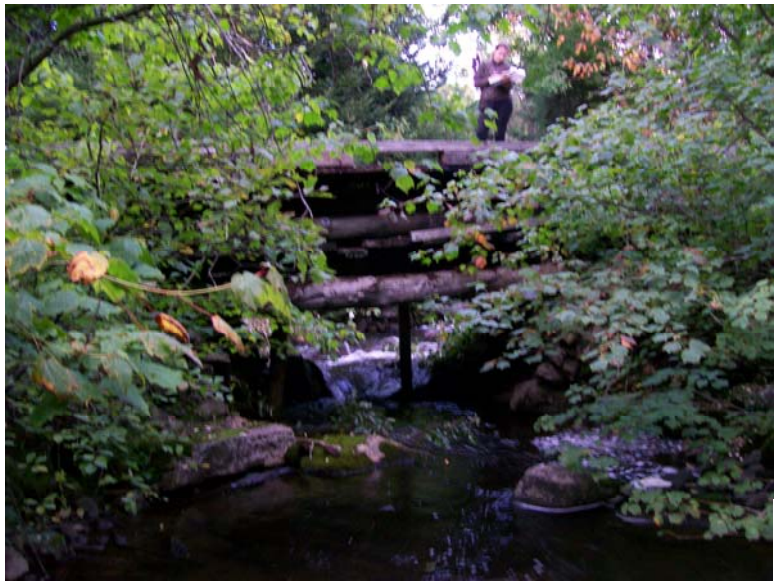
Segment ID: S1.02A	**Photo #:** 100_0919	**Date:** 9/12/2007	**Segment ID:** S1.02A	**Photo #:** 100_0918	**Date:** 9/12/2007
View: DS	**Description:** Inlet of Rt. 9 bridge		**View:** US	**Description:** Outlet of Rt. 9 bridge	

Segment ID: S1.02A	**Photo #:** 100_0920	**Date:** 9/12/2007	**Segment ID:** S1.02A	**Photo #:** 100_0921	**Date:** 9/18/2007
View: US	**Description:** Upstream of Rt. 9 bridge		**View:** DS	**Description:** Downstream of Rt. 9 bridge (reach break)	

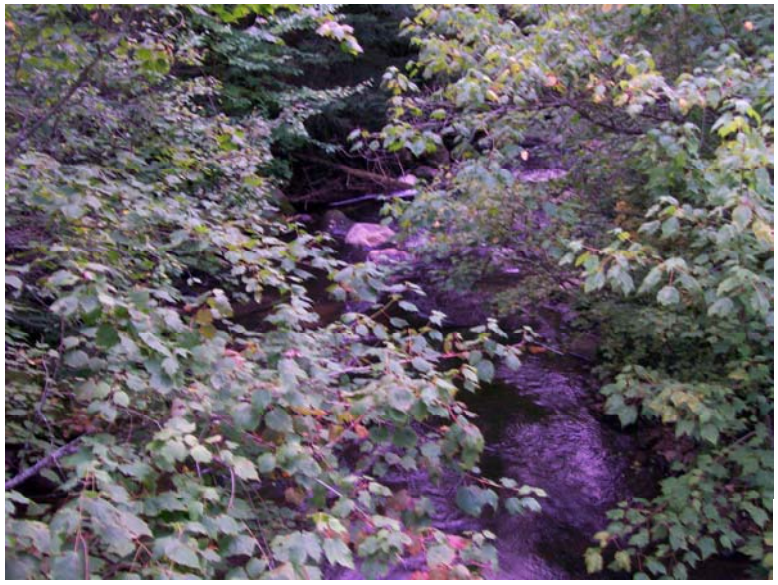
Segment ID: S1.03	**Photo #:** 100_0927	**Date:** 9/12/2007	**Segment ID:** S1.03	**Photo #:** 100_0926	**Date:** 9/12/2007
View: DS	**Description:** Inlet of arch on City Stream Rd.		**View:** US	**Description:** Outlet of arch on City Stream Rd.	

Segment ID: S1.03	**Photo #:** 100_0922	**Date:** 9/12/2007	**Segment ID:** S1.03	**Photo #:** 100_0924	**Date:** 9/12/2007
View: US	**Description:** Upstream of arch on City Stream Rd.		**View:** DS	**Description:** Downstream of arch on City Stream Rd.	

Segment ID: S1.04A	**Photo #:** 100_0931	**Date:** 9/12/2007	**Segment ID:** S1.04A	**Photo #:** 100_0932	**Date:** 9/12/2007
View: DS	**Description:** Inlet of bridge on driveway off City Stream Rd.		**View:** US	**Description:** Outlet of bridge on driveway off City Stream Rd.	



Segment ID: S1.04A	**Photo #:** 100_0928	**Date:** 9/12/2007	**Segment ID:** S1.03	**Photo #:** 100_0929	**Date:** 9/12/2007
View: US	**Description:** Upstream of bridge off City Stream Rd.		**View:** DS	**Description:** Downstream of bridge off City Stream Rd.	



Segment ID: S1.04D	**Photo #:** 100_0917	**Date:** 9/12/2007
View: DS	**Description:** Inlet of culvert on driveway to Prospect Mt.	

Segment ID: S1.04C	**Photo #:** 100_0916	**Date:** 9/12/2007
View: US	**Description:** Outlet of culvert on driveway to Prospect Mt.	

Segment ID: S1.04D	**Photo #:** 100_0916	**Date:** 9/12/2007
View: US	**Description:** Upstream of culvert on driveway to Prospect Mt.	

Segment ID: S1.04C	**Photo #:** 100_0914	**Date:** 9/12/2007
View: DS	**Description:** Downstream of culvert on driveway to Prospect Mt.	

Segment ID: S1.04D	**Photo #:** 100_0912	**Date:** 9/12/2007
View: DS	**Description:** Inlet of culvert below Bugbee Mill Pond	

Segment ID: S1.04D	**Photo #:** 100_0913	**Date:** 9/12/2007
View: US	**Description:** Outlet of culvert below Bugbee Mill Pond	

Segment ID: S1.04D	**Photo #:** 100_0910	**Date:** 9/12/2007
View: US	**Description:** Upstream of culvert below Bugbee Mill Pond	

Segment ID: S1.04D	**Photo #:** 100_0911	**Date:** 9/12/2007
View: DS	**Description:** Downstream of culvert below Bugbee Mill Pond	

Segment ID: S1.06	**Photo #:** 100_0909	**Date:** 9/12/2007
View: DS	**Description:** Inlet of bridge on driveway off Rt. 9	

Segment ID: S1.06	**Photo #:** 100_0908	**Date:** 9/12/2007
View: US	**Description:** Outlet of bridge on driveway off Rt. 9	

Segment ID: S1.06	**Photo #:** 100_0906	**Date:** 9/12/2007
View: US	**Description:** Upstream of bridge on driveway off Rt. 9	

Segment ID: S1.06	**Photo #:** 100_0907	**Date:** 9/12/2007
View: DS	**Description:** Downstream of bridge on driveway off Rt. 9	

Segment ID: S1.06	**Photo #:** 100_0903	**Date:** 9/12/2007	**Segment ID:** S1.06	**Photo #:** 100_0902	**Date:** 9/12/2007
View: DS	**Description:** Inlet of snowmobile bridge		**View:** US	**Description:** Outlet of snowmobile bridge	

Segment ID: S1.06	**Photo #:** 100_0900	**Date:** 9/12/2007	**Segment ID:** S1.06	**Photo #:** 100_0901	**Date:** 9/12/2007
View: US	**Description:** Upstream of snowmobile bridge		**View:** DS	**Description:** Downstream of snowmobile bridge	

Segment ID: S1.06	**Photo #:** 100_0897	**Date:** 9/12/2007
View: DS	**Description:** Inlet of culvert across Rt. 9	

Segment ID: S1.06	**Photo #:** 100_0899	**Date:** 9/12/2007
View: US	**Description:** Outlet of culvert across Rt. 9	

Segment ID: S1.06	**Photo #:** 100_0896	**Date:** 9/12/2007
View: US	**Description:** Upstream of culvert across Rt. 9	

Segment ID: S1.06	**Photo #:** 100_0896	**Date:** 9/12/2007
View: DS	**Description:** Downstream of culvert across Rt. 9	

Segment ID: S1.06	**Photo #:** 100_0895	**Date:** 9/12/2007	**Segment ID:** S1.06	**Photo #:** 100_0894	**Date:** 9/12/2007
View: DS	**Description:** Inlet of culvert below Big Pond		**View:** US	**Description:** Outlet of culvert below Big Pond	

Segment ID: S1.06	**Photo #:** 100_0893	**Date:** 9/12/2007	**Segment ID:** S1.06	**Photo #:** 100_0892	**Date:** 9/12/2007
View: US	**Description:** Upstream of culvert below Big Pond		**View:** DS	**Description:** Downstream of culvert below Big Pond	

Segment ID: T3.05	**Photo #:** 100_0890	**Date:** 9/11/2007
View: DS	**Description:** Inlet of 1st Bolles Brook bridge on Harbor Rd.	

Segment ID: T3.05	**Photo #:** 100_0891	**Date:** 9/11/2007
View: US	**Description:** Outlet of 1st Bolles Brook bridge on Harbor Rd.	

Segment ID: T3.05	**Photo #:** 100_0888	**Date:** 9/11/2007
View: US	**Description:** Upstream of 1st Bolles Br. bridge on Harbor Rd.	

Segment ID: T3.05	**Photo #:** 100_0889	**Date:** 9/11/2007
View: DS	**Description:** Downstream of 1st Bolles Br. bridge on Harbor Rd.	

Segment ID: T3.05	**Photo #:** 100_0884	**Date:** 9/11/2007
View: DS	**Description:** Inlet of bridge above dam on Harbor Rd.	

Segment ID: T3.05	**Photo #:** 100_0886	**Date:** 9/11/2007
View: US	**Description:** Outlet of bridge above dam on Harbor Rd.	

Segment ID: T3.05	**Photo #:** 100_0882	**Date:** 9/11/2007
View: US	**Description:** Upstream of bridge above dam on Harbor Rd.	

Segment ID: T3.05	**Photo #:** 100_0883	**Date:** 9/11/2007
View: DS	**Description:** Downstream of bridge above dam on Harbor Rd.	

Segment ID: T3.06	**Photo #:** 100_0880	**Date:** 9/11/2007	**Segment ID:** T3.06	**Photo #:** 100_0881	**Date:** 9/11/2007
View: DS	**Description:** Inlet of bridge on National Forest road		**View:** US	**Description:** Outlet of bridge on National Forest road	

Segment ID: T3.06	**Photo #:** 100_0878	**Date:** 9/11/2007	**Segment ID:** T3.06	**Photo #:** 100_0879	**Date:** 9/11/2007
View: US	**Description:** Upstream of bridge on National Forest road		**View:** DS	**Description:** Downstream of bridge on National Forest road	

Appendix H: Standard Phase 2 Database Output Reports

Stream Geometry Data

Walloomsac Woodford

		Phase 2 Stream Type					Phase 1 Data			Phase 2 Channel Data												
Reach	Seg-ment	Stream Type	Bed Material	Bedform	Subcl. Slope	Sub Rch?	Channel Slope	Channel width	Bankfull width	Max. depth	Mean depth	Floodpr. width	Abandn FldPln	W/D Ratio	Entrench-ment	Incision Ratio	Stage Evol.	Evol. Model	RGA Cond.	RHA Cond.	QC Stf	QC Aut
M6T3.05	A	B	Cobble	Step-Pool	None	No	6.85	64.28	48.0	3.0	2.18	86.6	3.04	22.02	1.80	1.01	III	F	Fair	Good	F	P
M6T3.05	B	B	Cobble	Step-Pool	c	No	6.24	64.28	55.52	2.88	1.87	87.3	5.18	29.69	1.57	1.80	IV	F	Fair	Good	F	P
M6T3.05	C	B	Cobble	Step-Pool	c	No	12.03	64.28	32.0	4.22	2.62	59.2		12.21	1.85		II	F	Fair	Good	F	P
M6T3.05S1.01	A	B	Cobble	Step-Pool	None	No	9.26	46.27	62.0	2.92	1.98	99.6	6.97	31.31	1.61	2.39	III	F	Fair	Good	F	P
M6T3.05S1.01	B	F	Cobble	Step-Pool	None	No	16.34	46.27	56.66	3.07	2.11	65.0	7.36	26.85	1.15	2.40	III	F	Poor	Good	F	P
M6T3.05S1.01	C	B	Cobble	Step-Pool	None	No	5.61	46.27	54.0	3.25	2.19	88.5	4.51	24.66	1.64	1.39	III	F	Fair	Good	F	P
M6T3.05S1.02	A	F	Cobble	Step-Pool	None	No	6.99	43.96	60.64	2.94	1.7	67.7		35.67	1.12		III	F	Fair	Fair	F	P
M6T3.05S1.02	B	B	Cobble	Step-Pool	a	No	8.34	43.96	52.0	3.35	1.97	63.0	6.16	26.40	1.21	1.84	II	F	Fair	Good	F	P
M6T3.05S1.03	0					No	6.18	24.65													F	F
M6T3.05S1.04	A					No	13.65	20.33													F	F
M6T3.05S1.04	B	F	Gravel	Riffle-Pool	None	No	6.38	20.33	23.38	1.74	0.89	30.3	3.49	26.27	1.30	2.01	II	F	Fair	Good	F	P
M6T3.05S1.04	C					No	16.03	20.33													F	F
M6T3.05S1.04	D	F	Gravel	Riffle-Pool	None	No	3.63	20.33	16.0	1.43	1.09	21.0	3.23	14.68	1.31	2.26	II	F	Fair	Good	F	P
M6T3.05S1.06	0	D	Gravel	Braided	b	No	3.32	14.59	16.0	1.39	0.97	34.8	2.22	16.49	2.17	1.60	IV	F	Good	Good	F	P
M6T3.06	0	D	Cobble	Braided	b	No	3.40	39.13	29.0	2.8	1.76	115.0	5.55	16.48	3.97	1.98	IV	F	Good	Good	F	P

Rapid Geomorphic Assessment

Walloomsac Woodford

Reach	Segment	Sub-Rch?	Degradation			Aggradation			Widening		Planform		Geo. Score	Geo. Condition	Evol. Stage	Confinement Type	Sensitivity	QC Stf	QC Aut
			Score	STD	Historic	Score	STD	Historic	Score	Historic	Score	Historic							
M6T3.05	A	No	5	None	No	14	None	No	9	No	12	No	0.50	Fair	III	BD	High	F	P
M6T3.05	B	No	5	None	Yes	13	None	No	10	No	17	No	0.56	Fair	IV	BD	High	F	P
M6T3.05	C	No	5	None	No	15	None	No	14	No	14	No	0.60	Fair	II	VB	High	F	P
M6T3.05S1.01	A	No	10	C to B	No	14	None	No	11	No	13	No	0.60	Fair	III	SC	High	F	P
M6T3.05S1.01	B	No	5	C to F	Yes	15	None	No	10	No	11	No	0.51	Poor	III	NC	Extreme	F	P
M6T3.05S1.01	C	No	8	C to B	Yes	12	None	No	9	No	9	No	0.48	Fair	III	NW	High	F	P
M6T3.05S1.02	A	No	5	B to F	Yes	10	None	No	8	No	11	No	0.43	Fair	III	NC	Extreme	F	P
M6T3.05S1.02	B	No	5	None	No	13	None	No	11	No	12	No	0.51	Fair	II	NW	Extreme	F	P
M6T3.05S1.03	0	No											0.00					F	F
M6T3.05S1.04	A	No											0.00					F	F
M6T3.05S1.04	B	No	5	C to F	No	16	None	No	12	No	18	No	0.64	Fair	II	VB	Extreme	F	P
M6T3.05S1.04	C	No											0.00					F	F
M6T3.05S1.04	D	No	5	C to F	No	13	None	No	13	No	16	No	0.59	Fair	II	VB	Extreme	F	P
M6T3.05S1.06	0	No	14	None	No	15	None	No	13	No	16	No	0.73	Good	IV	VB	Extreme	F	P
M6T3.06	0	No	13	None	No	16	None	No	12	No	13	No	0.68	Good	IV	VB	Extreme	F	P

Stream: **City Stream** Reach # **M6T3.05S1.01** Segment: **A** Completion Date: **September 17, 2007**

Organization: **Bennington County NRCD** Observers: **Jason George and Jill Winton** Why Not assessed: Rain: **Yes**

Segment Length (ft): **2,377** Segment Location: **From confluence with Bolles Brook upstream to old logging road stream ford.**

QC Status - Staff: Provisional Consultant: Provisional

Step 1. Valley and Floodplain

1.1 Segmentation **Valley Width**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	**1,228**	**0**
height	**0**	**0**
Roads	**675**	**0**
height	**0**	**0**
Railroads	**0**	**0**
height	**0**	**0**
Improved Paths	**0**	**0**
height	**0**	**0**
Development	**834**	**0**

1.4 Adjacent Side	Left	Right
Hillside Slope	**Very Steep**	**Extremely**
Continuous w/	**Never**	**Always**
W/in 1 Bankfill	**Never**	**Always**
Texture	**Not Evalua**	**Mixed**

1.5 Valley Features

Valley Width (ft) **230**

Width Determination **Measured**

Confinement Type **Semi-confined**

Rock Gorge? **No**

Human-caused Change? **Yes**

Step 2. Stream Channel

2.1 Bankfull Width **62**

2.2 Max Depth (ft) **2.92**

2.3 Mean Depth (ft) **1.98**

2.4 Floodprone Width (ft) **100**

Notes:

Berms constructed of dredged material.

Step 2. (Contued)

2.5 Aband. Floodpln **6.97** ft.

Human Elev Floodpln **11.62** ft.

2.6 Width/Depth Ratio **31.31**

2.7 Entrenchment Ratio **1.61**

2.8 Incision Ratio **2.39**

Human Elevated Inc Rat **3.98**

2.9 Sinuosity **Low**

2.10 Riffles Type **Complete**

2.11 Riffle/Step Spacing (ft) **70**

2.12 Substrate Composition

Bedrock	**0**%
Boulder	**29**%
Cobble	**44**%
Coarse Gravel	**19**%
Fine Gravel	**7**%
Sand	**1**%
Silt and smaller	**0**%

Silt/Clay Present? **No**

Detritus **3** %

Large Woody **18**

2.13 Average Largest Particle on

Bed **36.0** **inches**

Bar **15.0** **inches**

2.14 Stream Type

Stream Type: **B**

Bed Material: **Cobble**

Subclass Slope: **None**

Bed Form: **Step-Pool**

Field Measured Slope: **2.5**

2.15 Reference Stream Type

(if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	**None**	**0.00**
Gullies	**None**	**0.00**

Step 3. Riparian Features

3.1 Stream Banks

Typical Bank Slope **Steep**

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

Bank Erosion	Left	Right
Erosion Length (ft)	**110**	**0**
Erosion Height (ft)	**6.00**	**0.00**
Revetmt. Type	**None**	**Rip-Rap**
Revetmt. Length (ft)	**0**	**10**

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

Bank Canopy	Left	Right
Canopy %	**26-50**	**76-100**

Mid-Channel Canopy **Open**

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**51-100**	**>100**
Sub-dominant	**0-25**	**None**
W less than 25	**33**	**181**

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	**Residential**	**None**
Mass Failures	**0**	**0**
Height	**0**	**0**
Gullies	**0**	**0**
Height	**0**	**0**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps **Minimal**

4.2 Adjacent Wetlands **None**

4.3 Flow Status **Moderate**

4.4 # of Debris Jams **0**

4.5 Flow Regulation Type **None**

Flow Regulation Use

Impoundments **None**

Impoundmt. Location

4.6 Up/Down strm flow reg **None**

(old) Upstrm Flow Reg **None**

4.7 StormwaterInputs

Field Ditch	**0**	Road Ditch	**0**
Other	**0**	Tile Drain	**0**
Overland Flow	**0**	Urb Strm Wtr Pipe	**0**

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	**1**	**1**

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

5.2 Other Features

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

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
1	**1**	**No**

5.4 Stream Ford or Animal **Yes**

5.5 Straightening **Straightening**

Straightening Length: **126**

5.5 Dredging **Dredging**

Note: Step 1.6 - Grade Controls and Step 4.8 - Channel Constrictions are on The second page of this report - with 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	90.0	Yes	Yes	No	Yes

Problem Deposition Below

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Confined**

	Score	STD	Historic
7.1 Channel Degradation	**10**	**C to B**	**No**
7.2 Channel Aggradation	**14**	**None**	**No**
7.3 Widening Channel	**11**		**No**
7.4 Change in Planform	**13**		**No**
Total Score	**48**		
Geomorphic Rating	**0.6**		
Channel Evolution Model	**F**		
Channel Evolution Stage	**III**		
Geomorphic Condition	**Fair**		
Stream Sensitivity	**High**		

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type **High**

	Score
6.1 Epifaunal Substrate - Available Cover	15
6.2 Embeddedness	18
6.3 Velocity/Depth Patterns	15
6.4 Sediment Deposition	10
6.5 Channel Flow Status	14
6.6 Channel Alteration	10
6.7 Frequency of Riffles/Steps	18
6.8 Bank Stability	Left: 8 Right: 9
6.9 Bank Vegetation Protection	Left: 7 Right: 9
6.10 Riparian Vegetation Zone Width	Left: 5 Right: 10
Total Score	148
Habitat Rating	0.74
Habitat Stream Condition	**Good**

Narrative:
Degradation

Project: **Walloomsac Woodford** | **Phase 2 Segment Summary** | November 27, 2007 SGAT Version: 4.56

Stream: **City Stream** Reach # **M6T3.05S1.01** Segment: **B** Completion Date: **September 18, 2007**

Organization: **Bennington County NRCD** Observers: **Jason George and Jill Winton** Why Not assessed: Rain: **Yes**

Segment Length (ft): **1,346** Segment Location: **From old logging road stream ford upstream to just above bedrock constriction (straight,**

QC Status - Staff: Provisional Consultant: Provisional

Step 1. Valley and Floodplain

1.1 Segmentation **Valley Width**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	434	0
height	0	0
Roads	1,346	0
height	0	0
Railroads	0	0
height	0	0
Improved Paths	0	0
height	0	0
Development	0	0

1.4 Adjacent Side	Left	Right
Hillside Slope	Very Steep	Extremely
Continuous w/	Never	Sometimes
W/in 1 Bankfill	Never	Always
Texture	Not Evalua	Mixed

1.5 Valley Features

Valley Width (ft) **82**

Width Determination **Measured**

Confinement Type **Narrowly**

Rock Gorge? **No**

Human-caused Change? **Yes**

Step 2. Stream Channel

2.1 Bankfull Width **57**

2.2 Max Depth (ft) **3.07**

2.3 Mean Depth (ft) **2.11**

2.4 Floodprone Width (ft) **65**

Notes:

Berms constructed of dredged material.

Step 2. (Contued)

2.5 Aband. Floodpln **7.36** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **26.85**

2.7 Entrenchment Ratio **1.15**

2.8 Incision Ratio **2.40**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Low**

2.10 Riffles Type **Eroded**

2.11 Riffle/Step Spacing (ft) **35**

2.12 Substrate Composition

Bedrock	0%
Boulder	27%
Cobble	45%
Coarse Gravel	17%
Fine Gravel	7%
Sand	4%
Silt and smaller	0%

Silt/Clay Present? **No**

Detritus **5** %

Large Woody **10**

2.13 Average Largest Particle on

Bed	48.0	inches
Bar	18.0	inches

2.14 Stream Type

Stream Type: **F**

Bed Material: **Cobble**

Subclass Slope: **None**

Bed Form: **Step-Pool**

Field Measured Slope: **1.5**

2.15 Reference Stream Type

(if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	None	0.00
Gullies	None	0.00

Step 3. Riparian Features

3.1 Stream Banks

Typical Bank Slope **Undercut**

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)	222	0
Erosion Height (ft)	5.00	0.00
Revetmt. Type	Rip-Rap	None
Revetmt. Length (ft)	303	0

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

Bank Canopy	Left	Right
Canopy %	1-25	51-75

Mid-Channel Canopy **Open**

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	0-25	>100
Sub-dominant	26-50	None
W less than 25	0	0

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

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Bare	Forest
Sub-dominant	Shrubs/Saplin	Shrubs/Saplin
Mass Failures	0	0
Height	0	0
Gullies	0	0
Height	0	0

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps **None**

4.2 Adjacent Wetlands **None**

4.3 Flow Status **Moderate**

4.4 # of Debris Jams **0**

4.5 Flow Regulation Type **None**

Flow Regulation Use

Impoundments **None**

Impoundmt. Location

4.6 Up/Down strm flow reg **None**

(old) Upstrm Flow Reg **None**

4.7 StormwaterInputs

Field Ditch	0	Road Ditch	0
Other	0	Tile Drain	0
Overland Flow	0	Urb Strm Wtr Pipe	0

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	0	0

Diagonal	Delta	Island
0	0	0

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
0	0	0	0

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
0	1	No

5.4 Stream Ford or Animal **No**

5.5 Straightening **Straightening**

Straightening Length: **1,346**

5.5 Dredging **Dredging**

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

Stream: **City Stream** Reach # **M6T3.05S1.01** Segment: **B** Completion Date: **September 18,**

Organization: **Bennington County NRCD** Observers: **Jason George and Jill Winton** Rain: **Yes**

Segment Length (ft): **1,346** Segment Location: **From old logging road stream ford upstream to just above bedrock constriction (straight,**

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?
Bedrock	15.0	Yes	Yes	Yes	No

Problem Deposition Above

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Confined**

	Score	STD	Historic
7.1 Channel Degradation	**5**	**C to F**	**Yes**
7.2 Channel Aggradation	**15**	**None**	**No**
7.3 Widening Channel	**10**		**No**
7.4 Change in Planform	**11**		**No**
Total Score	**41**		
Geomorphic Rating	**0.5125**		
Channel Evolution Model	**F**		
Channel Evolution Stage	**III**		
Geomorphic Condition	**Poor**		
Stream Sensitivity	**Extreme**		

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type **High**

	Score
6.1 Epifaunal Substrate - Available Cover	10
6.2 Embeddedness	16
6.3 Velocity/Depth Patterns	13
6.4 Sediment Deposition	18
6.5 Channel Flow Status	10
6.6 Channel Alteration	10
6.7 Frequency of Riffles/Steps	13
6.8 Bank Stability	Left: 5 Right: 9
6.9 Bank Vegetation Protection	Left: 5 Right: 10
6.10 Riparian Vegetation Zone Width	Left: 3 Right: 10
Total Score	132
Habitat Rating	0.66
Habitat Stream Condition	**Good**

Narrative:

Degradation and widening.

Modified from "Fair" to "Poor" condition due to departure from "C" to "F" stream type.

Project: **Walloomsac Woodford** | **Phase 2 Segment Summary** | November 27, 2007 SGAT Version: 4.56

Stream: **City Stream** Reach # **M6T3.05S1.01** Segment: **C** Completion Date: **September 18, 2007**

Organization: **Bennington County NRCD** Observers: **Jason George and Jill Winton** Why Not assessed: Rain: **Yes**

Segment Length (ft): **3,924** Segment Location: **From just above bedrock constriction to just below Route 9 bridge.**

QC Status - Staff: Provisional Consultant: Provisional

Step 1. Valley and Floodplain

1.1 Segmentation **Valley Width**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	**2,617**	**0**
height	**0**	**0**
Roads	**1,758**	**0**
height	**0**	**0**
Railroads	**0**	**0**
height	**0**	**0**
Improved Paths	**0**	**0**
height	**0**	**0**
Development	**522**	**0**

1.4 Adjacent Side	Left	Right
Hillside Slope	**Very Steep**	**Extremely**
Continuous w/	**Never**	**Sometimes**
W/in 1 Bankfill	**Never**	**Sometimes**
Texture	**Not Evalua**	**Mixed**

1.5 Valley Features

Valley Width (ft) **240**

Width Determination **Measured**

Confinement Type **Narrow**

Rock Gorge? **No**

Human-caused Change? **Yes**

Step 2. Stream Channel

2.1 Bankfull Width **54**

2.2 Max Depth (ft) **3.25**

2.3 Mean Depth (ft) **2.19**

2.4 Floodprone Width (ft) **89**

Notes:

Berms constructed of dredged material.

Step 2. (Contued)

2.5 Aband. Floodpln **4.51** ft.

Human Elev Floodpln **13.62** ft.

2.6 Width/Depth Ratio **24.66**

2.7 Entrenchment Ratio **1.64**

2.8 Incision Ratio **1.39**

Human Elevated Inc Rat **4.19**

2.9 Sinuosity **Low**

2.10 Riffles Type **Complete**

2.11 Riffle/Step Spacing (ft) **0**

2.12 Substrate Composition

Bedrock	**1** %
Boulder	**28** %
Cobble	**47** %
Coarse Gravel	**15** %
Fine Gravel	**7** %
Sand	**2** %
Silt and smaller	**0** %

Silt/Clay Present? **No**

Detritus **5** %

Large Woody **13**

2.13 Average Largest Particle on

Bed	**48.0**	**inches**
Bar	**18.0**	**inches**

2.14 Stream Type

Stream Type: **B**

Bed Material: **Cobble**

Subclass Slope: **None**

Bed Form: **Step-Pool**

Field Measured Slope: **3.1**

2.15 Reference Stream Type

(if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	**None**	**0.00**
Gullies	**None**	**0.00**

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)	**551**	**319**
Erosion Height (ft)	**5.17**	**6.67**
Revetmt. Type	**Rip-Rap**	**None**
Revetmt. Length (ft)	**279**	**0**

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

Bank Canopy	Left	Right
Canopy %	**51-75**	**51-75**

Mid-Channel Canopy **Open**

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**51-100**	**>100**
Sub-dominant	**26-50**	**None**
W less than 25	**0**	**0**

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	**Residential**	**None**
Mass Failures	**0**	**43**
Height	**0**	**20**
Gullies	**0**	**0**
Height	**0**	**0**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps **Minimal**

4.2 Adjacent Wetlands **None**

4.3 Flow Status **Moderate**

4.4 # of Debris Jams **0**

4.5 Flow Regulation Type **None**

Flow Regulation Use

Impoundments **None**

Impoundmt. Location

4.6 Up/Down strm flow reg **None**

(old) Upstrm Flow Reg **None**

4.7 StormwaterInputs

Field Ditch	**0**	Road Ditch	**3**
Other	**0**	Tile Drain	**0**
Overland Flow	**0**	Urb Strm Wtr Pipe	**0**

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	**3**	**4**

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

5.2 Other Features

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

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 **Straightening**

Straightening Length: **3,911**

5.5 Dredging **Dredging**

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

Stream: **City Stream** Reach # **M6T3.05S1.01** Segment: **C** Completion Date: **September 18,**

Organization: **Bennington County NRCD** Observers: **Jason George and Jill Winton** Rain: **Yes**

Segment Length (ft): **3,924** Segment Location: **From just above bedrock constriction to just below Route 9 bridge.**

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?

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Confined**

	Score	STD	Historic
7.1 Channel Degradation	**8**	**C to B**	**Yes**
7.2 Channel Aggradation	**12**	**None**	**No**
7.3 Widening Channel	**9**		**No**
7.4 Change in Planform	**9**		**No**
Total Score	**38**		
Geomorphic Rating	**0.475**		
Channel Evolution Model	**F**		
Channel Evolution Stage	**III**		
Geomorphic Condition	**Fair**		
Stream Sensitivity	**High**		

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type **High**

	Score
6.1 Epifaunal Substrate - Available Cover	13
6.2 Embeddedness	18
6.3 Velocity/Depth Patterns	16
6.4 Sediment Deposition	10
6.5 Channel Flow Status	12
6.6 Channel Alteration	10
6.7 Frequency of Riffles/Steps	16
6.8 Bank Stability	Left: 4 Right: 6
6.9 Bank Vegetation Protection	Left: 5 Right: 9
6.10 Riparian Vegetation Zone Width	Left: 7 Right: 10
Total Score	136
Habitat Rating	0.68
Habitat Stream Condition	**Good**

Narrative:

Degradation, widening, and planform.

Used confined RGA form even though confinement ratio at cross-section was 4.44.

Stream: **City Stream** Reach # **M6T3.05S1.02** Segment: **A** Completion Date: **September 19, 2007**

Organization: **Bennington County NRCD** Observers: **Jason George and Jill Winton** Why Not assessed: Rain: **Yes**

Segment Length (ft): **1,073** Segment Location: **From just below Route 9 bridge upstream to sharp increase in slope/substrate size.**

QC Status - Staff: Provisional Consultant: Provisional

Step 1. Valley and Floodplain

1.1 Segmentation **Planform and Scope**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	655	353
height	0	0
Railroads	0	0
height	0	0
Improved Paths	0	0
height	0	0
Development	0	0

1.4 Adjacent Side	Left	Right
Hillside Slope	Extremely	Extremely
Continuous w/	Always	Always
W/in 1 Bankfill	Always	Always
Texture	Mixed	Mixed

1.5 Valley Features

Valley Width (ft) **72**

Width Determination **Measured**

Confinement Type **Narrowly**

Rock Gorge? **No**

Human-caused Change? **Yes**

Step 2. Stream Channel

2.1 Bankfull Width **61**

2.2 Max Depth (ft) **2.94**

2.3 Mean Depth (ft) **1.70**

2.4 Floodprone Width (ft) **68**

Notes:

Step 2. (Contued)

2.5 Aband. Floodpln **0.00** ft.

Human Elev Floodpln **22.06** ft.

2.6 Width/Depth Ratio **35.67**

2.7 Entrenchment Ratio **1.12**

2.8 Incision Ratio **0.00**

Human Elevated Inc Rat **7.50**

2.9 Sinuosity **Low**

2.10 Riffles Type **Sedimented**

2.11 Riffle/Step Spacing (ft) **65**

2.12 Substrate Composition

Bedrock	0%
Boulder	20%
Cobble	47%
Coarse Gravel	20%
Fine Gravel	10%
Sand	3%
Silt and smaller	0%

Silt/Clay Present? **No**

Detritus **1** %

Large Woody **5**

2.13 Average Largest Particle on

Bed **36.0** **inches**

Bar **30.0** **inches**

2.14 Stream Type

Stream Type: **F**

Bed Material: **Cobble**

Subclass Slope: **None**

Bed Form: **Step-Pool**

Field Measured Slope: **1.9**

2.15 Reference Stream Type

(if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	None	0.00
Gullies	None	0.00

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)	75	58
Erosion Height (ft)	8.00	8.00
Revetmt. Type	Multiple	Rip-Rap
Revetmt. Length (ft)	845	393

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

Bank Canopy	Left	Right
Canopy %	1-25	1-25

Mid-Channel Canopy **Open**

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	26-50	51-100
Sub-dominant	0-25	0-25
W less than 25	0	0

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

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Shrubs/Saplin	Forest
Sub-dominant	Bare	Bare
Mass Failures	0	0
Height	0	0
Gullies	0	0
Height	0	0

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps **None**

4.2 Adjacent Wetlands **None**

4.3 Flow Status **Moderate**

4.4 # of Debris Jams **0**

4.5 Flow Regulation Type **None**

Flow Regulation Use

Impoundments **None**

Impoundmt. Location

4.6 Up/Down strm flow reg **None**

(old) Upstrm Flow Reg **None**

4.7 StormwaterInputs

Field Ditch	0	Road Ditch	3
Other	0	Tile Drain	0
Overland Flow	0	Urb Strm Wtr Pipe	0

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	1	1

Diagonal	Delta	Island
0	0	0

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
0	0	0	0

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 **Straightening**

Straightening Length: **1,049**

5.5 Dredging **None**

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

Stream: **City Stream** Reach # **M6T3.05S1.02** Segment: **A** Completion Date: **September 19,**

Organization: **Bennington County NRCD** Observers: **Jason George and Jill Winton** Rain: **Yes**

Segment Length (ft): **1,073** Segment Location: **From just below Route 9 bridge upstream to sharp increase in slope/substrate size.**

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?

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Confined**

	Score	STD	Historic
7.1 Channel Degradation	**5**	**B to F**	**Yes**
7.2 Channel Aggradation	**10**	**None**	**No**
7.3 Widening Channel	**8**		**No**
7.4 Change in Planform	**11**		**No**
Total Score	**34**		
Geomorphic Rating	**0.425**		
Channel Evolution Model	**F**		
Channel Evolution Stage	**III**		
Geomorphic Condition	**Fair**		
Stream Sensitivity	**Extreme**		

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type **High**

	Score
6.1 Epifaunal Substrate - Available Cover	10
6.2 Embeddedness	16
6.3 Velocity/Depth Patterns	15
6.4 Sediment Deposition	10
6.5 Channel Flow Status	11
6.6 Channel Alteration	9
6.7 Frequency of Riffles/Steps	16
6.8 Bank Stability	Left: 6 Right: 6
6.9 Bank Vegetation Protection	Left: 6 Right: 5
6.10 Riparian Vegetation Zone Width	Left: 5 Right: 5
Total Score	120
Habitat Rating	0.6
Habitat Stream Condition	**Fair**

Narrative:

Aggradation and widening after historic degradation and channelization.
Evolution stage III-IV.

Stream: **City Stream** Reach # **M6T3.05S1.02** Segment: **B** Completion Date: **September 19, 2007**

Organization: **Bennington County NRCD** Observers: **Jason George and Jill Winton** Why Not assessed: Rain: **Yes**

Segment Length (ft): **899** Segment Location: **From sharp increase in slope/substrate size to confluence with Stamford Stream**

QC Status - Staff: Provisional Consultant: Provisional

Step 1. Valley and Floodplain

1.1 Segmentation **Planform and Scope**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	**127**	**0**
height	**0**	**0**
Roads	**899**	**0**
height	**0**	**0**
Railroads	**0**	**0**
height	**0**	**0**
Improved Paths	**0**	**0**
height	**0**	**0**
Development	**42**	**0**

1.4 Adjacent Side	Left	Right
Hillside Slope	**Extremely**	**Extremely**
Continuous w/	**Always**	**Sometimes**
W/in 1 Bankfill	**Always**	**Always**
Texture	**Mixed**	**Mixed**

1.5 Valley Features

Valley Width (ft) **267**

Width Determination **Measured**

Confinement Type **Narrow**

Rock Gorge? **No**

Human-caused Change? **Yes**

Step 2. Stream Channel

2.1 Bankfull Width **52**

2.2 Max Depth (ft) **3.35**

2.3 Mean Depth (ft) **1.97**

2.4 Floodprone Width (ft) **63**

Notes:

Pile of dredged material on left bank.

Step 2. (Contued)

2.5 Aband. Floodpln **6.16** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **26.40**

2.7 Entrenchment Ratio **1.21**

2.8 Incision Ratio **1.84**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Low**

2.10 Riffles Type **Complete**

2.11 Riffle/Step Spacing (ft) **60**

2.12 Substrate Composition

Bedrock	**0** %
Boulder	**27** %
Cobble	**47** %
Coarse Gravel	**19** %
Fine Gravel	**6** %
Sand	**1** %
Silt and smaller	**0** %

Silt/Clay Present? **No**

Detritus **3** %

Large Woody **9**

2.13 Average Largest Particle on

Bed **60.0** **inches**

Bar **24.0** **inches**

2.14 Stream Type

Stream Type: **B**

Bed Material: **Cobble**

Subclass Slope: **a**

Bed Form: **Step-Pool**

Field Measured Slope: **4.4**

2.15 Reference Stream Type

(if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	**None**	**0.00**
Gullies	**None**	**0.00**

Step 3. Riparian Features

3.1 Stream Banks

Typical Bank Slope **Steep**

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

Bank Erosion	Left	Right
Erosion Length (ft)	**321**	**172**
Erosion Height (ft)	**3.00**	**6.00**
Revetmt. Type	**Hard Bank**	**None**
Revetmt. Length (ft)	**70**	**0**

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

Bank Canopy	Left	Right
Canopy %	**26-50**	**26-50**

Mid-Channel Canopy **Open**

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**51-100**	**>100**
Sub-dominant	**26-50**	**None**
W less than 25	**0**	**0**

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

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	**Forest**	**Forest**
Sub-dominant	**Shrubs/Saplin**	**Shrubs/Saplin**
Mass Failures	**0**	**0**
Height	**0**	**0**
Gullies	**0**	**0**
Height	**0**	**0**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps **None**

4.2 Adjacent Wetlands **None**

4.3 Flow Status **Moderate**

4.4 # of Debris Jams **0**

4.5 Flow Regulation Type **None**

Flow Regulation Use

Impoundments **None**

Impoundmt. Location

4.6 Up/Down strm flow reg **None**

(old) Upstrm Flow Reg **None**

4.7 StormwaterInputs

Field Ditch	**0**	Road Ditch	**0**
Other	**0**	Tile Drain	**0**
Overland Flow	**0**	Urb Strm Wtr Pipe	**0**

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	**1**	**1**

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

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
0	**0**	**0**	**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 **Straightening**

Straightening Length: **838**

5.5 Dredging **Dredging**

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

Stream: **City Stream** Reach # **M6T3.05S1.02** Segment: **B** Completion Date: **September 19,**

Organization: **Bennington County NRCD** Observers: **Jason George and Jill Winton** Rain: **Yes**

Segment Length (ft): **899** Segment Location: **From sharp increase in slope/substrate size to confluence with Stamford Stream**

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?

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Confined**

	Score	STD	Historic
7.1 Channel Degradation	**5**	**None**	**No**
7.2 Channel Aggradation	**13**	**None**	**No**
7.3 Widening Channel	**11**		**No**
7.4 Change in Planform	**12**		**No**
Total Score	**41**		
Geomorphic Rating	**0.5125**		
Channel Evolution Model	**F**		
Channel Evolution Stage	**II**		
Geomorphic Condition	**Fair**		
Stream Sensitivity	**Extreme**		

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type **High**

	Score
6.1 Epifaunal Substrate - Available Cover	16
6.2 Embeddedness	18
6.3 Velocity/Depth Patterns	16
6.4 Sediment Deposition	11
6.5 Channel Flow Status	13
6.6 Channel Alteration	13
6.7 Frequency of Riffles/Steps	18
6.8 Bank Stability	Left: 5 Right: 8
6.9 Bank Vegetation Protection	Left: 8 Right: 8
6.10 Riparian Vegetation Zone Width	Left: 7 Right: 10
Total Score	151
Habitat Rating	0.755
Habitat Stream Condition	**Good**

Narrative:

Degradation.

Used confined RGA form even though confinement ratio at cross-section was 5.13.

Stream: **City Stream** Reach # **M6T3.05S1.03** Segment: **0** Completion Date:

Organization: **Bennington County NRCD** Observers: Why Not assessed: **Other (to be explained in** Rain:

Segment Length (ft): **10,443** Segment Location: **From confluence with Stamford Stream upstream to bridge on driveway off of City Stream**

QC Status - Staff: Provisional Consultant: Provisional

Step 1. Valley and Floodplain

1.1 Segmentation

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	**0**	**0**
height	**0**	**0**
Roads	**7,249**	**62**
height	**0**	**0**
Railroads	**0**	**0**
height	**0**	**0**
Improved Paths	**0**	**0**
height	**0**	**0**
Development	**1,089**	**0**

1.4 Adjacent Side	Left	Right
Hillside Slope		
Continuous w/		
W/in 1 Bankfill		
Texture		

1.5 Valley Features

Valley Width (ft) **0**

Width Determination

Confinement Type

Rock Gorge?

Human-caused Change?

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**

Notes:

Reach not assessed due to extreme confinement between Route 9 and valley wall.

Step 2. (Contued)

2.5 Aband. Floodpln **0.00** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **0.00**

2.7 Entrenchment Ratio **0.00**

2.8 Incision Ratio **0.00**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity

2.10 Riffles Type

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**

2.14 Stream Type

Stream Type:

Bed Material:

Subclass Slope:

Bed Form:

Field Measured Slope:

2.15 Reference Stream Type

(if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	**None**	**0.00**
Gullies	**None**	**0.00**

Step 3. Riparian Features

3.1 Stream Banks

Typical Bank Slope

Bank Texture	Left	Right
Upper		
Material Type		
Consistency		
Lower		
Material Type		
Consistency		

Bank Erosion	Left	Right
Erosion Length (ft)	**0**	**0**
Erosion Height (ft)	**0.00**	**0.00**
Revetmt. Type	**None**	**None**
Revetmt. Length (ft)	**0**	**0**

Near Bank Veg. Type	Left	Right
Dominant		
Sub-dominant		

Bank Canopy	Left	Right
Canopy %		
Mid-Channel Canopy		

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant		
Sub-dominant		
W less than 25	**147**	**3,884**

Buffer Veg. Type	Left	Right
Dominant		
Sub-dominant		

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant		
Sub-dominant		
Mass Failures	**0**	**0**
Height	**0**	**0**
Gullies	**0**	**0**
Height	**0**	**0**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps

4.2 Adjacent Wetlands

4.3 Flow Status

4.4 # of Debris Jams **0**

4.5 Flow Regulation Type **None**

Flow Regulation Use

Impoundments

Impoundmt. Location

4.6 Up/Down strm flow reg **None**

(old) Upstrm Flow Reg

4.7 StormwaterInputs

Field Ditch	**0**	Road Ditch	**0**
Other	**0**	Tile Drain	**0**
Overland Flow	**0**	Urb Strm Wtr Pipe	**0**

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	**0**	**0**

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

5.2 Other Features

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

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
0	**0**	

5.4 Stream Ford or Animal **No**

5.5 Straightening **None**

Straightening Length: **0**

5.5 Dredging **None**

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

1.6 Grade Controls

Type	Location	Total	Total Height Above Water	Photo Taken	GPS Taken
Ledge	Mid-segment	0.00	0.00	Yes	

4.8 Channel Constrictions

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?
Bridge	16.0	Yes	Yes	Yes	Yes

Problem None

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

Narrative:

Stream: **City Stream** Reach # **M6T3.05S1.04** Segment: **A** Completion Date:

Organization: **Bennington County NRCD** Observers: Why Not assessed: **bedrock gorge** Rain:

Segment Length (ft): **520** Segment Location: **From bridge on driveway off of City Stream Road upstream to sharp right bend above**

QC Status - Staff: Provisional Consultant: Provisional

Step 1. Valley and Floodplain

1.1 Segmentation

1.2 Alluvial Fan

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	**0**	**0**
height	**0**	**0**
Roads	**73**	**0**
height	**0**	**0**
Railroads	**0**	**0**
height	**0**	**0**
Improved Paths	**0**	**0**
height	**0**	**0**
Development	**0**	**0**

1.4 Adjacent Side	Left	Right
Hillside Slope		
Continuous w/		
W/in 1 Bankfill		
Texture		

1.5 Valley Features

Valley Width (ft) **0**

Width Determination

Confinement Type

Rock Gorge?

Human-caused Change?

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**

Notes:

Step 2. (Contued)

2.5 Aband. Floodpln **0.00** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **0.00**

2.7 Entrenchment Ratio **0.00**

2.8 Incision Ratio **0.00**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity

2.10 Riffles Type

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**

2.14 Stream Type

Stream Type:

Bed Material:

Subclass Slope:

Bed Form:

Field Measured Slope:

2.15 Reference Stream Type

(if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	**None**	**0.00**
Gullies	**None**	**0.00**

Step 3. Riparian Features

3.1 Stream Banks

Typical Bank Slope

Bank Texture	Left	Right
Upper		
Material Type		
Consistency		
Lower		
Material Type		
Consistency		

Bank Erosion	Left	Right
Erosion Length (ft)	**0**	**0**
Erosion Height (ft)	**0.00**	**0.00**
Revetmt. Type	**None**	**None**
Revetmt. Length (ft)	**0**	**0**

Near Bank Veg. Type	Left	Right
Dominant		
Sub-dominant		

Bank Canopy	Left	Right
Canopy %		
Mid-Channel Canopy		

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant		
Sub-dominant		
W less than 25	**35**	**0**

Buffer Veg. Type	Left	Right
Dominant		
Sub-dominant		

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant		
Sub-dominant		
Mass Failures	**0**	**0**
Height	**0**	**0**
Gullies	**0**	**0**
Height	**0**	**0**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps

4.2 Adjacent Wetlands

4.3 Flow Status

4.4 # of Debris Jams **0**

4.5 Flow Regulation Type **None**

Flow Regulation Use

Impoundments

Impoundmt. Location

4.6 Up/Down strm flow reg **None**

(old) Upstrm Flow Reg

4.7 StormwaterInputs

Field Ditch	**0**	Road Ditch	**0**
Other	**0**	Tile Drain	**0**
Overland Flow	**0**	Urb Strm Wtr Pipe	**0**

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	**0**	**0**

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

5.2 Other Features

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

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
0	**0**	

5.4 Stream Ford or Animal **No**

5.5 Straightening **None**

Straightening Length: **0**

5.5 Dredging **None**

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

1.6 Grade Controls

Type	Location	Total	Total Height Above Water	Photo Taken	GPS Taken
Waterfall	Mid-segment	6.00	5.00	Yes	
Ledge	Mid-segment	1.00	0.00	Yes	

4.8 Channel Constrictions

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

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

Narrative:

Project: **Walloomsac Woodford** | **Phase 2 Segment Summary** | November 27, 2007 | SGAT Version: 4.56

Stream: **City Stream** | Reach # **M6T3.05S1.04** | Segment: **B** | Completion Date: **September 14, 2007**

Organization: **Bennington County NRCD** | Observers: **Jason George and Jill Winton** | Why Not assessed: | Rain: **Yes**

Segment Length (ft): **1,112** | Segment Location: **From sharp right bend above bedrock gorge upstream to beaver dam below culvert across**

QC Status - Staff: Provisional Consultant: Provisional

Step 1. Valley and Floodplain

1.1 Segmentation **Planform and Scope**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	0	0
height	0	0
Railroads	0	0
height	0	0
Improved Paths	301	0
height	0	0
Development	0	0

1.4 Adjacent Side	Left	Right
Hillside Slope	Very Steep	Flat
Continuous w/	Sometimes	Always
W/in 1 Bankfill	Always	Always
Texture	Mixed	Silt/Clay

1.5 Valley Features

Valley Width (ft)	1,013
Width Determination	Measured
Confinement Type	Very Broad
Rock Gorge?	No
Human-caused Change?	No

Step 2. Stream Channel

2.1 Bankfull Width	23
2.2 Max Depth (ft)	1.74
2.3 Mean Depth (ft)	0.89
2.4 Floodprone Width (ft)	30

Notes:

Step 2. (Contued)

2.5 Aband. Floodpln	3.49 ft.
Human Elev Floodpln	0.00 ft.
2.6 Width/Depth Ratio	26.27
2.7 Entrenchment Ratio	1.30
2.8 Incision Ratio	2.01
Human Elevated Inc Rat	0.00
2.9 Sinuosity	Low
2.10 Riffles Type	Complete
2.11 Riffle/Step Spacing (ft)	41

2.12 Substrate Composition

Bedrock	0%
Boulder	8%
Cobble	21%
Coarse Gravel	42%
Fine Gravel	16%
Sand	10%
Silt and smaller	3%

Silt/Clay Present?	No
Detritus	5 %
# Large Woody	6

2.13 Average Largest Particle on

Bed	12.0	inches
Bar	3.0	inches

2.14 Stream Type

Stream Type:	F
Bed Material:	Gravel
Subclass Slope:	None
Bed Form:	Riffle-Pool
Field Measured Slope:	0.9

2.15 Reference Stream Type (if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	None	0.00
Gullies	None	0.00

Step 3. Riparian Features

3.1 Stream Banks

Typical Bank Slope **Moderate**

Bank Texture	Left	Right
Upper		
Material Type	Mix	Mix
Consistency	Cohesive	Cohesive
Lower		
Material Type	Mix	Mix
Consistency	Cohesive	Cohesive

Bank Erosion	Left	Right
Erosion Length (ft)	0	0
Erosion Height (ft)	0.00	0.00
Revetmt. Type	None	None
Revetmt. Length (ft)	0	0

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

Bank Canopy	Left	Right
Canopy %	0	0
Mid-Channel Canopy		Open

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	>100	>100
Sub-dominant	51-100	None
W less than 25	0	0

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

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Forest	Shrubs/Saplin
Sub-dominant	Shrubs/Saplin	Forest
Mass Failures	0	0
Height	0	0
Gullies	0	0
Height	0	0

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps	Minimal
4.2 Adjacent Wetlands	Abundant
4.3 Flow Status	Moderate
4.4 # of Debris Jams	0
4.5 Flow Regulation Type	None
Flow Regulation Use	
Impoundments	None
Impoundmt. Location	
4.6 Up/Down strm flow reg	None
(old) Upstrm Flow Reg	None

4.7 StormwaterInputs

Field Ditch	0	Road Ditch	0
Other	0	Tile Drain	0
Overland Flow	0	Urb Strm Wtr Pipe	0

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	5	4

Diagonal	Delta	Island
0	0	0

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
0	0	0	0

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	None
Straightening Length:	0
5.5 Dredging	None

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

1.6 Grade Controls

Type	Location	Total	Total Height Above Water	Photo Taken	GPSTaken
Ledge	Mid-segment	2.00	1.00	Yes	
Ledge	Mid-segment	1.00	1.00	Yes	

4.8 Channel Constrictions **None**

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

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Unconfined**

	Score	STD	Historic
7.1 Channel Degradation	**5**	**C to F**	**No**
7.2 Channel Aggradation	**16**	**None**	**No**
7.3 Widening Channel	**12**		**No**
7.4 Change in Planform	**18**		**No**
Total Score	**51**		
Geomorphic Rating	**0.6375**		
Channel Evolution Model	**F**		
Channel Evolution Stage	**II**		
Geomorphic Condition	**Fair**		
Stream Sensitivity	**Extreme**		

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type **High**

	Score
6.1 Epifaunal Substrate - Available Cover	17
6.2 Embeddedness	15
6.3 Velocity/Depth Patterns	16
6.4 Sediment Deposition	15
6.5 Channel Flow Status	17
6.6 Channel Alteration	17
6.7 Frequency of Riffles/Steps	15
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	166
Habitat Rating	0.83
Habitat Stream Condition	**Good**

Narrative:
Degradation.

Stream: **City Stream** Reach # **M6T3.05S1.04** Segment: **C** Completion Date:

Organization: **Bennington County NRCD** Observers: Why Not assessed: **impounded** Rain:

Segment Length (ft): **443** Segment Location: **From beaver dam below culvert across Prospect Mt. driveway upstream to culvert.**

QC Status - Staff: Provisional Consultant: Provisional

Step 1. Valley and Floodplain

1.1 Segmentation

1.2 Alluvial Fan

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	60	0
height	0	0
Railroads	0	0
height	0	0
Improved Paths	0	0
height	0	0
Development	0	263

1.4 Adjacent Side	Left	Right
Hillside Slope		
Continuous w/		
W/in 1 Bankfill		
Texture		

1.5 Valley Features

Valley Width (ft) **0**

Width Determination

Confinement Type

Rock Gorge?

Human-caused Change?

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**

Notes:

Step 2. (Contued)

2.5 Aband. Floodpln **0.00** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **0.00**

2.7 Entrenchment Ratio **0.00**

2.8 Incision Ratio **0.00**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity

2.10 Riffles Type

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**

2.14 Stream Type

Stream Type:

Bed Material:

Subclass Slope:

Bed Form:

Field Measured Slope:

2.15 Reference Stream Type

(if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	**None**	**0.00**
Gullies	**None**	**0.00**

Step 3. Riparian Features

3.1 Stream Banks

Typical Bank Slope

Bank Texture	Left	Right
Upper		
Material Type		
Consistency		
Lower		
Material Type		
Consistency		

Bank Erosion	Left	Right
Erosion Length (ft)	0	0
Erosion Height (ft)	0.00	0.00
Revetmt. Type	Rip-Rap	Rip-Rap
Revetmt. Length (ft)	23	15

Near Bank Veg. Type	Left	Right
Dominant		
Sub-dominant		

Bank Canopy	Left	Right
Canopy %		
Mid-Channel Canopy		

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant		
Sub-dominant		
W less than 25	0	0

Buffer Veg. Type	Left	Right
Dominant		
Sub-dominant		

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant		
Sub-dominant		
Mass Failures	0	0
Height	0	0
Gullies	0	0
Height	0	0

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps

4.2 Adjacent Wetlands

4.3 Flow Status

4.4 # of Debris Jams **0**

4.5 Flow Regulation Type **None**

Flow Regulation Use

Impoundments

Impoundmt. Location

4.6 Up/Down strm flow reg **None**

(old) Upstrm Flow Reg

4.7 StormwaterInputs

Field Ditch	0	Road Ditch	0
Other	0	Tile Drain	0
Overland Flow	0	Urb Strm Wtr Pipe	0

4.9 # of Beaver Dams **1**

Affected Length (ft) **420**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
0	0	0

Diagonal	Delta	Island
0	0	0

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
0	0	0	0

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
0	0	

5.4 Stream Ford or Animal **No**

5.5 Straightening **Straightening**

Straightening Length: **254**

5.5 Dredging **None**

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

Stream: **City Stream** Reach # **M6T3.05S1.04** Segment: **C** Completion Date:

Organization: **Bennington County NRCD** Observers: Rain:

Segment Length (ft): **443** Segment Location: **From beaver dam below culvert across Prospect Mt. driveway upstream to culvert.**

1.6 Grade Controls

Type	Location	Total	Total Height Above Water	Photo Taken	GPS Taken

4.8 Channel Constrictions

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

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

Narrative:

Project: **Walloomsac Woodford** | **Phase 2 Segment Summary** | November 27, 2007 SGAT Version: 4.56

Stream: **City Stream** Reach # **M6T3.05S1.04** Segment: **D** Completion Date: **September 14, 2007**

Organization: **Bennington County NRCD** Observers: **Jason George and Jill Winton** Why Not assessed: Rain: **Yes**

Segment Length (ft): **1,957** Segment Location: **From culvert across Prospect Mt. driveway upstream to Bugbee Mill Pond dam.**

QC Status - Staff: Provisional Consultant: Provisional

Step 1. Valley and Floodplain

1.1 Segmentation **Other Reason**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	786	0
height	0	0
Railroads	0	0
height	0	0
Improved Paths	501	0
height	0	0
Development	244	227

1.4 Adjacent Side	Left	Right
Hillside Slope	Flat	Flat
Continuous w/	Always	Always
W/in 1 Bankfill	Always	Always
Texture	Silt/Clay	Silt/Clay

1.5 Valley Features

Valley Width (ft) **1,028**

Width Determination **Measured**

Confinement Type **Very Broad**

Rock Gorge? **No**

Human-caused Change? **No**

Step 2. Stream Channel

2.1 Bankfull Width **16**

2.2 Max Depth (ft) **1.43**

2.3 Mean Depth (ft) **1.09**

2.4 Floodprone Width (ft) **21**

Notes:

Step 2. (Contued)

2.5 Aband. Floodpln **3.23** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **14.68**

2.7 Entrenchment Ratio **1.31**

2.8 Incision Ratio **2.26**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Low**

2.10 Riffles Type **Eroded**

2.11 Riffle/Step Spacing (ft) **0**

2.12 Substrate Composition

Bedrock	0%
Boulder	0%
Cobble	0%
Coarse Gravel	33%
Fine Gravel	35%
Sand	9%
Silt and smaller	23%

Silt/Clay Present? **No**

Detritus **10** %

Large Woody **1**

2.13 Average Largest Particle on

Bed **6.0** **inches**

Bar **N/A** **inches**

2.14 Stream Type

Stream Type: **F**

Bed Material: **Gravel**

Subclass Slope: **None**

Bed Form: **Riffle-Pool**

Field Measured Slope: **0.8**

2.15 Reference Stream Type

(if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	None	0.00
Gullies	None	0.00

Step 3. Riparian Features

3.1 Stream Banks

Typical Bank Slope **Steep**

Bank Texture	Left	Right
Upper		
Material Type	Silt	Silt
Consistency	Cohesive	Cohesive
Lower		
Material Type	Silt	Silt
Consistency	Cohesive	Cohesive

Bank Erosion	Left	Right
Erosion Length (ft)	0	0
Erosion Height (ft)	0.00	0.00
Revetmt. Type	None	Rip-Rap
Revetmt. Length (ft)	0	187

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

Bank Canopy	Left	Right
Canopy %	0	0

Mid-Channel Canopy **Open**

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	>100	>100
Sub-dominant	26-50	0-25
W less than 25	0	509

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

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Shrubs/Saplin	Shrubs/Saplin
Sub-dominant	None	Residential
Mass Failures	0	0
Height	0	0
Gullies	0	0
Height	0	0

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps **Minimal**

4.2 Adjacent Wetlands **Abundant**

4.3 Flow Status **Moderate**

4.4 # of Debris Jams **0**

4.5 Flow Regulation Type **None**

Flow Regulation Use

Impoundments

Impoundmt. Location

4.6 Up/Down strm flow reg **None**

(old) Upstrm Flow Reg

4.7 StormwaterInputs

Field Ditch	0	Road Ditch	0
Other	0	Tile Drain	0
Overland Flow	0	Urb Strm Wtr Pipe	0

4.9 # of Beaver Dams **1**

Affected Length (ft) **150**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
1	2	0

Diagonal	Delta	Island
0	0	0

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
0	0	0	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 **Straightening**

Straightening Length: **1,032**

5.5 Dredging **None**

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

Stream: **City Stream** Reach # **M6T3.05S1.04** Segment: **D** Completion Date: **September 14,**

Organization: **Bennington County NRCD** Observers: **Jason George and Jill Winton** Rain: **Yes**

Segment Length (ft): **1,957** Segment Location: **From culvert across Prospect Mt. driveway upstream to Bugbee Mill Pond dam.**

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?
Culvert	10.5	Yes	Yes	Yes	Yes
Problem	None				
Culvert	12.0	Yes	Yes	Yes	Yes
Problem	Deposition Below				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Unconfined**

	Score	STD	Historic
7.1 Channel Degradation	**5**	**C to F**	**No**
7.2 Channel Aggradation	**13**	**None**	**No**
7.3 Widening Channel	**13**		**No**
7.4 Change in Planform	**16**		**No**
Total Score	**47**		
Geomorphic Rating	**0.5875**		
Channel Evolution Model	**F**		
Channel Evolution Stage	**II**		
Geomorphic Condition	**Fair**		
Stream Sensitivity	**Extreme**		

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type **Low**

	Score
6.1 Epifaunal Substrate - Available Cover	13
6.2 Pool Substrate	15
6.3 Pool Variability	16
6.4 Sediment Deposition	11
6.5 Channel Flow Status	16
6.6 Channel Alteration	15
6.7 Channel Sinuosity	10
6.8 Bank Stability	Left: 9 Right: 8
6.9 Bank Vegetation Protection	Left: 8 Right: 6
6.10 Riparian Vegetation Zone Width	Left: 8 Right: 5
Total Score	140
Habitat Rating	0.7
Habitat Stream Condition	**Good**

Narrative:
Degradation.

Stream: **City Stream** Reach # **M6T3.05S1.06** Segment: **0** Completion Date: **September 12, 2007**

Organization: **Bennington County NRCD** Observers: **Jason George and Jill Winton** Why Not assessed: Rain: **Yes**

Segment Length (ft): **2,260** Segment Location: **From top of wetland area above Bugbee Mill Pond to small dam above culvert across Route**

QC Status - Staff: Provisional Consultant: Provisional

Step 1. Valley and Floodplain

1.1 Segmentation **None**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	467	0
height	0	0
Railroads	0	0
height	0	0
Improved Paths	0	0
height	0	0
Development	0	307

1.4 Adjacent Side	Left	Right
Hillside Slope	Hilly	Flat
Continuous w/	Never	Sometimes
W/in 1 Bankfill	Sometimes	Sometimes
Texture	Mixed	Mixed

1.5 Valley Features

Valley Width (ft) **705**

Width Determination **Measured**

Confinement Type **Very Broad**

Rock Gorge? **No**

Human-caused Change? **Yes**

Step 2. Stream Channel

2.1 Bankfull Width **16**

2.2 Max Depth (ft) **1.39**

2.3 Mean Depth (ft) **0.97**

2.4 Floodprone Width (ft) **35**

Notes:

Step 2. (Contued)

2.5 Aband. Floodpln **2.22** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **16.49**

2.7 Entrenchment Ratio **2.17**

2.8 Incision Ratio **1.60**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Low**

2.10 Riffles Type **Complete**

2.11 Riffle/Step Spacing (ft) **40**

2.12 Substrate Composition

Bedrock	1%
Boulder	26%
Cobble	21%
Coarse Gravel	25%
Fine Gravel	18%
Sand	9%
Silt and smaller	0%

Silt/Clay Present? **No**

Detritus **5** %

Large Woody **20**

2.13 Average Largest Particle on

Bed **18.0** **inches**

Bar **10.0** **inches**

2.14 Stream Type

Stream Type: **D**

Bed Material: **Gravel**

Subclass Slope: **b**

Bed Form: **Braided**

Field Measured Slope: **3.3**

2.15 Reference Stream Type

(if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	None	0.00
Gullies	None	0.00

Step 3. Riparian Features

3.1 Stream Banks

Typical Bank Slope **Steep**

Bank Texture	Left	Right
Upper		
Material Type	Mix	Mix
Consistency	Cohesive	Cohesive
Lower		
Material Type	Mix	Mix
Consistency	Cohesive	Cohesive

Bank Erosion	Left	Right
Erosion Length (ft)	0	0
Erosion Height (ft)	0.00	0.00
Revetmt. Type	None	None
Revetmt. Length (ft)	0	0

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

Bank Canopy	Left	Right
Canopy %	76-100	76-100
Mid-Channel Canopy	Closed	

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	>100	>100
Sub-dominant	0-25	26-50
W less than 25	356	365

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	Residential	Residential
Mass Failures	0	0
Height	0	0
Gullies	0	0
Height	0	0

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps **Minimal**

4.2 Adjacent Wetlands **None**

4.3 Flow Status **Moderate**

4.4 # of Debris Jams **5**

4.5 Flow Regulation Type **None**

Flow Regulation Use

Impoundments **None**

Impoundmt. Location

4.6 Up/Down strm flow reg **None**

(old) Upstrm Flow Reg

4.7 StormwaterInputs

Field Ditch	0	Road Ditch	0
Other	0	Tile Drain	0
Overland Flow	0	Urb Strm Wtr Pipe	0

4.9 # of Beaver Dams **0**

Affected Length (ft) **0**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
3	2	2
Diagonal	**Delta**	**Island**
0	0	3

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
1	0	0	5

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 **Straightening**

Straightening Length: **249**

5.5 Dredging **None**

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

1.6 Grade Controls

Type	Location	Total	Total Height Above Water	Photo Taken	GPSTaken
Ledge	Mid-segment	1.00	1.00	Yes	
Ledge	Mid-segment	2.00	1.00	Yes	

4.8 Channel Constrictions

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?
Bridge	14.5	Yes	Yes	Yes	Yes
Problem	None				
Culvert	3.20	Yes	Yes	Yes	Yes
Problem	None				
Old	8.00	Yes	Yes	Yes	Yes
Problem	Deposition Above				
Old	12.0	Yes	Yes	No	No
Problem	Deposition Above,Scour Above				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Unconfined**

	Score	STD	Historic
7.1 Channel Degradation	**14**	**None**	**No**
7.2 Channel Aggradation	**15**	**None**	**No**
7.3 Widening Channel	**13**		**No**
7.4 Change in Planform	**16**		**No**
Total Score	**58**		
Geomorphic Rating	**0.725**		
Channel Evolution Model	**F**		
Channel Evolution Stage	**IV**		
Geomorphic Condition	**Good**		
Stream Sensitivity	**Extreme**		

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type **High**

	Score
6.1 Epifaunal Substrate - Available Cover	18
6.2 Embeddedness	16
6.3 Velocity/Depth Patterns	18
6.4 Sediment Deposition	15
6.5 Channel Flow Status	16
6.6 Channel Alteration	15
6.7 Frequency of Riffles/Steps	19
6.8 Bank Stability	Left: 9 Right: 9
6.9 Bank Vegetation Protection	Left: 8 Right: 7
6.10 Riparian Vegetation Zone Width	Left: 9 Right: 8
Total Score	167
Habitat Rating	0.835
Habitat Stream Condition	**Good**

Narrative:
Planform.

Project: **Walloomsac Woodford** | **Phase 2 Segment Summary** | November 27, 2007 SGAT Version: 4.56

Stream: **Bolles Brook** Reach # **M6T3.05** Segment: **A** Completion Date: **September 25, 2007**

Organization: **Bennington County NRCD** Observers: **Jason George and Jill Winton** Why Not assessed: Rain: **No**

Segment Length (ft): **2,042** Segment Location: **From confluence with City Stream upstream to tributary just below second bridge on Harbor**

QC Status - Staff: Provisional Consultant: Provisional

Step 1. Valley and Floodplain

1.1 Segmentation **Corridor Encroachment**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	882	0
height	0	0
Railroads	0	0
height	0	0
Improved Paths	0	0
height	0	0
Development	1,775	0

1.4 Adjacent Side	Left	Right
Hillside Slope	Very Steep	Extremely
Continuous w/	Never	Sometimes
W/in 1 Bankfill	Never	Always
Texture	Mixed	Mixed

1.5 Valley Features

Valley Width (ft) **445**

Width Determination **Measured**

Confinement Type **Broad**

Rock Gorge? **No**

Human-caused Change? **Yes**

Step 2. Stream Channel

2.1 Bankfull Width **48**

2.2 Max Depth (ft) **3.00**

2.3 Mean Depth (ft) **2.18**

2.4 Floodprone Width (ft) **87**

Notes:

No evidence of dredging observed in the field.

Step 2. (Contued)

2.5 Aband. Floodpln **3.04** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **22.02**

2.7 Entrenchment Ratio **1.80**

2.8 Incision Ratio **1.01**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Low**

2.10 Riffles Type **Eroded**

2.11 Riffle/Step Spacing (ft) **115**

2.12 Substrate Composition

Bedrock	0%
Boulder	27%
Cobble	46%
Coarse Gravel	15%
Fine Gravel	9%
Sand	3%
Silt and smaller	0%

Silt/Clay Present? **No**

Detritus **5** %

Large Woody **12**

2.13 Average Largest Particle on

Bed **30.0** **inches**

Bar **21.0** **inches**

2.14 Stream Type

Stream Type: **B**

Bed Material: **Cobble**

Subclass Slope: **None**

Bed Form: **Step-Pool**

Field Measured Slope: **2**

2.15 Reference Stream Type

(if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	None	0.00
Gullies	None	0.00

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)	138	182
Erosion Height (ft)	7.00	4.00
Revetmt. Type	None	None
Revetmt. Length (ft)	0	0

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

Bank Canopy	Left	Right
Canopy %	26-50	51-75

Mid-Channel Canopy **Open**

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	26-50	>100
Sub-dominant	0-25	None
W less than 25	698	185

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

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Residential	Forest
Sub-dominant	Forest	None
Mass Failures	0	148
Height	0	20
Gullies	0	0
Height	0	0

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 Flow Regulation Type **None**

Flow Regulation Use

Impoundments **None**

Impoundmt. Location

4.6 Up/Down strm flow reg **None**

(old) Upstrm Flow Reg **None**

4.7 StormwaterInputs

Field Ditch	0	Road Ditch	0
Other	0	Tile Drain	0
Overland Flow	0	Urb Strm Wtr Pipe	0

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	1	2
Diagonal	**Delta**	**Island**
1	0	1

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
1	0	0	1

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
0	2	No

5.4 Stream Ford or Animal **No**

5.5 Straightening **Straightening**

Straightening Length: **1,727**

5.5 Dredging **None**

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

Stream: **Bolles Brook** Reach # **M6T3.05** Segment: **A** Completion Date: **September 25,**

Organization: **Bennington County NRCD** Observers: **Jason George and Jill Winton** Rain: **No**

Segment Length (ft): **2,042** Segment Location: **From confluence with City Stream upstream to tributary just below second bridge on Harbor**

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?

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Unconfined**

	Score	STD	Historic
7.1 Channel Degradation	**5**	**None**	**No**
7.2 Channel Aggradation	**14**	**None**	**No**
7.3 Widening Channel	**9**		**No**
7.4 Change in Planform	**12**		**No**
Total Score	**40**		
Geomorphic Rating	**0.5**		
Channel Evolution Model	**F**		
Channel Evolution Stage	**III**		
Geomorphic Condition	**Fair**		
Stream Sensitivity	**High**		

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type **High**

	Score
6.1 Epifaunal Substrate - Available Cover	12
6.2 Embeddedness	14
6.3 Velocity/Depth Patterns	15
6.4 Sediment Deposition	14
6.5 Channel Flow Status	12
6.6 Channel Alteration	11
6.7 Frequency of Riffles/Steps	16
6.8 Bank Stability	Left: 5 Right: 5
6.9 Bank Vegetation Protection	Left: 5 Right: 7
6.10 Riparian Vegetation Zone Width	Left: 4 Right: 9
Total Score	129
Habitat Rating	0.645
Habitat Stream Condition	**Good**

Narrative:
Degradation and widening.

Project: **Walloomsac Woodford** | **Phase 2 Segment Summary** | November 27, 2007 SGAT Version: 4.56

Stream: **Bolles Brook** Reach # **M6T3.05** Segment: **B** Completion Date: **September 25, 2007**

Organization: **Bennington County NRCD** Observers: **Jason George and Jill Winton** Why Not assessed: Rain: **No**

Segment Length (ft): **2,242** Segment Location: **From tributary just below second bridge on Harbor Road to sharp right bend before straight,**

QC Status - Staff: Provisional Consultant: Provisional

Step 1. Valley and Floodplain

1.1 Segmentation **Corridor Encroachment**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	1,664	0
height	0	0
Railroads	0	0
height	0	0
Improved Paths	0	0
height	0	0
Development	647	0

1.4 Adjacent Side	Left	Right
Hillside Slope	Extremely	Steep
Continuous w/	Sometimes	Never
W/in 1 Bankfill	Sometimes	Never
Texture	Bedrock	Not Evalua

1.5 Valley Features

Valley Width (ft) **535**

Width Determination **Measured**

Confinement Type **Broad**

Rock Gorge? **No**

Human-caused Change? **No**

Step 2. Stream Channel

2.1 Bankfull Width **56**

2.2 Max Depth (ft) **2.88**

2.3 Mean Depth (ft) **1.87**

2.4 Floodprone Width (ft) **87**

Notes:

Step 2. (Contued)

2.5 Aband. Floodpln **5.18** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **29.69**

2.7 Entrenchment Ratio **1.57**

2.8 Incision Ratio **1.80**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Low**

2.10 Riffles Type **Complete**

2.11 Riffle/Step Spacing (ft) **45**

2.12 Substrate Composition

Bedrock	0%
Boulder	26%
Cobble	55%
Coarse Gravel	12%
Fine Gravel	6%
Sand	1%
Silt and smaller	0%

Silt/Clay Present? **No**

Detritus **5** %

Large Woody **19**

2.13 Average Largest Particle on

Bed **40.0** **inches**

Bar **26.0** **inches**

2.14 Stream Type

Stream Type: **B**

Bed Material: **Cobble**

Subclass Slope: **c**

Bed Form: **Step-Pool**

Field Measured Slope: **1.8**

2.15 Reference Stream Type

(if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	None	0.00
Gullies	None	0.00

Step 3. Riparian Features

3.1 Stream Banks

Typical Bank Slope **Moderate**

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)	236	95
Erosion Height (ft)	8.00	4.00
Revetmt. Type	Multiple	Rip-Rap
Revetmt. Length (ft)	151	62

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

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

Mid-Channel Canopy **Open**

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	>100	>100
Sub-dominant	None	51-100
W less than 25	0	136

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	None	Residential
Mass Failures	0	0
Height	0	0
Gullies	0	0
Height	0	0

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps **Minimal**

4.2 Adjacent Wetlands **None**

4.3 Flow Status **Low**

4.4 # of Debris Jams **0**

4.5 Flow Regulation Type **None**

Flow Regulation Use

Impoundments **None**

Impoundmt. Location

4.6 Up/Down strm flow reg **None**

(old) Upstrm Flow Reg

4.7 StormwaterInputs

Field Ditch	0	Road Ditch	0
Other	0	Tile Drain	0
Overland Flow	0	Urb Strm Wtr Pipe	0

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	1	1

Diagonal	Delta	Island
0	0	11

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
2	0	0	1

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
3	0	No

5.4 Stream Ford or Animal **No**

5.5 Straightening **Straightening**

Straightening Length: **1,519**

5.5 Dredging **None**

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

Stream: **Bolles Brook** Reach # **M6T3.05** Segment: **B** Completion Date: **September 25,**

Organization: **Bennington County NRCD** Observers: **Jason George and Jill Winton** Rain: **No**

Segment Length (ft): **2,242** Segment Location: **From tributary just below second bridge on Harbor Road to sharp right bend before straight,**

1.6 Grade Controls

Type	Location	Total	Total Height Above Water	Photo Taken	GPSTaken
Ledge	Mid-segment	3.00	2.00	Yes	
Ledge	Mid-segment	5.00	4.00	Yes	

4.8 Channel Constrictions

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?
Bridge	75.0	Yes	Yes	No	Yes

Problem Deposition Below

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Unconfined**

	Score	STD	Historic
7.1 Channel Degradation	**5**	**None**	**Yes**
7.2 Channel Aggradation	**13**	**None**	**No**
7.3 Widening Channel	**10**		**No**
7.4 Change in Planform	**17**		**No**

Total Score	**45**
Geomorphic Rating	**0.5625**
Channel Evolution Model	**F**
Channel Evolution Stage	**IV**
Geomorphic Condition	**Fair**
Stream Sensitivity	**High**

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type **High**

	Score
6.1 Epifaunal Substrate - Available Cover	17
6.2 Embeddedness	16
6.3 Velocity/Depth Patterns	16
6.4 Sediment Deposition	15
6.5 Channel Flow Status	13
6.6 Channel Alteration	18
6.7 Frequency of Riffles/Steps	16
6.8 Bank Stability	Left: 8 Right: 9
6.9 Bank Vegetation Protection	Left: 9 Right: 9
6.10 Riparian Vegetation Zone Width	Left: 9 Right: 8
Total Score	163
Habitat Rating	0.815
Habitat Stream Condition	**Good**

Narrative:
Widening and Aggradation.

Project: **Walloomsac Woodford** | **Phase 2 Segment Summary** | November 27, 2007 SGAT Version: 4.56

Stream: **Bolles Brook** Reach # **M6T3.05** Segment: **C** Completion Date: **September 25, 2007**

Organization: **Bennington County NRCD** Observers: **Jason George and Jill Winton** Why Not assessed: Rain: **No**

Segment Length (ft): **1,163** Segment Location: **From sharp right bend below straight, channelized section upstream to confluence with**

QC Status - Staff: Provisional Consultant: Provisional

Step 1. Valley and Floodplain

1.1 Segmentation **Corridor Encroachment**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	961	172
height	0	0
Railroads	0	0
height	0	0
Improved Paths	0	0
height	0	0
Development	1,150	0

1.4 Adjacent Side	Left	Right
Hillside Slope	Extremely	Very Steep
Continuous w/	Sometimes	Never
W/in 1 Bankfill	Sometimes	Never
Texture	Bedrock	Not Evalua

1.5 Valley Features

Valley Width (ft) **457**

Width Determination **Measured**

Confinement Type **Very Broad**

Rock Gorge? **No**

Human-caused Change? **No**

Step 2. Stream Channel

2.1 Bankfull Width **32**

2.2 Max Depth (ft) **4.22**

2.3 Mean Depth (ft) **2.62**

2.4 Floodprone Width (ft) **59**

Notes:

Step 2. (Contued)

2.5 Aband. Floodpln **0.00** ft.

Human Elev Floodpln **12.20** ft.

2.6 Width/Depth Ratio **12.21**

2.7 Entrenchment Ratio **1.85**

2.8 Incision Ratio **0.00**

Human Elevated Inc Rat **2.89**

2.9 Sinuosity **Low**

2.10 Riffles Type **Eroded**

2.11 Riffle/Step Spacing (ft) **90**

2.12 Substrate Composition

Bedrock	10%
Boulder	38%
Cobble	31%
Coarse Gravel	3%
Fine Gravel	12%
Sand	6%
Silt and smaller	0%

Silt/Clay Present? **No**

Detritus **5** %

Large Woody **1**

2.13 Average Largest Particle on

Bed **24.0** **inches**

Bar **N/A** **inches**

2.14 Stream Type

Stream Type: **B**

Bed Material: **Cobble**

Subclass Slope: **c**

Bed Form: **Step-Pool**

Field Measured Slope: **1.7**

2.15 Reference Stream Type

(if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	None	0.00
Gullies	None	0.00

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)	0	0
Erosion Height (ft)	0.00	0.00
Revetmt. Type	None	Rip-Rap
Revetmt. Length (ft)	0	637

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

Bank Canopy	Left	Right
Canopy %	51-75	1-25

Mid-Channel Canopy **Open**

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	51-100	26-50
Sub-dominant	26-50	0-25
W less than 25	91	889

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

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Forest	Residential
Sub-dominant	Residential	Shrubs/Saplin
Mass Failures	0	0
Height	0	0
Gullies	0	0
Height	0	0

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 Flow Regulation Type **Small Bypass**

Flow Regulation Use **Drinking**

Impoundments

Impoundmt. Location

4.6 Up/Down strm flow reg **None**

(old) Upstrm Flow Reg

4.7 StormwaterInputs

Field Ditch	0	Road Ditch	0
Other	0	Tile Drain	0
Overland Flow	0	Urb Strm Wtr Pipe	0

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

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
0	0	0	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 **Straightening**

Straightening Length: **871**

5.5 Dredging **Dredging**

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

Stream: **Bolles Brook** Reach # **M6T3.05** Segment: **C** Completion Date: **September 25,**

Organization: **Bennington County NRCD** Observers: **Jason George and Jill Winton** Rain: **No**

Segment Length (ft): **1,163** Segment Location: **From sharp right bend below straight, channelized section upstream to confluence with**

1.6 Grade Controls

Type	Location	Total	Total Height Above Water	Photo Taken	GPSTaken
Dam	Mid-segment	8.00	5.00	Yes	

4.8 Channel Constrictions

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?
Bridge	80.0	Yes	Yes	No	Yes

Problem None

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Unconfined**

	Score	STD	Historic
7.1 Channel Degradation	**5**	**None**	**No**
7.2 Channel Aggradation	**15**	**None**	**No**
7.3 Widening Channel	**14**		**No**
7.4 Change in Planform	**14**		**No**
Total Score	**48**		
Geomorphic Rating	**0.6**		
Channel Evolution Model	**F**		
Channel Evolution Stage	**II**		
Geomorphic Condition	**Fair**		
Stream Sensitivity	**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	14
6.4 Sediment Deposition	14
6.5 Channel Flow Status	15
6.6 Channel Alteration	10
6.7 Frequency of Riffles/Steps	16
6.8 Bank Stability	Left: 8 Right: 6
6.9 Bank Vegetation Protection	Left: 9 Right: 2
6.10 Riparian Vegetation Zone Width	Left: 9 Right: 3
Total Score	129
Habitat Rating	0.645
Habitat Stream Condition	**Good**

Narrative:
Degradation

Stream: **Bolles Brook** Reach # **M6T3.06** Segment: **0** Completion Date: **September 24, 2007**

Organization: **Bennington County NRCD** Observers: **Jason George and Jill Winton** Why Not assessed: Rain: **No**

Segment Length (ft): **5,734** Segment Location: **From confluence with Bickford Hollow Brook to intersection with National Forest Road 278.**

QC Status - Staff: Provisional Consultant: Provisional

Step 1. Valley and Floodplain

1.1 Segmentation **None**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	**345**	**0**
height	**0**	**0**
Roads	**1,947**	**0**
height	**0**	**0**
Railroads	**0**	**0**
height	**0**	**0**
Improved Paths	**0**	**0**
height	**0**	**0**
Development	**481**	**0**

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

1.5 Valley Features

Valley Width (ft) **476**

Width Determination **Measured**

Confinement Type **Very Broad**

Rock Gorge? **No**

Human-caused Change? **No**

Step 2. Stream Channel

2.1 Bankfull Width **29**

2.2 Max Depth (ft) **2.80**

2.3 Mean Depth (ft) **1.76**

2.4 Floodprone Width (ft) **115**

Notes:

Step 2. (Contued)

2.5 Aband. Floodpln **5.55** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **16.48**

2.7 Entrenchment Ratio **3.97**

2.8 Incision Ratio **1.98**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Low**

2.10 Riffles Type **Complete**

2.11 Riffle/Step Spacing (ft) **45**

2.12 Substrate Composition

Bedrock	**0** %
Boulder	**18** %
Cobble	**56** %
Coarse Gravel	**13** %
Fine Gravel	**12** %
Sand	**1** %
Silt and smaller	**0** %

Silt/Clay Present? **No**

Detritus **5** %

Large Woody **55**

2.13 Average Largest Particle on

Bed **48.0** **inches**

Bar **22.0** **inches**

2.14 Stream Type

Stream Type: **D**

Bed Material: **Cobble**

Subclass Slope: **b**

Bed Form: **Braided**

Field Measured Slope: **3.4**

2.15 Reference Stream Type

(if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	**None**	**0.00**
Gullies	**None**	**0.00**

Step 3. Riparian Features

3.1 Stream Banks

Typical Bank Slope **Moderate**

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)	**101**	**108**
Erosion Height (ft)	**8.00**	**6.00**
Revetmt. Type	**None**	**None**
Revetmt. Length (ft)	**0**	**0**

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 **Closed**

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**>100**	**>100**
Sub-dominant	**26-50**	**None**
W less than 25	**339**	**0**

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

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	**Forest**	**Forest**
Sub-dominant	**Pasture**	**None**
Mass Failures	**0**	**0**
Height	**0**	**0**
Gullies	**0**	**0**
Height	**0**	**0**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps **Abundant**

4.2 Adjacent Wetlands **None**

4.3 Flow Status **Low**

4.4 # of Debris Jams **0**

4.5 Flow Regulation Type **None**

Flow Regulation Use

Impoundments **None**

Impoundmt. Location

4.6 Up/Down strm flow reg **None**

(old) Upstrm Flow Reg

4.7 StormwaterInputs

Field Ditch	**0**	Road Ditch	**0**
Other	**0**	Tile Drain	**0**
Overland Flow	**0**	Urb Strm Wtr Pipe	**0**

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	**2**	**2**

Diagonal	Delta	Island
0	**0**	**12**

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
10	**0**	**0**	**11**

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 **None**

Straightening Length: **0**

5.5 Dredging **None**

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

Stream: **Bolles Brook** Reach # **M6T3.06** Segment: **0** Completion Date: **September 24,**

Organization: **Bennington County NRCD** Observers: **Jason George and Jill Winton** Rain: **No**

Segment Length (ft): **5,734** Segment Location: **From confluence with Bickford Hollow Brook to intersection with National Forest Road 278.**

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?

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Unconfined**

	Score	STD	Historic
7.1 Channel Degradation	**13**	**None**	**No**
7.2 Channel Aggradation	**16**	**None**	**No**
7.3 Widening Channel	**12**		**No**
7.4 Change in Planform	**13**		**No**
Total Score	**54**		
Geomorphic Rating	**0.675**		
Channel Evolution Model	**F**		
Channel Evolution Stage	**IV**		
Geomorphic Condition	**Good**		
Stream Sensitivity	**Extreme**		

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type **High**

	Score
6.1 Epifaunal Substrate - Available Cover	19
6.2 Embeddedness	16
6.3 Velocity/Depth Patterns	16
6.4 Sediment Deposition	13
6.5 Channel Flow Status	10
6.6 Channel Alteration	17
6.7 Frequency of Riffles/Steps	18
6.8 Bank Stability	Left: 8 Right: 8
6.9 Bank Vegetation Protection	Left: 9 Right: 9
6.10 Riparian Vegetation Zone Width	Left: 9 Right: 10
Total Score	162
Habitat Rating	0.81
Habitat Stream Condition	**Good**

Narrative:
Planform.